4.2.6 Geology and Soils

Evaluation of potential geologic and soil-related impacts were based on the *Geological Reconnaissance Evaluation, Blythe Mesa Solar Project, Blythe, California*, prepared by Ninyo & Moore (refer to Appendix E). This section discusses geologic hazards. While the impacts of the existing environment on the Project and Alternatives are not encompassed by CEQA or NEPA, this section discusses those issues to assist decision-makers in addressing regulatory concerns. It also discusses potential impacts of the Project and Alternatives, and describes the methods used to determine the impacts of the Project, and measures to mitigate (i.e., avoid, minimize, rectify, reduce, eliminate, or compensate for) impacts accompany each impact discussion.

Methodology for Analysis

The Project's geotechnical investigation included review of pertinent background data, including geotechnical reports, topographic maps, geologic data, fault maps, and aerial photographs. A geological reconnaissance was conducted at the Project area, which included observation and photo-documentation of existing geologic conditions across the site and an evaluation of possible geologic hazards that may impact the proposed Project. Site-specific subsurface exploration, laboratory testing, and engineering analysis was not conducted in preparation of the geotechnical report prepared for the proposed Project. However, subsurface data was obtained from nearby borings during previous geologic reconnaissance for the Blythe Energy Center, and included in this analysis.

It is assumed that geotechnical design considerations for future structures are in accordance with applicable requirements of the 2010 California Building Code (CBC), the County of Riverside County Code (for the portion of the Project under County jurisdiction), the City of Blythe Municipal Code (for the portion of the Project under City jurisdiction), the International Building Code (IBC) (for the portion of the Project under BLM jurisdiction), and any applicable building and seismic codes in effect at the time the grading plans are approved.

For ease of reference, both potential impacts of the Project and Alternatives on the environment and potential impacts of the existing environment on the Project are both referred to as impacts of the Project and Alternatives, and measures to ameliorate both types of impacts are referred to as mitigation measures. However, as noted below, CEQA and NEPA address only the impacts of the Project and Alternatives on the environment and not impacts of the environment on the Project and Alternatives. Impacts of the environment on the Project and Alternatives are nonetheless addressed to assist decision-makers in addressing regulatory concerns.

CEQA Significance Criteria

The criteria used to determine the significance of potential geology and soils and mineral resources impacts are based on Appendix G of the CEQA Guidelines. The Project would result in a significant impact under CEQA related to geology, soils, and mineral resources if it would:

GEO-1) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death, involving:

- *a) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault.*
- *b) Strong Seismic ground shaking.*
- *c) Seismic-related ground failure, including liquefaction.*
- *d) Landslides.*

GEO-2) Result in substantial soil erosion or the loss of topsoil.

GEO-3) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse.

GEO-4) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life and property.

GEO-5) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water.

MR-1) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state.

MR-2) Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan.

The following additional significance criteria from the County of Riverside CEQA Environmental Assessment Form are used in the analysis. A project could have potentially significant impacts if it would:

GEO-6) Be subject to geologic hazards, such as seiche, mudflow, or volcanic hazard.

GEO-7) Change topography or ground surface relief features.

GEO-8) Create cut or fill slopes greater than 2:1 or higher than 10 feet.

GEO-9) Result in grading that affects or negates subsurface sewage disposal systems.

GEO-10) Change deposition, siltation, or erosion that may modify the channel of a river or stream or the bed of a lake.

GEO-11) Result in any increase in water erosion either on- or off-site.

GEO-12) Be impacted by or result in an increase in wind erosion and blowsand, either on- or off-site.

GEO-13) Be an incompatible land use located adjacent to a State classified or designated area or existing surface mine.

GEO-14) Expose people or property to hazards from proposed, existing or abandoned quarries or mines.

NEPA Requirements

The potential effects of the proposed Project and Alternatives are analyzed in relation to the baseline conditions (described in Chapter 3). Potential direct and indirect impacts of the Project and Alternatives are analyzed below and discussed as construction-related, operation- and maintenance-related, and decommissioning effects.

Applicable Best Management Practices

As part of the Project and Alternatives, the following applicable BMPs would minimize the environmental impacts to geology and soils. The full BMPs have been detailed below (see also Table 2-4 in Chapter 2) and are further referenced (by number) within the impact discussion.

NUMBER	BMP DESCRIPTION
BMP-1	**Drainage, Erosion, and Sedimentation Control Plan**. As part of the County of Riverside's Conditional Use Permit (CUP) requirements, a Drainage, Erosion, and Sedimentation Control Plan would be developed for the Project. The plan would address the drainage, erosion, and sediment control requirements to support all activities associated with construction, operation, maintenance, and decommissioning of the Project. For example, any stockpiles created would be kept on-site, with an upslope barrier in place to divert runoff. Stockpiles would be sprayed with water, covered with tarpaulins, and/or treated with appropriate dust suppressants, especially in preparation for high wind or storm conditions. Certified weed-free straw bale barriers would be installed to control sediment in runoff water; straw bale barriers would be installed only where sediment-laden water can pond, thus allowing the sediment to settle out. Topsoil from the site would be stripped, stockpiled, and stabilized before excavating earth for facility construction. Topsoil would be segregated and spread on freshly disturbed areas to reduce color contrast and aid rapid revegetation.
BMP-2	**Stormwater Pollution Prevention Plan.** In compliance with requirements of the National Pollutant Discharge Elimination System (NPDES) permit, a Stormwater Pollution Prevention Plan (SWPPP) would be developed and prepared for the Project to ensure that protection of water quality and soil resources is consistent with County and State regulations. The plan would identify site surface water runoff patterns and include measures that prevent excessive and unnatural soil deposition and erosion throughout and downslope of the Project area and Project-related construction areas, and would also include measures for non-stormwater discharge and waste management. The SWPPP would cover all activities associated with the construction of the Project, including clearing, grading, and other ground disturbance such as stockpiling or excavation erosion control. The plan would prevent off-site migration of contaminated stormwater, changes in pre-Project storm hydrographs, or increased soil erosion.
BMP-3	**Fugitive Dust Abatement Plan.** As required by the Mojave Desert Air Quality Management District Rule 403, a Fugitive Dust Abatement Plan would be prepared to address fugitive dust emissions during Project construction, operation, maintenance, and decommissioning. The plan would include measures to minimize fugitive dust emissions from wrecking, excavation, grading, clearing of land, and solid waste disposal operations, and would take every reasonable precaution to prevent visible particulate matter from being deposited upon public roadways as a direct result of operations. During construction, all unpaved roads, disturbed areas (e.g., areas of scraping, excavation, backfilling, grading, and compacting), and loose materials generated during Project construction activities would be watered as frequently as necessary to minimize fugitive dust generation. However, the amount of water will be minimized each time to prevent temporarily ponding water that may occur as a result of the fugitive dust plan. In water-deprived locations, water spraying would be limited to active disturbance areas only, and non-water-based dust control measures would be implemented in areas with intermittent use or use that is not heavy, such as stockpiles or access roads. Alternatively, chemical dust suppressants or durable polymeric soil stabilizers could be used. The dust suppression measures would consider the sensitivity of wildlife to the windborne dispersal of fugitive dust containing dust suppressants and the potential impact on future reclamation.
BMP-11	**Project structures, gen-tie line, and building surfaces.** Project facilities would be sited to ensure that there is adequate space (i.e., setbacks of no less than 100 feet) between solar facilities and natural washes. These setbacks would preserve and maintain the natural washes' hydrological functions. The color and finish of Project structure and building surfaces that are visible to the public will be designed to ensure minimal visual intrusion, contrast, and glare. Grouped structures will be painted the same color to reduce visual complexity and color contrast. Solar panel backs will be color-treated to reduce visual contrast with the landscape setting. Materials, coatings, or paints having little or no reflectivity will be used wherever possible. The visual color contrast of graveled surfaces will be reduced with approved color treatment practices.

Alternative 1: Proposed Project

Analysis of Direct and Indirect Impacts

Construction

The Project area is relatively flat and slopes gently toward the southeast. The PV solar panels proposed for the site can operate on slopes up to nine percent in all directions; therefore, no mass grading would be required. Some of the parcels where facilities and arrays would be located would require light grubbing. Access roads would require minimal grading. After grubbing and light grading, construction of staging

areas would occur. During the three-year construction period, approximately 1,354 acre-feet (AF) of water (or about 451 AF per year) would be required for each year of construction for dust suppression, concrete manufacturing, and fire safety (POWER 2013b).

Demolition of existing site structures (e.g., storage buildings in citrus grove and three residences on the Project area) would be required prior to construction of proposed Project components. Installation of the electrical collection system would require excavations to a depth of about three feet for underground electrical circuits, inverter and switchgear enclosure foundations, and transformer foundation. The O&M building foundations would also be excavated to a depth of about three feet. The O&M buildings would include bathroom facilities serviced by a private septic system and would be designated occupancy classification U[5].

The gen-tie line facilities would include a set of double-circuit tubular steel poles (only one circuit would be strung and the other circuit would be vacant) that are 85 to 125 feet tall with an average tower-to-tower span length of 500 to 800 feet (see Figure 2-7). Structure heights and corresponding span lengths would meet Federal Aviation Administration (FAA) requirements for the nearby Blythe Airport. The suspension poles would typically be four to six feet in diameter. At angle or dead-end points along the gen-tie path, larger poles (approximately six to ten feet in diameter) would be required. The poles would be directly embedded in the soil or set in concrete foundations approximately four to six feet in diameter and 20 to 30 feet deep. Concrete foundations, if used, would typically extend one foot laterally beyond the base of the poles, adding up to two feet to the overall diameter of the permanent footprint of each pole location. Any native soil not used to backfill would be spread around the poles. Although not expected, the use of a backhoe could be necessary in some instances because of specific geologic conditions. Laydown areas would be required for construction of the gen-tie line; ideally, an already disturbed area would be used for this purpose, which will be determined at the onset of construction. The ground disturbing activities related to the preparation for the laydown areas would involve grubbing and some possible light grading. Temporary access roads to each structure would be 12 to 16 feet wide, covered with eight inches of gravel over compacted sub-grade, and within the proposed ROW.

Seismic Hazards

The solar facility, as with the entire Southern California region, is subject to secondary effects from earthquakes. As shown in Table 3.2.6-1, Principal Active Faults, in Chapter 3, the closest active fault to the solar facility is the Brawley Seismic Zone, approximately 57.9 miles from the solar facility. As such, the solar facility would not be within a designated Alquist-Priolo Fault Zone, and there are no known active or potentially active faults underlying the solar facility. Therefore, the potential for surface ground rupture and lurching or cracking of the ground surface at the solar facility is considered low.

While the solar facility would not be within a designated Alquist-Priolo Fault Zone and there are no known active or potentially active faults underlying the Solar facility, severe ground-shaking along the faults identified in Table 3.2.6-1 could result in damage to site structures, including the PV solar panels, inverters/transformers, interior collection power lines, on-site substations, and O&M buildings, as well as the 8.4-mile gen-tie line on BLM-managed lands. Implementation of the proposed Project would not change the intensity of ground shaking that would occur on the solar facility during a seismic event. Potential effects to the solar facility and associated structures related to ground shaking would be reduced through compliance with State and local regulations and standards and established engineering procedures. Future structures would be designed in accordance with the County of Riverside and City of Blythe Building Codes and the most recent CBC and IBC requirements, and would be consistent with the recommendations outlined in a final design level geotechnical report prepared for the proposed Project.

[5] Utility and Miscellaneous Group U: uses intended for structures of an accessory character and not classified in any specific occupancy, 2009 International Building Code, Chapter 3.

Liquefaction/Lateral Spreading

Liquefaction and associated lateral spreading is the phenomenon in which loosely deposited, saturated granular soils (located below the water table), with clay contents (particles less than 0.005 millimeter) of less than 15 percent, a liquid limit of less than 35 percent, and natural moisture content greater than 90 percent of the liquid limit undergo rapid loss of shear strength due to development of excess pore pressure during strong earthquake-induced ground shaking. Ground shaking of sufficient duration results in the loss of grain-to-grain contact due to rapid rise in pore water pressure, and it eventually causes the soil to behave as a fluid for a short period of time. Liquefaction generally occurs in saturated or near-saturated cohesionless soils at depths shallower than approximately 50 feet below grade. Factors known to influence liquefaction potential include composition and thickness of soil layers, grain size, relative density, groundwater level, degree of saturation, and both intensity and duration of ground shaking.

The RCGP, Figure S-3, indicates the site is mapped within a zone described as “moderately susceptible” to liquefaction for areas with deep groundwater. However, borings conducted at Project area indicated that the groundwater is at a depth greater than 50 feet. Therefore, due to the lack of shallow groundwater, liquefaction and seismically induced settlement at the Project area are unlikely.

Landslides/Slope Stability

Landslides may be induced by strong vibratory motion produced by earthquakes. Research and historical data indicate that seismically induced landslides tend to occur in weak soil and rock on sloping terrain. Based on review of the RCGP Figure S-4, on the relatively gentle slopes in areas underlain by alluvium, and on the dense nature of the older alluvium, the potential for seismically induced landslides and debris flows at the site is considered low. In addition, no landslides, debris flows, or rock falls are known to be present on the site.

Preliminary Project plans indicate that the Project boundary would be adjacent to the descending bluff along the eastern site boundary. A review of the RCGP Figure S-5 indicates that this slope has a low to locally moderate susceptibility to seismically induced landslides and rockfalls. However, proposed Project improvements are not anticipated to be constructed on or near the bluff slope. Because the solar facility would be on relatively flat terrain and not subject to landslides, and Project components would not be on or near the bluff slope, the potential for seismically induced landslides and debris flows at the site is considered low.

Soil Erosion

In general, erosion refers to the process by which soil or earth material is loosened or dissolved and removed from its original location. Erosion can occur by varying processes and may occur in the Project area where bare soil (or rock) is exposed to wind or moving water (both rainfall and surface runoff). The processes of erosion are generally functions of material type, terrain steepness, rainfall or irrigation levels, surface drainage conditions, wind velocity, and general land use. According to the geotechnical report prepared for the Project, surface soils on the solar facility generally comprise sand and gravels. Based on the gentle gradients across the site, the potential for water erosion is low. However, portions of the Project area situated along the eastern boundary may be subject to water erosion down the bluff face.

According to the geotechnical report, eolian deposits (wind deposited) and areas of deflation (coarse sand and gravel concentrated due to wind erosion of the fine-grain silts and sands) are present across portions of the Project area. The presence of eolian sand across the Project area indicates that the Project area has been historically subject to moderate to relatively high winds. Based on review of the RCGP Figure S-8, the solar facility and the gen-tie line are moderately to highly susceptible to wind erosion.

Construction of the Project would require ground-disturbing activities, including solar panel installation, substation and O&M buildings and associated septic systems, installation of the gen-tie line in the transmission corridor, and construction of access roads. Disturbed soils accelerate erosion and increase sediment in stormwater runoff to receiving waters, causing increased turbidity and sedimentation.

The soils on the solar facility site would be subject to wind erosion during construction activities. The proposed Project would implement fugitive dust control measures as required under MDAQMD Rule 403 as a matter of regulation.

Subsidence

Subsidence is characterized as a settlement of the ground surface relative to surrounding areas and generally occurs where deep alluvial deposits are present in valley areas. Subsidence in alluvial valley areas is typically associated with groundwater withdrawal or other fluid withdrawal from the subsurface, such as of oil or natural gas. Extraction of these geologic components can cause subsidence, which can result in the development of surface ground cracks and fissures, particularly near valley margins. Cracks and earth fissures can cause damage to improvements, including roads, transmission lines, foundations, and structures. The RCGP Figure S-7 designates the Project area as a "Susceptible Area." Based on the geotechnical report's site reconnaissance, no ground cracks or earth fissures were observed. However, the solar generation site and gen-tie ROW are generally covered with a mantle of eolian sand or active or plowed agricultural fields that may conceal underlying cracks or fissures. Subsidence can also occur as a result of placement of new loads such as new structures or other improvements unless the underlying soils are given appropriate site preparation.

Based on the geotechnical report, the proposed Project is geotechnically feasible. Prior to final Project design and construction, and to address regulatory concerns rather than impacts of the Project on the environment, a site-specific subsurface geotechnical evaluation would be required to assess the potential for subsidence and/or the presence of earth fissures underlying the solar facility.

Based on the geotechnical report, the underlying alluvium is expected to consist of loose to dense layers of silty sands and gravel. Therefore, some settlement of the loose soils underlying the surface is possible.

Expansive Soil

Expansive soils generally result from specific clay minerals that have the capacity to shrink or swell in response to changes in moisture content. Based on review of regional geologic maps and geologic reconnaissance, the deposits underlying the solar generation site and gen-tie ROW consist of granular alluvial deposits (sand and gravel). It is expected that grading recommendations would likely be specified as granular. Therefore, the potential for near-surface expansive soils to adversely affect proposed improvements at the solar facility is considered low. However, the geotechnical report recommends that, prior to final Project design and construction, a site-specific subsurface evaluation be performed to assess the potential for expansive soils so that, to address regulatory concerns rather than impacts of the Project on the environment, appropriate site-specific structural design techniques for both the solar array site and the gen-tie line can be implemented as necessary.

Septic Tanks/Alternative Waste Water Disposal Systems

On-site Wastewater Treatment Systems or Advanced Treatment Units would be installed to treat domestic sewage (non-hazardous liquid waste) from the O&M buildings on-site. Prior to the issuance of a building permit, the Project shall be required to obtain permit approval from DEH to install an On-site Wastewater Treatment Systems or ATU. Additional soils percolation testing shall be required at time of building plan check submittal.

Mineral Resources

The Project area and area in the vicinity of the gen-tie line are not used for mineral production, nor is it under claim, lease, or permit for the production of locatable, leasable, or salable minerals or mineral materials. However, the solar facility site and gen-tie line corridor are underlain by sand and gravel, which potentially could represent a source of saleable minerals or mineral materials if there is a sufficient local demand for construction aggregate.

The fact that the Project would make land unavailable for the life of the Project represents minor potential for an adverse impact on mineral resources for several reasons:

1) Deposits of similar age and lithology that are likewise potential sources of sand and gravel are estimated to underlie a large portion of eastern Riverside County.
2) There is no information to indicate that the sand and gravel underlying the site is unique, of higher quality, or any more marketable than other similar deposits that are widespread throughout eastern Riverside County.
3) There is an existing producer of sand and gravel close to the Blythe Landfill, which likely would be able to serve local future demand for sand and gravel.
4) Following the decommissioning of the Project, the land previously occupied by the Project would again be as available for exploration or production of aggregate construction materials as it is currently.

The Project and gen-tie line would not block or otherwise impair access to a major public roadway. The presence of the Project would not prevent permitted prospectors or owners of mineral leases in the surrounding region from accessing areas outside the footprint of the Project, such as the McCoy Mountains, because there are other routes available to access the surrounding mountains.

Seiche, Mudflow or Volcanic Hazard

There are no bodies of constant water in proximity to the Project area, and the site is not near the shoreline or within 50 feet of sea level; therefore, hazards from a seiche or tsunami are considered to be negligible. There are no hillside areas within the Project vicinity that would generate mudflow. In addition, no known active volcanic features occur in the Project area.

Operation and Maintenance

As stated above, the solar facility would be in a seismically active region, and people and structures associated with the Project could be exposed to seismic ground shaking and subsequent seismic-related ground failure.

Operation and maintenance activities could include daily operations and routine maintenance activities, such as PV panel washing, which are anticipated to occur up to two times per year, if necessary, to optimize output. Cleaning of the panels would require up to 345 AF/year[6]. Cleaning operations would not alter the drainage patterns on-site, and would not lead to a substantial increase in erosion or loss of topsoil. Any surface water runoff resulting from permanent Project features is not anticipated to influence surface runoff in a manner that would result in erosion or loss of topsoil.

Operation and maintenance vehicles would include trucks (pickup and flatbed), forklifts, and loaders for routine and unscheduled maintenance and water trucks for solar panel washing. Large, heavy-haul transport equipment may be brought to the solar facility infrequently for equipment repair or replacement. Due to the infrequent and temporary nature of operation and maintenance activities, no substantial erosion or loss of topsoil is anticipated.

The O&M buildings would include bathroom facilities serviced by a private septic system and would be designated occupancy classification U. The septic system would be placed in soils capable of adequately supporting the septic system as required by local permitting; therefore, operation of the septic system would not adversely affect soil resources.

Decommissioning

Decommissioning and dismantling activities could include recovering the silicon from the solar panels, reselling the aluminum, and recycling the glass. Other components of the solar installation, such as the

[6] The operational water needs would be further refined pre-construction.

tracker structures and mechanical assemblies, can also be recycled, as they are made from galvanized steel. Equipment such as drive controllers, inverters, transformers, and switchgear can be either reused or their components recycled. The equipment pads would be made of concrete, which can be crushed and recycled. Underground conduit and wire can be removed by uncovering trenches and backfilling when done. The electrical wiring would be made of copper and/or aluminum and can be reused or recycled, as well. The 230 kV gen-tie line would also be dismantled and its material recycled. Because areas subject to decommissioning would have been disturbed during construction, no additional direct (at the time of decommissioning) or indirect (in the future after decommissioning is completed) effects to geological/soil resources within the Project area are anticipated during decommissioning of the proposed Project.

As stated above, the solar facility and gen-tie line would be in a seismically active region, and people and structures could be exposed to seismic ground shaking and subsequent seismic-related ground failure. These potentially significant impacts have been addressed above, and the regulatory requirements put in place prior to final Project design and construction would minimize any potential effects to geological/soil resources during decommissioning activities.

Application of CEQA Significance Thresholds

The solar facility would be in a seismically active region, and people and structures could be exposed to seismic ground shaking. In addition, impacts related secondary seismic effects, including liquefaction and liquefaction-induced settlement, may be potentially significant. However, geotechnical design considerations for structures shall be in accordance with applicable requirements of the 2010 CBC, the County of Riverside Municipal Code, and any applicable building and seismic codes in effect at the time the grading plans are approved. Additionally, with implementation of Mitigation Measure Geology-1, impacts would be considered less than significant during construction, operation, maintenance, and decommissioning.

GEO-1) Would the Project expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death, involving:

a) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault.
b) Strong Seismic ground shaking.
c) Seismic-related ground failure, including liquefaction.
d) Landslides.

The solar facility would be in a seismically active region, and people and structures could be exposed to seismic ground shaking. Implementation of Mitigation Measure Geology-1 requires subsequent geotechnical work to determine site specific parameters for foundation design and engineering. Implementation of Mitigation Measure Geology-3 would require the removal of loose soil layers and replacement with compacted fill or specialized foundation design, including the use of deep foundation systems, if appropriate, to help support structures. With implementation of Mitigation Measures Geology-1 and Geology-3, impacts would be reduced to less than significant levels.

GEO-2) Would the Project result in substantial soil erosion or the loss of topsoil?

Implementation of the proposed Project would result in both short-term, construction-related wind and water erosion related to Project operation and maintenance activities if not managed appropriately. Cleaning operations would not alter the drainage patterns on-site, and would not lead to a substantial increase in erosion or loss of topsoil. Any surface water runoff resulting from permanent Project features is not anticipated to influence surface runoff in a manner that would result in erosion or loss of topsoil. As part of the proposed Project, a Drainage, Erosion, and Sedimentation Control Plan (BMP-1) would be implemented, which would identify site surface water runoff patterns; develop mitigation measures that prevent excessive, unnatural

soil deposition and erosion throughout and downslope of the Project area and Project-related construction areas; minimize impacts related to soil erosion during construction; and protect soil resources consistent with City, County, and State regulations. Also as part of the proposed Project, a SWPPP (BMP-2) would be implemented, which would prevent excessive and unnatural soil deposition and erosion throughout and downslope of the Project area and Project-related construction areas, and would also include measures for non-stormwater discharge and waste management. Impacts would be less than significant for construction, operation, maintenance, and decommissioning.

GEO-3) Would the Project be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?

The underlying alluvium is expected to consist of loose to dense layers of silty sands and gravel, and some settlement of the loose soils underlying the surface is possible. This potentially significant impact would be reduced to a level considered less than significant with implementation of Mitigation Measures Geology-1 through Geology 4.

Seismic ground-shaking impacts resulting in on- or off-site landslides and lateral spreading are considered less than significant during construction, operation, maintenance, and decommissioning, and no mitigation measures are recommended.

GEO-4) Would the Project be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life and property?

The potential for expansive soils to be encountered on the solar facility site and in the vicinity of the gen-tie line is considered low; however, implementation of Mitigation Measure Geology-4 would reduce any significant impacts during construction to a level considered less than significant. No impacts are anticipated during operation and decommissioning, as Project design and construction would minimize any potential effects to geological/soil resources.

GEO-5) Would the Project have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?

The proposed Project would require the use of a septic tank system on the solar facility site to treat domestic wastewater from the two O&M buildings. Preliminary soils percolation testing (POWER Engineers: 123128 Percolation Test Report dated October 5, 2012) showed soils ranging from poorly graded, fine to medium grained, loose to medium dense sand with a trace of silt indicating that the proposal for an on-site wastewater treatment system or advanced treatment unit is feasible. Construction-related impacts from the septic system would be considered less than significant with implementation of Mitigation Measure Geology-3. No operation or decommissioning impacts are anticipated.

GEO-6) Would the Project be subject to geologic hazards, such as seiche, mudflow, or volcanic hazard?

There are no bodies of constant water in proximity to the Project area, and the site is not near the shoreline or within 50 feet of sea level; therefore, hazards from a seiche or tsunami are considered to be negligible. There are no hillside areas within the Project vicinity that would generate mudflow. In addition, no known active volcanic features occur in the Project area. No impacts would occur and no mitigation is recommended.

GEO-7) Would the Project change topography or ground surface relief features?

The Project boundary would be adjacent to the descending bluff along the eastern site boundary. The proposed Project improvements are not anticipated to be constructed on or near the bluff slope. Since most of the site has nearly level to gently sloping topography, no mass grading would be required. Because the solar facility would be on relatively flat terrain and

Project components would not be on or near the bluff slope, implementation of the proposed Project would not significantly change site topography or ground surface relief features. Construction would not substantially grade, excavate, or cut and fill slopes greater than 2:1 or higher than 10 feet. No impact.

GEO-8) Would the Project create cut or fill slopes greater than 2:1 or higher than 10 feet?

As discussed above in GEO-7, the proposed Project would be located on relatively flat terrain and would not be located on or near the bluff slope; therefore no significant change in site topography or ground surface relief features. No impact.

GEO-9) Would the Project result in grading that affects or negates subsurface sewage disposal systems?

Implementation of the Project would require the removal of three residences within the Project area that may have septic systems to treat domestic wastewater. These septic systems would be removed prior to Project construction under permit with the County of Riverside, Department of Environmental Health. In addition, the proposed Project would not require extensive grading. Impacts would be less than significant.

GEO-10) Would the Project change deposition, siltation, or erosion that may modify the channel of a river or stream or the bed of a lake?

Although on-site grading would be minimized, construction of the proposed facilities, including roads, fencing, and solar arrays, could result in deposition, siltation, or erosion to on-site drainages; such changes could result in altered runoff and erosional processes on-site, which could lead to increased erosion and sedimentation on-site or downstream. Project construction, operation, maintenance, and decommissioning may result in potentially significant impacts to surface and stormwater quality. With implementation of Mitigation Measures Hydrology-1 through Hydrology-4 in Section 4.2.9, *Hydrology and Water Quality*, impacts would be reduced to less than significant levels.

GEO-11) Would the Project result in any increase in water erosion either on- or off-site?

See GEO-6 above. The soils on the Project area would be subject to wind and water erosion during construction activities. The proposed Project would implement fugitive dust control measures as required under MDAQMD Rule 403 as a matter of regulation. Further, as part of the proposed Project, a Drainage, Erosion, and Sedimentation Control Plan (BMP-1) would be implemented, which would minimize impacts related to water erosion during construction. The Drainage, Erosion, and Sedimentation Control Plan would protect soil resources consistent with City, County, and State regulations. The plan will identify site surface water runoff patterns and develop mitigation measures that prevent excessive and unnatural soil deposition and erosion throughout and downslope of the Project area and Project-related construction areas. Also as part of the proposed Project, a SWPPP (BMP-2) would be implemented, which would prevent excessive and unnatural soil deposition and erosion throughout and downslope of the Project area and Project-related construction areas, and would also include measures for non-stormwater discharge and waste management. The SWPPP would also prevent off-site migration of contaminated stormwater, changes in pre-Project storm hydrographs, or increased soil erosion. Impacts would be less than significant; no mitigation is recommended.

GEO-12) Would the Project be impacted by or result in an increase in wind erosion and blowsand, either on- or off-site?

See analysis for GEO-11 above. Impacts would be less than significant

MR-1) Would the Project result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?

Based on the RCGP Figure OS-5, Mineral Resource Area, the proposed Project would be within the State of California-designated Mineral Resources Zone (MRZ) Classification of MRZ-

4, which is defined as an area where there is not enough information available to determine the presence or absence of mineral deposits. Therefore, the Project would not result in the loss of availability of a known mineral resource classified by the State, and there would be no impact.

MR-2) Would the Project result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?

The proposed Project area is not delineated in the PVVAP or RCGP as a locally important mineral resource recovery site; therefore, the loss of availability of a delineated locally important mineral resource recovery site would not occur. There would be no impact.

MR-3) Would the Project be an incompatible land use located adjacent to a State classified or designated area or existing surface mine?

Because there are other major roadways within the Project area, the Project would not prevent permitted prospectors or owners of mineral leases in the surrounding region from accessing areas outside the footprint of the Project, such as the McCoy Mountains. Therefore, the Project would not be an incompatible land use with a State-classified or designated area for mining operations. No impact would occur.

MR-4) Would the Project expose people or property to hazards from proposed, existing or abandoned quarries or mines?

The Project area is not used for mineral production, nor is it under claim, lease, or permit for the production of locatable, leasable, or salable minerals or mineral materials. The Project would not expose people or property to hazards from proposed, existing, or abandoned quarries or mines. No impact would occur.

Alternative 2: No Project Alternative

Alternative 2, the No Project Alternative, assumes that the Project would not be constructed. Under this Alternative, no federal approval would be required, as no BLM-managed land would be crossed. Continuation of existing land uses would be expected based on the current General Plan and land use ordinance designations. Potential geologic resources in the affected environment, including highly erosion-sensitive soils, would not be impacted by construction, operation and maintenance, and decommissioning of the Project.

The baseline conditions associated with geologic and soil resources would continue under the No Project Alternative.

Alternative 3: Northern Alternative 230 kV Gen-tie Line Location

Alternative 3 would be similar to Alternative 1, with the exception of the location of the proposed 230 kV gen-tie line. Alternative 3's gen-tie line would cause the same types of geologic and soil resource-related impacts as the proposed Project's gen-tie line, although the location of the impacts associated with this Alternative would be shifted to the north relative to the proposed Project's gen-tie line. Alternative 3's gen-tie line would be slightly longer than the proposed Project's gen-tie line. Consequently, activities associated with construction, operation, maintenance, and decommissioning of this Alternative would affect or occupy a slightly larger area of potential geologic and soil resources. Nonetheless, there would be no substantial difference between impacts related to Alternative 3's gen-tie line and the proposed Project's gen-tie line.

Application of CEQA Significance Thresholds

GEO-1) Would Alternative 3 expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death, involving:

a) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault.
b) Strong Seismic ground shaking.
c) Seismic-related ground failure, including liquefaction.
d) Landslides.

The solar facility would be in a seismically active region, and people and structures could be exposed to seismic ground shaking. Potentially significant impacts related to secondary seismic effects, including liquefaction and liquefaction-induced settlement, would be reduced to less than significant with implementation of Mitigation Measure Geology-1.

GEO-2) Would Alternative 3 result in substantial soil erosion or the loss of topsoil?

Implementation of Alternative 3 would result in both temporary, construction-related wind and water erosion and wind and water erosion related to operation and maintenance over the life of Alternative 3 if not managed appropriately. However, as part of Alternative 3, a Drainage, Erosion, and Sedimentation Control Plan (BMP-1) and SWPPP (BMP-2) would be implemented. The Drainage, Erosion, and Sedimentation Control Plan would protect soil resources consistent with City, County, and State regulations. The plan will identify site surface water runoff patterns and develop mitigation measures that prevent excessive and unnatural soil deposition and erosion throughout and downslope of the Alternative 3 site and Alternative 3-related construction areas. Impacts would be less than significant. Impacts would also be less than significant during decommissioning.

GEO-3) Would Alternative 3 be located on a geologic unit or soil that is unstable, or that would become unstable as a result of Alternative 3, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?

The underlying alluvium is expected to consist of loose to dense layers of silty sands and gravel, and some settlement of the loose soils underlying the surface is possible. This potentially significant impact would be reduced to a level considered less than significant with implementation of Mitigation Measure Geology-1.

Seismic ground-shaking impacts resulting in on- or off-site landslides and lateral spreading are considered less than significant during construction, operation, maintenance, and decommissioning, and no mitigation measures are recommended.

GEO-4) Would Alternative 3 be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life and property?

The potential for expansive soils to be encountered on the solar facility site is considered low; however, implementation of Mitigation Measure Geology-1 would reduce any significant impacts during construction to a level considered less than significant. No impacts are anticipated during operation and decommissioning, as Alternative 3 design and construction would minimize any potential effects to geologic and soil resources.

GEO-5) Would Alternative 3 have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?

Alternative 3 would require the use of a septic tank system on the solar facility site to treat domestic wastewater from the two O&M buildings. Preliminary soils percolation testing (POWER Engineers: 123128 Percolation Test Report dated October 5, 2012) showed soils ranging from poorly graded, fine to medium grained, loose to medium dense sand with a trace of silt indicating that the proposal for an on-site wastewater treatment system or advanced treatment unit is feasible. Construction-related impacts from the septic system would be considered less than significant with implementation of Mitigation Measure Geology-2. No operation or decommissioning impacts are anticipated.

GEO-6) Would Alternative 3 be subject to geologic hazards, such as seiche, mudflow, or volcanic hazard?

There are no bodies of constant water in proximity to the Alternative 3 site, and the site is not near the shoreline or within 50 feet of sea level; therefore, hazards from a seiche or tsunami are considered to be negligible. There are no hillside areas within the Alternative 3 vicinity that would generate mudflow. In addition, no known active volcanic features occur in the Alternative 3 area. No impacts would occur and no mitigation is recommended.

GEO-7) Would Alternative 3 change topography or ground surface relief features?

The Alternative 3 boundary would be adjacent to the descending bluff along the eastern site boundary. Alternative 3 improvements are not anticipated to be constructed on or near the bluff slope. Since most of the site has nearly level to gently sloping topography, no mass grading would be required. Because the solar facility would be on relatively flat terrain and Alternative 3 components would not be on or near the bluff slope, implementation of Alternative 3 would not significantly change site topography or ground surface relief features. Construction would not substantially grade, excavate, or cut and fill slopes greater than 2:1 or higher than 10 feet. No mitigation is recommended.

GEO-8) Would Alternative 3 create cut or fill slopes greater than 2:1 or higher than 10 feet?

See GEO-7 analysis above.

GEO-9) Would Alternative 3 result in grading that affects or negates subsurface sewage disposal systems?

Implementation of Alternative 3 would require the removal of three residences within the Alternative 3 site that may have septic systems to treat domestic wastewater. These septic systems would be removed prior to Alternative 3 construction. In addition, Alternative 3 would not require extensive grading. Impacts would be less than significant.

GEO-10) Would Alternative 3 change deposition, siltation, or erosion that may modify the channel of a river or stream or the bed of a lake?

Although on-site grading would be minimized, construction of the proposed facilities, including roads, fencing, and solar arrays, could result in deposition, siltation, or erosion to on-site drainages; such changes could result in altered runoff and erosional processes on-site, which could lead to increased erosion and sedimentation on-site or downstream. Alternative 3's construction, operation, maintenance, and decommissioning may result in potentially significant impacts to surface and stormwater quality. With implementation of Mitigation Measures Hydrology-1 through Hydrology-4 in Section 4.2.9, *Hydrology and Water Quality*, impacts would be reduced to less than significant levels.

GEO-11) Would Alternative 3 result in any increase in water erosion either on- or off-site?

See GEO-6 analysis above. The soils on the Alternative 3 site would be subject to wind and water erosion during construction activities. Alternative 3 would implement fugitive dust control measures as required under MDAQMD Rule 403 as a matter of regulation. As previously described, a Drainage, Erosion, and Sedimentation Control Plan (BMP-1) and SWPPP (BMP-2) would be implemented as part of Alternative 3. The Drainage, Erosion, and Sedimentation Control Plan would protect soil resources consistent with City, County, and State regulations. The plan will identify site surface water runoff patterns and develop mitigation measures that prevent excessive and unnatural soil deposition and erosion throughout and downslope of the Alternative 3 site and related construction areas. The SWPPP would also prevent off-site migration of contaminated stormwater, changes in pre-Project storm hydrographs, or increased soil erosion. Impacts would be less than significant. No further mitigation is required.

GEO-12) Would Alternative 3 be impacted by or result in an increase in wind erosion and blowsand, either on- or off-site?

See GEO-11 analysis above.

MR-1) Would Alternative 3 result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?

Based on the RCGP Figure OS-5, Mineral Resource Area, the proposed Project would be within the State of California-designated MRZ Classification of MRZ-4, which is defined as an area where there is not enough information available to determine the presence or absence of mineral deposits. Alternative 3 would not result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state. No impacts would occur.

MR-2) Would Alternative 3 result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?

The proposed Project area is not delineated in the PVVAP or RCGP as a locally important mineral resource recovery site; therefore, the loss of availability of a delineated locally important mineral resource recovery site would not occur. Alternative 3 would not result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan. No impacts would occur.

MR-3) Would Alternative 3 be an incompatible land use located adjacent to a State classified or designated area or existing surface mine?

Because there are other major roadways within the Alternative 3 area, Alternative 3 would not prevent permitted prospectors or owners of mineral leases in the surrounding region from accessing areas outside the footprint of Alternative 3, such as the McCoy Mountains. Therefore, Alternative 3 would not be an incompatible land use with a State-classified or designated area for mining operations. No impact would occur.

MR-4) Would Alternative 3 expose people or property to hazards from proposed, existing or abandoned quarries or mines?

The Alternative 3 site is not used for mineral production, nor is it under claim, lease, or permit for the production of locatable, leasable, or salable minerals or mineral materials. Alternative 3 would not expose people or property to hazards from proposed, existing, or abandoned quarries or mines. No impact would occur.

Alternative 4: Southern Alternative 230 kV Gen-tie Line Location

Alternative 4 would be similar to Alternative 1, with the exception of the location of the proposed 230 kV gen-tie line. Although the location of the impacts associated with this Alternative would be shifted to the south, Alternative 4's gen-tie line would cause the same types of geologic and soil resource-related impacts as the proposed Project's gen-tie line. Alternative 4's gen-tie line would be longer than the proposed Project's gen-tie line. Consequently, activities associated with construction, operation, maintenance, and decommissioning of this Alternative would affect or occupy a slightly larger area of potential geologic and soil resources. Nonetheless, there would be no substantial difference in impacts between Alternative 4's gen-tie line and the proposed Project's gen-tie line.

Application of CEQA Significance Thresholds

Under Alternative 4, the implementation of mitigation measures would reduce impacts to less than significant.

GEO-1) Would Alternative 4 expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death, involving:

a) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault.
b) Strong Seismic ground shaking.
c) Seismic-related ground failure, including liquefaction.
d) Landslides.

The solar facility would be in a seismically active region, and people and structures could be exposed to seismic ground shaking. Potentially significant impacts related to secondary seismic effects, including liquefaction and liquefaction-induced settlement, would be reduced to less than significant with implementation of Mitigation Measure Geology-1.

GEO-2) Would Alternative 4 result in substantial soil erosion or the loss of topsoil?

Implementation of Alternative 4 would result in both short-term, construction-related wind and water erosion, and wind and water erosion related to long-term operation and maintenance activities if not managed appropriately. Implementation of Alternative 4 would result in both temporary, construction-related wind and water erosion and wind and water erosion related to operation and maintenance over the life of Alternative 4. However, as part of Alternative 4, a Drainage, Erosion, and Sedimentation Control Plan (BMP-1) and SWPPP (BMP-2) would be implemented. The Drainage, Erosion, and Sedimentation Control Plan would protect soil resources consistent with City, County, and State regulations. The plan will identify site surface water runoff patterns and develop mitigation measures that prevent excessive and unnatural soil deposition and erosion throughout and downslope of the Alternative 4 site and related construction areas. Impacts would be less than significant. Impacts would also be less than significant during decommissioning.

GEO-3) Would Alternative 4 be located on a geologic unit or soil that is unstable, or that would become unstable as a result of Alternative 4, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?

The underlying alluvium is expected to consist of loose to dense layers of silty sands and gravel, and some settlement of the loose soils underlying the surface is possible. This potentially significant impact would be reduced to a level considered less than significant with implementation of Mitigation Measure Geology-1.

Seismic ground-shaking impacts resulting in on- or off-site landslides and lateral spreading are considered less than significant during construction, operation, maintenance, and decommissioning, and no mitigation measures are recommended.

GEO-4) Would Alternative 4 be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life and property?

The potential for expansive soils to be encountered on the solar facility site is considered low; however, implementation of Mitigation Measure Geology-1 would reduce any significant impacts during construction to a level considered less than significant. No impacts are anticipated during operation and decommissioning, as Alternative 4 design and construction would minimize any potential effects to geological/soil resources.

GEO-5) Would Alternative 4 have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?

Alternative 4 would require the use of a septic tank system on the solar facility site to treat domestic wastewater from the two O&M buildings. Preliminary soils percolation testing (POWER Engineers: 123128 Percolation Test Report dated October 5, 2012) showed soils

ranging from poorly graded, fine to medium grained, loose to medium dense sand with a trace of silt indicating that the proposal for an on-site wastewater treatment system or advanced treatment unit is feasible. Construction-related impacts from the septic system would be considered less than significant with implementation of Mitigation Measure Geology-2. No operation or decommissioning impacts are anticipated.

GEO-6) Would Alternative 4 be subject to geologic hazards, such as seiche, mudflow, or volcanic hazard?

There are no bodies of constant water in proximity to the Alternative 4 site, and the site is not near the shoreline or within 50 feet of sea level; therefore, hazards from a seiche or tsunami are considered to be negligible. There are no hillside areas within the Alternative 4 vicinity that would generate mudflow. In addition, no known active volcanic features occur in the Alternative 4 area. No impacts would occur and no mitigation is recommended.

GEO-7) Would Alternative 4 change topography or ground surface relief features?

The Alternative 4 boundary would be adjacent to the descending bluff along the eastern site boundary. Alternative 4 improvements are not anticipated to be constructed on or near the bluff slope. Since most of the site has nearly level to gently sloping topography, no mass grading would be required. Because the solar facility would be on relatively flat terrain and Alternative 4 components would not be on or near the bluff slope, implementation of Alternative 4 would not significantly change site topography or ground surface relief features. Construction would not substantially grade, excavate, or cut and fill slopes greater than 2:1 or higher than 10 feet. No mitigation is recommended.

GEO-8) Would Alternative 4 create cut or fill slopes greater than 2:1 or higher than 10 feet?

As discussed above in GEO-7, the proposed Project would be located on relatively flat terrain and would not be located on or near the bluff slope; therefore no significant change in site topography or ground surface relief features. No impact.

GEO-9) Would Alternative 4 result in grading that affects or negates subsurface sewage disposal systems?

Implementation of Alternative 4 would require the removal of three residences within the Alternative 4 site that may have septic systems to treat domestic wastewater. These septic systems would be removed prior to Alternative 4 construction in accordance with local permit requirements. In addition, Alternative 4 would not require extensive grading. Impacts would be less than significant.

GEO-10) Would Alternative 4 change deposition, siltation, or erosion that may modify the channel of a river or stream or the bed of a lake?

Although on-site grading would be minimal, construction of the proposed facilities, including roads, fencing, and solar arrays, could result in deposition, siltation, or erosion to on-site drainages; such changes could result in altered runoff and erosional processes on-site, which could lead to increased erosion and sedimentation on-site or downstream. Alternative 4's construction, operation, maintenance, and decommissioning may result in potentially significant impacts to surface and stormwater quality. With implementation of Mitigation Measures Hydrology-1 through Hydrology-4 in Section 4.2.9, *Hydrology and Water Quality*, impacts would be reduced to less than significant levels.

GEO-11) Would Alternative 4 result in any increase in water erosion either on- or off-site?

See GEO-6 above. The soils on the Alternative 4 site would be subject to wind and water erosion during construction activities. Alternative 4 would implement fugitive dust control measures as required under MDAQMD Rule 403 as a matter of regulation. As previously described, a Drainage, Erosion, and Sedimentation Control Plan (BMP-1) and SWPPP (BMP-2) would be implemented as part of Alternative 4. The Drainage, Erosion, and Sedimentation

Control Plan would protect soil resources consistent with City, County, and State regulations. The plan will identify site surface water runoff patterns and develop mitigation measures that prevent excessive and unnatural soil deposition and erosion throughout and downslope of the Alternative 4 site and related construction areas. The SWPPP would also prevent off-site migration of contaminated stormwater, changes in pre-Project storm hydrographs, or increased soil erosion. Impacts would be less than significant. No further mitigation is required.

GEO-12) Would Alternative 4 be impacted by or result in an increase in wind erosion and blowsand, either on- or off-site?

See GEO-11 above. Impacts would be less than significant.

MR-1) Would Alternative 4 result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?

Based on the RCGP Figure OS-5, Mineral Resource Area, the proposed Project would be within the State of California-designated MRZ Classification of MRZ-4, which is defined as an area where there is not enough information available to determine the presence or absence of mineral deposits. Alternative 4 would not result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state. No impacts would occur.

MR-2) Would Alternative 4 result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?

Alternative 4 would not result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan. No impacts would occur.

MR-3) Would Alternative 4 be an incompatible land use located adjacent to a State classified or designated area or existing surface mine?

Because there are other major roadways within the Alternative 4 area, Alternative 4 would not prevent permitted prospectors or owners of mineral leases in the surrounding region from accessing areas outside the footprint of Alternative 4, such as the McCoy Mountains. Therefore, Alternative 4 would not be an incompatible land use with a State-classified or designated area for mining operations. No impact would occur.

MR-4) Would Alternative 4 expose people or property to hazards from proposed, existing or abandoned quarries or mines?

The Alternative 4 site is not used for mineral production, nor is it under claim, lease, or permit for the production of locatable, leasable, or salable minerals or mineral materials. Alternative 4 would not expose people or property to hazards from proposed, existing, or abandoned quarries or mines. No impact would occur.

Alternative 5: Reduced Acreage Alternative

Similar to Alternative 1, Alternative 5 would include the construction, operation, maintenance, and decommissioning of a solar facility and associated infrastructure. The primary difference between Alternatives 1 and 5 is the absence of solar facility development north of I-10, which would reduce electrical output from a 485 MW down to a 315 MW alternating current solar PV facility. The Reduced Acreage Alternative would be on a reduced footprint of approximately 2,476 acres (from 3,660 acres for the proposed Project). Alternative 5 would include approximately 2,403 acres for the solar field. Similar to the proposed Project, 73 acres would be utilized for the 230 kV gen-tie line. In comparison to Alternative 1, Alternative 5 would eliminate one on-site substation and one O&M building and would have one access

point (planned on Seeley Avenue). The Reduced Acreage Alternative would also no longer extend a 230 kV overhead gen-tie line from an on-site substation north of I-10, as this Alternative would not be developed on land north of I-10. Instead, this Alternative would construct an approximately 7.8-mile-long, 230 kV overhead gen-tie line from the proposed on-site substation south of I-10 to the approved Colorado River Substation. Approximately three miles of the gen-tie line would be within the solar facility. Alternative 5 would avoid impacts that would result from the construction, operation, maintenance, and decommissioning of a solar development north of I-10; however, continuation of existing land uses in this area would be expected based on the current General Plan and land use ordinance designations. Potential geologic resources in the affected environment, including highly erosion-sensitive soils, would not be impacted by construction, operation and maintenance, and decommissioning of a solar project north of I-10. The baseline conditions associated with geologic and soil resources north of I-10 would continue under Alternative 5.

The Reduced Acreage Alternative solar facility and a portion of the gen-tie line would be within the jurisdiction of the County of Riverside but not within the City limits of Blythe in comparison to the proposed Project. Alternative 5 would need to comply with the RCGP (2003) and PVVAP (2008). The remaining portion of the gen-tie line would traverse lands managed by the BLM and would need to comply with the CDCA Plan. The construction, operation, maintenance, and decommissioning of Alternative 5 would not exceed the impacts to geology and soils identified under the Alternative 1 analysis. Therefore, the Alternative 1 analysis would be applicable to Alternative 5, outside of those differences identified in the discussion below.

Analysis of Direct and Indirect Impacts

Construction

The construction of Alternative 5 would be similar to that of Alternative 1, with the exclusion of solar development north of I-10. Due to a reduced solar facility footprint under Alternative 5, the projected construction water requirements ([non-potable] used for dust suppression, concrete manufacturing, and fire safety) would be reduced below those estimated under Alternative 1.

Seismic Hazards

Seismic hazards related to Alternative 5 development would be similar to those under Alternative 1. The analysis under Alternative 1 would apply. The solar facility, as with the entire Southern California region, is subject to secondary effects from earthquakes. The closest active fault to the solar facility is the Brawley Seismic Zone. Severe ground shaking along the faults could result in damage to site structures, including the PV solar panels, inverters/transformers, interior collection power lines, the two on-site substations, and one O&M building, as well as the 7.8-mile gen-tie line. Implementation of Alternative 5 would not change the intensity of ground shaking that would occur on the solar facility during a seismic event.

Liquefaction

The RCGP indicates the Alternative 1 site is mapped within a zone described as “moderately susceptible” to liquefaction for areas with deep groundwater. As the Alternative 5 development footprint would fall within this area, the analysis for Alternative 1 would apply.

Landslides/Slope Stability

Preliminary Project plans indicate that the Alternative 1 Project boundary would be adjacent to the descending bluff along the eastern site boundary. A review of the RCGP Figure S-5 indicates that this slope has a low to locally moderate susceptibility to seismically induced landslides and rockfalls. However, Alternative 1 improvements are not anticipated to be constructed on or near the bluff slope. Because the Alternative 1 solar facility would be on relatively flat terrain and not subject to landslides, and Alternative 1 Project components would not be on or near the bluff slope, the potential for seismically induced landslides and debris flows at the site is considered low. As Alternative 5 would eliminate

development north of I-10, which also represents the eastern limits of Alternative 1, the potential for seismically induced landslides and debris flows at the site is considered even lower.

Soil Erosion

According to the geotechnical report prepared for the Project area, surface soils on the solar facility are generally comprised of sands and gravels. Based on the gentle gradients across the site, the potential for water erosion is low. However, portions of the site situated along the eastern boundary may be subject to water erosion down the bluff face. With implementation of Alternative 5, the area north of I-10, which also represents the eastern boundary, would not be developed. The remaining developed area of Alternative 5 would be similar to that of Alternative 1; as such, the Alternative 1 analysis would apply.

Subsidence/Lateral Spreading

RCGP Figure S-7 designates the Alternative 1 Project area as a "Susceptible Area." As the Alternative 5 development footprint is in the Alternative 1 Project area, the analysis under Alternative 1 would apply.

Expansive Soil

Based on a review of regional geologic maps and geologic reconnaissance, the deposits underlying the Alternative 1 solar generation site and gen-tie ROW consist of granular alluvial deposits (sands and gravels) with a low clay component which is generally not susceptible to expansion. This would also apply to Alternative 5, as the Alternative 5 footprint falls within the same areas as Alternative 1, with the exception of solar facility development north of I-10. Therefore, the same analysis for Alternative 1 would be applicable to Alternative 5.

Septic Tanks/Alternative Waste Water Disposal Systems

Alternative 5 would require the use of a septic tank system on the solar facility to treat domestic wastewater from one O&M building proposed to be adjacent to the solar facility. Alternative 5 would require a septic system permit from the Riverside County Department of Environmental Health Services prior to the installation of the septic system on the solar facility site.

Mineral Resources

Alternative 5 would make land unavailable for mineral extraction during the life of the Project on the solar facility site south of I-10. This would represent a minor potential for an adverse impact on mineral resources for several reasons:

1) Deposits of similar age and lithology that are likewise potential sources of sand and gravel are estimated to underlie a large portion of eastern Riverside County.
2) There is no information to indicate that the sand and gravel underlying the site is unique, of higher quality, or any more marketable than other similar deposits that are widespread throughout eastern Riverside County.
3) There is an existing producer of sand and gravel close to the Blythe Landfill, which likely would be able to serve local future demand for sand and gravel.
4) Following the decommissioning of Alternative 5, the land previously occupied by Alternative 5 would again be as available for exploration or production of aggregate construction materials as it is currently.

Alternative 5 and the associated gen-tie line would not block or otherwise impair access to a major public roadway. The presence of Alternative 5 would not prevent permitted prospectors or owners of mineral leases in the surrounding region from accessing areas outside the footprint of Alternative 5, such as the McCoy Mountains, because there are other routes available to access the surrounding mountains.

Seiche, Mudflow or Volcanic Hazard

There are no bodies of constant water in proximity to the Alternative 5 site, and the site is not near the shoreline or within 50 feet of sea level; therefore, hazards from a seiche or tsunami are considered to be negligible. Refer to the analysis for Alternative 1.

Operation and Maintenance

Similar to Alternative 1, and as stated above, the Alternative 5 solar facility would be in a seismically active region, and people and structures associated with Alternative 5 could be exposed to seismic ground shaking and subsequent seismic-related ground failure. The analysis for Alternative 1 would apply. Cleaning of the panels would require fewer AF/year under Alternative 5 as compared to Alternative 1. Cleaning operations would not alter the drainage patterns on-site, and would not lead to a substantial increase in erosion or loss of topsoil. Any surface water runoff resulting from permanent Alternative 5 features is not anticipated to influence surface runoff in a manner that would result in erosion or loss of topsoil.

The one O&M building under Alternative 5 would include a bathroom facility serviced by a private septic system and would be designated occupancy classification U. The septic system would be placed in soils capable of adequately supporting the septic system; therefore, operation of the septic system would not adversely affect soil resources.

Decommissioning

Because areas subject to decommissioning would have been disturbed during construction, no additional direct (at the time of decommissioning) or indirect (in the future after decommissioning is completed) effects to geologic and soil resources within the Alternative 5 area are anticipated during decommissioning of Alternative 5.

As stated above, the solar facility and gen-tie line would be in a seismically active region, and people and structures could be exposed to seismic ground shaking and subsequent seismic-related ground failure. These potentially significant impacts have been addressed above, and the regulatory requirements put in place prior to final design and construction would minimize any potential effects to geologic and soil resources during decommissioning activities.

Application of CEQA Significance Thresholds

GEO-1) Would Alternative 5 expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death, involving:

a) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault.
b) Strong Seismic ground shaking.
c) Seismic-related ground failure, including liquefaction.
d) Landslides.

The Alternative 5 solar facility would be in a seismically active region, and people and structures could be exposed to seismic ground shaking. Potentially significant impacts related to secondary seismic effects, including liquefaction and liquefaction-induced settlement, would be reduced to less than significant with implementation of Mitigation Measure Geology-1.

GEO-2) Would Alternative 5 result in substantial soil erosion or the loss of topsoil?

Implementation of Alternative 5 would result in both short-term, construction-related wind and water erosion and wind and water erosion related to Alternative 5 operation and maintenance

activities. These impacts would be reduced slightly in comparison to Alternative 1; however, the GEO-2 analysis under Alternative 1 would apply.

GEO-3) Would Alternative 5 be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?

The GEO-3 analysis under Alternative 1 would apply to Alternative 5, as the underlying alluvium is expected to consist of loose to dense layers of silty sands and gravel, and some settlement of the loose soils underlying the surface is possible.

GEO-4) Would Alternative 5 be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life and property?

The potential for expansive soils to be encountered on the solar facility site and in the vicinity of the gen-tie line is considered low for Alternative 1. As the Alternative 5 development footprint falls within this same area, the GEO-4 analysis for Alternative 1 would apply.

GEO-5) Would Alternative 5 have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?

Alternative 5 would require the use of a septic tank system on the solar facility site to treat domestic wastewater from the one O&M building under this Alternative. Preliminary soils percolation testing (POWER Engineers: 123128 Percolation Test Report dated October 5, 2012) showed soils ranging from poorly graded, fine to medium grained, loose to medium dense sand with a trace of silt indicating that the proposal for an on-site wastewater treatment system or advanced treatment unit is feasible. Construction-related impacts from the septic system would be considered less than significant with implementation of Mitigation Measure Geology-2. No operation or decommissioning impacts are anticipated.

GEO-6) Would Alternative 5 be subject to geologic hazards, such as seiche, mudflow, or volcanic hazard?

There are no bodies of constant water in proximity to the Alternative 1 site, and the site is not near the shoreline or within 50 feet of sea level. Alternative 5 falls within this same location. Therefore, the GEO-6 analysis for Alternative 1 would apply.

GEO-7) Would Alternative 5 change topography or ground surface relief features?

The Alternative 5 boundary would not be adjacent to the descending bluff along the eastern site boundary as with Alternative 1. The remaining portion of the Alternative 5 site south of I-10 would be identical to Alternative 1. As such, the GEO-7 analysis for Alternative 1 would apply in this area.

GEO-8) Would Alternative 5 create cut or fill slopes greater than 2:1 or higher than 10 feet?

See GEO-7 above.

GEO-9) Would Alternative 5 result in grading that affects or negates subsurface sewage disposal systems?

Similar to Alternative 1, implementation of Alternative 5 would require the removal of three residences within the proposed development site that may have septic systems to treat domestic wastewater. These septic systems would be removed prior to Alternative 5 construction. In addition, Alternative 5 would not require extensive grading. Impacts would be less than significant.

GEO-10) Would Alternative 5 change deposition, siltation, or erosion that may modify the channel of a river or stream or the bed of a lake?

Refer to the Alternative 1 analysis for GEO-10.

GEO-11) Would Alternative 5 result in any increase in water erosion either on- or off-site?

See GEO-6 above.

GEO-12) Would Alternative 5 be impacted by or result in an increase in wind erosion and blowsand, either on- or off-site?

See GEO-11 above.

MR-1) Would Alternative 5 result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?

Based on the RCGP Figure OS-5, Mineral Resource Area, Alternative 1 would be within the State of California-designated MRZ Classification of MRZ-4, which is defined as an area where there is not enough information available to determine the presence or absence of mineral deposits. Alternative 5 would fall within this same location; therefore, the MR-1 analysis for Alternative 1 would apply.

MR-2) Would Alternative 5 result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?

Similar to Alternative 1, the Alternative 5 site is not delineated in the PVVAP or RCGP as a locally important mineral resource recovery site; therefore, the loss of availability of a delineated locally important mineral resource recovery site would not occur. There would be no impact.

MR-3) Would Alternative 5 be an incompatible land use located adjacent to a State classified or designated area or existing surface mine?

Because there are other major roadways within the Alternative 5 area, Alternative 5 would not prevent permitted prospectors or owners of mineral leases in the surrounding region from accessing areas outside the footprint of the Project, such as the McCoy Mountains. Therefore, Alternative 5 would not be an incompatible land use with a State-classified or designated area for mining operations. No impact would occur.

MR-4) Would Alternative 5 expose people or property to hazards from proposed, existing or abandoned quarries or mines?

Similar to Alternative 1, the Alternative 5 site is not used for mineral production, nor is it under claim, lease, or permit for the production of locatable, leasable, or salable minerals or mineral materials. Alternative 5 would not expose people or property to hazards from proposed, existing, or abandoned quarries or mines. No impact would occur.

Cumulative Impacts

Geographic Scope

Potential cumulative impacts to geology and soil resources would be limited to soil erosion and soil subsidence because many of the cumulative projects which would require soil disturbances in areas with loosely placed deposits, and collectively are cumulatively considerable. These potential cumulative impacts would apply mostly to construction and decommissioning phases of the Project. Other potential geology and soils issues (such as strong seismic ground shaking, liquefaction potential, collapsible soils, and expansive soils) relate to local and site-specific soil conditions, the severity of which is not connected with activities at the Project area. Such issues are site-specific and unaffected by the presence of other projects in the cumulative scenario.

The geographic scope of cumulative effects for mineral resources could include all areas within the cumulative projects area shown on Table 4.1-1. However, the proposed solar array site and private land portion of the gen-tie line are not in a designated mineral resource zone, and mineral extraction from the ROW portion on federal lands is not likely due to use of the area Solar Energy Zone. Consequently, the cumulative impacts relative to mineral resources are not cumulatively considerable and will not be discussed further.

Temporal Scope

The temporal scope of impacts associated with the proposed Project includes both short and long-term impacts to geology, soils, and seismicity during the construction and operation and maintenance periods. Short-term impacts related to construction are related to ground-disturbing activities such as grading and excavation to install or remove foundations. Long-term impacts associated with the Project include potential damage to proposed facilities due to seismic hazards that could occur over the operational life of the Project.

Analysis of Direct and Indirect Impacts

Alternative 1: Proposed Project

Construction, Operation, Maintenance, and Decommissioning

Environmental impacts related to geology and soils are generally site-specific. While geotechnical impacts may be associated with other developments in the Project area, by the very nature of the impacts (e.g., unstable soil units, expansive soils, seismic hazards), the constraints are site-specific and need to be addressed on a project-specific basis (impacts GEO-1 through GEO-12 and MR-1 through MR-4). Liquefaction and unstable soil hazards are very site-specific and are not cumulatively additive, but rather depend on local conditions as well as the characteristics of the overlying improvements.

The proposed Project, as well as other development projects, would be required to comply with the applicable State and local requirements including, but not limited to, the CBC, the County of Riverside County Code, and the City of Blythe Municipal Code (impact GEO-4). As such, Project-specific impacts, as well as the potential impacts associated with other projects, would be reduced to a less than significant level. Seismic impacts are a regional issue and are also addressed through compliance with applicable codes and design standards. The nature of these projects do not represent cumulatively significant impacts to geologic and soil resources following a seismic event, as the effects would be site-specific based on site-specific underlying conditions and proximity to the source of the seismic event. Therefore, the Project's contribution to cumulative geotechnical and soils impacts would be less than considerable (impact GEO-1).

In addition, implementation of site-specific SWPPPs (BMP-2) would minimize erosion potential from the Project areas (impact GEO-2). Impacts from erosion or loss of topsoil for other cumulative projects may require site-specific analysis to determine the underlying permeability, slope angle and length, extent of groundcover, and human influence on the sites; however, all projects in the cumulative setting would be required to adhere to similar erosion control requirements of a Drainage, Erosion, and Sedimentation Control Plan (BMP-1), as would the proposed Project. All construction phases of this Project, and other foreseeable projects in the area, would be required to adhere to all federal, State, and local programs, requirements, and policies pertaining to building safety and construction permitting. Accordingly, no significant cumulative impact would result from the cumulative scenario to which the Project's incremental impact could contribute.

Decommissioning activities are anticipated to be similar construction-related impacts, and would be required to comply with all local, State, and federal laws, regulations, and standards applicable at the time of decommissioning. Accordingly, no significant cumulative impact would result from the cumulative scenario to which the Project's incremental impacts resulting from decommissioning could contribute.

Alternative 2: No Project Alternative

Under the No Project Alternative, gen-tie facilities would not be constructed on BLM-managed lands and solar facilities would not be constructed on private lands. The public lands in the Project area would continue to be managed by BLM in accordance with existing land use designations in the CDCA Plan, whereas the private lands would continue to be managed for agricultural production. Alternative 2 would not contribute cumulative geology and soils impacts.

Alternative 3: Northern Alternative 230 kV Gen-tie Line Location

Alternative 3 is similar to Alternative 1 (proposed Project), with the exception of the location of the Northern 230 kV gen-tie line, which would be approximately 700 feet north of Alternative 1's proposed 230 kV gen-tie line. The cumulative impacts associated with the construction, operation, maintenance, and decommissioning of the solar facility would be the same as Alternative 1. As previously described under the cumulative analysis for Alternative 1, environmental impacts related to geology and soils are generally site-specific. While geotechnical impacts may be associated with other developments in the Project area, by the very nature of the impacts (e.g., unstable soil units, expansive soils, seismic hazards), the constraints are site-specific and need to be addressed on a project-specific basis (impacts GEO-1 through GEO-12 and MR-1 through MR-4). Liquefaction and unstable soil hazards are very site-specific and are not cumulatively additive, but rather depend on local conditions as well as the characteristics of the overlying improvements.

This Alternative, along with other development projects, would be required to comply with the applicable State and local requirements including, but not limited to, the CBC, the County of Riverside County Code, and the City of Blythe Municipal Code (impact GEO-4). As such, specific impacts with the development of Alternative 3, as well as the potential impacts associated with other projects, would be reduced to a less than significant level. Seismic impacts are a regional issue and are also addressed through compliance with applicable codes and design standards. The nature of these projects do not represent cumulatively significant impacts to geologic and soil resources following a seismic event, as the effects would be site-specific based on site-specific underlying conditions and proximity to the source of the seismic event. Therefore, Alternative 3's contribution to cumulative geotechnical and soils impacts would be less than considerable (impact GEO-1).

As also with Alternative 1, implementation of site-specific SWPPPs (BMP-2) would minimize erosion potential from the Project areas (impact GEO-2). Impacts from erosion or loss of topsoil for other cumulative projects may require site-specific analysis to determine the soils' permeability, slope angle and length, extent of groundcover, and human influence on the sites; however, all projects in the cumulative setting would be required to adhere to similar erosion control requirements of a Drainage, Erosion, and Sedimentation Control Plan (BMP-1), as would Alternative 3. All construction phases of this Project, and other foreseeable projects in the area, would be required to adhere to all federal, State, and local programs, requirements, and policies pertaining to building safety and construction permitting. Accordingly, no significant cumulative impact would result from the cumulative scenario to which this Alternative's incremental impact could contribute.

Decommissioning activities are anticipated to have similar construction-related impacts as described under Alternative 1.

Alternative 4: Southern Alternative 230 kV Gen-tie Line Location

Alternative 4 is similar to Alternative 1 (proposed Project), with the exception of the location of the Southern 230 kV gen-tie line, which would be approximately 0.8 mile south of Alternative 1's proposed 230 kV gen-tie line. The cumulative impacts associated with the construction, operation, maintenance, and decommissioning of the solar facility would be the same as Alternative 1. As previously described under the cumulative analysis for Alternative 1, environmental impacts related to geology and soils are generally site-specific. While geotechnical impacts may be associated with other developments in the Project area, by the very nature of the impacts (e.g., unstable soil units, expansive soils, seismic hazards), the constraints are site-specific and need to be addressed on a project-specific basis (impacts

GEO-1 through GEO-12 and MR-1 through MR-4). Liquefaction and unstable soil hazards are very site-specific and are not cumulatively additive, but rather depend on local conditions as well as the characteristics of the overlying improvements.

This Alternative, along with other development projects, would be required to comply with the applicable State and local requirements including, but not limited to, the CBC, the County of Riverside County Code, and the City of Blythe Municipal Code (impact GEO-4). As such, specific impacts with the development of Alternative 4, as well as the potential impacts associated with other projects, would be reduced to a less than significant level. Seismic impacts are a regional issue and are also addressed through compliance with applicable codes and design standards. The nature of these projects do not represent cumulatively significant impacts to geologic and soil resources following a seismic event, as the effects would be site-specific based on site-specific underlying conditions and proximity to the source of the seismic event. Therefore, Alternative 4's contribution to cumulative geotechnical and soils impacts is less than considerable (impact GEO-1).

As also with Alternative 1, implementation of site-specific SWPPPs (BMP-2) would minimize erosion potential from the Project areas (impact GEO-2). Impacts from erosion of loss or topsoil for other cumulative projects may require site-specific analysis to determine the soils' permeability, slope angle and length, extent of groundcover, and human influence on the sites; however, all projects in the cumulative setting would be required to adhere to similar erosion control requirements of a Drainage, Erosion, and Sedimentation Control Plan (BMP-1), as would Alternative 4. All construction phases of this Project, and other foreseeable projects in the area, would be required to adhere to all federal, State, and local programs, requirements, and policies pertaining to building safety and construction permitting. Accordingly, no significant cumulative impact would result from the cumulative scenario to which this Alternative's incremental impact could contribute.

Decommissioning activities are anticipated to be similar construction-related impacts as described under Alternative 1.

Alternative 5: Reduced Acreage Alternative

Construction, Operation, Maintenance, and Decommissioning

Alternative 5, as well as other development projects, would be required to comply with the applicable State and local requirements including, but not limited to, the CBC and the County of Riverside County Code; as such, the cumulative discussion under Alternative 1 would apply.

Mitigation Measures

The following mitigation measures would minimize and avoid impacts to geological and soil resources. No mitigation measures were proposed for mineral resources.

Geology-1 Prior to final design and construction, a site-specific subsurface geotechnical evaluation/report shall be prepared to evaluate the potential ground-shaking hazard, which would meet the requirements of the most recent version of the California Building Code. A state certified Project geologist shall ensure appropriate structural design and mitigation techniques achieve adequate protection according to industry standards and building code requirements.

Geology-2 Should future data suggest the presence of active faulting at the Project area, a fault evaluation may be performed. Mitigation of potential fault rupture hazard would typically include locating improvements away from the trace of an active fault, designing structures for an acceptable amount of movement, or implementing systems to maintain safety and that allow for displacement that could be repaired.

Geology-3 Removal of loose soil layers shall be replaced with compacted fill or specialized foundation design, including the use of deep foundation systems, to support structures. The septic system shall be placed in soils capable of adequately supporting the septic system as determined by the Project Geologist and in accordance with County requirements specified in the Department of Environmental Health Technical Guidance Manual.

Geology-4 Additional hydro-consolidation tests should be performed to verify soil stability during the design stages of the Project. Mitigation recommendations for hydro-consolidation may include removal of the collapsible soil layers and replacement with compacted fill or specialized foundation design including the use of deep foundations systems to support structures.

Residual Impacts After Mitigation

Implementation of mitigation measures Geology-1 and Geology-4 would reduce impacts to less than significant under CEQA and not substantial under NEPA.

NEPA Conclusions

The Project and each of the action Alternatives would have the impacts and contribution to cumulative impacts described above. These would not be significant with implementation of the mitigation measures described above. The Project would comply with all federal laws and criteria relating to geology and soils. The No Project Alternative would not have impacts, as the existing circumstances and operations would continue essentially unchanged.

4.2.7 Greenhouse Gas Emissions

This section describes the impact analysis relating to greenhouse gas (GHG) emissions for the proposed Project and Alternatives. Information in this section was derived from the Project *Air Quality and Global Climate Change Technical Report* prepared by SRA, 2012 (included in this Draft EIR/EA as Appendix B).

The Climate Scenarios Report (CCC 2006) uses a range of emissions scenarios developed by the Intergovernmental Panel on Climate Change (IPCC) to project a series of potential warming ranges (i.e., temperature increases) that may occur in California during the twenty-first century. Three warming ranges were identified: lower warming range (3.0 to 5.5 degrees Fahrenheit [ºF]); medium warming range (5.5 to 8.0 ºF); and higher warming range (8.0 to 10.5 ºF). The Climate Scenarios Report then presents an analysis of the future projected climate changes in California under each warming range scenario.

According to the report, substantial temperature increases would result in a variety of impacts to the people, economy, and environment of California. These impacts would result from a projected increase in extreme conditions, with the severity of the impacts depending upon actual future emissions of GHGs and associated warming. If the Project were to contribute substantially to climate change, then it would be contributing to the following potential consequences of climate change.

Public Health. Higher temperatures are expected to increase the frequency, duration, and intensity of conditions conducive to air pollution formation. For example, days with weather conducive to ozone (O_3) formation are projected to increase by 25 to 35 percent under the lower warming range and 75 to 85 percent under the medium warming range. In addition, if global background O_3 levels increase as is predicted in some scenarios, it may become impossible to meet local air quality standards. An increase in wildfires could also occur, and the corresponding increase in the release of pollutants, including fine particulate matter less than or equal to 2.5 microns in diameter ($PM_{2.5}$), could further compromise air quality. The Climate Scenarios Report indicates that large wildfires could become up to 55 percent more frequent if GHG emissions are not significantly reduced.

Potential health effects from global climate change may arise from temperature increases, climate-sensitive diseases, extreme events, and air quality degradation. There may be direct temperature effects through increases in average temperature leading to more extreme heat waves and less extreme cold spells. Those living in warmer climates are likely to experience more stress- and heat-related problems (e.g., heat rash and heat stroke). In addition, climate-sensitive diseases (such as malaria, dengue fever, yellow fever, and encephalitis) may increase, such as those spread by mosquitoes and other disease-carrying insects.

Water Resources. A vast network of reservoirs and aqueducts captures and transports water throughout the state from northern California rivers and the Colorado River. The current distribution system relies on Sierra Nevada mountain snowpack to supply water during the dry spring and summer months. Rising temperatures, potentially compounded by decreases in precipitation, could severely reduce spring snowpack, increasing the risk of summer water shortages. In addition, if temperatures continue to rise, more precipitation would fall as rain instead of snow, further reducing the Sierra Nevada spring snowpack by as much as 70 to 90 percent. The state's water resources are also at risk from rising sea levels. An influx of seawater would degrade California's estuaries, wetlands, and groundwater aquifers.

Agriculture. Increased GHG and associated increases in temperature are expected to cause widespread changes to the agricultural industry, reducing the quantity and quality of agricultural products statewide. Significant reductions in available water supply to support agriculture would also impact production. Crop growth and development would change, as would the intensity and frequency of pests and diseases.

Ecosystems/Habitats. Continued global warming would likely shift the ranges of existing invasive plants and weeds, thus altering competition patterns with native plants. Range expansion is expected in many species, while range contractions are less likely in rapidly evolving species with significant populations already established. Continued global warming is also likely to increase the populations and types of pests. Continued global warming would also affect natural ecosystems and biological habitats throughout

the state. This effect of global climate change could affect current ecosystems/habitats in desert areas near the proposed solar facility.

Wildland Fires. Global warming is expected to increase the risk of wildfire and alter the distribution and character of natural vegetation. If temperatures rise into the medium warming range, the risk of large wildfires in California could increase by as much as 55 percent, which is almost twice the increase expected if temperatures stay in the lower warming range. However, since wildfire risk is determined by a combination of factors including precipitation, winds, temperature, and landscape and vegetation conditions, future risks would not be uniform throughout the State. Global climate change in the Southern California region could lead to increased risk of wildfires, which could reduce solar energy output by obscuring sunlight.

Rising Sea Levels. Rising sea levels, more intense coastal storms, and warmer water temperatures would increasingly threaten the State's coastal regions. Under the high warming scenario, sea level is anticipated to rise 22 to 35 inches by 2100. A sea level risk of this magnitude would inundate coastal areas with salt water, accelerate coastal erosion, threaten levees and inland water systems, and disrupt wetlands and natural habitats.

Methodology for Analysis

The effects of GHG emissions that would be generated from the proposed Project, as well as the consistency of the proposed Project with the applicable plans and programs that have been implemented by various federal, State, and local agencies with jurisdiction over the Project area, are addressed in this section. Potential GHG emissions from construction and operation, as well as potential emission reductions from fossil-fuel fired electricity generation displacement, are estimated quantitatively to evaluate the Project's contribution to cumulative GHG emissions.

CEQA Significance Criteria

The effects of project-specific greenhouse gas emissions are cumulative, and therefore global climate change impacts are addressed as a cumulative, rather than a direct, impact. The guidance for determining significance of impacts has been developed from the requirements of AB 32. The guideline addresses the potential cumulative impacts that a project's GHG emissions could have on global climate change. Based on Appendix G of the CEQA Guidelines and the County of Riverside CEQA Environmental Assessment Form, the following criteria indicate that a project could have potentially significant impacts to global climate change if it would:

GHG-1) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment.

GHG-2) Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases.

As discussed in Section 15064.4 of the CEQA Regulations, the determination of the significance of GHG emissions requires a good-faith effort to assess the significance of impacts from GHG emissions, considering:

1) The extent to which the project may increase or reduce GHG emissions as compared to the existing environmental setting.
2) Whether the project emissions exceed a threshold of significance that the lead agency determines applies to the project.
3) The extent to which the project complies with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of GHG emissions.

The California Air Pollution Controls Officers Association (CAPCOA) suggested several thresholds and approaches that could be used to determine the significance of greenhouse gas emissions (CAPCOA

2008). Of these, the threshold of 900 metric tons of CO_2-equivalent (CO_2e) was determined to be an appropriate threshold to determine a significant GHG impact because it is a very conservative threshold that is on the low end of CEQA significance thresholds that have been considered for implementation by other California air pollution responsible agencies, such as the Bay Area Air Quality Management District. The County of Riverside has not adopted this particular threshold for GHG emissions; however, the MDAQMD CEQA and Federal Conformity Guidelines (August 2011) includes the 100,000 tons per year (tpy) CO_2e and 548,000 pounds per day (lbs/day) CO_2e thresholds. As such, the significance criteria are used to provide a context for the magnitude of Project emissions in relation to its contribution to the cumulative impact of global climate change.

The CAPCOA approach directs that a GHG inventory be prepared for each project, and that GHG emissions associated with project implementation and operation be disclosed under "business as usual" conditions. "Business as usual" is defined as the emissions that would have occurred in the absence of reductions mandated under AB 32.

NEPA Requirements

On February 18, 2010, the CEQ issued draft guidance to federal agencies regarding GHG emissions. This guidance instructs agencies to take the following steps in an analysis of the direct effects of GHG emissions: quantify cumulative emissions over the life of the project; discuss measures to reduce emissions, including consideration of reasonable alternatives; and qualitatively discuss the link between such emissions and climate change. The CEQ further recommends that if a proposed action is reasonably anticipated to annually cause direct emissions of 25,000 metric tons or more of carbon dioxide equivalent (CO_2e) GHGs, agencies should consider conducting a quantitative and qualitative assessment. The guidance also states that "it is not currently useful for the NEPA analysis to attempt to link specific climatological changes, or the environmental impacts thereof, to the particular project or emissions, as such direct linkage is difficult to isolate and to understand."

Applicable Best Management Practices

No BMPs are proposed for GHG emissions.

Alternative 1: Proposed Project

Direct, Indirect and Cumulative Effects

Construction

The main source of GHG emissions associated with the Project would be combustion of fossil fuels during construction of the Project. Emissions of GHG were calculated using the same approach as emissions for overall construction emissions discussed in Section 4.2.3 and described in the *Air Quality and Global Climate Change Technical Report*, Appendix B. Construction of the solar arrays, substation, associated buildings, and gen-tie line, using "business as usual" conditions, would generate approximately 5,479 tons of CO_2e.

Emissions associated with construction would be temporary, occurring in one three-year period. Climate change, by contrast, occurs as a result of long-term changes in the earth's atmosphere. Accordingly, the total construction emissions were amortized over the life of the Project. Amortization of the construction emissions over the life of the Project would result in a contribution of about 183 metric tons of CO_2e per year.

It is noted that the existing baseline conditions on the site include GHG emissions associated with cultivation and harvest of field and orchard crops; however, the GHG emissions from these activities have not been estimated.

Operation and Maintenance

Emissions associated with operations are estimated to be 271 metric tons per year of CO_2e. It should be noted that the purpose of the Project is to provide electricity generation from a renewable resource. The Project would serve to meet the State's goals for the Renewable Portfolio Standard (RPS), which has been identified by the State as a means of meeting the goals of AB 32 to reduce emissions to 1990 levels by the year 2020. The Project's operational emissions would therefore be offset by the Project's provision of renewable energy that would replace conventionally generated electricity in the service area.

The Project is proposed to produce approximately 485 MW of electrical energy, which would be approximately 1,329,439,261 kilowatt hours (kWh) of electrical energy per year. In comparison, GHG emissions were estimated for a conventional fossil-fuel combustion power plant producing the same electrical energy (kWh) per year as the Project facility. Data from the U.S. Department of Energy, the EPA, and the Electric Power Research Institute provided GHG production rates per megawatt-hour (MWh). GHG emissions from the most efficient combined cycle gas turbine power plant and a coal-fired power plant were calculated based on 0.35 and 1.0 metric tons of CO_2e per MWh of electricity produced by gas turbine and coal-fired plants, respectively. Gas turbine and coal-fired plants are estimated to produce approximately 371,922 and 1,062,635 metric tons of CO_2e, respectively. The Project would result in a net GHG reduction (displacement) through the replacement of fossil-fuel generated electricity with solar electricity of from 371,116 to 1,061,829 metric tons of CO_2e per year. Operation of the Project would result in a substantial net displacement of GHG emissions in the region with the implementation of the Project's solar facility, when compared to a conventional fossil-fuel combustion power plant.

Decommissioning

Decommissioning of the proposed Project would require removal of the solar equipment and facilities (including gen-tie structures) and transporting all components off-site. Equipment used for decommissioning would generally be similar to that used for construction; however, it is anticipated that the overall activity necessary during decommissioning could be completed in one year and would be much less than that of construction. Conservatively, it is estimated that the annual GHG emissions for decommissioning would be about one half that of construction, resulting in emissions during the one-year decommissioning period of 913 metric tons of CO_2e.

Total GHG from All Phases

Adding the construction, operations, and decommissioning emissions, amortized over the life of the Project (considering three years of construction, 25 years of operation, and two years of decommissioning), the total GHG emissions from the Project are estimated to be approximately 484 metric tons of CO_2e annually, which is below the CAPCOA-based threshold of 900 metric tons per year of CO_2e and is also below the federal mandatory GHG emissions reporting threshold of 25,000 metric tons of CO_2e. Consequently, even if displacement of electricity use were not considered, the proposed Project's GHG emissions would not contribute substantially to global GHG emissions.

As explained above, the Project's operation would result in a net GHG reduction (displacement) through the replacement of fossil-fuel-generated electricity with solar electricity of from 371,116 to 1,061,829 metric tons of CO_2e per year. The Project's displacement of emissions from fossil-fuel-generated electricity offsets the total GHG emissions from all aspects of the Project, and results in a substantial Project benefit.

Application of CEQA Significance Thresholds

Construction, Operation, Maintenance, and Decommissioning

GHG-1) Would the Project generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?

The proposed Project would not generate GHG emissions, either directly or indirectly, such that they would have a significant impact on the environment. Overall, the total GHG emissions for all phases amortized over the life of the Project would not exceed CAPCOA thresholds and would be less than significant. In addition, the Project would result in a substantial benefit by offsetting GHG emission from fossil-fuel-generated electricity, and would assist in meeting the State's adopted RPS.

GHG-2) Would the Project conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases?

Since the proposed Project would result in a significant offset of regional air emissions associated with energy production from fossil fuels, a net reduction in GHG emissions could result. The Project would serve to meet the State's goals for the RPS, which has been identified by the State as a means of meeting the goals of AB 32 to reduce emissions to 1990 levels by the year 2020.

Alternative 2: No Project Alternative

The Project would not be constructed or require any operations or maintenance or decommissioning activities should Alternative 2, the No Project Alternative, be selected. As such, there would be no effects related to GHG emissions beyond those that already occur on the Project area as a result of existing agricultural operations. However, the beneficial impacts of the proposed Project associated with providing renewable energy in accordance with the State's adopted RPS would also not occur under this Alternative. That is, under the No Project Alternative, renewable energy would not be available to offset the use of energy from other sources, including fossil fuels. Consequently, the No Project Alternative would not achieve the GHG reduction associated with the proposed Project's operation, which was estimated to range from 371,116 to 1,061,829 metric tons of CO_2e per year.

Alternative 3: Northern Alternative 230 kV Gen-tie Line Location

Alternative 3 would be similar to Alternative 1, with the exception of the location of the proposed 230 kV gen-tie line. Considering that Alternative 3 would require a slightly longer gen-tie line outside of the solar array site, the GHG emissions are estimated to be slightly greater than Alternative 1 during construction. Total GHG emissions would be minimally higher than Alternative 1, but would remain below the CAPCOA-recommended threshold of 900 metric tons per year of CO_2e; there would be no material difference in the level of significance of the impact. In addition, Alternative 3 would result in a substantial benefit by offsetting GHG emission from fossil-fuel-generated electricity, and would assist in meeting the State's adopted RPS.

Application of CEQA Significance Thresholds

Construction, Operation, Maintenance, and Decommissioning

GHG-1) Would Alternative 3 generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?

Alternative 3 would not generate GHG emissions, either directly or indirectly, such that they would have a significant impact on the environment. Overall, the total GHG emissions for all phases amortized over the life of Alternative 3 would not exceed CAPCOA thresholds and would be less than significant. In addition, Alternative 3 would result in a substantial benefit by offsetting GHG emission from fossil-fuel-generated electricity, and would assist in meeting the State's adopted RPS.

GHG-2) Would Alternative 3 conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases?

Alternative 3 would not conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHG. No impacts would occur.

Alternative 4: Southern Alternative 230 kV Gen-tie Line Location

Alternative 4 would be very similar to Alternative 1, with the exception of the location of the proposed 230 kV gen-tie line. Considering that Alternative 4 would require a slightly longer total length of gen-tie line, the total GHG emissions are estimated to be slightly greater than Alternative 1 construction. Total GHG emissions would be minimally higher than Alternative 1, but would remain below the CAPCOA-recommended threshold of 900 metric tons per year of CO_2e; there would be no material difference in the level of significance of the impact. In addition, Alternative 4 would result in a substantial benefit by offsetting GHG emission from fossil-fuel-generated electricity, and would assist in meeting the State's adopted RPS.

Application of CEQA Significance Thresholds

Construction, Operation, Maintenance, and Decommissioning

GHG-1) Would Alternative 4 generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?

Alternative 4 would not generate GHG emissions, either directly or indirectly, such that they would have a significant impact on the environment. Overall, the total GHG emissions for all phases amortized over the life of Alternative 4 would not exceed CAPCOA thresholds and would be less than significant. In addition, Alternative 4 would result in a substantial benefit by offsetting GHG emission from fossil-fuel-generated electricity, and would assist in meeting the State's adopted RPS.

GHG-2) Would Alternative 3 conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases?

Alternative 4 would not conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHG. No impacts would occur.

Alternative 5: Reduced Acreage Alternative

Similar to Alternative 1, Alternative 5 would include the construction, operation, maintenance, and decommissioning of a solar facility and associated infrastructure. The primary difference between Alternatives 1 and 5 is the absence of solar facility development north of I-10, which would reduce electrical output from a 485 MW down to a 315 MW alternating current solar PV facility. The Reduced Acreage Alternative would be on a reduced footprint of approximately 2,476 acres (from 3,660 acres for the proposed Project). Alternative 5 would include approximately 2,403 acres for the solar field. Similar to the proposed Project, 73 acres would be utilized for the 230 kV gen-tie line. In comparison to Alternative 1, Alternative 5 would eliminate one on-site substation and one O&M building and would have one access point (planned on Seeley Avenue). The Reduced Acreage Alternative would also no longer extend a 230 kV overhead gen-tie line from an on-site substation north of I-10, as this Alternative would not be developed on land north of I-10. Instead, this Alternative would construct an approximately 7.8-mile-long, 230 kV overhead gen-tie line from the proposed on-site substation south of I-10 to the approved Colorado River Substation. Approximately three miles of the gen-tie line would be within the solar facility.

Under Alternative 5, a solar facility north of I-10 would not be constructed or require any operation, maintenance, or decommissioning activities. As such, there would be fewer GHG emissions from construction, maintenance, and decommissioning activities because the actual project development footprint would be smaller. However, the portion of the proposed Project's beneficial impacts of a solar development in the area north of I-10, associated with providing renewable energy in accordance with the State's adopted RPS, would also not occur under Alternative 5.

Direct, Indirect, and Cumulative Effects

Construction

As with Alternative 1, the main source of GHG emissions associated with Alternative 5 would be combustion of fossil fuels during construction. Alternative 5, because it proposes less construction, would emit fewer GHG than Alternative 1. When these emissions are amortized over the life of Alternative 5, these emissions would be less than significant and would not contribute considerably to a cumulative impact.

Operation and Maintenance

Operational emissions of Alternative 1 would not exceed the GHG significance threshold. Alternative 5 operations would result in reduced air emissions compared to Alternative 1, due to fewer full-time employees and a smaller footprint with less solar facilities. Accordingly, it too would not exceed the GHG significance threshold. Similar to Alternative 1, the purpose of Alternative 5 is to provide electricity generation from a renewable resource. The Reduced Acreage Alternative's operational emissions would therefore be offset by this Alternative's provision of renewable energy that would replace conventionally generated electricity in the service area. The extent of the benefit from replacing conventionally generated electricity with renewable energy would be less under Alternative 5 than under the proposed Project.

Decommissioning

Decommissioning of Alternative 5 would result in no greater GHG emissions than what was estimated under Alternative 1. As such, the annual GHG emissions for decommissioning would be approximately one half that of construction.

Total GHG from All Phases

Adding the construction, operation, maintenance, and decommissioning emissions, amortized over the life of the Project (considering three years of construction, 25 years of operation, and two years of decommissioning), the total GHG emissions from Alternative 5 would still remain below the CAPCOA-based threshold and also below the federal mandatory GHG emissions reporting threshold. Moreover, the long-term benefits of replacing conventionally generated electricity with renewable energy would reduce GHG emissions and is considered beneficial. Consequently, the Reduced Acreage Alternative's GHG emissions would not constitute a cumulatively considerable contribution to global climate change.

Application of CEQA Significance Thresholds

Construction, Operation, Maintenance, and Decommissioning

GHG-1) Would Alternative 5 generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?

Alternative 5 would not generate GHG emissions, either directly or indirectly, such that they would have a significant impact on the environment. The Reduced Acreage Alternative's construction and decommissioning GHG emissions would be temporary, and long-term operational GHG emissions would be less than significant. Moreover, the long-term benefits of replacing conventionally generated electricity with renewable energy would reduce GHG emissions and is considered beneficial. Overall, the total GHG emissions for all phases amortized over the life of Alternative 5 would be less than significant and would not constitute a cumulatively considerable contribution to global climate change.

GHG-2) Would Alternative 5 conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases?

Since Alternative 5 would result in a significant offset of regional air emissions associated with energy production from fossil fuels, a net reduction in GHG emissions would result. Alternative 5 would serve to meet the State's goals for the RPS, which has been identified by the State as a means of meeting the goals of AB 32 to reduce emissions to 1990 levels by the year 2020.

Cumulative Impacts

The potential effects of proposed GHG emissions are by nature global and are cumulative in scope. As individual sources, GHG emissions are not large enough to have an appreciable effect on climate change. Therefore, the impact of proposed GHG emissions on climate change as discussed previously in this section is meant to address cumulative impacts of the proposed Project. As noted in the analysis, the proposed Project would contribute approximately 484 metric tons of CO_2e annually, which would not contribute considerably to a cumulative GHG impact, even if offsetting reductions in emissions from fossil-fuel-generated electricity were not considered. Alternatives 3 and 4 would generate slightly greater annual GHG emissions than Alternative 1 but would not contribute considerably to cumulative GHG impact. There would be fewer GHG emissions from construction, maintenance, and decommissioning activities for Alternative 5 because the actual project development footprint would be smaller. However, the portion of the proposed Project's beneficial impacts of a solar development in the area north of I-10, associated with providing renewable energy in accordance with the State's adopted RPS, would also not occur under Alternative 5. In addition, the proposed Project and Alternatives 3, 4, and 5 would result in a substantial benefit by offsetting GHG emissions from fossil-fuel-generated electricity, and would assist in meeting the State's adopted RPS.

The No Project Alternative would generate net zero GHG emissions, which would not contribute to a cumulative impact. However, the No Project Alternative also would not assist in meeting the State's adopted RPS.

Geographic Scope

By their nature, GHG emission impacts are cumulative, as GHG emission are aggregated across the global atmosphere and cumulatively contribute to climate change. Since GHG emission impacts are considered to be global effects, Earth's atmosphere is used as the geographic scope for analysis of GHG emissions impacts.

Temporal Scope

The temporal scope refers to the duration over which GHG impacts would occur. Given that GHG concentrations in Earth's atmosphere can lead to global climate change, which has the potential to impact numerous environmental resources through potential, though uncertain, impacts related to future air temperatures and precipitation patterns, there is currently no way to determine a definitive timeline wherein the full scale of consequences may occur from GHG impacts. Thus, it is not possible to determine the specific impact on global climate change from GHG emissions associated with the BMSP over the life of the Project.

Analysis of Direct and Indirect Impacts

Alternative 1 (Proposed Project), Alternative 3 (Northern 230 kV Gen-tie Line Location), and Alternative 4 (Southern 230 kV Gen-tie Line Location)

Construction, Operation, Maintenance, and Decommissioning

As discussed above, the proposed Project would contribute approximately 484 metric tons of CO_2e annually, which would not contribute considerably to a cumulative GHG impact even if offsetting reductions in emissions from fossil fuel generation of electricity were not considered. Alternatives 3 and 4

would generate slightly greater annual GHG emissions than Alternative 1 but would not contribute considerably to a cumulative GHG impact. In addition, as a renewable energy project, Alternatives 1, 3, and 4 would have a net benefit on climate change by reducing the State's reliance on non-renewable energy sources.

As described in the Solar PEIS, utility-scale solar energy development contributes relatively minor GHG emissions, generally from emissions from heavy equipment, primarily used during the construction phase; vehicular emissions; and natural gas or propane combustion of back-up generators (a factor not present in the proposed Project). The removal of plants from within a Project area can also reduce the amount of carbon intake from terrestrial vegetation, but only by a minimal amount. As discussed in the Solar PEIS, however, utility-scale solar energy production over the next 20 years will likely result in fewer CO_2 emissions from utilities by offsetting emissions from new fossil fuel energy sources. Overall, CO_2 emission offsets from increased solar energy production can range from a few percentage points to more than twenty percent in some study area states. According to the analysis in the Solar PEIS, "an estimated 716 kg (1,578 lb) of CO_2 would be displaced annually per megawatt-hour of solar energy produced" (DPEIS, § 5.11.1.2. Table 5.11-1, and § 5.11.4).

While in the near term, solar facilities such as development under Alternative scenarios 1, 3, 4, and 5 would tend to offset facilities serving peak loads rather than baseline loads served by large fossil-fuel plants, GHG emissions from future fossil fuel plants serving peak loads, typically natural gas-fired plants, would nevertheless be offset and CO_2 emissions on a per-average megawatt basis from non-renewable sources such as natural gas are exponentially higher than the incremental annual emissions from the proposed Alternatives. Further, the CARB has identified implementation of the Renewable Portfolio Standard as an integral part of AB 32. According to the AB 32 Scoping Plan, implementation of the RPS will contribute to a 21.3 million metric tons (MMT) of CO_2E reduction in GHG emissions by 2020 by reducing the State's reliance on fossil-fuel and natural gas-fired plants. The proposed Project is being designed and implemented in part to assist in achieving the RPS, and therefore the State's GHG reduction goals.

Since GHG emissions are aggregated across the global atmosphere and cumulatively contribute to climate change, it is not possible to determine the specific impact on global climate change from GHG emissions associated with the action Alternatives presented, or in conjunction with the identified cumulative projects. As noted in the analysis, however, the proposed Project would contribute approximately 484 metric tons of CO_2e annually, which would not contribute considerably to a cumulative GHG impact even if offsetting reductions in emissions from fossil fuel generation of electricity were not considered. Alternatives 3 and 4 would generate slightly greater annual GHG emissions than Alternative 1 but would not contribute considerably to a cumulative GHG impact. In addition, implementation of the proposed action Alternatives would likely lead to a net reduction in GHG emissions in the state overall, and thus a net benefit to global climate change, by displacing GHG emissions from non-renewable power sources. Implementation of the proposed action Alternatives would also assist the State in implementing the GHG reduction goals established in AB 32. In summary, it is likely that the proposed action Alternatives would have a net benefit on GHG emissions. The action Alternatives presented would not make a considerable contribution to global climate change, and therefore would not contribute significantly to cumulatively significant impacts related to global climate change when considered with other closely related past, present, and reasonably foreseeable future projects.

Alternative 2: No Project Alternative

The No Project Alternative would not contribute to any cumulative GHG effects. Unlike the action Alternatives, the No Project Alternative would not involve construction activities or operation of a solar generating facility; therefore, heavy equipment operation, truck deliveries, and construction worker commute trips would not be utilized, and increased GHG emissions would not occur as a result. However, the No Project Alternative would not assist in meeting AB 32 or Executive Order S-3-05 emission reduction targets, nor would it offset emissions generated by fossil-fuel-based sources of energy. Therefore, the No Project Alternative would have fewer impacts than the construction periods of the action Alternatives, but would result in greater impacts during the action Alternatives' operational periods.

Alternative 5: Reduced Acreage Alternative

Construction, Operation, Maintenance, and Decommissioning

Similar to the proposed Project, Alternative 5 would not contribute considerably to a cumulative GHG impact even if offsetting reductions in emissions from fossil fuel generation were not considered. In addition, as a renewable energy project, Alternatives 1, 3, 4, and 5 would have a net benefit on climate change by reducing the State's reliance on non-renewable energy sources.

In the near-term, solar facilities such as development under Alternative scenarios 1, 3, 4, and 5 would tend to offset facilities serving peak loads rather than baseline loads. In the long-term, such development would offset future fossil fuel plants serving peak loads, typically natural gas-fired plants. CO_2 emissions on a per-average megawatt basis from non-renewable sources such as natural gas are exponentially higher than the incremental annual emissions from the proposed Alternatives. Further, the CARB has identified implementation of the Renewable Portfolio Standard as an integral part of AB 32. According to the AB 32 Scoping Plan, implementation of the RPS will contribute to a 21.3 MMT of CO_2E reduction in GHG emissions by 2020 by reducing the State's reliance on fossil-fuel and natural gas-fired plants. The BMSP is being designed and implemented in part to assist in achieving the RPS, and therefore the State's GHG reduction goals.

Since GHG emissions are aggregated across the global atmosphere and cumulatively contribute to climate change, it is not possible to determine the specific impact on global climate change from GHG emissions associated with the action Alternatives presented, or in conjunction with the identified cumulative projects. Alternative 5 would contribute CO_2e annually, but would not contribute considerably to a cumulative GHG impact and its emissions would be more than offset by its replacement of fossil-fuel and natural gas-fired plants as noted above. Implementation of the proposed action Alternatives would likely lead to a net reduction in GHG emissions in the state overall, and thus a net benefit to global climate change, by displacing GHG emissions from non-renewable power sources. Implementation of the proposed action Alternatives would also assist the State in implementing the GHG reduction goals established in AB 32. In summary, it is likely that the proposed action Alternatives would have a net benefit on GHG emissions. The action Alternatives presented would not make a considerable contribution to global climate change, and therefore would not contribute significantly to cumulatively significant impacts related to global climate change when considered with other closely related past, present, and reasonably foreseeable future projects.

Mitigation Measures

Impacts would be less than significant for CEQA; no mitigation measures are recommended.

Residual Impacts After Mitigation

While the Project would generate some GHG emissions, the emissions are not projected to be substantial, and would not hinder compliance with any plans intended to avoid or reduce climate change. In addition, the Project would result in a substantial benefit by offsetting GHG emissions from fossil-fuel-generated electricity, and would assist in meeting the State's adopted RPS.

NEPA Conclusions

The Project and each of the action Alternatives would have the direct and indirect impacts and contribution towards cumulative impacts that are described above. The Project and the action Alternatives would conform to the policies and help achieve the goals of federal and State regulations and plans. The Project and each of the action Alternatives would help BLM implement the federal management objectives described in Chapter 1. The No Project Alternative would not have direct impacts, as the existing circumstances and operations would continue essentially unchanged. However, the No Project Alternative would not help achieve the goals of federal and State regulations and plans to reduce GHG emissions.

4.2.8 Hazards and Hazardous Materials

This section describes the impact analysis relating to hazards and hazardous materials for the proposed Project and Alternatives. It focuses on hazardous materials and hazards requiring remediation or mechanisms to prevent accidental release. Measures are identified to reduce or avoid adverse impacts anticipated from construction, operation, maintenance, and decommissioning of the proposed Project.

Various other hazards associated with the Project, such as exposure to electric and magnetic fields, interference with radio-frequency communications, hazardous shocks, fire hazards (non-wildland/operational), and valley fever are briefly discussed. These hazards are acknowledged as potential areas of concern, but there is no indication that the Project would cause a significant increase in these risks, as explained below.

This analysis does not address the potential exposure of workers to hazardous materials used at the proposed solar facility. Employers must inform employees of hazards associated with their work and provide those employees with special protective equipment and training to reduce the potential for health impacts from the handling of hazardous materials.

Methodology for Analysis

The hazardous materials analyzed include those potentially existing on the site and those that would be used as part of Project construction, operations and maintenance, and decommissioning. Potential existing hazards were assessed based on information contained in the *Phase I DataMap Area Study* prepared for the parcels comprising the Project area. This report is available in Appendix F of this Draft EIR/EA.

Some hazardous materials would be used on a short-term basis during construction and decommissioning. Others would be stored on-site for use during operations and maintenance. Therefore, this analysis was conducted by examining the choice and amount of chemicals to be used, the manner in which the Applicant would use the chemicals, the manner by which they would be transported to the facility, and the way in which the Applicant plans to store the materials on-site.

CEQA Significance Criteria

The criteria listed below were used to determine if the proposed Project would cause or exacerbate hazards on and in the vicinity of the solar facility. While CEQA and NEPA do not encompass a study of the environment on the Project, these criteria were also applied to determine whether the Project or any of its components would be exposed to substantial, existing risks. These criteria are the same as the significance criteria for Hazards and Hazardous Materials listed in the CEQA Environmental Checklist, Appendix G of the 2012 CEQA Guidelines. Under CEQA, the proposed Project and Alternatives would have a significant impact on hazards and hazardous materials if they would:

HAZ-1) *Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials.*

HAZ-2) *Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment.*

HAZ-3) *Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school.*

HAZ-4) *Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would create a significant hazard to the public or the environment.*

HAZ-5) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would result in a safety hazard for people residing or working in the project area.

HAZ-6) For a project within the vicinity of a private airstrip, would result in a safety hazard for people residing or working in the project area.

HAZ-7) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan.

HAZ-8) Expose people or structures to a significant risk of loss, injury, or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands.

The following additional significance criteria from the County of Riverside CEQA Environmental Assessment Form are used in the analysis. A project could have potentially significant impacts if it would:

HAZ-9) Result in an inconsistency with an Airport Master Plan.

HAZ-10) Require review by the Airport Land Use Commission.

NEPA Requirements

The potential effects of the proposed Project and Alternatives are analyzed in relation to the baseline conditions (described in Chapter 3). The context and intensity of the environmental effects (40 CFR Part 1508.27) of the proposed Project and Alternatives with regard to creation of hazards and use of hazardous materials, as well as with regard to exposure to any existing or potential hazards or hazardous materials, are analyzed below and discussed as construction-related, operation and maintenance-related, and decommissioning effects.

Applicable Best Management Practices

As part of the Project and Alternatives, the following applicable BMPs would minimize the environmental impacts for hazards and hazardous materials. The full BMPs have been detailed below (see also Table 2-4 in Chapter 2) and are further referenced (by number) within the impact discussion.

NUMBER	BMP DESCRIPTION
BMP-3	**Fugitive Dust Abatement Plan.** As required by the Mojave Desert Air Quality Management District Rule 403, a Fugitive Dust Abatement Plan would be prepared to address fugitive dust emissions during Project construction, operation, maintenance, and decommissioning. The plan would include measures to minimize fugitive dust emissions from wrecking, excavation, grading, clearing of land, and solid waste disposal operations, and would take every reasonable precaution to prevent visible particulate matter from being deposited upon public roadways as a direct result of operations. During construction, all unpaved roads, disturbed areas (e.g., areas of scraping, excavation, backfilling, grading, and compacting), and loose materials generated during Project construction activities would be watered as frequently as necessary to minimize fugitive dust generation. However, the amount of water will be minimized each time to prevent temporarily ponding water that may occur as a result of the fugitive dust plan. In water-deprived locations, water spraying would be limited to active disturbance areas only, and non-water-based dust control measures would be implemented in areas with intermittent use or use that is not heavy, such as stockpiles or access roads. Alternatively, chemical dust suppressants or durable polymeric soil stabilizers could be used. The dust suppression measures would consider the sensitivity of wildlife to the windborne dispersal of fugitive dust containing dust suppressants and the potential impact on future reclamation.

NUMBER	BMP DESCRIPTION
BMP-9	**Hazardous materials.** As required by the Clean Air Act, Section 401 of the Clean Water Act, the Toxic Substance Control Act, and the Hazardous Materials Transportation Act, all vehicles and equipment must be in proper working condition to ensure that there is no potential for fugitive emissions or accidental release of motor oil, fuel, antifreeze, hydraulic fluid, grease, or other hazardous materials. Equipment must be checked for leaks prior to operation and repaired as necessary. Refueling of equipment must take place on existing paved roads, where possible, and not within or adjacent to drainages. Hazardous spills must be cleaned up immediately. Contaminated soil would be disposed of at an approved off-site landfill, and spills reported to the permitting agencies. Service/maintenance vehicles should carry appropriate equipment and materials to isolate and remediate leaks or spills, and an on-site spill containment kit for fueling, maintenance, and construction will be available. Cleaning of construction vehicles at commercial car washes should be considered rather than washing vehicles on the Project area so that dirt, grease, and detergents are treated effectively at existing facilities designed to handle those types of wastes.
BMP-10	**Integrated Weed Management Plan.** In compliance with the Federal Noxious Weed Act and the Plant Protection Act, a Project-specific integrated weed management plan for the control of noxious weeds and invasive plant species would be prepared. The plan would identify presence, location, and abundance of weed species in the Project area and surrounding area adjacent to the Project, as well as identify suppression and containment measures to prevent the spread of weed species and introduction of weed species. Prevention techniques would include: limiting disturbance areas during construction to the minimum required to perform work; limiting ingress and egress to defined routes; maintaining vehicle wash and inspection stations; and closely monitoring the types of materials brought on-site to minimize the potential for weed introduction. During operations, noxious and invasive weed management will be incorporated as a part of mandatory site training for groundskeepers and maintenance personnel. Training will include weed identification and the impacts on agriculture, wildlife, and fire frequencies. Training will also cover the importance of preventing the spread of noxious weeds and of controlling the proliferation of existing weeds.

Alternative 1: Proposed Project

Analysis of Direct and Indirect Impacts

Construction

Pesticide Residue

Portions of the proposed Project area are in agricultural production. As a result, there is a potential for residual, low-level concentrations of pesticides and other agricultural chemicals to be present in soil and/or groundwater. Should there be chemically impacted soils (i.e., fuels, pesticides, herbicides) be present in the Project area, the risk of exposure to human health is not believed to be a significant concern (refer to Environmental Data Resources, Inc. [EDR] report in Appendix F of this Draft EIR/EA). The construction of the proposed Project would require minimal grading for the foundations of the substations and O&M buildings; therefore, it is anticipated that workers' exposure to impacted soils would be at low-level concentrations.

Asbestos-Containing Materials and Lead-Based Paint

The three properties (APNs 821-120-026, 821-120-039, and 863-100-106) within the solar facility site would be removed as part of the proposed Project. These properties were constructed prior to or during the 1970s; therefore, it is very likely that the building materials used for the on-site structures have asbestos-containing materials (ACM) or lead-based paint (LBP). Generally, asbestos removal operations are low risk. When following asbestos-related regulations, the possibility of exposure to airborne asbestos fibers from asbestos removal projects is limited. Buildings identified as containing building components coated with LBP would tested for LBP. All on-site construction workers that would be working with coated or glazed building components would be knowledgeable about LBP removal and abatement.

Hazardous Materials on Adjacent Properties

The Project area is situated on the very east end of the Palo Verde Mesa. Urban development near and adjacent to the Project area includes the community of Nicholls Warm Springs/Mesa Verde, Blythe Airport, the 520-MW natural gas-fired Blythe Generating Plant, an existing solar facility site (Blythe Solar Project, owned by NRG), electrical substations, electrical transmission lines, ancillary agricultural facilities, dirt roads, and commercial businesses. I-10 crosses through the study area in an east-west alignment. It is not anticipated, however, that there would be associated risks resulting from hazardous materials on adjacent properties due to the nature of these developments and their proximity to the Project facility.

Herbicide Use

During the construction period, herbicide may be applied to control weed growth. Use of herbicides would occur in accordance with all recommended application procedures as identified on product labels as well as in cooperation with the County Agricultural Commissioner and BLM. In addition, a project-specific Integrated Weed Management Plan (BMP-10) would be developed and approved by the County Agricultural Commissioner and BLM prior to any application of herbicides on the Project for weed management.

Hazardous Materials Use

A variety of hazardous materials listed below would be used during construction of the proposed Project and stored on-site:

- 20 – cans of miscellaneous paint stored in its original tin-coated steel quart or gallon containers
- 20 – 30 gallon diesel tank storage drum barrels
- 20 – 30 gallon gasoline tank storage drum barrels
- 100 – Silicone Sealants (12 ounce tubes)
- 100 – Foam Sealants (24 ounce tubes)
- 100 – Silicone Adhesives (12 ounce tubes)

No secondary containment method is included in these containers. Basic hazardous material spill kits will be stored in the temporary construction trailers located on the Project area during construction. The Project will coordinate with registered hazardous waste transporters if spills or release result in contaminated soils.

Transport

Some hazardous materials, which would be transported to the site, would be required during construction of the proposed Project. These include diesel fuel, oil, and grease for heavy equipment as well as paints and solvents. Large quantities of these materials are not anticipated to be transported. However, all hazardous materials transported to the site would be managed in compliance with applicable laws and regulations. Should a vehicle such as a gasoline tank be required, transport would occur in compliance with Department of Toxic Substances Control (DTSC) regulations.

Use and Storage

As described above, a variety of hazardous materials would be used during construction of the proposed Project. Typical materials associated with construction include gasoline, diesel fuel, oils, and lubricants for operation and maintenance of heavy equipment. Solvents, detergents, and degreasers are also used in association with heavy equipment. Other materials, such as paints, ethylene glycol, and welding materials, may all be used to varying extents as the Project is constructed. No acutely toxic hazardous materials would be used during construction. Further, none of the materials are anticipated to pose a

significant potential for off-site impacts as a result of the quantities used, their relative toxicity, physical states (e.g., liquid or gas), and/or environmental mobility (e.g., ability to travel through soil or water).

Disposal

Leftover or spent materials would be generated during construction of the Project. These materials could include empty containers, used oil filters, used batteries, used hydraulic fluid, oils, and grease. BMPs have been identified to prevent improper handling and disposal of materials by prohibiting hazardous materials from being drained onto the ground or into streams or drainage areas. Likewise, all construction waste, including petroleum products, and other potentially hazardous materials would be required to be removed to a disposal facility authorized to accept such materials. Hazardous wastes generated during construction (such as spent oil) or remaining from construction activities would be disposed of in an approved landfill (Blythe Landfill). All hazardous wastes shipped off-site for disposal would be transported by a licensed and permitted hazardous waste hauler. Any waste generated by the Project will be disposed of at the Blythe Landfill. It is estimated that the remaining disposal capacity of the Blythe Landfill will last until approximately 2047. Compliance with these BMPs and haul methods would be effective to ensure proper disposal of hazardous materials.

If any underground storage tanks are discovered during construction and require removal, the Project will comply with the Underground Storage Tank Guidelines to Closure by Removal procedures published by the Hazardous Materials Management Division of Riverside County Department of Environmental Health.

Hazardous Materials/Spill Release Response Procedures

The Project will have an Emergency Action Team on-site to lead hazardous material or spill release response procedures as outlined in the *Release Reporting Guidelines* published by the Riverside County Department of Environmental Health, Hazardous Materials Management Branch. The Emergency Action Team is made up of two to three construction personnel who include the Construction Manager (Team Leader), a Field Engineer, and a construction worker.

The Emergency Action Team will initiate emergency communication and full evacuation procedures when conditions warrant for the following major emergencies (including, but not limited too);

1) Large or rapidly spreading fires.
2) Combustible gas line/tank ruptures.
3) Other immediate releases of flammable, corrosive, or noxious, oxidizer/highly visible gases, vapor, smoke and dust or toxic gases.
4) Spills, leaks or releases of flammable, corrosive or toxic materials of a large enough quantity to present a hazard to site occupants, adjacent properties and personnel or the community at large.
5) Explosions, Detonations or Deflagrations.
6) Earthquakes.
7) Bomb threats.
8) Security, violence, civil disobedience incident/situations.
9) Severe weather conditions (heat, cold, lightning).

Other actions to take may include:

1) Fires: Close all doors or tight fitting enclosures leading to the fire area during evacuation.
2) Interior Flammable or Combustible/Explosive Gas Releases: Leave all doors and building entry doors open during evacuation.
3) Earthquakes: Move away from window areas. Take cover in a doorway if possible. Do not leave the building during the earthquake. Be aware of overhead hazards, power lines, cranes,
4) Hoists or scaffolding or other heavy materials that could fall.
5) Bomb threats: Consult "Bomb Threat Procedures" located in the "Emergency Action Plan" section.

For smaller spills or leaks, the Emergency Action Team will shut-off valves or otherwise attempt to stop leaks at the source only if it is safe to do so. Small spills or leaks that can be safely controlled will be immediately contained by members of the Emergency Action Team in accordance with instructions from the Team Leader.

One universal spill kit and one oil-only spill kit will be located on-site at the temporary construction trailer throughout the duration of the construction process. Tables 4.2.8-1 and 4.2.8-2 list the contents of each spill release kit.

Table 4.2.8-1 Universal Spill Kit (Absorbs 24.6 gallons)

QUANTITY	CONTENTS
100	Gray universal heavyweight SonicBonded pads 15" x 19"
6	Gray universal polypropylene socks 3" x 4'
4	Gray universal polypropylene pillows 8" x 18"
1	Nitrile gloves, pair
1	Safety goggles
1	DOT Emergency Response GuideBook
1	7" Epoxy putty stick
3	Yellow disposal bag (black text: "Caution Handle with Care")
3	8" Nylon zip tie
1	Wheeled Kaddie with interior shelves and easy-view compartments

Table 4.2.8-2 Oil-only Spill Kit (Absorbs 24.6 gallons)

QUANTITY	CONTENTS
100	White oil-only heavyweight SonicBonded pads 15" x 19"
6	White oil-only polypropylene socks 3" x 4'
4	White oil-only polypropylene pillows 8" x 18"
1	Nitrile gloves, pair
1	Safety goggles

Hazardous spill mitigation materials and equipment, as well as personal protective equipment, will be used as needed in an effort to prevent spills into waterways by protecting drainage inlets, gutters, etc., and for cleanup. Sand or other absorbent materials can also be useful for absorption and containment. Material Safety Data Sheets for the materials in use on-site will be located at the temporary construction trailer.

Airport Land Use Compatibility Plan

The proposed Project falls within the Blythe Municipal Airport Influence Area (AIA), which is covered by the Riverside County Airport Land Use Compatibility Plan (RCALUCP). The majority of the proposed Project components would be within Compatibility Zones C, D, and E; no structures are proposed in Zone B1 (see Figure 4.2.8-1). Construction of the proposed Project is expected to require about three years total to complete. During the peak 24-month period, the number of construction workers could at times reach 500 persons and would typically range between 300 and 500 workers at the site. Up to 400 workers could be involved with solar panel installation at one time, and up to 150 persons could be involved with substation and O&M facility construction at any one time.

It is estimated that the construction of solar panels would proceed in stages, with about six blocks (600 acres total) under construction at any one time. Up to 350 workers could be involved with assembling these blocks. Assuming that all 350 workers could be involved with assembling an individual 100-acre block, the average intensity would be about four workers per acre, which does not exceed any RCALUCP Zone average occupancy criteria. For peak intensity, it is reasonable to expect that up to 50 persons

could be involved with assembling panels on any acre of the Project area. This level of activity would not exceed any RCALUCP Zone peak occupancy criteria.

The O&M sites each measure about two acres in area; one would be in Zone D and the other in Zone E. The three substation sites are each about two acres in area; two would be in Zone D and one in Zone E. The peak construction work force for these facilities would be about 150 persons, or about 75 persons per acre. This level of activity would not exceed the peak or average intensity factor for Zone D.

Operation and Maintenance

Herbicides

A long-term strategy for weed control and management would be implemented during operation of the Project. An Integrated Weed Management Plan (BMP-10) would be prepared and approved by the County and BLM prior to ground-disturbing activities, and implemented during operation and maintenance of the gen-tie line. The Integrated Weed Management Plan would describe specific ongoing measures to remove weedy plant species from the ROW and encourage native plant growth. If herbicides are used, they would be applied in accordance with all recommended application procedures as identified on product labels as well as in cooperation with the County Agricultural Commissioner for application on County lands.

Transport, Use and Storage, and Disposal of Hazardous Materials

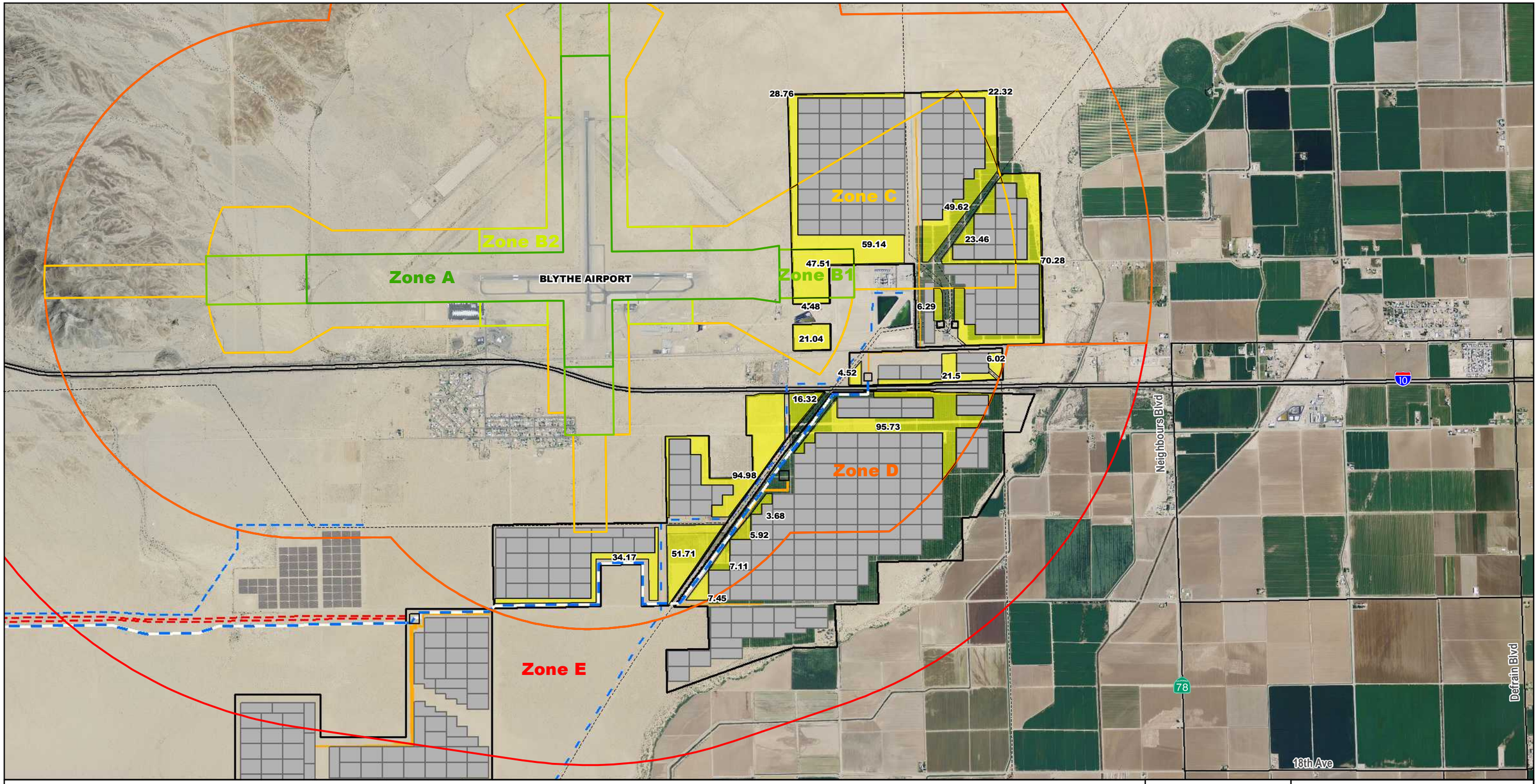
Small quantities of hazardous materials would be transported to the site (in accordance with DTSC regulations, as applicable) and used and stored on-site for miscellaneous, general maintenance activities. Hazardous materials are expected to include consumer-sized containers of oils, grease, paints, and solvents. Small quantities of diesel fuel and gasoline may also be stored at the facility for use in off-road service vehicles and generators. Dielectric insulating oil would be used in some electrical equipment, such as the on-site transformer(s). Oil-containing equipment would be installed with a spill containment system designed to contain all the oil in the event of a leak designed to contain all the oil in the event of a leak.

As part of the proposed Project, BMP-9 (Hazardous Materials) would be implemented, which would ensure that impacts would be minimized associated with hazardous materials storage and use during operation and maintenance by requiring that all fuels, fluids, and components with hazardous materials/wastes be handled in accordance with applicable regulations. Likewise, all such materials would be required to be kept in segregated storage with secondary containment. Compliance with applicable laws and the implementation of BMPs would be adequate to address storage and handling of hazardous materials for the solar facility. Vehicles and equipment would also be in proper working condition to ensure there is no potential for fugitive dust (BMP-3) and accidental release of motor oil, fuel, or other hazardous materials.

In addition to Riverside Waste Management, several agencies impose regulations regarding storage and management of hazardous materials. The Riverside County Fire Department, Riverside County Office of Emergency Services, the DTSC, and the Certified Unified Program Agency (CUPA) all regulate storage of hazardous materials. Compliance with the standards of these agencies must be followed. As with construction, any hazardous materials requiring disposal would be disposed of in an approved landfill.

Riverside County Airport Land Use Compatibility Plan

Table 4.2.8-3 lists the total acreage of the proposed solar facility site that would be within the Compatibility Zones, acreage of disturbance (areas with above-ground structures), open space (areas without above-ground structures that are a minimum size of 300 feet by 75 feet), percentage of the solar facility site that contains open space within each zone, and the RCALUCP's minimum open space requirements. As illustrated in the table below and Figure 4.2.8-1, the Project would meet the RCALUCP's minimum open space requirements.



Legend

Proposed Project
- Blythe Mesa Solar Project Boundary
- Solar Array Location
- Proposed 230 kV Transmission Line
- Proposed 34.5 kV Transmission Line

Transmission Lines
- Existing 138-161 kV Line
- Existing 500 kV Line
- Planned 500 kV Line
- Existing 230 kV Line
- Planned 230 kV Line

Blythe Airport Zoning
- Zone A
- Zone B1
- Zone B2
- Zone C
- Zone D
- Zone E
- Open Space

N

0 3,000 6,000
Feet
1:36,000



FIGURE 4.2.8-1
AIRPORT COMPATIBILITY ZONES AND OPEN SPACE

BLYTHE MESA SOLAR PROJECT

POWER ENGINEERS | RENEWABLE RESOURCES GROUP

Source: USDA NAIP Imagery, 2012.

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Table 4.2.8-3 Blythe Municipal Airport Compatibility Zones Associated with the Solar Facility

ZONE	TOTAL ACRES WITHIN ZONE	ACRES OF DISTURBANCE	OPEN SPACE ACRES	% OF OPEN SPACE	MIN. RCALUCP REQUIREMENTS
Zone B1	47.5	0.0	47.5	**100.0%**	30%
Zone C	668.2	510.4	157.8	**23.6%**	20%
Zone D	1,676.6	1,199.8	476.8	**28.4%**	10%
Zone E	901.3	771.5	129.8	**14.4%**	not applicable

Source: Compiled by POWER 2012.

The electricity from the PV panels would be transferred along medium-voltage (34.5 kV) distribution lines that would consist of above-ground poles (35 to 60 feet tall), with an average tower-to-tower span of 200 feet, and cross through Compatibility Zones C, D, and E.

The 230 kV gen-tie line (poles approximately 85 to 125 feet in height) would cross through Compatibility Zones D and E and proceed generally from I-10 in a southwesterly direction. The line would continue in a westerly direction, where it would terminate at the Colorado River Substation outside the Blythe Municipal AIA. The structure heights for the 34.5 kV distribution lines and 230 kV gen-tie line would be below the maximum height requirements of the RCALUCP's Policy 1.5.3(a)(9). The proposed gen-tie line would be within or adjacent to an existing utility corridor and co-located with other existing and planned transmission lines of similar height (see Figure 4.2.8-1 and Table 3.3.8-1). In addition, FAA issued "No Hazard to Air Navigation" Determinations for the 230 kV gen-tie line structures.

The Riverside County Airport Land Use Commission (ALUC) was concerned about the height of the 230 kV gen-tie line poles' potential reflection and glare impacts, and cumulative impacts and potential impacts to operations at the Blythe Airport. However, as requested by the ALUC, several 230 kV structures within Compatibility Zone C were relocated approximately 2,500 feet farther from Runway 17-35. In addition, as described in Section 4.2.1, *Aesthetics, Visual Resources, and Reflection*, a Glare Study was performed for the Project to assess potential impacts from reflection and glare. The findings from the Glare Study, as well as simulated animations, were presented to the ALUC. In April 2012, the ALUC found the Project is consistent with the RCALUCP (refer to Appendix N of this Draft EIR/EA).

Decommissioning

During decommissioning, substantial quantities of solid wastes (concrete, metal) and industrial wastes (dielectric insulating oil, diesel fuel) could result from dismantling the proposed Project. Large quantities of broken concrete from gen-tie line structure and building foundations and rock or gravel from on-site roads or electrical substations would be generated in addition to metal from fencing, structures, wiring, and water storage tanks. Transformers, inverters, the substation, and the septic system would all require removal and disposal. Other concrete foundations, such as those for buildings and inverter pads, would be demolished and removed or used on-site for fill as needed.

Gravel from roads would be either used on-site for fill or removed. Commercially reasonable efforts would be made to recycle or reuse materials from the decommissioning. All other materials would be disposed of at a licensed facility.

As part of the Project, BMP-9 (Hazardous Materials) would be implemented to ensure minimization of impacts associated with hazardous materials storage and use during decommissioning, as would be applied during construction and operation and maintenance. Compliance with applicable laws, as well as standards enforced by the agencies, including the DTSC, would reduce potential impacts from the use of hazardous materials at the solar facility such that no direct (spill or accidental release) or indirect (residual contamination after decommissioning) impact would occur during decommissioning of the proposed

Project. After decommissioning activities, the use of hazardous materials associated with the proposed Project would no longer exist.

The construction workforce anticipated for decommissioning would require a similar workforce to construction, but decommissioning would be less intense and last for a shorter duration; therefore, it is anticipated that the proposed Project would not exceed the RCALUCP's maximum densities/intensities thresholds during decommissioning.

Several hazards of potential concern to the public with no corresponding criteria are briefly discussed below. These hazards are acknowledged and discussed to the extent that they would result from the proposed Project and Alternatives.

Electric and Magnetic Fields

Any electricity generation project poses a potential for impacts to public health with respect to electric and magnetic fields (EMF). Both electric and magnetic fields occur together whenever electricity flows. Electric voltage (electric field) and electric current (magnetic field) from the proposed gen-tie line and the electrical collection system that would serve the solar array would create the potential for EMF exposure. The available evidence as evaluated by the California Public Utilities Commission (CPUC) and other regulatory agencies has not established that such fields pose a significant health hazard to exposed humans. To date, there are no health-based federal regulations or industry codes specifying environmental limits on the strengths of fields from power lines. Likewise, the State has not adopted any specific limits or regulations on EMF levels related to electric power facilities.

The potential for the gen-tie line on BLM-managed land to impact human health is minimal because it would primarily be within Utility Corridor K of the CDCA Plan. No residential uses are allowed within this corridor. In addition to the gen-tie line, the Project would include an electrical collection system that would primarily be installed underground. Based on the undeveloped and unpopulated nature of the setting for the Project overall (gen-tie line and PV solar facility), long-term exposure to EMF related to the Project is not expected and no impact would occur.

Interference with Radio-Frequency Communications

Gen-tie line-related radio-frequency interference is one of the indirect effects of Project operation. Interference may be produced by the physical interactions of line electric fields. Such interference is due to the radio noise produced by the action of the electric fields on the surface of the energized conductor. The phenomena involved is known as "corona discharge," but is referred to as "spark gap electric discharge" when it occurs within gaps between the conductor and insulators or metal fittings. When generated, spark gap electric discharge manifests itself as perceivable interference with radio or television signal reception or with other forms of radio communication. The level of interference depends on such factors as line voltage, distance from the line to the receiving device, orientation of the antenna, signal level, line configuration, and weather conditions. As a result, maximum interference levels are not specified as design criteria for modern transmission lines. The level of any such interference usually depends on the magnitude of the electric fields involved and the distance from the line. The potential for such impacts is minimized by reducing the line electric fields and locating the line away from inhabited areas. The proposed gen-tie line is primarily proposed within CDCA Corridor K in an unpopulated portion of the county.

The proposed gen-tie line would be built and maintained in keeping with all applicable standards and regulations, including those prescribed by the CPUC and State of California Rules for Overhead Electric Line Construction, General Order No. 95 (GO-95). The potential for spark gap electric discharge interference is usually of concern for lines of 345 kV and above, not for 230 kV lines. Since the proposed gen-tie line would be in rural and uninhabited desert open space, no direct (at the time of construction) or indirect (during operation of the gen-tie line) impacts related to radio-frequency interference would occur.

Hazardous Shocks

Hazardous shocks are those that could result from direct or indirect contact between an individual and an energized line. No design-specific federal regulations have been established to prevent hazardous shocks from overhead power lines. Safety is ensured within the industry through compliance with the requirements specifying the minimum national safe operating clearances applicable in areas where the line might be accessible to the public. The proposed gen-tie line would be in rural and uninhabited desert open space, making it highly unlikely that the public would come in contact with the line. Moreover, the gen-tie line would primarily be in a designated utility corridor (Corridors J and K) within the CDCA. The Project would be designed, constructed, and operated to meet or exceed the requirements of GO-95. The Project would include a grounding system that would dissipate current created by lightning and ground faults). Additionally, the Project would comply with the applicable U.S. Department of Labor, Occupational Safety and Health Standards.

The solar energy facility inverters and transformers would be placed on concrete foundations. Inverters would be housed in brick enclosures, while transformers would be housed in metal cabinets designed to meet National Electric Manufacturers Association 3R IP44 standards for electrical enclosures. Additionally, all electrical equipment would be subject to the product safety standard requirements of the Underwriters Laboratory and Conformance European certifications, which include assurance that the equipment would be safe to touch by humans and wildlife, and would not pose electrical shock or fire hazards. Therefore, no direct (during construction) or indirect (during operations and maintenance) impacts associated with hazardous shocks are anticipated to occur.

Fire Hazard (Non-Wildland/Operational)

Standard fire prevention and suppression measures would be implemented for the proposed Project. O&M buildings would be designed with fire protection systems based on applicable Riverside County and City of Blythe requirements. Systems where pressurized firewater is used would have electric pumps. Portable fire extinguishers of appropriate sizes and types would be located throughout the facility site. Class C (electrical) rated fire extinguishers would be mounted at each inverter.

The PV modules are typically Class C fire-rated and the remainder of the equipment would be of nonflammable material (aluminum, steel, and glass). The solar facility would be maintained with a minimum of vegetation and other combustible materials. Up to nine 10,000-gallon firewater tanks would be distributed throughout the solar facility. Access roads would provide emergency access throughout the solar facility. The Applicant would design, construct, and operate the solar facility to meet or exceed the requirements of GO-95, as well as implement BMP-4 (Fire Management and Protection Plan) to minimize potential hazards and accidents. Compliance with GO-95 includes clearance-related aspects that would apply to the gen-tie line to ensure adequate emergency access in the event of a fire.

Based on compliance with applicable requirements and design features incorporated as part of the Project, no direct impacts relative to fire hazards are anticipated during operation of the proposed Project.

Valley Fever

Construction of the proposed Project would occur in an area favorable to the growth of Valley Fever, a fungus (*Coccidioides immitis*) that grows in soils in areas of low rainfall, high summer temperatures, and moderate winter temperatures. Project construction would disturb the soil and cause the fungal spores to become airborne, potentially putting construction personnel and wildlife at risk of contracting Valley Fever. Most Valley Fever cases are very mild, and more than half of infected people either have no symptoms or experience flu-like symptoms and never seek medical attention.

While the potential for a direct impact could occur during construction in association with exposure of workers to Valley Fever spores, a dust abatement plan as required by the MDAQMD would minimize the spread of fungal spores, thereby reducing potential for contracting Valley Fever during construction (refer

to BMP-2: Fugitive Dust). No direct or indirect impacts associated with exposure to Valley Fever would occur during operation and maintenance.

Application of CEQA Significance Thresholds

HAZ-1) Would the Project create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?

The Project would not create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials. The hazardous materials used during the construction phase would be typical of most construction projects of this type. Hazardous materials would be stored, managed, and disposed of per requirements of the Riverside County Fire Department, Riverside County Office of Emergency Services, DTSC, and CUPA. In addition, BMPs listed above would be implemented to minimize or avoid impacts related to the routine transport, use, or disposal of hazardous materials. Three structures on APNs 821-120-026 (shop), 821-120-039 (shop), and 863-100-016 (residence) would be removed as part of the proposed Project. These properties were constructed prior to or during the 1970s; therefore, it is very likely that the building materials used for the on-site structures ACM or LBP. With implementation of Mitigation Measures Hazards-1 and Hazards-2, impacts regarding the transport, use, and handling of hazardous materials during construction and operation of the proposed Project would be reduced to less than significant levels. It is anticipated that impacts from decommissioning would be similar to construction; however, decommissioning would not impact ACM or LBP.

HAZ-2) Would the Project create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?

The Project would not create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment. Impacts would be less than significant.

HAZ-3) Would the Project emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?

The Project would not emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school. No impacts would occur.

HAZ-4) Would the Project be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would create a significant hazard to the public or the environment?

One aboveground storage tank was located within the Project solar facility site. It would be removed in compliance with all rules, laws, and regulations. Therefore, the Project would result in a less than significant hazard to the public or the environment.

HAZ-5) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the Project result in a safety hazard for people residing or working in the project area?

The Project would be within an existing airport land use plan. With implementation of Mitigation Measures Noise-1 and Noise-2, the Project would result in less than significant impacts to the safety of people residing and working in the Project area. In addition, the Project was designed to minimize and avoid obstructions that would compromise safe operations at the Blythe Airport. Accordingly, impacts would be less than significant.

HAZ-6) For a project within the vicinity of a private airstrip, would the Project result in a safety hazard for people residing or working in the project area?

The Project would not be within the vicinity of a private airstrip; therefore, no impact would occur.

HAZ-7) Would the Project impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?

The Project would not impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan; therefore, no impact would occur.

HAZ-8) Would the Project expose people or structures to a significant risk of loss, injury, or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?

The Project would not expose people or structures to a significant risk of loss, injury, or death involving wildland fires; therefore, no impact would occur.

HAZ-9) Would the Project result in an inconsistency with an Airport Master Plan?

The proposed Project would not conflict with the RCALUCP. As described above, the proposed Project would not exceed the RCALUCP Zone maximum densities/intensities per acre for the average and peak criteria, as well as minimum open space requirements during construction, operation, maintenance, and decommissioning. The gen-tie line poles and 34.5 kV distribution line poles would not exceed the RCALUCP development height for Zones B1, C, D, or E. The gen-tie lines would also be parallel to existing and planned transmission lines that would be similar in height. In April 2012, the ALUC found the Project to be consistent with the RCALUCP. In addition, the FAA issued "No Hazard to Air Navigation" Determinations for the 230 kV gen-tie line structures. Less than significant impact would occur and no mitigation recommended.

HAZ-10) Would the Project require review by the Airport Land Use Commission?

See HAZ-9 above.

Alternative 2: No Project Alternative

Alternative 2, the No Project Alternative, assumes that the proposed Project would not be constructed. Under this Alternative, no federal approval would be required and no BLM-managed land would be crossed. The continuation of existing land uses would be expected based on the current General Plan and land use ordinance designations, and existing agricultural operations would continue on the site. Under the No Project Alternative, existing on-site hazards in the form of oil staining, unauthorized solid waste piles, and 55-gallon storage drums would remain on the solar facility.

Alternative 3: Northern Alternative 230 kV Gen-tie Line Location

Alternative 3 would be similar to Alternative 1, with the exception of the location of the proposed 230 kV gen-tie line. Alternative 3 would place the gen-tie line several hundred feet north of the proposed alignment, and would impact essentially the same resources as the proposed alignment, except that the Alternative route would be closer to the airport. Given these similarities, potential impacts resulting from Alternative 3 would be essentially the same as those of Alternative 1.

Application of CEQA Significance Thresholds

HAZ-1) Would Alternative 3 create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?

Alternative 3 would not create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials. The hazardous materials used during the construction phase would be typical of most construction projects of this type. Hazardous materials would be stored, managed, and disposed of per requirements of the Riverside County Fire Department, Riverside County Office of Emergency Services, DTSC, and CUPA. In addition, BMPs listed above would be implemented to minimize or avoid impacts related to the routine transport, use, or disposal of hazardous materials. Three structures on APNs 821-120-026 (shop), 821-120-039 (shop), and 863-100-016 (residence) would be removed as part of the proposed Project. These properties were constructed prior to or during the 1970s; therefore, it is very likely that the building materials used for the on-site structures have ACM or LBP. With implementation of Mitigation Measures Hazards-1 and Hazards-2, impacts regarding the transport, use, and handling of hazardous materials during construction and operation of the proposed Project would be reduced to less than significant levels. It is anticipated that impacts from decommissioning would be similar to construction; however, decommissioning would not impact ACM or LBP.

HAZ-2) Would Alternative 3 create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?

Alternative 3 would not create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment. Impacts would be less than significant.

HAZ-3) Would Alternative 3 emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?

Alternative 3 would not emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school. No impacts would occur.

HAZ-4) Would Alternative 3 be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would create a significant hazard to the public or the environment?

One aboveground storage tank was located within the Alternative 3 solar facility site. It would be removed in compliance with all rules, laws, and regulations. Therefore, Alternative 3 would result in a less than significant hazard to the public or the environment.

HAZ-5) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would Alternative 3 result in a safety hazard for people residing or working in the Alternative 3 area?

Alternative 3 would be within an existing airport land use plan. With implementation of Mitigation Measures Noise-1 and Noise-2, Alternative 3 would result in less than significant impacts to the safety of people residing and working in Alternative 3 area. In addition, Alternative 3 was designed to minimize and avoid obstructions that would compromise safe operations at the Blythe Airport.

HAZ-6) For a project within the vicinity of a private airstrip, would Alternative 3 result in a safety hazard for people residing or working in the Alternative 3 area?

Alternative 3 would not be within the vicinity of a private airstrip; therefore, no impact would occur.

HAZ-7) Would Alternative 3 impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?

Alternative 3 would not impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan; therefore, no impact would occur.

HAZ-8) Would Alternative 3 expose people or structures to a significant risk of loss, injury, or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?

Alternative 3 would not expose people or structures to a significant risk of loss, injury, or death involving wildland fires; therefore, no impact would occur.

HAZ-9) Would Alternative 3 result in an inconsistency with an Airport Master Plan?

Alternative 3 would not conflict with the RCALUCP. Alternative 3 would require the same number of workers as the proposed Project; therefore, it would not exceed the RCALUCP Zone maximum densities/intensities per acre for the average and peak criteria, as well as minimum open space requirements during construction, operation, maintenance, and decommissioning. The gen-tie line poles and 34.5 kV distribution line poles would not exceed the RCALUCP development height for Zones B1, C, D, or E. The gen-tie line, which would be slightly closer to the Blythe Airport than the proposed Project, would also be parallel to existing and planned transmission lines that would be similar in height. The FAA issued "No Hazard to Air Navigation" Determinations for Alternative 3's gen-tie poles on June 15, 2012. No impact would occur and no mitigation recommended.

HAZ-10) Would Alternative 3 require review by the Airport Land Use Commission?

The solar facility component of Alternatives 1 and 3 are the same; therefore, the ALUC has reviewed this component of Alternative 3. However, within the Blythe AIA, seven poles have not been reviewed by the ALUC and would require review. Since the FAA issued "No Hazard to Air Navigation" Determinations for these poles, no impacts are anticipated from the review of the ALUC.

Alternative 4: Southern Alternative 230 KV Gen-tie Line Location

Alternative 4 would be similar to Alternative 1, with the exception of the location of the proposed 230 kV gen-tie line. Alternative 4 would place the gen-tie line several hundred feet south of the proposed alignment, and would impact the essentially the same resources as the proposed alignment, though the Alternative route would be farther away from the airport. Given these similarities, potential impacts resulting from Alternative 4 would be the essentially the same as or slightly less than those of Alternative 1.

Application of CEQA Significance Thresholds

HAZ-1) Would Alternative 4 create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?

Alternative 4 would not create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials. The hazardous materials used during the construction phase would be typical of most construction projects of this type. Hazardous materials would be stored, managed, and disposed of per requirements of the Riverside County Fire Department, Riverside County Office of Emergency Services, DTSC, and CUPA. In addition, BMPs listed above would be implemented to minimize or avoid impacts related to the routine transport, use or disposal of hazardous materials. Three structures on APNs 821-120-026 (shop), 821-120-039 (shop), and 863-100-016 (residence) would be removed as part of the proposed Project. These properties were constructed prior to or during the 1970s; therefore, it is very likely that the building materials used for the on-site structures have ACM or LBP. With implementation of Mitigation Measures Hazards-1 and

Hazards-2, impacts regarding the transport, use, and handling of hazardous materials during construction and operation of the proposed Project would be reduced to less than significant levels. It is anticipated that impacts from decommissioning would be similar to construction; however, decommissioning would not impact ACM or LBP.

HAZ-2) Would Alternative 4 create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?

Alternative 4 would not create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment. Impacts would be less than significant.

HAZ-3) Would Alternative 4 emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?

Alternative 4 would not emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school. No impacts would occur.

HAZ-4) Would Alternative 4 be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would create a significant hazard to the public or the environment?

One aboveground storage tank was located within the Alternative 4 solar facility site. It would be removed in compliance with all rules, laws, and regulations. Therefore, Alternative 4 would result in a less than significant hazard to the public or the environment.

HAZ-5) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would Alternative 4 result in a safety hazard for people residing or working in the Alternative 4 area?

Alternative 4 would be within an existing airport land use plan. With implementation of Mitigation Measures Noise-1 and Noise-2, Alternative 4 would result in less than significant impacts to the safety of people residing and working in the Project area. In addition, Alternative 4 was designed to minimize and avoid obstructions that would compromise safe operations at the Blythe Airport.

HAZ-6) For a project within the vicinity of a private airstrip, would Alternative 4 result in a safety hazard for people residing or working in the Alternative 4 area?

Alternative 4 would not be within the vicinity of a private airstrip; therefore, no impact would occur.

HAZ-7) Would Alternative 4 impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?

Alternative 4 would not impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan; therefore, no impact would occur.

HAZ-8) Would Alternative 4 expose people or structures to a significant risk of loss, injury, or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?

Alternative 4 would not expose people or structures to a significant risk of loss, injury, or death involving wildland fires; therefore, no impact would occur.

HAZ-9) Would Alternative 4 result in an inconsistency with an Airport Master Plan?

Alternative 4 would not conflict with the RCALUCP. Alternative 4 would require the same number of workers as the proposed Project; therefore, it would not exceed the RCALUCP Zone maximum densities/intensities per acre for the average and peak criteria, as well as minimum open space requirements during construction, operation, maintenance, and decommissioning. Alternative 4's gen-tie line poles would be farther away from the Blythe Airport than the proposed Project's (Alternative 1). Therefore, the gen-tie line poles would not exceed the RCALUCP development height for Zones B1, C, D, or E. The gen-tie line would also be parallel to existing and planned transmission lines that are similar in height. No impact would occur and no mitigation recommended.

HAZ-10) Would Alternative 4 require review by the Airport Land Use Commission?

The solar facility component of Alternatives 1, 3, and 4 are the same; therefore, the ALUC has reviewed this component of Alternative 4. The portion of the gen-tie line that would extend outside the solar facility site would not be within the Blythe AIA; therefore, no review would be required by the ALUC. No impact would occur.

Alternative 5: Reduced Acreage Alternative

Similar to Alternative 1, Alternative 5 would include the construction, operation, maintenance, and decommissioning of a solar facility and associated infrastructure. The primary difference between Alternatives 1 and 5 is the absence of solar facility development north of I-10, which would reduce electrical output from a 485 MW down to a 315 MW alternating current solar PV facility. The Reduced Acreage Alternative would be on a reduced footprint of approximately 2,476 acres (from 3,660 acres for the proposed Project). Alternative 5 would include approximately 2,403 acres for the solar field. Similar to the proposed Project, 73 acres would be utilized for the 230 kV gen-tie line. In comparison to Alternative 1, Alternative 5 would eliminate one on-site substation and one O&M building and would have one access point (planned on Seeley Avenue). The Reduced Acreage Alternative would also no longer extend a 230 kV overhead gen-tie line from an on-site substation north of I-10, as this Alternative would not be developed on land north of I-10. Instead, this Alternative would construct an approximately 7.8-mile-long, 230 kV overhead gen-tie line from the proposed on-site substation south of I-10 to the approved Colorado River Substation. Approximately three miles of the gen-tie line would be within the solar facility. Alternative 5 would avoid impacts that would result from the construction, operation, maintenance, and decommissioning of a solar development north of I-10; however, the land on which Alternative 1 is proposed would continue with existing uses. Current agricultural practices north of I-10 would continue, and the expected current use of pesticides, fertilizers, and fuels for farming equipment would remain unchanged.

The Reduced Acreage Alternative solar facility and a portion of the gen-tie line would be within the jurisdiction of the County of Riverside but not within the City limits of Blythe in comparison to the proposed Project. Alternative 5 would need to comply with the RCGP (2003) and PVVAP (2008). The remaining portion of the gen-tie line would traverse lands managed by the BLM and would need to comply with the CDCA Plan. The construction, operation, maintenance, and decommissioning of Alternative 5 would not exceed those hazards and hazardous materials impacts identified under the Alternative 1 analysis. Therefore, the Alternative 1 analysis would be applicable to Alternative 5, outside of those differences identified in the discussion below.

Analysis of Direct and Indirect Impacts

Construction

Pesticide Residue

Similar to the Alternative 1 site, portions of the Alternative 5 site are in agricultural production. As a result, there is a potential for residual, low-level concentrations of pesticides and other agricultural chemicals to

be present in soil and/or groundwater. Application of herbicides and pesticides used in accordance with manufacturer-prescribed and labeled instructions would result in the potential presence of low concentrations of agricultural chemicals on the solar facility site, which is not anticipated to be at hazardous levels. Should they be chemically impacted soils (i.e., fuels, pesticides, herbicides) be present in the Project area, the risk of exposure to human health is not believed to be a significant concern. Furthermore, Alternative 5 would not contain a residential or commercial component that would expose people to potential pesticides or herbicides.

Hazardous Materials on Adjacent Properties

Refer to the analysis under Alternative 1.

Herbicide Use

During the construction period, herbicide may be applied to control weed growth. Use of herbicides would occur in accordance with all recommended application procedures as identified on product labels as well as in cooperation with the County Agricultural Commissioner and BLM. In addition, a project-specific Integrated Weed Management Plan (BMP-10) would be developed and approved by the County Agricultural Commissioner and BLM prior to any application of herbicides on Alternative 5 for weed management.

Hazardous Materials Use

Transport

Some hazardous materials, which would be transported to the Alternative 5 site, would be required during construction. These include diesel fuel, oil, and grease for heavy equipment as well as paints and solvents. Large quantities of these materials are not anticipated to be transported. However, all hazardous materials transported to the site, under the reduced access point for Alternative 5, would be managed in compliance with applicable laws and regulations. Should a vehicle such as a gasoline tank be required, transport would occur in compliance with DTSC regulations.

Use and Storage

Similar to Alternative 1, a variety of hazardous materials would be used during construction of Alternative 5. The analysis under Alternative 1 would apply.

Disposal

Although reduced under Alternative 5, leftover or spent materials would be generated during construction, similar to Alternative 1. The analysis under Alternative 1 would apply.

Airport Land Use Compatibility Plan

Although reduced to only the area south of I-10, Alternative 5 would fall within the Blythe Municipal AIA, which is covered by the RCALUCP. Similar to Alternative 1, the majority of Alternative 5 components would be within Compatibility Zones C, D and E; no structures are proposed in Zone B1. Construction of the proposed Project is expected to require about three years total to complete. During the peak 24-month period, the number of construction workers could at times reach 400 persons and would typically range between 200 and 400 workers at the site. As these numbers would fall under estimations for Alternative 1 and Alternative 1 does not exceed any RCALUCP Zone average occupancy criteria, it is reasonable to expect that the Alternative 5 level of activity would not exceed any RCALUCP Zone peak occupancy criteria.

Under Alternative 5, one O&M site would be developed in Zone D and the other in Zone E. The three substation sites would each about two acres in area; two would be in Zone E. The peak construction work

force for this facility would be about 150 persons, or about 75 persons per acre. This level of activity would not exceed the peak or average intensity factor.

Operation and Maintenance

Herbicides

A long-term strategy for weed control and management would be implemented during operation of Alternative 5, similar to Alternative 1. Refer to analysis under Alternative 1.

Transport, Use and Storage, and Disposal of Hazardous Materials

As with Alternative 1, small quantities of hazardous materials would be transported to the site for Alternative 5 (in accordance with DTSC regulations, as applicable) and used and stored on-site for miscellaneous, general maintenance activities. Refer to analysis under Alternative 1.

Riverside County Airport Land Use Compatibility Plan

As development of Alternative 1 would meet the RCALUCP's minimum open space requirements, so would development of Alternative 5, since the Reduced Acreage Alternative would fall within the portion of Alternative 1 that would occur south of I-10. All remaining development under Alternative 5 south of I-10 would mirror Alternative 1; as such, the analysis for Alternative 1 in this area would apply. The FAA issued "No Hazard to Air Navigation" Determinations for the 230 kV gen-tie line structures.

The findings from the Glare Study, as well as simulated animations, were presented to the ALUC. On April 2012, the ALUC found Alternative 1 to be consistent with the RCALUCP. As Alternative 5 would develop a portion of the Alternative 1 site, Alternative 5 would be consistent with the RCALUCP determination, as well.

Decommissioning

During decommissioning, substantial quantities of solid wastes (concrete, metal) and industrial wastes (dielectric insulating oil, diesel fuel) could result from dismantling Alternative 5, similar to Alternative 1. The analysis under Alternative 1 would apply.

Application of CEQA Significance Thresholds

HAZ-1) Would Alternative 5 create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?

Similar to Alternative 1, Alternative 5 would not create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials. The hazardous materials used during the construction phase would be typical of most construction projects of this type. Hazardous materials would be stored, managed, and disposed of per requirements of the Riverside County Fire Department, Riverside County Office of Emergency Services, DTSC, and CUPA. In addition, BMPs listed above would be implemented to minimize or avoid impacts related to the routine transport, use, or disposal of hazardous materials. Alternative 5 would avoid the removal of two structures that would be impacted by Alternative 1—APNs 821-120-026 (shop) and 821-120-039 (shop). Alternative 5 would require the removal of a residential structure on APN 863-100-016. The residence was constructed prior to or during the 1970s; therefore, it is very likely that the building materials used for the structure contain ACM and/or LBP. With implementation of Mitigation Measures Hazards-1 and Hazards-2, impacts regarding the transport, use, and handling of hazardous materials during construction and operation of Alternative 5 would be reduced to less than significant levels. It is anticipated that impacts from decommissioning would be similar to construction; however, decommissioning would not impact ACM or LBP.

HAZ-2) Would Alternative 5 create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?

Similar to Alternative 1, Alternative 5 would not create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment. As such, the HAZ-2 analysis under Alternative 1 would apply.

HAZ-3) Would Alternative 5 emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?

Similar to Alternative 1, Alternative 5 would not emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school. As such, the HAZ-3 analysis under Alternative 1 would apply.

HAZ-4) Would Alternative 5 be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would create a significant hazard to the public or the environment?

One aboveground storage tank was located within the Alternative 1 solar facility site. This site is north of I-10, outside of the Alternative 5 development footprint. No impact would occur.

HAZ-5) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would Alternative 5 result in a safety hazard for people residing or working in the project area?

Similar to Alternative 1, Alternative 5 would be within an existing airport land use plan. The HAZ-5 analysis for Alternative 1 would apply.

HAZ-6) For a project within the vicinity of a private airstrip, would Alternative 5 result in a safety hazard for people residing or working in the project area?

Alternative 5 would not be within the vicinity of a private airstrip; therefore, no impact would occur.

HAZ-7) Would Alternative 5 impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?

Alternative 5 would not impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan; therefore, no impact would occur.

HAZ-8) Would Alternative 5 expose people or structures to a significant risk of loss, injury, or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?

Alternative 5 would not expose people or structures to a significant risk of loss, injury, or death involving wildland fires; therefore, no impact would occur.

HAZ-9) Would Alternative 5 result in an inconsistency with an Airport Master Plan?

Similar to Alternative 1, Alternative 5 would not conflict with the RCALUCP. The HAZ-9 analysis for Alternative 1 would apply.

HAZ-10) Would Alternative 5 require review by the Airport Land Use Commission?

See HAZ-9 above.

Cumulative Impacts

Geographic Scope

The geographic scope considered for cumulative impacts from health, safety, and hazardous materials/fire and fuels management is the area within one mile of the boundary of the study area. One mile is the American Society of Testing and Materials standard search distance for hazardous materials and captures all areas within which a receptor might be expected to experience hazard impacts from the Project along with hazard impacts of other projects. This one-mile standard distance was also applied to other potential safety risks associated with fire and fuels management.

Temporal Scope

The temporal scope refers to the duration over which an impact would occur: short-term or long-term; for example, only during the months of construction, only during operation and maintenance, or during both phases. This limits the projects whose impacts are to be analyzed in the cumulative effects analysis to those that would cause impacts at the same time as the BMSP. Determining the temporal scope requires estimating the length of time the effects of the proposed action would last, either individually or in combination with other anticipated effects. The temporal scope of impacts to hazards and hazardous materials would be during the development of cumulative projects through the end of Project decommissioning, because any direct or indirect effects of the Project would only occur during the life of the Project. The temporal scope of the cumulative impact analysis includes related project construction schedules that overlap with those of the BMSP and the operation of related projects after the construction of the proposed Project has been completed and through the end of Project decommissioning.

Analysis of Direct and Indirect Impacts

Alternative 1: Proposed Project

Construction, Operation, Maintenance, and Decommissioning

Compliance with existing BMP-9 (Hazardous Materials) and agency regulations that address the handling of hazardous materials would ensure that the proposed Project would not create a significant hazard to the public or the environment related to the handling or accidental release of hazardous materials. Past, present, and reasonably foreseeable future projects are also subject to existing agency regulations that address the handling and accidental release of hazardous materials (impact HAZ-1). Therefore, existing agency regulations would ensure that the incremental effects of the Project, when considered together with the effects of past, present, and reasonably foreseeable projects, would not create a cumulatively considerable hazard to the public or environment related to the handling or accidental release of hazardous materials (impact HAZ-2).

Under cumulative conditions, implementation of the proposed Project in conjunction with development of projects listed in Table 4.1-1 is not anticipated to present a public health and safety hazard to residents. Implementation of BMP-3 (Fugitive Dust Abatement Plan) and BMP-9 (Hazardous Materials) would ensure that Project-specific health and safety hazards would be minimized. Additionally, the proposed Project and projects listed in Table 4.1-1 would all involve the storage, use, disposal, and transport of hazardous materials to varying degrees during construction and operation. Impacts from these activities are less than significant for the projects because the storage, use, disposal, and transport of hazardous materials are extensively regulated by various federal, State, and local laws, regulations, and policies. The proposed Project and projects listed in Table 4.1-1 would likely implement and comply with these existing hazardous materials laws, regulations, and policies. Therefore, the projects listed in Table 4.1-1 would not cause a cumulative impact, and the Project would not result in a cumulatively considerable incremental contribution to a cumulative impact related to use or routine transport of hazardous materials (impacts HAZ-1 through HAZ-4).

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The gen-tie line component of the proposed Project would connect with other off-site proposed and planned transmission infrastructure to the west of the study area and run parallel to these facilities. As a result of this circumstance, the cumulative projects would be contained within the same ROW as the off-site Project facilities and would not subject additional land areas to hazards associated with hazardous materials and fuels management. Thus, the Project's incremental contribution to any potential cumulative impacts would not be considerable.

Alternative 2: No Project Alternative

If the No Project Alternative is implemented, the proposed action Alternatives would not be implemented and the current agricultural practices and expected current use of pesticides, fertilizers, and fuels for farming equipment would remain unchanged.

Alternative 3: Northern 230 kV Gen-tie Line Location

Alternative 3 is similar to Alternative 1 (proposed Project), with the exception of the location of the Northern 230 kV gen-tie line, which would be approximately 700 feet north of Alternative 1's proposed 230 kV gen-tie line. The cumulative impacts associated with the construction, operation, maintenance, and decommissioning of the solar facility would be the same as Alternative 1. As with Alternative 1, compliance with BMP-9 (Hazardous Materials) and existing agency regulations that address the handling of hazardous materials would ensure that Alternative 3 would not create a significant hazard to the public or the environment related to the handling or accidental release of hazardous materials. Past, present, and reasonably foreseeable future projects are also subject to existing agency regulations that address the handling and accidental release of hazardous materials (impact HAZ-1). Therefore, existing agency regulations would ensure that the incremental effects of Alternative 3, when considered together with the effects of past, present, and reasonably foreseeable projects, would not create a cumulatively considerable hazard to the public or environment related to the handling or accidental release of hazardous materials (impact HAZ-2).

Under cumulative conditions, implementation of Alternative 3 in conjunction with development of projects under the cumulative scenario is not anticipated to present a public health and safety hazard to residents. Implementation of BMP-3 (Fugitive Dust Abatement Plan) and BMP-9 (Hazardous Materials) would ensure that Alternative 3-specific health and safety hazards would be minimized. Additionally, development of Alternative 3 and the projects listed in Table 4.1-1 would all involve the storage, use, disposal, and transport of hazardous materials to varying degrees during construction and operation. Impacts from these activities are less than significant for the projects because the storage, use, disposal, and transport of hazardous materials are extensively regulated by various federal, State, and local laws, regulations, and policies. Alternative 3 and the cumulative scenario projects listed in Table 4.1-1 would likely implement and comply with these existing hazardous materials laws, regulations, and policies. Therefore, the projects listed in Table 4.1-1 would not cause a cumulative impact, and Alternative 3 would not result in a cumulatively considerable incremental contribution to a cumulative impact related to use or routine transport of hazardous materials (impacts HAZ-1 through HAZ-4).

The gen-tie line component of this Alternative would connect with other off-site proposed and planned transmission infrastructure to the west of the study area and run parallel to these facilities. As a result of this circumstance, the cumulative projects would be contained within the same ROW as the off-site Project facilities and would not subject additional land areas to hazards associated with hazardous materials and fuels management. Thus, Alternative 3's incremental contribution to any potential cumulative impacts would not be considerable.

Alternative 4: Southern 230 kV Gen-tie Line Location

Alternative 4 is similar to Alternative 1 (proposed Project), with the exception of the location of the Southern 230 kV gen-tie line, which would be approximately 0.8 mile south of Alternative 1's proposed 230 kV gen-tie line. The cumulative impacts associated with the construction, operation, maintenance, and decommissioning of the solar facility would be the same as Alternative 1. As with Alternative 1, compliance with BMP-9 (Hazardous Materials) and existing agency regulations that address the handling

of hazardous materials would ensure that Alternative 4 would not create a significant hazard to the public or the environment related to the handling or accidental release of hazardous materials. Past, present, and reasonably foreseeable future projects are also subject to existing agency regulations that address the handling and accidental release of hazardous materials (impact HAZ-1). Therefore, existing agency regulations would ensure that the incremental effects of Alternative 4, when considered together with the effects of past, present, and reasonably foreseeable projects, would not create a cumulatively considerable hazard to the public or environment related to the handling or accidental release of hazardous materials (impact HAZ-2).

Under cumulative conditions, implementation of Alternative 4 in conjunction with development of projects under the cumulative scenario is not anticipated to present a public health and safety hazard to residents. Implementation of BMP-3 (Fugitive Dust Abatement Plan) and BMP-9 (Hazardous Materials) would ensure that Alternative 4-specific health and safety hazards would be minimized. Additionally, development of Alternative 4 and the projects listed in Table 4.1-1 would all involve the storage, use, disposal, and transport of hazardous materials to varying degrees during construction and operation. Impacts from these activities are less than significant for the projects because the storage, use, disposal, and transport of hazardous materials are extensively regulated by various federal, State, and local laws, regulations, and policies. Alternative 4 and the cumulative scenario projects listed in Table 4.1-1 would likely implement and comply with these existing hazardous materials laws, regulations, and policies. Therefore, the projects listed in Table 4.1-1 would not cause a cumulative impact, and Alternative 4 would not result in a cumulatively considerable incremental contribution to a cumulative impact related to use or routine transport of hazardous materials (impacts HAZ-1 through HAZ-4).

The gen-tie line component of this alternative would be approximately 0.8 mile south of Alternative 1's proposed 230 kV gen-tie line. However, cumulative scenario projects would likely connect with other proposed and planned transmission infrastructure to the west of the study area and run parallel to these facilities. As a result of this circumstance, the cumulative projects would be contained within the same ROW as the off-site Project facilities and would not subject additional land areas to hazards associated with hazardous materials and fuels management. Thus, Alternative 4's incremental contribution to any potential cumulative impacts would be greater than the proposed Alternatives 1 and 3, but would not be considerable.

Alternative 5: Reduced Acreage Alternative

Construction, Operation, Maintenance, and Decommissioning

Similar to Alternative 1, compliance with BMP-9 (Hazardous Materials) and existing agency regulations, under Alternative 5, that address the handling of hazardous materials would ensure that Alternative 5 would not create a significant hazard to the public or the environment related to the handling or accidental release of hazardous materials. Past, present, and reasonably foreseeable future projects are also subject to existing agency regulations that address the handling and accidental release of hazardous materials (impact HAZ-1). Therefore, existing agency regulations would ensure that the incremental effects of Alternative 5, when considered together with the effects of past, present, and reasonably foreseeable projects, would not create a cumulatively considerable hazard to the public or environment related to the handling or accidental release of hazardous materials (impact HAZ-2).

Under cumulative conditions, implementation of Alternative 5 in conjunction with development of projects listed in Table 4.1-1 is not anticipated to present a public health and safety hazard to residents. Implementation of BMP-3 (Fugitive Dust Abatement Plan) and BMP-9 (Hazardous Materials) would ensure that Alternative 5-specific health and safety hazards would be minimized. Additionally, Alternative 5 and projects listed in Table 4.1-1 would all involve the storage, use, disposal, and transport of hazardous materials to varying degrees during construction and operation. Impacts from these activities are less than significant for the projects because the storage, use, disposal, and transport of hazardous materials are extensively regulated by various federal, State, and local laws, regulations, and policies. Alternative 5 and projects listed in Table 4.1-1 would likely implement and comply with these existing hazardous materials laws, regulations, and policies. Therefore, the projects listed in Table 4.1-1 would not cause a cumulative impact, and Alternative 5 would not result in a cumulatively considerable incremental

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contribution to a cumulative impact related to use or routine transport of hazardous materials (impacts HAZ-1 through HAZ-4).

The gen-tie line component of Alternative 5 would connect with other off-site proposed and planned transmission infrastructure to the west of the study area and run parallel to these facilities. As a result of this circumstance, the cumulative projects would be contained within the same ROW as the off-site Alternative 5 facilities and would not subject additional land areas to hazards associated with hazardous materials and fuels management. Thus, Alternative 5's incremental contribution to any potential cumulative impacts would not be considerable.

Mitigation Measures

Hazards-1 Prior to issuance of permits for any demolition activity involving the removal of structures that may contain ACM, an asbestos survey and sampling shall be conducted for existing structures. If ACM are present, they shall be abated in compliance with SCAQMD Rule 1403. Additionally, SCAQMD would be notified prior to any structure renovation or demolition pursuant Rule 1403 (d)(1)(B).

Hazards-2 Prior to issuance of permits for any demolition activity involving structures that may contain LBP, a LBP assessment of each existing structure shall be conducted. LBP found within the Project area shall be removed and disposed of as a hazardous waste in accordance with all applicable regulations.

Residual Impacts

With implementation of the above-listed BMPs as part of the Project and Mitigation Measures Hazards-1 and Hazards-2, the Project would result in less than significant impacts from hazards and hazardous materials.

NEPA Conclusions

The No Project Alternative would not have impacts, as the existing circumstances and operations would continue essentially unchanged. The Project and each of the action Alternatives would comply with federal, State, and local laws, regulations, and policies for hazardous waste and materials. With implementation of BMPs and Mitigation Measures Hazards-1 and Hazards-2, the Project and each of the action Alternatives would not create a significant hazard to the public or the environment related to the handling or accidental release of hazardous materials, use or routine transport of hazardous materials, or subject additional land areas to hazards associated with hazardous materials and fuels management.

4.2.9 Hydrology and Water Quality

This section describes the impact analysis relating to hydrology and water quality for the proposed Project and Alternatives. Additional information on water supply for the Project can be found in the *Water Supply Assessment for the Blythe Mesa Solar Project*, prepared by POWER Engineers, Inc. 2013 (provided in Appendix G of this Draft EIR/EA). Information regarding the floodplain was obtained from the *Blythe Mesa CUP 03685 Wash Feature Summary of Findings* (Appendix H of this Draft EIR/EA).

Methodology for Analysis

To assess potential effects of the proposed Project and Alternatives related to hydrology and water quality, water resources on the proposed solar facility site and within the area were inventoried to allow a location-specific analysis of temporary and permanent effects of the proposed Project. Potential effects to hydrology and water quality include temporary (i.e., construction-related and those related to decommissioning) effects and long term (i.e., operational) effects. When evaluating potential effects of the proposed Project resulting from construction, operation and maintenance, and decommissioning of the Project, it was assumed that the Project would comply with all applicable federal, State, and local regulatory requirements and permits that protect surface water and groundwater.

CEQA Significance Criteria

In compliance with CEQA requirements, determinations were made regarding the significance of each identified impact that would potentially result from construction and operation of the proposed Project. Appropriate criteria derived from the CEQA Guidelines have been identified and utilized to make these significance determinations. Potential impacts are assessed and determined to be either of no impact, less than significant impact, less than significant impact with implementation of mitigation measures, or significant impact. Impacts resulting from the proposed Project would be considered significant and would require mitigation if the Project would:

HYD-1) Violate any water quality standards or waste discharge regulations.

HYD-2) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted).

HYD-3) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site.

HYD-4) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site.

HYD-5) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff.

HYD-6) Otherwise substantially degrade water quality.

HYD-7) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map.

HYD-8) Place within a 100-year flood hazard area structures which would impede or redirect flood flows.

HYD-9) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam.

HYD-10) Be at risk of inundation by seiche, tsunami, or mudflow.

The following additional significance criteria from the County of Riverside CEQA Environmental Assessment Form are used in the analysis. A project could have potentially significant impacts if it would:

HYD-11) Include new or retrofitted Stormwater Treatment Control BMPs (e.g., water quality treatment basins, constructed treatment wetlands), the operation of which could result in significant environmental effects (i.e., increased vectors and/or odors).

HYD-12) Cause changes in absorption rates or the rate and amount of surface runoff.

HYD-13) Cause changes in the amount of surface water in any water body.

NEPA Requirements

Pursuant to NEPA, this analysis is intended to compare the Alternatives and identify any adverse effects to water resources that cannot be avoided. Adverse effects may be direct, indirect, or cumulative. Potential direct and indirect effects of the proposed Project and Alternatives are analyzed below and discussed as construction-related, operation- and maintenance-related, and decommissioning effects.

Applicable Best Management Practices

As part of the Project and Alternatives, the following applicable BMPs would minimize the environmental impacts to hydrology and water quality. The full BMPs have been detailed below (see also Table 2-4 in Chapter 2) and are further referenced (by number) within the impact discussion.

NUMBER	BMP DESCRIPTION
BMP-1	**Drainage, Erosion, and Sedimentation Control Plan**. As part of the County of Riverside's Conditional Use Permit (CUP) requirements, a Drainage, Erosion, and Sedimentation Control Plan would be developed for the Project. The plan would address the drainage, erosion, and sediment control requirements to support all activities associated with construction, operation, maintenance, and decommissioning of the Project. For example, any stockpiles created would be kept on-site, with an upslope barrier in place to divert runoff. Stockpiles would be sprayed with water, covered with tarpaulins, and/or treated with appropriate dust suppressants, especially in preparation for high wind or storm conditions. Certified weed-free straw bale barriers would be installed to control sediment in runoff water; straw bale barriers would be installed only where sediment-laden water can pond, thus allowing the sediment to settle out. Topsoil from the site would be stripped, stockpiled, and stabilized before excavating earth for facility construction. Topsoil would be segregated and spread on freshly disturbed areas to reduce color contrast and aid rapid revegetation.
BMP-2	**Stormwater Pollution Prevention Plan.** In compliance with requirements of the National Pollutant Discharge Elimination System (NPDES) permit, a Stormwater Pollution Prevention Plan (SWPPP) would be developed and prepared for the Project to ensure that protection of water quality and soil resources is consistent with County and State regulations. The plan would identify site surface water runoff patterns and include measures that prevent excessive and unnatural soil deposition and erosion throughout and downslope of the Project area and Project-related construction areas, and would also include measures for non-stormwater discharge and waste management. The SWPPP would cover all activities associated with the construction of the Project, including clearing, grading, and other ground disturbance such as stockpiling or excavation erosion control. The plan would prevent off-site migration of contaminated stormwater, changes in pre-Project storm hydrographs, or increased soil erosion.
BMP-3	**Fugitive Dust Abatement Plan.** As required by the Mojave Desert Air Quality Management District Rule 403, a Fugitive Dust Abatement Plan would be prepared to address fugitive dust emissions during Project construction, operation, maintenance, and decommissioning. The plan would include measures to minimize fugitive dust emissions from wrecking, excavation, grading, clearing of land, and solid waste disposal operations, and would take every reasonable precaution to prevent visible particulate matter from being deposited upon public roadways as a direct result of operations. During construction, all unpaved roads, disturbed areas (e.g., areas of scraping, excavation, backfilling, grading, and compacting), and loose materials generated during Project construction activities would be watered as frequently as necessary to minimize fugitive dust generation. However, the amount of water will be minimized each time to prevent temporarily ponding water that may occur as a result of the fugitive dust plan. In water-deprived locations, water spraying would be limited to active disturbance areas only, and non-water-based dust control measures would be implemented in areas with

NUMBER	BMP DESCRIPTION
	intermittent use or use that is not heavy, such as stockpiles or access roads. Alternatively, chemical dust suppressants or durable polymeric soil stabilizers could be used. The dust suppression measures would consider the sensitivity of wildlife to the windborne dispersal of fugitive dust containing dust suppressants and the potential impact on future reclamation.
BMP-9	**Hazardous materials.** As required by the Clean Air Act, Section 401 of the Clean Water Act, the Toxic Substance Control Act, and the Hazardous Materials Transportation Act, all vehicles and equipment must be in proper working condition to ensure that there is no potential for fugitive emissions or accidental release of motor oil, fuel, antifreeze, hydraulic fluid, grease, or other hazardous materials. Equipment must be checked for leaks prior to operation and repaired as necessary. Refueling of equipment must take place on existing paved roads, where possible, and not within or adjacent to drainages. Hazardous spills must be cleaned up immediately. Contaminated soil would be disposed of at an approved offsite landfill, and spills reported to the permitting agencies. Service/maintenance vehicles should carry appropriate equipment and materials to isolate and remediate leaks or spills, and an on-site spill containment kit for fueling, maintenance, and construction will be available. Cleaning of construction vehicles at commercial car washes should be considered rather than washing vehicles on the Project area so that dirt, grease, and detergents are treated effectively at existing facilities designed to handle those types of wastes.
BMP-10	**Integrated Weed Management Plan.** In compliance with the Federal Noxious Weed Act and the Plant Protection Act, a Project-specific integrated weed management plan for the control of noxious weeds and invasive plant species would be prepared. The plan would identify presence, location, and abundance of weed species in the Project area and surrounding area adjacent to the Project, as well as identify suppression and containment measures to prevent the spread of weed species and introduction of weed species. Prevention techniques would include: limiting disturbance areas during construction to the minimum required to perform work; limiting ingress and egress to defined routes; maintaining vehicle wash and inspection stations; and closely monitoring the types of materials brought on-site to minimize the potential for weed introduction. During operations, noxious and invasive weed management will be incorporated as a part of mandatory site training for groundskeepers and maintenance personnel. Training will include weed identification and the impacts on agriculture, wildlife, and fire frequencies. Training will also cover the importance of preventing the spread of noxious weeds and of controlling the proliferation of existing weeds.
BMP-11	**Project structures, gen tie line, and building surfaces.** Project facilities would be sited to ensure that there is adequate space (i.e., setbacks of no less than 100 feet) between solar facilities and natural washes. These setbacks would preserve and maintain the natural washes' hydrological functions. The color and finish of Project structure and building surfaces that are visible to the public will be designed to ensure minimal visual intrusion, contrast, and glare. Grouped structures will be painted the same color to reduce visual complexity and color contrast. Solar panel backs will be color-treated to reduce visual contrast with the landscape setting. Materials, coatings, or paints having little or no reflectivity will be used wherever possible. The visual color contrast of graveled surfaces will be reduced with approved color treatment practices.
BMP-13	**Ground and surface disturbance.** Construction boundaries would be clearly delineated to minimize areas of ground and surface disturbance. Ground-disturbing activities shall be minimized, especially during the rainy season. To the maximum extent possible, construction-related activities (such as vehicle and foot traffic) would avoid areas with intact biological soil crusts. For cases in which impacts cannot be avoided, soil crusts would be salvaged and restored on the basis of recommendations by the County of Riverside and BLM once construction has been completed. Existing rocks, vegetation, and drainage patterns shall be preserved to the maximum extent possible. No paint or permanent discoloring agents shall be applied to rocks or vegetation (to indicate surveyor construction activity limits or for any other purpose). All stakes and flagging shall be removed from the construction area and disposed of in an approved facility. Where feasible, brush-beating, mowing, or use of protective surface matting rather than removing vegetation shall be employed. Clearing and disturbing of sensitive areas (e.g., steep slopes and natural drainages) and other areas shall be avoided outside the construction zone. Surface disturbance would be minimized by utilizing undulating surface disturbance edges; stripping, salvaging, and replacing topsoil; using contoured grading; controlling erosion; using dust suppression techniques; and restoring exposed soils to their original contour and vegetation.
BMP-14	**Travel and traffic.** Vehicular traffic on-site shall be confined to existing or designated travel routes and designated work areas. Access to the construction site and staging areas shall be limited to authorized vehicles and only through the designated roads. The extent of habitat disturbance during construction shall be reduced by keeping vehicles on access roads and minimizing foot and vehicle traffic through undisturbed areas. To the

NUMBER	BMP DESCRIPTION
	extent practical, travel shall be limited to stabilized roads. Road maintenance activities shall avoid blading existing forbs and grasses in ditches and adjacent to roads. Abandoned roads and roads no longer needed shall be subsoiled to increase infiltration and reduce soil compaction, then recontoured and revegetated. Construction traffic shall avoid unpaved surfaces to the extent practical (to reduce the risk of compaction) and reduce speed to lessen fugitive dust emissions. On unpaved or unstabilized surfaces within the construction site, speed limits (e.g., 20 mph) shall be posted with visible signs and enforced to minimize airborne fugitive dust. Project vehicle speeds shall be limited in areas occupied by special-status animal species. Traffic shall stop to allow wildlife to cross roads. Shuttle vans or carpooling shall be used to reduce the amount of traffic on access roads. Workers shall be trained to comply with the speed limit, use good engineering practices, minimize the drop height of materials, and minimize the number and extent of disturbed areas. The Project developer shall enforce these requirements.
BMP-15	**New access roads and parking lots.** New access roads shall be designed and constructed to the appropriate road design standards, such as those described in BLM Manual 9113 or County standards, whichever is applicable. New access roads shall be designed to follow natural land contours in the Project area and avoid existing desert washes. The specifications and codes developed by the U.S. Department of Transportation (DOT) and County of Riverside Transportation Department are also to be taken into account. Primary access roads and parking lots shall be surfaced with aggregate that is hard enough that vehicles cannot crush it and thus cause dust or compacted soil conditions. Paving may also be used on access roads and parking lots. Alternatively, chemical dust suppressants or durable polymeric soil stabilizers would be used on these locations.

Alternative 1: Proposed Project

Analysis of Direct and Indirect Impacts

Construction

Water Quality

Construction of the solar facility, gen-tie lines, new substations, access roads, and O&M buildings would require ground-disturbing activities, including clearing and grading for structure installation work areas, and access for construction. Disturbed soils accelerate erosion and increase sediment in stormwater runoff to receiving waters, causing increased turbidity and sedimentation if not managed appropriately. Construction-related erosion and sedimentation as a result of soil disturbance would be minimized as part of the Project with preparation of a Drainage, Erosion, and Sedimentation Control Plan (BMP-1) and Stormwater Pollution Prevention Plan (BMP-2). Construction of the proposed Project would not permanently alter the course of any of the drainages. Additionally, fuel, oil, and other fluids used in construction vehicles, equipment, and heavy machinery could enter drainages via storm flow and contaminate water, introducing additional sources of polluted stormwater runoff. The potential for accidental release of motor oil, fuel, antifreeze, hydraulic fluid, grease, and other hazardous materials would be minimized as part of the Project with implementation of BMP-2 and BMP-9.

Ground disturbance related to construction of the Project could potentially degrade water quality through the inadvertent release of residual pesticides from former agricultural lands. All pesticides used in the United States must be registered (licensed) by the EPA, which requires that pesticides would not cause unreasonable harm to the environment. Registered pesticides must be used in accordance with directions contained on the label of the product. The Project would not include the use of pesticides during construction or operation. While the Project may involve the use of herbicides as part of the Integrated Weed Management Plan (BMP-10), herbicides would be applied in accordance with all recommended or required application procedures.

Hazardous material storage and management would be implemented in accordance with requirements set forth by the Riverside County Fire Department (RCFD), Riverside County Office of Emergency Services, DTSC, and CUPA for storage and handling of hazardous materials. As part of the Project, the potential for accidental release of motor oil, fuel, antifreeze, hydraulic fluid, grease, and other hazardous

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materials would be minimized with implementation of BMP-9. In addition, construction activities would occur according to Occupational Safety and Health Administration (OSHA) regulatory requirements; therefore, it is not anticipated that construction activities for the proposed Project would release hazardous materials, substances, or waste.

Surface Water, Groundwater, and Water Supply

An ephemeral drainage bisects the gen-tie line and a portion of the solar facility site and may be affected by construction, operation, or maintenance of the proposed Project. The solar panels have been designed to avoid placement within the ephemeral drainage; however, one gen-tie pole would be within the potential ordinary high water mark of the drainage. Construction of the new substations (approximately 90,000 square feet each), O&M buildings (approximately 3,500 square feet each), and equipment pads (approximately 360 square feet each) would introduce new areas of impermeable surfaces that would potentially interfere with groundwater recharge within the groundwater basin. The two primary access roads (Seeley Avenue and Riverside Drive) to the O&M buildings would be improved for approximately 100 feet and would be 16 to 20 feet wide. The interior access roads within the solar facility site would be unpaved and pervious. The new impermeable surface areas would not result in substantial negative effects on groundwater recharge due to the high proportion of permeable surfaces that would remain. Construction of the interior unpaved access roads and use of heavy equipment and vehicles across the Project area could result in soil compaction, which could increase surface water runoff rates and quantities, as well as decrease the rate at which water is able to percolate through the ground. As part of the Project, soil compaction would be reduced through minimization of ground disturbance (BMP-13) and use of aggregate for new access roads (BMP-15).

Based on the 2010 Palo Verde Irrigation District (PVID) records, irrigation of the agricultural fields on the proposed solar facility site used approximately 12,000 AF per year (AF/yr) of surface water. It is assumed that Project construction would not involve the use of groundwater pumped from existing wells on-site. During the 36-month (three-year) construction period for the proposed Project, the water supply supplied by the PVID would be reduced to approximately 1,354 AF of water compared to earlier agricultural uses (totaling approximately 1,354 AF over the three-year construction period). Construction water would be used for dust suppression, concrete manufacturing, and fire safety. Accordingly, there would be a beneficial impact to the water supply via reduced need for water.

Existing Drainage Patterns

Project facilities would be sited to provide adequate setbacks between most solar facility components (solar panels, gen-tie lines, substations, access roads, and O&M buildings) and ephemeral drainages (BMP-11). These setbacks would preserve and maintain the hydrological functions of the drainage to the extent possible (see Figure 3.2.9-1 *Floodplain Delineation*). Construction of the Project would require ground-disturbing activities, including solar array installation, substation and O&M building construction, and construction of access roads. Grading could potentially alter naturally occurring drainage patterns and result in soil erosion, sedimentation, long-term siltation, and increased stormwater runoff, which increases the potential for flooding off-site or downstream of the construction areas. However, the Project area is relatively flat and would not require mass grading for construction purposes. The majority of the existing topography at the Project area would be maintained and, therefore, no added storm drainage control would be required outside of the substations and switching station. Stormwater drainage inside the substations and switching station would be designed to minimize erosion and sediment-laden runoff, as described in mitigation measure Hydrology-4. Blading and other methods of vegetation removal for clearance of roads and construction areas decrease the ability of the soil to absorb water, which also increases stormwater runoff from such disturbed areas. As part of the Project, BMP-1 (Drainage, Erosion, and Sedimentation Control Plan) and BMP-2 (Stormwater Pollution Prevention Plan) would be implemented; this would minimize impacts from storm water runoff and existing drainage patterns. In addition, the minimization of ground and surface disturbance (BMP-13), limitation of vehicle travel and traffic (BMP-14), and limited construction of new access roads and parking lots (BMP-15) would minimize impacts to the existing drainage patterns.

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Operation and Maintenance

Water Quality

The new substations and O&M buildings would create new areas of impermeable surfaces, which have the potential to increase the rate of stormwater runoff, leading to increased erosion and long-term siltation and flooding downstream of the new impermeable areas, and contribute additional sources of polluted runoff. As part of the Project, however, BMP-1 and BMP-2 would be implemented, which would minimize impacts to water quality that would result from erosion and increased turbidity and sedimentation downstream. Maintenance of access roads and structure pads (e.g., gravelling and vegetation clearance) would contribute additional sources of runoff. As part of the Project, BMP-13 through BMP-15 would be implemented, which would also minimize potential impacts from runoff.

The O&M buildings would generate a minimum volume of wastewater as result of daily activities. Wastewater would be treated via a septic system permitted through the Riverside County Department of Environmental Health Services, and would be in compliance with Department requirements.

Groundwater and Water Supply

The Project would require a limited amount of water for periodic washing of the solar panels, fire water supply, and supply for the operations and maintenance buildings. A total of up to 345 AF per year of non-potable water would be required for Project operation, which is well below the existing (pre-Project) irrigation use of approximately 12,000 AF/yr. Water for the Project would be taken from existing PVID water entitlements that support the agricultural operations currently on the proposed solar facility site; current operations are not supported by groundwater wells. Riverside County Community Service Area #122 (CSA #122) has issued a will-serve letter for the Project's limited potable water needs. Less than one AF of groundwater per year would be required for potable use in the two O&M buildings.

The water supply from PVID sources and CSA #122 is sufficient to meet requirements of the proposed Project, including the minor potable groundwater demand under average-year, single-dry year, and multiple-dry year conditions over a 20-year future projection (refer to Appendix G, *Water Supply Assessment*).

Flood Hazards

The Project would be in an area designated by the Federal Emergency Management Agency (FEMA) as Zone D, which is reserved for areas where there are possible but undetermined flood hazards, and where no FEMA flood hazard analysis has been conducted. However, the Project would be on the Palo Verde Mesa, which is on high ground, at an elevation approximately 50 feet above the historic floodplain of the Colorado River (i.e., the Palo Verde Valley). Additionally, the Project would be approximately eight miles west of the current channel of the Colorado River, and it is unlikely floodwaters associated with the Colorado River that floodwaters would affect the Project.

The ephemeral drainage that bisects the southern portion of the proposed solar facility site was analyzed to determine the depth and extent of a 100-year flood hazard area associated with this drainage (see Appendix H *Blythe Mesa CUP 03685 Wash Feature Summary of Findings*). The extent of the floodplain for this area is delineated in Figure 3.2.9-1 *Floodplain Delineation*. The analysis determined a 100-year flood flow would have a flow velocity of 5,557 cubic feet per second and, given the wide, flat nature of the topography, flood depths would be shallow (3.71 feet maximum depth) and average stream velocities would vary from 6.8 feet per second (4.6 mph) to 2.4 feet per second (1.6 mph) outside of the main channel, and scour would be minimal. Based on the results of this analysis, solar panels, associated hardware, and substation foundations could be elevated to provide additional clearance above the calculated 100-year flood depth, and structured that could not be relocated (e.g., transmission line structures) would be designed to withstand potential flood hazards.

This ephemeral drainage would be crossed by the gen-tie line; the width of the calculated floodplain would preclude the floodplain from being crossed in a single span, and one pole structure would be sited

within the limits of the potential ordinary high water mark, as estimated by field personnel from the USACE. The Project would obtain a Nationwide Permit 12 from the USACE for the placement of the pole structure within the potential ordinary high water mark.

The Project would not be located in the vicinity of a levee or dam, nor would the Project be located such that it would expose people or structures to significant risk of loss, injury, or death involving flooding.

The Project would not be in a location that could be affected by a tsunami or seiche. The Project would be in an area characterized by well-drained soils and low precipitation and would not be within a State of California Earthquake Fault Zone for known active faults, and no known or potentially active faults are mapped within the vicinity of the Project area (the nearest active fault is approximately 58 miles away).

Decommissioning

Activities associated with decommissioning are similar to construction; therefore, effects related to hydrology and water quality associated with decommissioning would be similar to construction-related effects of the proposed Project.

Application of CEQA Significance Thresholds

HYD-1) Would the Project violate any water quality standards or waste discharge regulations?

Temporary, direct impacts to water quality could result from stormwater runoff during construction and operation of the Project, resulting in erosion and increased turbidity and sedimentation downstream if not managed appropriately. In addition, stormwater runoff could transport fuel, oil, and other fluids into drainages via stormwater flow. As part of the Project, BMP-1, BMP-2, BMP-9, BMP-13, BMP-14, and BMP-15 would be implemented to minimize potential impacts to water quality from sedimentation, turbidity, and oil/chemical contamination. Implementation of Mitigation Measure Hydrology-1 would further reduce these potential impacts to a less than significant level.

HYD-2) Would the Project substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?

Construction and operation of the O&M buildings, substations, and equipment pads would create new areas of impermeable surfaces that could potentially interfere with groundwater recharge; however, the new impermeable surfaces would be minimal in comparison to the total solar facility area which would be left in a pervious condition and would not significantly interfere with groundwater recharge. Water supplies required for construction, operation, and maintenance of the Project would be provided by PVID water entitlements that currently support the agricultural operations on-site; these operations are not currently supported by groundwater wells. The Watershed Supply Assessment conducted for the Project determined that adequate water supplies exist to serve the Project over the life of the Project (construction, operation and maintenance, and decommissioning). The great majority of water for the proposed Project (i.e., all of the non-potable water) would not be delivered by a public water system or using public water system connections. The proposed Project would use existing water infrastructure that currently delivers irrigation water from the PVID. Riverside County Community Service Area #122 (CSA #122) has substantiated its intention to provide this potable supply by issuing a will-serve letter (October 26, 2012 c/o Steve H. Jones – Manager) for the Project's limited potable water needs. CSA #122 has provided a will-serve letter for the small amount (up to 150 gallons per day) of potable water for the two O&M buildings. The Project would result in a beneficial increase in available PVID water supply due to the reduction in water demand for the Project compared to existing agricultural use. No impact

HYD-3) Would the Project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?

An ephemeral drainage bisects the gen-tie line and the southern portion of the proposed solar facility site; however, Project design includes buffers between Project facilities and natural washes, as described in BMP-11. Although on-site grading would be minimized, the installation of proposed facilities, including roads, fencing, solar arrays, and towers along the transmission corridor, could interfere with existing drainage patterns on-site. Any necessary grading would follow existing contours as feasible to minimize alteration of existing drainage patterns (BMP-11). Erosion and sedimentation would be minimized through implementation of the Project Drainage, Erosion, and Sedimentation Control Plan (BMP-1), as well as the required Project SWPPP (BMP-2), and other measures as described in Mitigation Measures Hydrology-1 through Hydrology-4. Implementation of the BMPs, as part of the Project, and mitigation measures would reduce these impacts to less than significant.

HYD-4) Would the Project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?

As described in HYD-2, the creation of impermeable surfaces relative to the Project area would be nominal. The proposed Project would result in slight alterations in the existing drainage pattern of the site or area (refer to discussion in HYD-3). The Project would be in an area characterized by well-drained soils and low precipitation, and any necessary grading would follow existing contours as feasible to minimize alteration to the existing drainage patterns as described in HYD-3. Designed setbacks, as described in BMP-11, would also minimize alterations to drainage patterns of the ephemeral wash and its associated floodplain, further reducing the potential for flooding on- or off-site. Therefore, there is low potential for flooding on- or off-site during construction, operation, maintenance, and decommissioning of the Project. Impacts would be less than significant.

HYD-5) Would the Project create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?

Creation of new permanent access roads (both paved and unpaved) and construction of the substations, O&M buildings, and equipment pads, along with grading for installation of the solar array, would create additional sources of runoff. Likewise, grading for construction of the solar facility would potentially contribute additional sources of runoff. As part of the Project BMPs discussed above, impacts related to the introduction of additional sources of polluted runoff would be minimized. The majority of the original grades and natural drainage features within the solar facility site and gen-tie line corridor would be maintained; within the substations and switching station, stormwater drainage would be designed to minimize erosion and sediment-laden runoff as well as control the flow of water leaving the property to minimize potential for erosion and flooding off-site, as described in mitigation measure Hydrology-4. Impacts would be less than significant.

HYD-6) Would the Project otherwise substantially degrade water quality?

Ground disturbance related to construction of the Project would potentially degrade water quality through the inadvertent release of hazardous materials, pesticides, and herbicides.

While Project construction and operation could include use or application of hazardous materials or wastewater with potential to degrade water quality, compliance with all applicable regulations and permit requirements would reduce the potential impacts to a less than significant level.

HYD-7) Would the Project place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?

The proposed Project would not include the construction of any residential units, and would not introduce new housing to the area. No impact would occur.

HYD-8) Would the Project place within a 100-year flood hazard area structures which would impede or redirect flood flows?

The Project would be on the Palo Verde Mesa, at an elevation approximately 50 feet above the historic floodplain of the Colorado River (i.e., Palo Verde Valley approximately eight miles west of the current channel of the Colorado River) and would be unlikely to impede or redirect flood flows associated with the Colorado River. The Project would relocate or elevate Project components to avoid placing structures within the 100-year flood hazard area associated with the ephemeral drainage; gen-tie line structures that could not be relocated would be designed to withstand flood flows to the extent possible to minimize potential of these structures to impede or redirect flood flows. Implementation of Mitigation Measures Hydrology-5 and Hydrology-6 would reduce impacts during construction, operation, maintenance, and decommissioning to less than significant levels.

HYD-9) Would the Project expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?

The Project would not be located in the vicinity of a levee or dam. Portions of the Project would be located in a floodplain, such that it would expose people or structures to significant risk of loss, injury, or death involving flooding. However, with implementation of Mitigation Measures Hydrology-5 and Hydrology-6 would reduce impacts during construction, operation, maintenance, and decommissioning to less than significant levels.

HYD-10) Would the Project be at risk of inundation by seiche, tsunami, or mudflow?

The Project would not be sited in a location that could be affected by a tsunami or seiche. The Project would be sited in an area characterized by well-drained soils and low precipitation, which is not within a State of California Earthquake Fault Zone for known active faults, and no known or potentially active faults are mapped within the vicinity of the Project area. The Project would not be affected by or result in a mudflow; no impact would occur.

HYD-11) Would the Project include new or retrofitted Stormwater Treatment Control BMPs (e.g., water quality treatment basins, constructed treatment wetlands), the operation of which could result in significant environmental effects (i.e., increased vectors and/or odors)?

No storm water drainage system exists on the Project area. Construction of the proposed Project would include implementation of a SWPPP (BMP-2). The plan would specify measures that would minimize or avoid potential effects associated with storm water runoff. Operation and maintenance would not introduce new infrastructure or alter existing surface water and drainage patterns beyond what occurred during the construction period. Therefore, impacts would be less than significant.

HYD-12) Would the Project cause changes in absorption rates or the rate and amount of surface runoff?

See HYD-3 and HYD-4 above. The proposed Project would cause slight changes in the absorption rates and amount of surface water to on-site or off-site drainages. Implementation of Mitigation Measures Hydrology-3 and Hydrology-4 would reduce potential impacts resulting from runoff and absorption rates.

HYD-13) Would the Project cause changes in the amount of surface water in any water body?

See HYD-2 above. The proposed Project would reduce the amount of water used on-site compared to existing agricultural use, which would not have an adverse effect on Colorado River water supplies or diversions.

Alternative 2: No Project Alternative

Under the No Project Alternative, no new construction and/or operational activities would result, and no new impacts would occur. However, the existing agricultural use on the Project area would continue to utilize a greater amount of water than the action Alternatives, resulting in a negative impact to water supplies as compared to the action Alternatives.

Alternative 3: Northern Alternative 230 KV Gen-tie Line Location

Similar to Alternative 1, Alternative 3 would include the construction, operation, maintenance, and decommissioning of a solar facility and associated infrastructure. The primary difference between Alternatives 1 and 3 is the location of the proposed 230 kV gen-tie alignment within the solar facility to the Colorado River Substation. Within the solar field, the same 230 kV gen-tie alignment would be used for both Alternatives 1 and 3; however, the gen-tie alignment for Alternative 3 would be shifted to the north, but primarily within the same BLM utility corridor and within the SEZ, and entirely on BLM-managed lands. All direct and indirect impacts to groundwater, water supply, water quality, drainage patterns, and flood hazards would be the same as Alternative 1.

Analysis of Direct and Indirect Impacts

Construction

Water Quality

Construction of the solar facility, gen-tie lines, new substations, access roads, and O&M buildings would require ground-disturbing activities, including clearing and grading for structure installation work areas, and access construction. Disturbed soils accelerate erosion and increase sediment in stormwater runoff to receiving waters, causing increased turbidity and sedimentation. Construction-related erosion and sedimentation as a result of soil disturbance would be minimized as part of Alternative 3 with preparation of a Drainage, Erosion, and Sedimentation Control Plan (BMP-1) and SWPPP (BMP-2). Construction of Alternative 3 would not permanently alter the course of any of the drainages. Additionally, fuel, oil, and other fluids used in construction vehicles, equipment, and heavy machinery could enter drainages via storm flow and contaminate water, introducing additional sources of polluted stormwater runoff. The potential for accidental release of motor oil, fuel, antifreeze, hydraulic fluid, grease, and other hazardous materials would be minimized as part of Alternative 3 with implementation of BMP-9, in addition to BMP-2.

Ground disturbance related to construction of Alternative 3 could potentially degrade water quality through the inadvertent release of residual pesticides from former agricultural uses. All pesticides used in the United States must be registered (licensed) by the EPA, which requires that pesticides would not cause unreasonable harm to the environment. Registered pesticides must be used in accordance with directions contained on the label of the product. Furthermore, similar to Alternative 1, Alternative 3 would not include the use of pesticides during construction or operation. While the Project may involve the use of herbicides as part of the Integrated Weed Management Plan (BMP-10), herbicides would be applied in accordance with all recommended or required application procedures.

Hazardous material storage and management would be implemented in accordance with requirements set forth by the RCFD, Riverside County Office of Emergency Services, DTSC, and CUPA for storage and handling of hazardous materials. As part of Alternative 3, the potential for accidental release of motor oil, fuel, antifreeze, hydraulic fluid, grease, and other hazardous materials would be minimized with implementation of BMP-9. In addition, construction activities would occur according to OSHA regulatory

requirements; therefore, it is not anticipated that construction activities for Alternative 3 would release hazardous materials, substances, or waste.

Surface Water, Groundwater, and Water Supply

The Alternative 3 site contains the same ephemeral drainage that bisects Alternative 1, and which may would be affected by construction, operation, or maintenance of Alternative 3. The solar panels would be designed to avoid placement within the ephemeral drainage; however, similar to Alternative 1 at least one gen-tie pole would be within the potential ordinary high water mark of the drainage. Construction of the new substations, O&M buildings, and equipment pads would introduce new areas of impermeable surfaces that would potentially interfere with groundwater recharge within the groundwater basin. The two primary access roads to the O&M buildings would be improved for approximately 100 feet and would be 20 feet wide. The interior access roads within the solar facility site would 12 feet wide and unpaved and pervious. The new impermeable surface areas would not result in substantial negative effects on groundwater recharge. Construction of the interior unpaved access roads and use of heavy equipment and vehicles across the Alternative 3 area could result in soil compaction, which could increase surface water runoff rates and quantities, as well as decrease the rate at which water is able to percolate through the ground. As part of Alternative 3, soil compaction would be minimized through minimization of ground disturbance (BMP-13) and use of aggregate for new access roads (BMP-15).

Based on the 2010 PVID records, irrigation of the agricultural fields on the proposed solar facility site used approximately 12,000 AF per year of surface water. It is assumed that Alternative 3 construction would not involve the use of groundwater pumped from existing wells on-site. During the 36-month construction period for Alternative 3, the water supply that is presently used for agricultural irrigation would be reduced to a maximum of 345 AF/year (up to 1,354 AF of water for the three-year construction period). Construction water would be used for dust suppression, concrete manufacturing, and fire safety. Accordingly, there would be a beneficial impact to the water supply through reduced usage.

Existing Drainage Patterns

Alternative 3 facilities would be sited to provide adequate setbacks between solar facility components and ephemeral drainage (BMP-11). These setbacks would preserve and maintain the hydrological functions of the drainage to the extent possible. Construction of Alternative 3 would require ground-disturbing activities, including solar array installation, substation and O&M building construction, and construction of access roads. Grading could potentially alter naturally occurring drainage patterns and result in soil erosion, sedimentation, long-term siltation, and increased stormwater runoff, which increases the potential for flooding off-site or downstream of the construction areas. However, the Alternative 3 site is relatively flat and would not require mass grading for construction purposes. The majority of the original grades and natural drainage features at the Alternative 3 site would be maintained and, therefore, no added storm drainage control would be required outside of the substations and switching station. Blading and other methods of vegetation removal for clearance of roads and construction areas decrease the ability of the soil to absorb water, which also increases stormwater runoff from such disturbed areas. As part of Alternative 3, BMP-1 (Drainage, Erosion, and Sedimentation Control Plan) and BMP-2 (Stormwater Pollution Prevention Plan) would be implemented; this would minimize impacts from storm water runoff and existing drainage patterns. In addition, the minimization of ground and surface disturbance (BMP-13), limitation of vehicle travel and traffic (BMP-14), and construction of new access roads and parking lots (BMP-15) would minimize impacts to the existing drainage patterns.

Operation and Maintenance

Water Quality

The new substations and O&M buildings would create new areas of impermeable surfaces, which have the potential to increase the rate of stormwater runoff, leading to increased erosion and long-term siltation and flooding downstream of the new impermeable areas, and contribute additional sources of polluted runoff. As part of Alternative 3, however, BMP-1 and BMP-2 would be implemented, which would minimize impacts to water quality that would result from erosion and increased turbidity and

sedimentation downstream. Maintenance of access roads and structure pads (e.g., gravelling and vegetation clearance) would contribute additional sources of runoff. As part of Alternative 3, BMP-13 through BMP-15 would be implemented, which would also minimize potential impacts from runoff.

The O&M buildings would generate a minimum volume of wastewater as result of daily activities. Wastewater would be treated via a septic system permitted through the Riverside County Department of Environmental Health Services, and would be in compliance with Department requirements.

Groundwater and Water Supply

Alternative 3 would require a limited amount of water for washing of the solar panels, fire water supply, and supply for the operations and maintenance buildings. Up to 345 AF/yr of non-potable water would be required for Alternative 3 operation, which is well below the existing irrigation use of approximately 12,000 AF/yr. Water for Alternative 3 would be taken from existing PVID water entitlements that support the agricultural operations currently on the proposed solar facility site; current operations are not supported by groundwater wells. CSA #122 has issued a will-serve letter for BMSP's limited potable water needs. Less than 1.0 AF of groundwater per year would be required for potable use in the two O&M buildings.

The water supply from PVID sources and CSA #122 is sufficient to meet requirements of Alternative 3, including the minor potable groundwater demand under average-year, single-dry year, and multiple-dry year conditions over a 20-year future projection (refer to Appendix G, *Water Supply Assessment Report*).

Flood Hazards

Alternative 3 would be in an area designated by FEMA as Zone D, which is reserved for areas where there are possible but undetermined flood hazards, and where no flood hazard analysis has been conducted. However, Alternative 3 would be on the Palo Verde Mesa, which is on high ground, at an elevation approximately 50 feet above the historic floodplain of the Colorado River. Additionally, Alternative 3 would be approximately eight miles west of the current channel of the Colorado River, and it is unlikely that floodwaters associated with the Colorado River would affect Alternative 3.

The ephemeral drainage that bisects the southern portion of the proposed solar facility site was analyzed to determine the depth and extent of a 100-year flood hazard area associated with this drainage (see Appendix H *Blythe Mesa CUP 03685 Wash Feature Summary of Findings*). The extent of the floodplain for this area is delineated in Figure 3.2.9-1 *Floodplain Delineation*. The analysis determined a 100-year flood flow would have a flow velocity of 5,557 cubic feet per second and, given the wide, flat nature of the topography, flood depths would be shallow (3.71 feet maximum depth) and average stream velocities would vary from 6.8 feet per second (4.6 mph) to 2.4 feet per second (1.6 mph) outside of the main channel, and scour would be minimal. Based on the results of this analysis, solar panels, associated hardware, and substation foundations could be elevated to provide additional clearance above the calculated 100-year flood depth, and structured that could not be relocated (e.g., gen-tie line structures) would be designed to withstand potential flood hazards.

Alternative 3 would not involve work in the vicinity of a levee or dam, nor would Alternative 3 be located such that it would expose people or structures to significant risk of loss, injury, or death involving flooding.

Alternative 3 would not be in a location that could be affected by a tsunami or seiche. Alternative 3 would be in an area characterized by well-drained soils and low precipitation and would not be within a State of California Earthquake Fault Zone for known active faults, and no known or potentially active faults are mapped within the vicinity of the Alternative 3 area (the nearest active fault is approximately 58 miles away).

Decommissioning

Activities associated with decommissioning are similar to construction; therefore, effects related to hydrology and water quality associated with decommissioning would be similar to construction-related effects of Alternative 3.

Application of CEQA Significance Thresholds

HYD-1) Would Alternative 3 violate any water quality standards or waste discharge regulations?

Temporary, direct impacts to water quality could result from stormwater runoff during construction and operation of Alternative 3, resulting in erosion and increased turbidity and sedimentation downstream if not managed appropriately. In addition, stormwater runoff could transport fuel, oil, and other fluids into drainages via stormwater flow. As part of the Project, BMP-1, BMP-2, BMP-9, BMP-13, BMP-14, and BMP-15 would be implemented to minimize potential impacts to water quality from sedimentation, turbidity, and oil/chemical contamination. Implementation of Mitigation Measure Hydrology-1 would further reduce these potential impacts to a less than significant level.

HYD-2) Would Alternative 3 substantially deplete supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?

Construction and operation of the O&M buildings, substations, and equipment pads would create new areas of impermeable surfaces that could potentially interfere with groundwater recharge; however, the new impermeable surfaces would be minimal in comparison to the total solar facility area, which would be left in a pervious condition, and would not significantly interfere with groundwater recharge. Water supplies required for construction, operation, and maintenance of Alternative 3 would be provided by PVID water entitlements that currently support the agricultural operations on-site; these operations are not currently supported by groundwater wells. The Watershed Supply Assessment conducted for the Project determined that adequate water supplies would exist to serve the Project over the life of Alternative 3 (construction, operation, maintenance, and decommissioning). The great majority of water for Alternative 3 (i.e., all of the non-potable water) would not be delivered by a public water system or using public water system connections. Alternative 3 would use existing water infrastructure that currently delivers irrigation water from the PVID. Riverside County Community Service Area #122 (CSA #122) has substantiated its intention to provide this potable supply by issuing a will-serve letter (October 26, 2012 c/o Steve H. Jones – Manager) for the Project's limited potable water needs. CSA #122 has provided a will-serve letter for the small amount (up to 150 gallons per day) of potable water for the two O&M buildings. Alternative 3 would result in a beneficial increase in available PVID water supply due to the reduction in water demand on compared to existing agricultural use.

HYD-3) Would Alternative 3 substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?

As described previously, an ephemeral drainage bisects the gen-tie line and the southern portion of the proposed solar facility site; however, Alternative 3 design would include buffers between Project facilities and natural washes, as described in BMP-11. Although on-site grading would be minimized, the installation of proposed facilities, including roads, fencing, solar arrays, and towers along the transmission corridor, could interfere with existing drainage patterns on-site. Any necessary grading would follow existing contours as feasible to minimize alteration of existing drainage patterns (BMP-11). Erosion and sedimentation would be minimized through implementation of the Project Drainage, Erosion, and Sedimentation Control Plan (BMP-1), as well as the required Project SWPPP (BMP-2), and other measures as described in Mitigation Measures Hydrology-1 through Hydrology-4. Implementation of the BMPs, as part of the Project, and mitigation measures would reduce these impacts to less than significant.

HYD-4) Would Alternative 3 substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?

As described in HYD-2, the creation of impermeable surfaces relative to the area of Alternative 3 would be nominal. The Alternative 3 would result in slight alterations in the existing drainage pattern of the site or area (refer to discussion in HYD-3). Alternative 3 would be in an area characterized by well-drained soils and low precipitation, and any necessary grading would follow existing contours as feasible to minimize alteration to the existing drainage patterns as described in HYD-3. Designed setbacks, as described in BMP-11, would also minimize alterations to drainage patterns of the ephemeral wash and its associated floodplain, further reducing the potential for flooding on- or off-site. Therefore, there is low potential for flooding on- or off-site during construction, operation, maintenance, and decommissioning of Alternative 3. Impacts would be less than significant.

HYD-5) Would Alternative 3 create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?

Creation of new permanent access roads (both paved and unpaved) and construction of the substations, O&M buildings, and equipment pads, along with grading for installation of the solar array, would create additional sources of runoff. Likewise, grading for construction of the solar facility would potentially contribute additional sources of runoff. As part of BMPs discussed above, impacts related to the introduction of additional sources of polluted runoff would be minimized. The majority of the original grades and natural drainage features within the solar facility site and gen-tie line corridor would be maintained; within the substations and switching station, stormwater drainage would be designed to minimize erosion and sediment-laden runoff as well as control the flow of water leaving the property to minimize potential for erosion and flooding off-site, as described in mitigation measure Hydrology-4. Impacts would be less than significant.

HYD-6) Would Alternative 3 otherwise substantially degrade water quality?

Ground disturbance related to construction of Alternative 3 would potentially degrade water quality through the inadvertent release of hazardous materials, pesticides, and herbicides.

While Alternative 3 construction and operation could include use or application of hazardous materials or wastewater with potential to degrade water quality, compliance with all applicable regulations and permit requirements would reduce the potential impacts to a less than significant level.

HYD-7) Would Alternative 3 place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?

Alternative 3 would not include the construction of any residential units, and would not introduce new housing to the area. No impact would occur.

HYD-8) Would Alternative 3 place within a 100-year flood hazard area structures which would impede or redirect flood flows?

Alternative 3 would be on the Palo Verde Mesa, at an elevation approximately 50 feet above the historic floodplain of the Colorado River (i.e., Palo Verde Valley approximately eight miles west of the current channel of the Colorado River) and would be unlikely to impede or redirect flood flows associated with the Colorado River. The Project would relocate or elevate Project components to avoid placing structures within the 100-year flood hazard area associated with the ephemeral drainage; gen-tie line structures that could not be relocated would be designed to withstand flood flows to the extent possible to minimize potential of these structures to

impede or redirect flood flows. Implementation of Mitigation Measures Hydrology-5 and Hydrology-6 would reduce impacts during construction, operation, maintenance, and decommissioning to less than significant levels.

HYD-9) Would Alternative 3 expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?

Alternative 3 would not be located in the vicinity of a levee or dam. Portions of the Project would be located in a floodplain, such that it would expose people or structures to significant risk of loss, injury, or death involving flooding. However, with implementation of Mitigation Measures Hydrology-5 and Hydrology-6 would reduce impacts during construction, operation, maintenance, and decommissioning to less than significant levels.

HYD-10) Would Alternative 3 be at risk of inundation by seiche, tsunami, or mudflow?

Alternative 3 would not be sited in a location that could be affected by a tsunami or seiche. Alternative 3 would be sited in an area characterized by well-drained soils and low precipitation, which is not within a State of California Earthquake Fault Zone for known active faults, and no known or potentially active faults are mapped within the vicinity of the Project area. Alternative 3 would not be affected by or result in a mudflow; no impact would occur.

HYD-11) Would Alternative 3 include new or retrofitted Stormwater Treatment Control BMPs (e.g., water quality treatment basins, constructed treatment wetlands), the operation of which could result in significant environmental effects (i.e., increased vectors and/or odors)?

No storm water drainage system exists on the Alternative 3 site. Construction of Alternative 3 would include implementation of a SWPPP (BMP-2). The plan would specify measures that would minimize or avoid potential effects associated with storm water runoff. Operation and maintenance would not introduce new infrastructure or alter existing surface water and drainage patterns beyond what occurred during the construction period. Therefore, impacts would be less than significant.

HYD-12) Would Alternative 3 cause changes in absorption rates or the rate and amount of surface runoff?

See HYD-2 above. Alternative 3 would cause slight changes in the absorption rates and amount of surface water to on-site or off-site drainages. Implementation of Mitigation Measures Hydrology-3 and Hydrology-4 would reduce potential impacts resulting from runoff and absorption rates.

HYD-13) Would Alternative 3 cause changes in the amount of surface water in any water body?

See HYD-2 above. Alternative 3 would reduce the amount of water used on-site compared to existing agricultural use, which would not have an adverse effect on Colorado River water supplies or diversions.

Alternative 4: Southern Alternative 230 kV Gen-tie Line Location

Also similar to Alternatives 1 and 3, Alternative 4 would include the construction, operation, maintenance, and decommissioning of a solar facility and associated infrastructure. The only difference between Alternatives 1, 3, and 4 is the location of the proposed 230 kV gen-tie line that would extend from the solar facility to the Colorado River Substation. The gen-tie alignment for Alternative 4 would be shifted approximately 0.8 mile to the south, leaving the southwestern section of the solar facility and continuing to the Colorado River Substation. Alternative 4 would be slightly longer than the proposed 230 kV gen-tie alignment (9.5 miles versus 8.4 miles); approximately three miles of the Alternative 4 230 kV gen-tie line would not parallel existing transmission lines, and new access roads may be required for construction of Alternative 4. In addition to the ephemeral stream that runs through the solar facility, the gen-tie line for this Alternative would twice cross an ephemeral drainage that drains from Mule Mountain. Alternative 4 would potentially have greater ground disturbance and areas of soil compaction than Alternatives 1 and 3.

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Unless noted below, all direct and indirect impacts to groundwater, water supply, water quality, drainage patterns, and flood hazards would be the same as Alternative 1.

Analysis of Direct and Indirect Impacts

Construction

Water Quality

Construction of Alternative 4 has the potential to affect an ephemeral drainage that flows north/northeast from Mule Mountain. Construction of the Alternative 4 gen-tie line would require ground-disturbing activities, including clearing and grading for structure installation work areas, and construction access. Disturbed soils can be susceptible to erosion and increase sediment in stormwater runoff to receiving waters, causing increased turbidity and sedimentation. Construction-related erosion and sedimentation as a result of soil disturbance would be minimized as part of Alternative 4, with preparation of a Drainage, Erosion, and Sedimentation Control Plan (BMP-1) and SWPPP (BMP-2). Additionally, fuel, oil, and other fluids used in construction vehicles, equipment, and heavy machinery could enter drainages via storm flow and contaminate water, introducing additional sources of polluted stormwater runoff. Implementation of BMP-9, as part of Alternative 4, would minimize the potential for accidental release of motor oil, fuel, antifreeze, hydraulic fluid, grease, and other hazardous materials.

Hazardous material storage and management would be implemented in accordance with requirements set forth by the RCFD, Riverside County Office of Emergency Services, DTSC, and CUPA for storage and handling of hazardous materials. Implementation of BMP-9 as part of Alternative 4 would minimize the potential for accidental release of motor oil, fuel, antifreeze, hydraulic fluid, grease, and other hazardous materials. In addition, construction activities would occur according to OSHA regulatory requirements; therefore, it is not anticipated that construction activities for Alternative 4 would release hazardous materials, substances, or waste.

Surface Water, Groundwater, and Water Supply

Construction of new access or spur roads for the Alternative 4 gen-tie line would potentially affect the ephemeral drainage that flows from Mule Mountain. These access roads would be sited to avoid natural drainages as feasible, would be unpaved and pervious, and would not result in substantial negative effects on groundwater recharge. Use of heavy equipment and vehicles on these access roads could result in soil compaction, which could increase surface water runoff rates and quantities, as well as increase the rate at which water is able to percolate through the ground. Minimization of ground disturbance (BMP-13) would minimize soil compaction.

Existing Drainage Patterns

Alternative 4 gen-tie lines and access roads would be sited to provide adequate setbacks from natural washes (BMP-11). These setbacks would preserve and maintain the hydrological functions of drainages. As described previously, construction of Alternative 4 would require ground-disturbing activities. Grading could potentially alter naturally-occurring drainage patterns and result in soil erosion, sedimentation, long-term siltation, and increased stormwater runoff, which increases the potential for flooding off-site or downstream of the construction areas. However, the Alternative 4 alignment is relatively flat and would not require significant grading for construction purposes. The majority of the original grades and natural drainage features along the Alternative 4 alignment would be maintained and, therefore, no added storm drainage control would be required outside of the substations and switching station. Blading and other methods of vegetation removal for clearance of roads and construction areas decrease the ability of the soil to absorb water, which also increases stormwater runoff from such disturbed areas. As part of Alternative 4, implementation of BMP-1 (Drainage, Erosion, and Sedimentation Control Plan) and BMP-2 (Stormwater Pollution Prevention Plan) would ensure minimization of impacts from storm water runoff and existing drainage patterns. In addition, the minimization of ground and surface disturbance (BMP-13), limitation of vehicle travel and traffic (BMP-14), and siting of new access roads (BMP-15) would minimize impacts to the existing drainage patterns.

Operation and Maintenance

Water Quality

Maintenance of access roads and structure pads (e.g., gravelling and vegetation clearance) would contribute additional sources of runoff that could result in erosion and increased turbidity and sedimentation downstream. As part of Alternative 4, BMP-13 through BMP-15 would be implemented, which would minimize potential impacts from runoff.

Decommissioning

Activities associated with decommissioning of Alternative 4 are similar to construction of Alternatives 1 and 3; therefore, effects related to hydrology and water quality associated with decommissioning of Alternative 4 would be similar to construction-related effects of the proposed Project.

Application of CEQA Significance Thresholds

With respect to Alternative 4, the application of CEQA significance thresholds applicable to construction, operation, maintenance, and decommissioning are as described below.

HYD-1) Would Alternative 4 violate any water quality standards or waste discharge regulations?

Temporary, direct impacts to water quality could result from stormwater runoff during construction and operation of Alternative 4, resulting in erosion and increased turbidity and sedimentation downstream if not managed appropriately. In addition, stormwater runoff could transport fuel, oil, and other fluids into drainages via stormwater flow. As part of Alternative 4, BMP-1, BMP-2, BMP-9, BMP-13, BMP-14, and BMP-15 would be implemented to minimize potential impacts to water quality from sedimentation, turbidity, and oil/chemical contamination. Implementation of Mitigation Measure Hydrology-1 would further reduce these potential impacts to a less than significant level.

HYD-2) Would Alternative 4 substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?

Construction and operation of Alternative 4 would create a new but small area of impermeable surfaces that could potentially interfere with groundwater recharge. Water supplies required for construction, operation, and maintenance of Alternative 4 would be provided by PVID water entitlements that currently support the agricultural operations on-site; these operations are not currently supported by groundwater wells. The Watershed Supply Assessment conducted for the Project determined that adequate water supplies exist to serve Alternative 4 over the life of the Project (construction, operation, maintenance, and decommissioning). The great majority of water for Alternative 4 (i.e., all of the non-potable water) would not be delivered by a public water system or using public water system connections. Alternative 4 would use existing water infrastructure that currently delivers irrigation water from the PVID. Riverside County Community Service Area #122 (CSA #122) has substantiated its intention to provide this potable supply by issuing a will-serve letter (October 26, 2012 c/o Steve H. Jones – Manager) for the Project's limited potable water needs. CSA #122 has provided a will-serve letter for the small amount (up to 150 gallons per day) of potable water for the two O&M buildings. Alternative 4 would result in a beneficial increase in available PVID water supply due to the reduction in water demand on-site.

HYD-3) Would Alternative 4 substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?

Alternative 4 would cross one ephemeral stream that could potentially be affected by the proposed gen-tie line alignment. However, BMP-11 would be implemented as part of the Project; therefore, the potential impacts to this drainage would be minimized by ensuring a setback between the drainage and access roads and construction areas. As such, no Project-related impact to this drainage would occur. Although on-site grading would be minimized, the installation of proposed facilities, including roads and towers along the Alternative 4 alignment, could interfere with existing drainage patterns on-site. Any necessary grading would follow existing contours as feasible to minimize alteration of existing drainage patterns (BMP-11). Erosion and sedimentation would be minimized through implementation of the Drainage, Erosion, and Sedimentation Control Plan (BMP-1), as well as the required SWPPP (BMP-2), and other measures as described in Mitigation Measures Hydrology-1 through Hydrology-4. Implementation of these BMPs and mitigation measures would reduce these impacts to less than significant.

HYD-4) Would Alternative 4 substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?

Construction of Alternative 4 would result in slight alterations in the existing drainage pattern of the site or area (refer to discussion in HYD-3). Alternative 4 would be in an area characterized by well-drained soils and low precipitation; furthermore, Alternative 4 would be on the Palo Verde Mesa, which is at a higher elevation than the Palo Verde Valley to the east. Although there is an ephemeral drainage that bisects the Project area, there are no existing perennial streams or rivers within the Project area. Therefore, there is a low potential for flooding on- or off-site during construction, operation, maintenance, and decommissioning of Alternative 4. Impacts would be less than significant.

HYD-5) Would Alternative 4 create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?

Creation of new permanent access roads (unpaved) would create additional sources of runoff. With implementation of the BMPs discussed above, impacts related to the introduction of additional sources of polluted runoff would be minimized. The majority of the original grades and natural drainage features along the Alternative 4 gen-tie line corridor would be maintained; therefore, no added storm drainage control would be required. Impacts would be less than significant.

HYD-6) Would Alternative 4 otherwise substantially degrade water quality?

While Alternative 4 construction and operation could include use or application of hazardous materials with potential to degrade water quality, compliance with all applicable regulations and permit requirements would reduce the potential impacts to a less than significant level.

HYD-7) Would Alternative 4 place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?

Alternative 4 would not include the construction of any residential units, and would not introduce new housing to the area. No impact would occur.

HYD-8) Would Alternative 4 place within a 100-year flood hazard area structures which would impede or redirect flood flows?

Alternative 4 would be on the Palo Verde Mesa, at an elevation approximately 50 feet above the historic floodplain of the Colorado River (i.e., Palo Verde Valley approximately eight miles west of the current channel of the Colorado River) and would be unlikely to impede or redirect flood flows associated with the Colorado River. Alternative 4 would relocate or elevate Project components to avoid placing structures within the 100-year flood hazard area associated with the ephemeral drainage described in Alternatives 1 and 3. Implementation of Mitigation Measures Hydrology-5 and Hydrology-6 would reduce impacts during construction, operation, maintenance, and decommissioning to less than significant levels.

HYD-9) Would Alternative 4 expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?

Alternative 4 would not be located in the vicinity of a levee or dam. Portions of the Project would be located in a floodplain, such that it would expose people or structures to significant risk of loss, injury, or death involving flooding. However, with implementation of Mitigation Measures Hydrology-5 and Hydrology-6 would reduce impacts during construction, operation, maintenance, and decommissioning to less than significant levels.

HYD-10) Would Alternative 4 be at risk of inundation by seiche, tsunami, or mudflow?

Alternative 4 would not be sited in a location that could be affected by a tsunami or seiche. Alternative 4 would be sited in an area characterized by well-drained soils and low precipitation, which is not within a State of California Earthquake Fault Zone for known active faults, and no known or potentially active faults are mapped within the vicinity of the Project area. Alternative 4 would not be affected by or result in a mudflow; no impact would occur.

HYD-11) Would Alternative 4 include new or retrofitted Stormwater Treatment Control BMPs (e.g., water quality treatment basins, constructed treatment wetlands), the operation of which could result in significant environmental effects (i.e., increased vectors and/or odors)?

No storm water drainage system exists on the Project area. Construction of Alternative 4 would include implementation of a SWPPP (BMP-2). The plan would specify measures that would minimize or avoid potential effects associated with storm water runoff. Operation and maintenance would not introduce new infrastructure or alter existing surface water and drainage patterns beyond what occurred during the construction period. Therefore, impacts would be less than significant.

HYD-12) Would Alternative 4 cause changes in absorption rates or the rate and amount of surface runoff?

See HYD-3 and HYD-4 above. Alternative 4 would cause slight changes in the absorption rates and amount of surface water to on-site or off-site drainages. Implementation of Mitigation Measures Hydrology-3 and Hydrology-4 would reduce potential impacts resulting from runoff and absorption rates.

HYD-13) Would Alternative 4 cause changes in the amount of surface water in any water body?

See HYD-2 above. Alternative 4 would reduce the amount of water used on-site compared to existing agricultural use, which would not have an adverse effect on Colorado River water supplies or diversions.

Alternative 5: Reduced Acreage Alternative

Similar to Alternative 1, Alternative 5 would include the construction, operation, maintenance, and decommissioning of a solar facility and associated infrastructure. The primary difference between Alternatives 1 and 5 is the absence of solar facility development north of I-10, which would reduce

electrical output from a 485 MW down to a 315 MW alternating current solar PV facility. The Reduced Acreage Alternative would be on a reduced footprint of approximately 2,476 acres (from 3,660 acres for the proposed Project). Alternative 5 would include approximately 2,403 acres for the solar field. Similar to the proposed Project, 73 acres would be utilized for the 230 kV gen-tie line. In comparison to Alternative 1, Alternative 5 would eliminate one on-site substation and one O&M building and would have one access point (planned on Seeley Avenue). The Reduced Acreage Alternative would also no longer extend a 230 kV overhead gen-tie line from an on-site substation north of I-10, as this Alternative would not be developed on land north of I-10. Instead, this Alternative would construct an approximately 7.8-mile-long, 230 kV overhead gen-tie line from the proposed on-site substation south of I-10 to the approved Colorado River Substation. Approximately three miles of the gen-tie line would be located within the solar facility. Alternative 5 would avoid impacts that would result from the construction, operation, maintenance, and decommissioning of a solar development north of I-10; however, the land on which Alternative 1 is proposed would continue with existing uses and the existing agricultural use north of I-10 would continue to utilize a greater amount of water than with utilization of this same area for a solar facility, resulting in a lesser degree of beneficial impact for Alternative 5 than for Alternative 1. Nonetheless, the impact of Alternative 5 would be beneficial as water demand would be less post-project than the pre-project agricultural usage.

The Reduced Acreage Alternative solar facility and a portion of the gen-tie line would be within the jurisdiction of the County of Riverside but not within the City limits of Blythe in comparison to the proposed Project. Alternative 5 would need to comply with the RCGP (2003) and PVVAP (2008). The remaining portion of the gen-tie line would traverse lands managed by the BLM and would need to comply with the CDCA Plan. The construction, operation and decommissioning of Alternative 5 would not exceed the impacts to hydrology and water quality identified under the Alternative 1 analysis. Therefore, the Alternative 1 analysis would be applicable to Alternative 5, outside of those differences identified in the discussion below.

Analysis of Direct and Indirect Impacts

Construction

Water Quality

In comparison to the proposed Project, Alternative 5 would be on a reduced footprint of approximately 2,476 acres from 3,660 acres. Although reduced in total acreage in comparison to Alternative 1, construction of the Alternative 5 solar facility, gen-tie line, new substations, access road, and O&M building would require ground-disturbing activities, including clearing and grading for structure installation work areas, and access construction similar to Alternative 1. As such, the direct and indirect impact analysis under Alternative 1 would apply.

Surface Water, Groundwater, and Water Supply

As previously analyzed, the Alternative 1 Project area contains one ephemeral drainage that would be affected by construction, operation, or maintenance of the proposed Project. Alternative 5 falls within the same footprint as Alternative 1, with the exception of the development north of I-10. As such, the Alternative 1 analysis would apply for Alternative 5 assuming construction of the new substations, one O&M building, and equipment pad. The one primary access road (Seeley Avenue) to the O&M building would be improved for approximately 100 feet and would be 16 to 20 feet wide.

Similar to Alternative 1, it is assumed that Alternative 5 construction would not involve the use of groundwater pumped from existing wells on-site. During the 36-month construction period for Alternative 5, a fraction of the water demand that is presently needed for agricultural irrigation would be reduced even greater than under Alternative 1 development. Construction water would be used for dust suppression, concrete manufacturing, and fire safety. Accordingly, there would be a beneficial impact to the water supply.

Existing Drainage Patterns

Similar to development of Alternative 1, facilities under Alternative 5 would be sited to provide adequate setbacks between solar facility components (solar panels, gen-tie lines, substations, access roads, and O&M building) and natural washes (BMP-11). These setbacks would preserve and maintain the natural washes' hydrological functions. Construction of Alternative 5 would require less ground-disturbing activities compared to Alternative 1, due to no development north of I-10. However, grading could potentially alter naturally occurring drainage patterns and result in soil erosion, sedimentation, long-term siltation, and increased stormwater runoff, which increases the potential for flooding off-site or downstream of the construction areas. Refer to the Alternative 1 analysis for the development area south of I-10.

Operation and Maintenance

Water Quality

The analysis for Alternative 1 would apply for Alternative 5, with the exception of no development north of I-10 and one less substation and O&M building that would create new areas of impermeable surfaces to potentially increase the rate of stormwater runoff, leading to increased erosion and long-term siltation and flooding downstream of the new impermeable areas, and contribute additional sources of polluted runoff.

Groundwater and Water Supply

Similar to Alternative 1, development of Alternative 5 would require a limited amount of water for washing of the solar panels, fire water supply, and supply for the operations and maintenance building. In comparison, Alternative 5 would require a reduced amount of water due to fewer facilities and a smaller footprint. As these water needs would fall within those specific under Alternative 1, the water supply from PVID sources and CSA #122 would be sufficient to meet requirements of Alternative 5, including the minor potable groundwater demand under average-year, single-dry year, and multiple-dry year conditions over a 20-year future projection.

Flood Hazards

Similar to Alternative 1, Alternative 5 would be in an area designated by FEMA as Zone D, which is reserved for areas where there are possible but undetermined flood hazards, and where no flood hazard analysis has been conducted. Alternative 5 would contain the floodplain of the small ephemeral drainage for which flood hazards were analyzed (see Appendix H *Blythe Mesa CUP 03685 Wash Feature Summary of Findings*). The Alternative 1 analysis would apply.

Decommissioning

Activities associated with decommissioning are similar to construction; therefore, effects related to hydrology and water quality associated with decommissioning would be similar to construction-related effects of Alternative 5.

Application of CEQA Significance Thresholds

HYD-1) Would Alternative 5 violate any water quality standards or waste discharge regulations?

Temporary, direct impacts to water quality could result from stormwater runoff during construction and operation of Alternative 5, similar to Alternative 1. The HYD-1 Alternative 1 analysis would apply.

HYD-2) Would Alternative 5 substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table (e.g., the production rate of pre-existing nearby

wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?

Alternative 5 construction and operation of the one O&M building, substations, and equipment pads would create new areas of impermeable surfaces that could potentially interfere with groundwater recharge, similar to Alternative 1; however, the new impermeable surfaces would be nominal in comparison to the solar facility area and would not significantly interfere with groundwater recharge. The great majority of water for Alternative 5 (i.e., all of the non-potable water) would not be delivered by a public water system or using public water system connections. Alternative 5 would use existing water infrastructure that currently delivers irrigation water from the PVID. Riverside County Community Service Area #122 (CSA #122) has substantiated its intention to provide this potable supply by issuing a will-serve letter (October 26, 2012 c/o Steve H. Jones – Manager) for the Project's limited potable water needs. CSA #122 has provided a will-serve letter for the small amount (up to 150 gallons per day) of potable water for the two O&M buildings. The HYD-2 Alternative 1 analysis would apply.

HYD-3) Would Alternative 5 substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?

Alternative 5 would be developed within the limits of Alternative 1, under reduced acreage; as such, the HYD-3 analysis for Alternative 1 would apply.

HYD-4) Would Alternative 5 substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?

As described in HYD-2, the creation of impermeable surfaces relative to the Alternative 5 area would be nominal. Alternative 5 would result in slight alterations in the existing drainage pattern of the site or area (refer to discussion in HYD-3). Alternative 5 would be in an area characterized by well-drained soils and low precipitation; furthermore, Alternative 5 would be on the Palo Verde Mesa, which is at a higher elevation than the Palo Verde Valley to the east. There is one ephemeral drainage, but no existing perennial streams or rivers are within the Alternative 5 area. Therefore, there is low potential for flooding on- or off-site during construction, operation, maintenance, and decommissioning of Alternative 5. Impacts would be less than significant.

HYD-5) Would Alternative 5 create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?

Although Alternative 5 would involve a reduced amount of development compared to Alternative 1, the HYD-1 analysis for Alternative 1 would apply to the Alternative 5 development portion south of I-10.

HYD-6) Would Alternative 5 otherwise substantially degrade water quality?

Similar to Alternative 1, ground disturbance related to construction of Alternative 5 would potentially degrade water quality through the inadvertent release of hazardous materials, pesticides, and herbicides. However, the development footprint of Alternative 5 would be reduced in comparison to Alternative 1. While Alternative 5 construction and operation could include use or application of hazardous materials or wastewater with potential to degrade water quality, compliance with all applicable regulations and permit requirements would reduce the potential impacts to a less than significant level.

HYD-7) Would Alternative 5 place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?

Alternative 5 would not include the construction of any residential units, and would not introduce new housing to the area. No impact would occur.

HYD-8) Would Alternative 5 place within a 100-year flood hazard area structures which would impede or redirect flood flows?

Similar to Alternative 1, it is unlikely that floodwaters would significantly affect Alternative 5, or that Project structures or components would impede or redirect flood flows, as Alternative 5 would be developed in the same area south of I-10. The HYD-8 analysis for Alternative 1 would apply. Implementation of Mitigation Measures Hydrology-5 and Hydrology-6 would reduce impacts during construction, operation, maintenance, and decommissioning to less than significant levels.

HYD-9) Would Alternative 5 expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?

Alternative 5 would not be located in the vicinity of a levee or dam. Portions of the Project would be located in a floodplain, such that it would expose people or structures to significant risk of loss, injury, or death involving flooding. However, with implementation of Mitigation Measures Hydrology-5 and Hydrology-6 would reduce impacts during construction, operation, maintenance, and decommissioning to less than significant levels.

HYD-10) Would Alternative 5 be at risk of inundation by seiche, tsunami, or mudflow?

Similar to Alternative 1, Alternative 5 would not be sited in a location that could be affected by a tsunami or seiche. Alternative 5 would be sited in an area characterized by well-drained soils and low precipitation, which is not within a State of California Earthquake Fault Zone for known active faults, and no known or potentially active faults are mapped within the vicinity of the Project area. Alternative 5 would not be affected by or result in a mudflow; no impact would occur.

HYD-11) Would Alternative 5 include new or retrofitted Stormwater Treatment Control BMPs (e.g., water quality treatment basins, constructed treatment wetlands), the operation of which could result in significant environmental effects (i.e., increased vectors and/or odors)?

The majority of the original grades and natural drainage features at the Alternative 5 site would be maintained and, therefore, no added storm drainage control would be required. The HYD-11 Alternative 1 analysis would apply.

HYD-12) Would Alternative 5 cause changes in absorption rates or the rate and amount of surface runoff?

See HYD-3 and HYD-4 above.

HYD-13) Would Alternative 5 cause changes in the amount of surface water in any water body?

See HYD-2 above.

Cumulative Impacts

Geographic Scope

Cumulative effects would result from incremental impacts of the proposed Project when added to other past, present, and reasonably foreseeable future actions within the designated region of influence. The term “cumulative effects” means those effects on water resources and water quality caused by other projects and activities unrelated to the proposed Project.

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The proposed Project would be within an undefined Hydrologic Sub-Area (HSA 715.40) of the Palo Verde Hydrologic Area. Since the BMSP has the potential to affect the entire hydrologic sub-area, rather than merely the immediate Project vicinity, this Hydrologic Sub-Area defines the impact area for this cumulative impact analysis.

Temporal Scope

The temporal scope refers to the duration over which an impact would occur, either short-term or long-term; for example, a short-term impact would occur only during the months of construction, and a long-term impact would occur during operation and maintenance, or during all phases. This limits the projects whose water resource impacts are included in the cumulative effects analysis to those that would cause impacts to water resources concurrently with the proposed Project. Determining the temporal scope of impacts requires an estimation of the temporality of the individual or cumulative effects. The temporal scope of cumulative impacts to water resources would be during the development of projects through the end of Project decommissioning, as any direct or indirect effects of the Project would occur only during the life of the Project.

Analysis of Direct and Indirect Impacts

Alternative 1: Proposed Project

Construction, Operation, Maintenance, and Decommissioning

Construction and operation of the proposed Project could potentially impact water quality of unnamed ephemeral streams downslope of the Project area as stormwater leaves the Project area as sheet flow. These impacts could occur as a result of ground-disturbing activities, including clearing and grading for structure installation work areas and access road construction. Disturbed soils accelerate erosion and increase delivery of sediment in stormwater runoff to receiving waters, causing increased turbidity and sedimentation. Additionally, fuel, oil, and other fluids used in construction vehicles, equipment, and heavy machinery could enter streams and contaminate water. Project-related ground disturbance could potentially alter drainage patterns within the work areas and result in soil erosion, leading to increased sedimentation or an increase in the rate or amount of surface water runoff. Grading activities could also potentially create additional sources of runoff, including polluted runoff. Many of the present and reasonably foreseeable projects involve grading activities, including those on a large-scale basis. These projects could also have potential to affect the impact area by altering drainage patterns, accelerating erosion, and adding additional sediment to local drainages. Compacted or new paved areas could potentially increase the rate or amount of stormwater runoff, or create additional sources of stormwater runoff. Polluted runoff could be introduced to the impact area as oil products, which collect on new paved or compacted surfaces and are washed into the system with stormwater runoff.

Impacts that are individually less than significant are cumulatively significant if they contribute incrementally to a cumulative impact that is already significant. For example, if a project results in sedimentation impacts that are less than significant on a project-level basis, the cumulative impact from sedimentation can be significant if the sediment is released into a stream that has not yet recovered from previous sedimentation impacts. However, potential impacts to water resources resulting from construction and operation of the proposed Project when combined with the cumulative effects on the Hydrologic Sub-Area would be less than significant with the implementation of the above-referenced BMPs, applicable local, State, and federal requirements, and mitigation measures. As previously explained, for the purposes of this Draft EIR/EA, BMPs are: 1) requirements of existing policies, practices, and measures required by law, regulation, or local policy; and 2) ongoing, regularly occurring practices. As such, the BMPs identified in this Draft EIR/EA are inherently part of the proposed Project and Alternatives. In addition, all of the cumulative scenario projects would be regulated under the same applicable local, State, and federal requirements, as discussed above. To ensure potential impacts are minimized, the projects under the cumulative scenario could also require additional mitigation, as required under the environmental review for each project. Adherence to these requirements and additional mitigation measures would ensure that impacts to water resources resulting from construction and

operation of the proposed Project when combined with the cumulative effects on the Hydrologic Sub-Area would be less than significant.

Therefore, during construction and operation of each of the projects under the cumulative scenario, the previously mentioned potential water quality pollutants would be regulated under applicable local, State, and federal requirements. Cumulative projects could require additional mitigation to minimize any potential impacts. Any remaining effects to water quality would be discreet in nature, associated with isolated incidents, and generally of low occurrence due to the nature of projects anticipated under the cumulative scenario. The projects listed under the cumulative scenario, which represent primarily renewable energy and other infrastructure projects, are not representative of major users of hazardous materials. Overall contributions to erosion and sedimentation within the Hydrologic Sub-Area would be minimized by mitigation measures that have been required of projects under the cumulative scenario and other applicable environmental regulations. These mitigation measures would minimize overall contributions to erosion and sedimentation within the watershed by establishing thresholds in the context of cumulative conditions through the inclusion of construction and operation period controls on stormwater management. These mitigation measures would also suffice in minimizing residual impacts that could occur for each project under the cumulative scenario by requiring avoidance and mitigation of components and actions that could cause erosion and sedimentation. The nature of the projects under the cumulative scenario would not involve extensive development of new impervious surfaces. Complying with proposed mitigation would also ensure that potential direct impacts to flood-related hazards would be avoided for the proposed Project and Alternatives. Individual projects under the cumulative scenario would utilize measures for drainage control and flood management and would implement mitigation measures to minimize potential harm to workers and on-site facilities.

Alternative 2: No Project Alternative

Under the No Project Alternative, the majority of the Project area would continue to be used for agricultural purposes. Public lands in the Project area would continue to be managed by the BLM in accordance with existing land use designations in the CDCA Plan and private lands would continue to be managed for agricultural production.

The No Project Alternative would eliminate the cumulative effects that would be contributed to the Hydrologic Sub-Area by construction, operation, maintenance, and decommissioning of the proposed Project or action Alternatives. The No Project Alternative would not prevent the present or reasonably foreseeable projects from being constructed, however, and those projects would continue to contribute cumulative impacts to the Hydrologic Sub-Area.

Alternative 3: Northern 230 kV Gen-tie Location

Construction, Operation, Maintenance, and Decommissioning

Alternative 3 is similar to Alternative 1 (the proposed Project), with the exception of the location of the gen-tie alignment, which would be approximately 700 feet north of the Alternative 1 gen-tie alignment. Cumulative effects to water resources associated with construction, operation, maintenance, and decommissioning of Alternative 3 would be the same as those of Alternative 1.

Alternative 4: Southern 230 kV Gen-tie Location

Construction, Operation, Maintenance, and Decommissioning

Alternative 4 is similar to Alternative 1 (proposed Project), with the exception of the location of the 230 kV gen-tie alignment. Although Alternative 4 would cross an ephemeral stream, the cumulative impacts associated with construction, operation, maintenance, and decommissioning of Alternative 4 would be the same as those of Alternative 1.

Alternative 5: Reduced Acreage Alternative

Construction, Operation, Maintenance, and Decommissioning

Potential impacts under Alternative 5 would be similar those described under Alternative 1, outside of the footprint reduction to development only occurring south of I-10. The potential impacts to water resources resulting from construction and operation of Alternative 5 when combined with the cumulative effects on the Hydrologic Sub-Area would be less than significant with the implementation of the above-referenced BMPs and applicable local, State, and federal requirements, and incorporation of mitigation measures. Refer to the cumulative analysis under Alternative 1.

Mitigation Measures

Where it was determined that a potential significant impact may occur, mitigation measures listed below would reduce potential impacts. Following application of BMPs and mitigation measures, potential impacts would be reduced to a level considered less than significant.

Hydrology-1 Existing drainage crossings shall be utilized at streams, washes, and irrigation channels to the extent feasible. New access roads not required for ongoing operation and maintenance shall be permanently closed after construction using the most effective and least environmentally damaging methods appropriate to that specific area, with concurrence of the land manager (e.g., stockpiling and replacing topsoil, rock replacement) in a manner that most closely matches undisturbed conditions of the area.

Hydrology-2 Roads would be built as near as possible to right angles to streams and washes, if feasible. Culverts would be installed where necessary and sized in accordance with local county regulations. All construction and maintenance activities shall be conducted in a manner that would minimize disturbance to vegetation and drainage channels, including ephemeral stream banks. In addition, road construction would include dust-control measures during construction especially in sensitive areas. All existing roads would be left in a condition equal to or better than their condition prior to the construction of the gen-tie line and other Project components.

Hydrology-3 New impervious areas associated with temporary construction would be restored to existing conditions, including but not limited to revegetation and decompaction, to the extent possible after completion of Project construction.

Hydrology-4 Stormwater drainage inside substations would be designed to minimize erosion and increase sediment control. Internal runoff would be released from the switching station by means of surface drainage structures designed to filter contaminants from water flow. Drainage from Project area, but not the gen-tie line, would be collected and controlled by surface improvements, as detailed in the SWPPP.

Hydrology-5 All new buildings (e.g., substation) shall be flood-proofed by constructing the finished floor a minimum of 24 inches above the highest adjacent ground or 100 year water surface elevation, whichever is greater. Slope protection may be required for buildings on fill. Additionally, the solar panels shall have a minimum clearance of 24 inches above the highest adjacent ground when upright to ensure flows are not obstructed.

Hydrology-6 No flow obstructing fences (chain link, block wall, etc.) shall be constructed along the north and west property lines, since these types of fences obstruct flows causing damage to adjacent properties. Fencing used in these areas shall contain openings of three inches high by six inches wide for first the 18 inches from the bottom, and openings of four inches high by six inches wide for the next eight inches and so forth. This fencing or equivalent shall be provided to allow the free flow of storm or flood runoff. No setback is

required with the use of this fencing. A detail of this fencing shall be provided to the County of Riverside.

Residual Impacts After Mitigation

With implementation of Project BMPs and mitigation measures, potential Project-specific and cumulative water quality and hydrology impacts would be less than significant.

NEPA Conclusions

The No Project Alternative would not have impacts, as the existing circumstances and operations would continue essentially unchanged. The Project and the action Alternatives would result in the direct and indirect impacts and contribution toward cumulative impacts that are described above. Impacts would be reduced with implementation of Mitigation Measures Hydrology-1 through Hydrology-6. The Project and the action Alternatives would additionally comply with all federal, State, and local laws and regulations. Taking all these measures into account, the Project and the action Alternatives would not have a significant impact on hydrological resources.

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4.2.10 Land Use and Planning

This section describes the impact analysis relating to land use planning for the proposed Project and Alternatives. This section focuses on consistency with existing land use plans, ordinances, regulations, and policies. The Project's compatibility with existing or reasonably foreseeable land uses is also evaluated.

Methodology for Analysis

Evaluation of potential land use conflicts of the proposed Project and Alternatives was based on a review of relevant documents, including the Riverside County General Plan, Riverside County Zoning Ordinance, City of Blythe General Plan 2025, City of Blythe Zoning Code, the Federal Land Policy and Management Act (FLPMA), CDCA Plan, Land & Mineral Legacy Rehost 2000 System of automated records (LR2000), and a field review of the proposed solar facility site and surrounding area. The focus of the land use analysis is on land use conflicts that would result from implementation of the proposed Project and Alternatives. Land use conflicts are identified and evaluated based on existing or authorized land uses, land uses proposed as part of the Project, land use designations, and standards and policies related to land use. Land use compatibility is based on the intensity and patterns of land use to determine whether the Project would result in incompatible uses or nuisance issues. Potential land use conflicts or incompatibility (specifically during construction activities) are usually the result of other environmental effects, such as generation of noise or air quality issues resulting from grading activities. Land use conflicts that would result from the Project's construction, operation, maintenance, and decommissioning are evaluated in this section.

CEQA Significance Criteria

The criteria listed below were used to determine if the proposed Project would result in impacts to land use. These criteria were obtained from the CEQA Environmental Checklist, Appendix G of the 2012 CEQA Guidelines. Under CEQA, the proposed Project and Alternatives would have a significant impact on land use if they would:

LU-1) Physically divide an established community.

LU-2) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the Project (including but not limited to the general plan, specific plan, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect.

LU-3) Conflict with any applicable habitat conservation plan or natural community conservation plan.

LU-4) Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated.

LU-5) Include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment.

The following additional significance criteria from the County of Riverside CEQA Environmental Assessment form are used in the analysis. A project could have potentially significant impacts if it would:

LU-6) Result in a substantial alteration of the present or planned land use of an area.

LU-7) Affect land use within a city sphere of influence and/or within adjacent city or county boundaries.

LU-8) Be inconsistent with the site's existing or proposed zoning.

LU-9) Be incompatible with existing surrounding zoning.

LU-10) Disrupt or divide the physical arrangement of an established community (including a low-income or minority community).

NEPA Requirements

The term *significantly* as used in NEPA requires considerations of both context and intensity (40 CFR Part 1508.27). Therefore, thresholds serve as a benchmark for determining if a project action would result in a significant adverse environmental impact when evaluated against the baseline. The environmental effects analysis of the proposed Project on land uses includes an assessment of the context and intensity of the impacts as defined in the NEPA implementing regulations at 40 CFR Part 1508.27.

Applicable Best Management Practices

Land Use and Planning would not require the implementation of BMPs.

Alternative 1: Proposed Project

Analysis of Direct and Indirect Impacts

Existing Land Use, Planning and Zoning Designations

The solar facility would occupy 3,587 acres on privately-owned land under the jurisdiction of the County, approximately 334 acres of which are within the City of Blythe. The above-ground 230 kV gen-tie line would connect all three proposed on-site substations, extending a distance of approximately 3.6 miles within the solar facility. From the southernmost on-site substation to the Colorado River Substation, the gen-tie line would extend another 4.8 miles within a 125-foot-wide ROW, or 73 acres (traversing 3.8 miles [58 acres] of BLM-managed lands and one mile of private land [15 acres]).

The Project would be on lands under the jurisdiction of the County of Riverside, the BLM, and the City of Blythe. A majority of the Project would be within the County of Riverside and governed by the County of Riverside's General Plan and the Palo Verde Valley Area Plan. A portion of the solar array field would be in the City of Blythe General Plan. A portion of the 230 kV gen-tie line would traverse BLM-managed lands.

Figure 1-4 illustrates the portion of the gen-tie line that would traverse BLM-managed lands within the CDCA. These lands are designated Multiple-Use Class M (Moderate). Within the CDCA, the gen-tie line would be within BLM's Utility Corridor K, which is also designated as Section 368 Federal Energy Corridor 30-52 (BLM 2009). A majority of the Project would also be within BLM's Utility Corridor J. The gen-tie line would also be within the SEZ.

Federal

Lands traversed by the proposed Project and Alternatives under the jurisdiction of the BLM would be subject to the following plans and policies.

Federal Land Policy and Management Act of 1976

Construction of the proposed gen-tie line would be consistent with the FLPMA (43 U.S.C. § 1701 et seq.), which encourages the utilization of rights-of-way in common to the extent practical and the designation of right-of-way corridors (§ 1763). The gen-tie line and access roads proposed under the Project would be consistent with this provision, because the proposed gen-tie line would be within a designated utility corridor. The solar facility would be on privately owned land and not subject to the FLPMA.

California Desert Conservation Area (CDCA) Plan, 1980 as Amended

The CDCA Plan is a comprehensive, long-range plan covering 25 million acres. Approximately 12 million acres of this total are public lands administered by the BLM on behalf of the CDCA Plan, including the portion of the proposed gen-tie line on federal lands. The proposed gen-tie line is included in the "Land Use Activities" category of Transmission Lines as identified in Table 1, Multiple-Use Class Guidelines, of

the CDCA Plan. As noted in Table 1, under Multiple-Use Classes L, M, and I, "New…electric transmission facilities…may be allowed only within designated corridors" (BLM 1980). The gen-tie line would be within Multiple-Use Class M. As explained below, because the Western Solar Plan amended the CDCA Plan to identify this area as associated with power generation or transmission, the gen-tie line would be consistent with the CDCA Plan.

Northern and Eastern Colorado Desert (NECO) Coordinated Management Plan

The NECO Plan primarily addresses recovery of the desert tortoise and conservation of a variety of other species, modifies management of wild burro herds in the planning area, and updates policies regarding off-highway vehicle use and public lands access and use. The gen-tie line would be constructed primarily within Utility Corridor K. Construction activities would comply with the NECO Plan. Please refer to Section 4.2.4, *Biological Resources*, and Section 4.3.13, *Recreation*, for discussion regarding impacts to the NECO Plan.

Approved Resource Management Plan Amendments/Record of Decision for Solar Energy Development in Six Southwestern States (Western Solar Plan) (BLM 2012)

The Western Solar Plan's purpose was "to implement a comprehensive Solar Energy Program to administer development of utility-scale solar energy resources on BLM-administered lands in the six states," including California. The Western Solar Plan identified exclusion areas for utility-scale solar energy ROWs, priority areas for utility-scale energy development ROWs (i.e. SEZs), and areas potentially available for utility-scale solar energy outside of exclusion areas and SEZs (i.e., variance areas) (page 3). The Western Solar Plan amended the CDCA Plan to "identify all SEZ lands within the CDCA as sites associated with power generation or transmission" (Appendix A, Land Use Plan Amendments, page 36). The gen-tie line would be constructed within the SEZ, and therefore is consistent with the Western Solar Plan and the CDCA Plan, as amended.

Local

Lands that would be traversed by the proposed Project and Alternatives would be subject to the following local plans and policies.

Riverside County General Plan

The solar facility portion and a portion of the gen-tie line would be on private lands within an unincorporated area of Riverside County and would be subject to the goals and policies of the RCGP. The proposed Project would within the "Agriculture" and "Rural Community: Estate Density Residential" land use designations and the Project would be consistent with these land use designations.

Riverside County Zoning Ordinance

The proposed Project would be a conditionally permitted use under the W-2-10, W-2-5, and A-1-10 zones. It would be authorized pursuant to the approval of a CUP by the Riverside County Board of Supervisors and in compliance with Riverside County Board of Supervisor's Policy B-29. Pending this approval, no conflicts with the Riverside County Zoning Ordinance would occur. Therefore, impacts would be considered less than significant.

City of Blythe General Plan 2025

The solar facility portion of the proposed Project would be in the City of Blythe and would be subject to the goals and policies of the City of Blythe General Plan 2025. The proposed Project would be a permitted use within the "Agriculture" and "Service Industrial" land use designations with approval of a CUP and completion of an environmental review. Approximately 334 acres of the 3,597 acre solar facility component are located within the City of Blythe. A majority of the Project would be within the County of Riverside and within the PVVAP. A portion of the solar facility would be in the City of Blythe General Plan.

As described in Chapter 1, the County is the "lead agency" responsible for preparation of the EIR in compliance with CEQA. As the CEQA lead agency, the County is responsible for conducting the CEQA review and has final approval of the Project. The County is responsible for coordinating with the Applicant, public and associated agencies during the CEQA process. When more than one agency is involved in a project, the agency with primary responsibility for approving a project is the lead agency, for purposes of following the CEQA protocol. Other agencies with discretionary approval power over the project are called "responsible agencies." The City of Blythe is a responsible agency that has actively participated in the NEPA/CEQA process and review of the Draft EIR/EA.

City of Blythe Zoning Code

The proposed Project would be a conditionally permitted use under the Agriculture and Service Industrial zones. No conflicts with the City of Blythe Zoning code would occur. Therefore, impacts would be considered less than significant.

Riverside County Airport Land Use Compatibility Plan (RCALUCP) and Federal Aviation Administration

In April 2012, the Riverside County ALUC found the Project to be consistent with the RCALUCP. In addition, the FAA provided "No Hazard to Air Navigation" determinations for the 230 kV gen-tie line structures. Refer to Section 4.2.8, *Hazards and Hazardous Waste*, for a more detailed discussion regarding impacts to the RCALUCP.

Compatibility with Local Plans and Policies

The Project is generally consistent with policies and goals set forth in the RCGP, PVVAP, and City of Blythe General Plan 2025. The Project would be consistent with the Riverside County Zoning Ordinance (Ordinance 348) and City of Blythe Zoning Code. The Project's conformity with these local policies and goals is summarized in Table 4.2.10-1 below.

Construction, Operation, and Maintenance

The discussion above regarding compatibility with applicable land use plans and policies applies to construction, operation, and maintenance of the proposed Project and Alternatives. Following construction, the gen-tie line would be accessed using only roadways that are necessary to maintain it. The gen-tie line would be operated and maintained primarily within Corridor K, and fully within the Riverside East SEZ. Maintenance activities would be confined to existing roadways and disturbed areas. Therefore, operation and maintenance of the proposed Project would be consistent with the CDCA Plan and NECO Plan.

Table 4.2.10-1 Consistency with Regional/Local Land Use Plans, Policies, and Regulations

POLICY/REGULATIONS/GOALS	DESCRIPTION	CONFLICT ANALYSIS
Riverside County General Plan 2008		
Land Use Element Policy LU 1.8	Requires submittal of certain proposed actions to the Riverside County Airport Land Use Commission for review. Such actions include proposed amendments to the general plan, area plans, or specific plans, as well as proposed revisions to the zoning ordinance and building codes.	NO: The Riverside County Airport Land Use Commission found the Project consistent with the Riverside County Airport Land Use Compatibility Plan. (See Section 4.2.8 Hazards and Hazardous Materials).
Land Use Element Policy LU 2.1.c	Requires a broad range of land uses, including a range of residential, commercial, business, industry, open space, recreation and public facility uses (General Plan pg. LU-20).	

POLICY/REGULATIONS/GOALS	DESCRIPTION	CONFLICT ANALYSIS
Land Use Element Policy LU 5.1	Requires development does not exceed the ability to adequately provide supporting infrastructure and services (General Plan LU-24).	NO: The Project would no create a permanent increase in population; therefore, existing infrastructure and services would be adequate.
Land Use Element Policy LU 6.1	Require land uses to develop in accordance with the Riverside County General Plan (RCGP) and area plans to ensure compatibility and minimize impacts.	NO: With the approval of a CUP, the Project would be compatible with the RCGP and the PVVAP.
Land Use Element Policy LU 6.2	Public facilities shall also be allowed in any other land use designation except for the Open Space-Conservation and Open Space-Conservation Habitat land use designations. For purposes of this policy, a public facility shall include all facilities operated by the federal government, the State of California, the County of Riverside, any special district governed by the County of Riverside or any city, and all facilities operated by any combination of these agencies.	NO: The solar facility and gen-tie line would not preclude construction of public facilities in unoccupied areas of the solar facility site.
Land Use Element Policy LU 7.1	Accommodate the development of a balance of land uses that maintain and enhance the County's fiscal viability, economic diversity and environmental integrity (General Plan LU-26).	NO: The Project would allow the generation of renewable energy. Additionally, it would increase revenue for the County of Riverside.
Land Use Element Policy LU 8.1	Provide for the permanent preservation of open space lands that contain important natural resources and scenic and recreational values (General Plan LU-28).	NO: The Project is not located in an area with natural resources or scenic and recreational values.
Land Use Element Policy LU 8.2	Require that development protect environmental resources by compliance with the Multipurpose Open Space Element of the RCGP and federal and state regulations such as CEQA, NEPA, the Clean Air Act, and the Clean Water Act.	NO: The Project would comply with NEPA and CEQA and all necessary compliance measures.
Land Use Element Policy LU 9.1	Require that new development contribute their fair share to fund infrastructure and public facilities such as police and fire facilities.	NO: The Project is not anticipated to cause additional impacts to public facilities. See Section 4.2.13, Socioeconomics, for further analysis.
Land Use Element Policy LU 13.1	Preserve and protect outstanding scenic vistas and visual features for the enjoyment of the traveling public (General Plan LU-31).	No: The Project would be located on disturbed lands that are adjacent to existing electrical facilities.
Land Use Element Policy LU 13.5	Require new or relocated electric or communication distribution lines, which would be visible from Designated and Eligible State and County Scenic Highways, to be placed underground.	YES: The Project proposes the use of above ground distribution lines within view of an Eligible Scenic Highway; however, they would be parallel to existing transmission and distribution lines.
Land Use Element Policy LU 15.15	Permit and encourage, in an environmentally and fiscally responsible manner, the development of renewable energy resources and related infrastructure, including but not limited to, the development of solar power plants in the County of Riverside (General Plan LU-37).	NO: The Project would provide 485 MW of renewable solar energy.

POLICY/REGULATIONS/GOALS	DESCRIPTION	CONFLICT ANALYSIS
Multi-Purpose Open Space Element Policy OS 11.3	Permit and encourage the use of passive solar devices and other state-of-the-art energy resources.	NO: The Project would provide renewable solar energy.
Land Use Element Policy LU 14.7	Ensures that no structures or activities encroach upon or adversely affect the use of navigable airspace.	NO: The Project has obtained Federal Aviation Administration and ALUC review and approval.
Land Use Element Policy LU 16.4	Encourages conservation of productive agricultural lands. Preserve prime agricultural lands for high-value crop production.	NO: The Project would impact Farmlands, but would not substantially interfere with the County's plans and goals to encourage conservation of Farmland county-wide.
Palo Verde Valley Area Plan 2008		
Agricultural Preservation Policy Palo Verde Valley Area Plan (PVVAP) 4.1	Protects farmland and agricultural resources in the Palo Verde Valley through adherence to the Agriculture sections of the RCGP Multipurpose Open Space and Land Use Elements.	NO: The Project would impact Farmland and agricultural resources in the Palo Verde Valley (as defined by the PVVAP); however, a mitigation measure was developed to Palo Verde Valley area.
Recreational Vehicle Development Policy PVVAP 5.4	Allows remote recreational vehicle developments within the following land use designations: Very Low Density Residential, Estate Density Residential, Rural Residential, Rural Mountainous, Rural Desert, Open Space-Recreation, and Open Space-Rural.	NO: The Project would not close open recreational vehicle routes of travel nor would the Project preclude recreational vehicle developments in these land use designations
Trials and Bikeway System Policy PVVAP 9.1	Develops a system of multi-purpose trails that enhances the Colorado River's recreational values and connects with the adopted trails system of Riverside County.	NO: The Project would not close or remove trails, nor would it impact trails near the Colorado River.
Scenic Highways Policy PVVAP 10.1	Protects the scenic highways in the Palo Verde Valley planning area from change that would diminish the aesthetic value of adjacent properties in accordance with the Scenic Corridors sections of the RCGP Land Use, Multipurpose Open Space, and Circulation Elements.	NO: The Project may have views from County eligible scenic highways 95 and I-10, but the Project and Alternatives would be within an area with existing electrical facilities.
Scenic Highways Policy PVVAP 10.2	Encourages the designation of I-10 and U.S. Highway 95 as eligible and subsequently Official Scenic Highways in accordance with the California State Scenic Highway Program.	NO. The Project may have views from County eligible scenic highways 95 and I-10; however, the Project would not significantly impact these views (refer to Section 4.2.1, Aesthetics).
Riverside County Zoning Ordinance (Ordinance 348)		
Section 15.1.d. (32) Uses Permitted in W-2 Zone (Controlled Development Areas)	This zone permits a solar power plant on lot 10 acres or larger upon issuance of a CUP.	NO: With approval of a CUP, the Project would be an allowable use under this zone.
Section 13.1.c. (12) Uses Permitted in A-1 Zone (Light Agriculture)	This zone permits a solar power plant on a lot 10 acres or larger. upon issuance of a CUP.	NO: With approval of a CUP, the Project would be an allowable use under this zone.
City of Blythe General Plan 2025/City of Blythe Zoning Code		
Open Space Guiding Policy 1	Maintain hillsides and viable agricultural lands as open space for resource conservation and preservation of views.	NO: The Project would impact viable agricultural lands on the Palo Verde Mesa, but would not interfere substantially with the City's goal of preserving hillside and viable agricultural lands city-wide.

POLICY/REGULATIONS/GOALS	DESCRIPTION	CONFLICT ANALYSIS
Open Space Guiding Policy 9	Promote continued agricultural use of important farmland outside the urban area.	NO: The Project would impact Important Farmland on the Palo Verde Mesa. While the City, if it approved this Project, would be favoring environmentally friendly power generation over retention of on-site agricultural uses, approval of the Project would not preclude the City from continuing to support agricultural uses city-wide.
Agriculture (A)	This zone permits, upon issuance of a CUP, "utility operations facilities."	NO: With approval of a CUP, the Project would be an allowable use under this zone.
Service Industrial (I-S)	This zone permits "utility operations facilities."	NO: The Project would be an allowable use under this zone.

Sources: Riverside County General Plan 2003; Palo Verde Valley Area Plan 2008; Riverside County Zoning Ordinance (Ordinance 348); City of Blythe General Plan 2025/Blythe Zoning Code.

Decommissioning

At the end of the proposed Project's operational life, all equipment and components would be decommissioned and deconstructed. Structures used to support above-ground wires would be removed. A ROW grant from the BLM and CUPs from Riverside County and the City of Blythe would no longer be required.

Application of CEQA Significance Thresholds

LU-1) Would the Project physically divide an established community?

The proposed Project would not physically divide an established community. The Project area would be east and south of an existing community (Nicholls Warm Springs/Mesa Verde). The gen-tie line, access roads, and 34.5 kV distribution line would not be located through an established community. No impacts would occur.

LU-2) Would the Project conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the Project (including but not limited to the general plan, specific plan, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?

The Project would be subject to the RCGP, PVVAP, City of Blythe General Plan 2025, CDCA Plan, and NECO Plan. As summarized in Table 4.2.10-1, *Conflicts with Regional/Local Land Use Plans, Policies, and Regulations*, the Project would not conflict with applicable local land use plans, policies, or regulations (with the exception of Land Use Element Policy LU 13). The Project would be consistent with goals and policies related to agriculture (Riverside County Land Use Element Policy LU 16.4; PVVAP Agricultural Preservation Policy 4.1; and City of Blythe's Open Space Guiding Policies 1 and 9). With approval of a CUP and Public Use Permit (PUP), the Project would be a permitted use on private land. The gen-tie line structures proposed on BLM land would be within or adjacent to Utility Corridor K, and fully within the Riverside East SEZ and therefore consistent with the CDCA Plan and NECO Plan. Impacts to existing plans, policies, and regulations would be considered less than significant.

LU-3) Would the Project conflict with any applicable habitat conservation plan or natural community conservation plan?

As discussed in Section 4.2.4, *Biological Resources*, the Project would not be within the jurisdiction of any adopted habitat conservation plan or natural community conservation plan; therefore, no impacts would occur.

LU-4) Would the Project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?

Increases in demand for recreational facilities are typically associated with substantial increases in population or employment. As described in Section 4.2.13, the proposed Project would not contain a residential component that would result in long-term increased use of existing recreational facilities. During the three-year construction period, construction workers and their families may temporarily increase the use of recreational facilities; however, the Project is not expected to draw a substantial number of new employees to the area over the long term. Therefore, implementation of the proposed Project is not expected to result in any substantial physical deterioration of existing facilities. Impacts would be less than significant.

LU-5) Would the Project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?

The Project would not include any plans for the addition of any recreational facilities, nor would it require the construction or expansion of recreational facilities. Therefore, the proposed Project would not result in any adverse physical effects on the environment from construction or expansion of additional recreational facilities; a less than significant impact would occur.

LU-6) Would the Project result in a substantial alteration of the present or planned land use of an area?

The Project would be on private lands that would be conditionally consistent (with approval of the CUP) with the RCGP and the PVVAP, as well as the City of Blythe General Plan 2025. The gen-tie line within BLM-managed lands would be consistent with the CDCA Plan and NECO Plan, because it would be within the Riverside East SEZ. Therefore, the Project would be consistent with present or planned land use of the area; impacts would be less than significant.

LU-7) Would the Project affect land use within a city sphere of influence and/or within adjacent city or county boundaries?

A portion of the Project's solar facility site would be within the City of Blythe Sphere of Influence; the gen-tie line that would extend outside of the solar facility would not. As discussed above, the Project would be conditionally consistent with the City of Blythe General Plan, RCGP, and PVVAP. Therefore, no impacts would occur to the City's sphere of influence.

LU-8) Would the Project be inconsistent with the site's existing or proposed zoning?

As described in LU-6 above, the solar facility for the Project would be conditionally consistent with existing zoning for the RCGP pursuant to the approval of a CUP and PUP, and compliance with Board of Supervisors Policy B-29, PVVAP, and City of Blythe General Plan. The gen-tie line would be consistent with the CDCA Plan and NECO Plan. The Project would not require a zone change or general plan amendment; therefore, the Project would be consistent with the site's existing zoning. No impacts would occur.

LU-9) Would the Project be incompatible with existing surrounding zoning?

The zoning surrounding the Project is similar to that of the Project area; therefore, the Project would be compatible with existing surrounding zoning; less than significant impact.

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LU-10) Would the Project disrupt or divide the physical arrangement of an established community (including a low-income or minority community)?

The Project would not be located through an established community (see LU-1). No impacts would occur.

Alternative 2: No Project Alternative

Under the No Project Alternative, the BLM would not grant a ROW, and Riverside County and the City of Blythe would not approve a CUP, PUP, and a Development Agreement for the proposed Project. As a result, no solar energy project would be constructed on county and city lands, and the solar facility would remain in agricultural production. No structures to support a gen-tie line in association with the proposed Project would occur on BLM-managed land. Under the No Project Alternative, the proposed Project would not be constructed and no operations, maintenance, or decommissioning activities would occur. Agricultural operations would continue on the solar facility, and no impacts to land use would occur.

Alternative 3: Northern Alternative 230 kV Gen-tie Line Location

Alternative 3 is similar to Alternative 1 (proposed Project), with the exception of the location of the Northern 230 kV gen-tie line, which is approximately 700 feet north of Alternative 1's proposed 230 kV gen-tie line. The solar facility would be within private lands under the jurisdiction of the County of Riverside and City of Blythe. The 230 kV gen-tie line that extends outside of the solar facility would be within or adjacent to the same utility corridor as Alternative 1 and within the same SEZ, but within BLM-managed lands only (no private lands). The direct and indirect impacts associated with the construction, operation, maintenance, and decommissioning of the solar facility would be essentially the same as Alternative 1.

Application of CEQA Significance Thresholds

LU-1) Would Alternative 3 physically divide an established community?

Alternative 3 would not be located through an established community. Therefore, no impacts would occur.

LU-2) Would Alternative 3 conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over Alternative 3 (including but not limited to the general plan, specific plan, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?

Alternative 3 would not conflict with applicable land use plans, policies, or regulations adopted for the purpose of avoiding or mitigating an environmental effect. No impacts would occur.

LU-3) Would Alternative 3 conflict with any applicable habitat conservation plan or natural community conservation plan?

Alternative 3 would not be within the jurisdiction of any adopted habitat conservation plan or natural community conservation plan; therefore, no impacts would occur.

LU-4) Would Alternative 3 increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?

Alternative 3 would not contain a residential component that would result in an increased use of existing recreational facilities, and would not bring a substantial number of new employees to the area over the long term. Therefore, implementation of Alternative 3 is not expected to result in any substantial physical deterioration of existing facilities. Impacts would be less than significant.

LU-5) Would Alternative 3 include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?

Alternative 3 would not include any plans for the addition of any recreational facilities, nor would it require the construction or expansion of recreational facilities. Therefore, Alternative 3 would not result in any adverse physical effects on the environment from construction or expansion of additional recreational facilities; a less than significant impact would occur.

LU-6) Would Alternative 3 result in a substantial alteration of the present or planned land use of an area?

Similar to Alternative 1, portions of Alternative 3 within private lands would be conditionally consistent (with approval of the CUP) with the RCGP, PVVAP, and City of Blythe General Plan 2025. The gen-tie line within BLM-managed lands would be consistent with the CDCA Plan and NECO Plan, because it would be within the Riverside East SEZ. Therefore, Alternative 3 would be consistent with present or planned land use of the area.

LU-7) Would Alternative 3 affect land use within a city sphere of influence and/or within adjacent city or county boundaries?

A portion of Alternative 3's solar facility site would be within the City of Blythe Sphere of Influence; the gen-tie line that extends outside of the solar facility would not. Alternative 3 would be conditionally consistent with the City of Blythe General Plan, RCGP, and PVVAP. Therefore; no impacts would occur to the City's sphere of influence.

LU-8) Would Alternative 3 be inconsistent with the site's existing or proposed zoning?

As described in LU-6 above, the solar facility would be conditionally consistent with existing zoning for the RCGP, PVVAP, and City of Blythe General Plan. The gen-tie line would be consistent with the CDCA Plan and NECO Plan. Alternative 3 would not require a zone change or general plan amendment; therefore, it would be consistent with the site's existing zoning. No impacts would occur.

LU-9) Would Alternative 3 be incompatible with existing surrounding zoning?

Alternative 3 would have the same existing surrounding zoning as Alternative 1; therefore, Alternative 3 would be compatible with existing surrounding zoning. No impacts would occur.

LU-10) Would Alternative 3 disrupt or divide the physical arrangement of an established community (including a low-income or minority community)?

Alternative 3 would not be located through an established community (see LU-1 above). No impacts would occur.

Alternative 4: Southern Alternative 230 kV Gen-tie Line Location

Alternative 4 would be similar to Alternative 1, as the solar facility would be within private lands under the jurisdiction of the County of Riverside and City of Blythe; however, Alternative 4's 230 kV gen-tie line that extends outside of the solar facility would be several hundred feet south of the proposed alignment. Approximately three miles of Alternative 4's gen-tie line would not parallel existing transmission lines and would require construction of new access roads.

Application of CEQA Significance Thresholds

LU-1) Would Alternative 4 physically divide an established community?

Alternative 4 would not be located through an established community. Therefore, no impacts would occur.

LU-2) Would Alternative 4 conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over Alternative 4 (including but not limited to the general plan, specific plan, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect ?

Alternative 4 would not conflict with applicable land use plans, policies, or regulations adopted for the purpose of avoiding or mitigating an environmental effect. No impacts would occur.

LU-3) Would Alternative 4 conflict with any applicable habitat conservation plan or natural community conservation plan?

Alternative 4 would not be within the jurisdiction of any adopted habitat conservation plan or natural community conservation plan; therefore, no impacts would occur.

LU-4) Would Alternative 4 increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?

Increases in demand for recreational facilities are typically associated with substantial increases in population or employment. Alternative 4 would not contain a residential component that would result in an increased use of existing recreational facilities, and would not bring a substantial number of employees to the area over the long term. Therefore, implementation of Alternative 4 is not expected to result in any substantial physical deterioration of existing facilities. Impacts would be less than significant.

LU-5) Would Alternative 4 include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?

Alternative 4 would not include any plans for the addition of any recreational facilities, nor would it require the construction or expansion of recreational facilities. Therefore, Alternative 4 would not result in any adverse physical effects on the environment from construction or expansion of additional recreational facilities; a less than significant impact would occur.

LU-6) Would Alternative 4 result in a substantial alteration of the present or planned land use of an area?

Similar to Alternatives 1 and 3, portions of Alternative 4 within private lands would be conditionally consistent (with approval of the CUP) with the RCGP, PVVAP, and City of Blythe General Plan 2025. The gen-tie line within BLM-managed lands would be consistent with the CDCA Plan and NECO Plan, because it would be within the Riverside East SEZ. Therefore, Alternative 4 would be consistent with present or planned land use of the area.

LU-7) Would Alternative 4 affect land use within a city sphere of influence and/or within adjacent city or county boundaries?

A portion of Alternative 4's solar facility site would be within the City of Blythe Sphere of Influence; the gen-tie line that would extend outside of the solar facility would not. Alternative 4 would be conditionally consistent with the City of Blythe General Plan, RCGP, and PVVAP. Therefore; no impacts would occur to the City's sphere of influence.

LU-8) Would Alternative 4 be inconsistent with the site's existing or proposed zoning?

As described in LU-6 above, the solar facility would be conditionally consistent (with approval of the CUP) with existing zoning for the RCGP, PVVAP, and City of Blythe General Plan. The gen-tie line would be consistent with the CDCA Plan and NECO Plan. Alternative 4 would not require a zone change or general plan amendment; therefore, it would be consistent with the site's existing zoning. No impacts would occur.

LU-9) Would Alternative 4 be incompatible with existing surrounding zoning?

Alternative 4 would have the same existing surrounding zoning as Alternatives 1 and 3; therefore, Alternative 4 would be compatible with existing surrounding zoning. No impacts would occur.

LU-10) Would Alternative 4 disrupt or divide the physical arrangement of an established community (including a low-income or minority community)?

Alternative 4 would not be located through an established community (see LU-1 above). No impacts would occur.

Alternative 5: Reduced Acreage Alternative

Similar to Alternative 1, Alternative 5 would include the construction, operation, maintenance, and decommissioning of a solar facility and associated infrastructure. The primary difference between Alternatives 1 and 5 is the absence of solar facility development north of I-10, which would reduce electrical output from a 485 MW down to a 315 MW alternating current solar PV facility. The Reduced Acreage Alternative would be on a reduced footprint of approximately 2,476 acres (from 3,660 acres for the proposed Project). Alternative 5 would include approximately 2,403 acres for the solar field. Similar to the proposed Project, 73 acres would be utilized for the 230 kV gen-tie line. In comparison to Alternative 1, Alternative 5 would eliminate one on-site substation and one O&M building and would have one access point (planned on Seeley Avenue). The Reduced Acreage Alternative would also no longer extend a 230 kV overhead gen-tie line from an on-site substation north of I-10, as this Alternative would not be developed on land north of I-10. Instead, this Alternative would construct an approximately 7.8-mile-long, 230 kV overhead gen-tie line from the proposed on-site substation south of I-10 to the approved Colorado River Substation. Approximately three miles of the gen-tie line would be within the solar facility. Alternative 5 would avoid impacts that would result from the construction, operation, maintenance, and decommissioning of a solar development north of I-10; however, the land on which Alternative 1 is proposed would continue with existing uses. Under Alternative 5, the City of Blythe would not approve a CUP, PUP, and a Development Agreement for Alternative 5. As a result, no solar energy project would be constructed within the City's limits, and the site would remain in agricultural uses north of I-10. Under Alternative 5, no impacts to land use would occur in the area north of I-10.

The Reduced Acreage Alternative solar facility and a portion of the gen-tie line would be within the jurisdiction of the County of Riverside but only within the Sphere of Influence of the City of Blythe in comparison to the proposed Project; therefore, Alternative 5 would need to comply with the RCGP (2003) and PVVAP (2008). The remaining portion of the gen-tie line would traverse lands managed by the BLM and would need to comply with the CDCA Plan. The construction, operation, maintenance, and decommissioning of Alternative 5 would not exceed those land use impacts identified under the Alternative 1 analysis. Therefore, the Alternative 1 analysis would be applicable to Alternative 5, outside of those differences identified in the discussion below.

Analysis of Direct and Indirect Impacts

Existing Land Use, Planning and Zoning Designations

The Alternative 5 solar facility would occupy 2,403 acres on privately owned land under the jurisdiction of the County, and would be within the PVVAP. As no development would occur north of I-10, there would be no portion of Alternative 5 within the City of Blythe limits (only City of Blythe sphere of influence), as compared to Alternative 1. The above-ground 230 kV gen-tie line would connect two rather than three proposed on-site substations, extending a distance of approximately three miles within the solar facility. From the southernmost on-site substation to the Colorado River Substation, the gen-tie line would extend another 4.8 miles within a 125-foot-wide ROW, or 73 acres (traversing 3.8 miles [58 acres] of BLM-managed lands and one mile of private land [15 acres]), similar to Alternative 1.

Federal

Lands traversed by the proposed Project and Alternatives under the jurisdiction of the BLM would be subject to the same plans and policies as detailed under Alternative 1. The Alternative 1 analysis would apply.

Local

Lands that would be traversed by Alternative 5 would be subject to the local plans and policies detailed in the Alternative 1 analysis. No development of Alternative 5 would occur north of I-10 and in the City of Blythe limits; the City of Blythe Zoning Code would not apply.

Riverside County Airport Land Use Compatibility Plan (RCALUCP) and Federal Aviation Administration

In April 2012, the Riverside County ALUC found the Alternative 1 Project to be consistent with the RCALUCP. In addition, the FAA provided "No Hazard to Air Navigation" determinations for the 230 kV gen-tie line structures. Alternative 5 would develop a reduced footprint within the same area as Alternative 1; as such, the same determinations would apply to Alternative 5.

Compatibility with Local Plans and Policies

Alternative 1 would be generally consistent with policies and goals set forth in the RCGP, PVVAP, and City of Blythe General Plan 2025. In addition, Alternative 1 would be consistent with the Riverside County Zoning Ordinance (Ordinance 348) and City of Blythe Zoning Code. As Alternative 5 would develop within the same footprint as Alternative 1, the same compatibility with local plans and policies would apply, as detailed in Table 4.2.10-1 within the Alternative 1 analysis. Under Alternative 5, solar facility development would not occur north of I-10 and within the City limits of Blythe; however, the Reduced Acreage Alternative would occur within the City's Sphere of Influence.

Construction, Operation, and Maintenance

The discussion above regarding compatibility with applicable land use plans and policies applies to construction, operation, and maintenance of the proposed Project and Alternatives. Following construction, the gen-tie line would be accessed using only roadways that are necessary to maintain it. The gen-tie line would be operated and maintained primarily within Corridor K, and fully within the Riverside East SEZ. Maintenance activities would be confined to existing roadways and disturbed areas. Therefore, operation and maintenance of Alternative 5 would be consistent with the CDCA Plan and NECO Plan.

Decommissioning

At the end of the operational life of Alternative 5, all equipment and components would be decommissioned and deconstructed. Structures used to support above-ground wires would be removed. A ROW grant from the BLM and CUP from Riverside County would no longer be required.

Application of CEQA Significance Thresholds

LU-1) Would Alternative 5 physically divide an established community?

Similar to Alternative 1, Alternative 5 would not physically divide an established community. Alternative 5 would be east and south of an existing community (Nicholls Warm Springs/Mesa Verde), south of I-10. The gen-tie line, access roads, and 34.5 kV distribution line would not be located through an established community. No impacts would occur.

LU-2) Would Alternative 5 conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the Project (including but not limited to the general plan,

specific plan, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?

Alternative 5 would be subject to the RCGP, PVVAP, CDCA Plan, and NECO Plan. As summarized in Table 4.2.10-1 under the analysis for Alternative 1, the Project would not conflict with applicable local land use plans, policies, or regulations (with the exception of Land Use Element Policy LU 13). Similar to Alternative 1, Alternative 5 would be consistent with goals and policies related to agriculture (Riverside County Land Use Element Policy LU 16.4, PVVAP Agricultural Preservation Policy 4.1). With approval of a CUP, Alternative 5 would be a permitted use on private land. The gen-tie line structures proposed on BLM land would be within the Riverside East SEZ and therefore consistent with the CDCA Plan and NECO Plan. Impacts to existing plans, policies, and regulations would be considered less than significant.

LU-3) Would Alternative 5 conflict with any applicable habitat conservation plan or natural community conservation plan?

As discussed in Section 4.2.4, *Biological Resources*, Alternative 5 would not be within the jurisdiction of any adopted habitat conservation plan or natural community conservation plan; therefore, no impacts would occur.

LU-4) Would Alternative 5 increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?

Similar to Alternative 1, Alternative 5 would not contain a residential component that would result in long-term increased use of existing recreational facilities. During the three-year construction period, construction workers and their families may temporarily increase the use of recreational facilities; however, Alternative 5 is not expected to draw a substantial number of new employees to the area over the long term. Therefore, implementation of Alternative 5 is not expected to result in any substantial physical deterioration of existing facilities. Impacts would be less than significant.

LU-5) Would Alternative 5 include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?

Similar to Alternative 1, Alternative 5 would not include any plans for the addition of any recreational facilities, nor would it require the construction or expansion of recreational facilities. The LU-5 analysis for Alternative 1 would apply.

LU-6) Would Alternative 5 result in a substantial alteration of the present or planned land use of an area?

Alternative 5 would be on private lands south of I-10 that would be conditionally consistent (with approval of the CUP) with the RCGP and the PVVAP. The gen-tie line within BLM-managed lands would be consistent with the CDCA Plan and NECO Plan, because it would be within the Riverside East SEZ. Therefore, Alternative 5 would be consistent with present or planned land use of the area.

LU-7) Would Alternative 5 affect land use within a city sphere of influence and/or within adjacent city or county boundaries?

Unlike Alternative 1, Alternative 5 would not develop solar facilities within the City of Blythe limits, only within the City's Sphere of Influence; the gen-tie line that would extend outside of the solar facility would not be within the City's Sphere of Influence. As discussed above, and similar to Alternative 1, Alternative 5 would be conditionally consistent with the RCGP and PVVAP. Therefore, no impacts would occur.

LU-8) Would Alternative 5 be inconsistent with the site's existing or proposed zoning?

As described in LU-6 above, the solar facility for Alternative 5 would be conditionally consistent with existing zoning for the RCGP and PVVAP. The gen-tie line would be consistent with the CDCA Plan and NECO Plan. Development of Alternative 5 would not require a zone change or general plan amendment; therefore, Alternative 5 would be consistent with the site's existing zoning. No impacts would occur.

LU-9) Would Alternative 5 be incompatible with existing surrounding zoning?

Alternative 5 would not develop within the City of Blythe limits. The zoning surrounding Alternative 5 is similar to that of the Alternative 1 site; therefore, Alternative 5 would be compatible with existing surrounding zoning.

LU-10) Would Alternative 5 disrupt or divide the physical arrangement of an established community (including a low-income or minority community)?

Similar to Alternative 1, Alternative 5 would not be located through an established community (see LU-1). No impacts would occur.

Cumulative Impacts

Geographic Scope

Impacts resulting from construction, operation, maintenance, and decommissioning of the Project could result in a cumulative effect on land use with other past, present, or reasonably foreseeable future actions. Cumulative impacts to agriculture are addressed in Section 4.2.2, *Agriculture*. The geographic scope of the cumulative effects analysis for land use consists of eastern Riverside County. This is based on the jurisdictional boundaries within which the impacts of land use decisions of the BMSP and other projects described in Table 4.1-1 could be additive or synergistic.

Temporal Scope

The timeframe refers to the duration over which impacts associated with land use and special designations would occur: short-term or long-term. Short-term impacts to land use and special designations would occur during the construction and decommissioning period. Long-term impacts associated with land use and special designations would occur as a result of developing a solar facility on the Project area and the resulting change in land use to accommodate the Project over its operational life (approximately 25 years).

Analysis of Direct and Indirect Impacts

Alternative 1: Proposed Project

Construction, Operation, Maintenance, and Decommissioning

Impacts resulting from construction, operation, maintenance, and decommissioning of the proposed Project could contribute to a cumulative effect on land use with other past, present, or reasonably foreseeable future actions. Cumulative impacts to agriculture are addressed in Section 4.2.2, *Agriculture*. The geographic scope of the cumulative effects analysis for land use consists of eastern Riverside County. This is based on the jurisdictional boundaries within which the impacts of land use decisions of the proposed Project and other projects described in Table 4.1-1 could be additive or synergistic.

Past development has increased human use of land in the Project area. However, because of the limited availability of water, human development in the Project area has been limited to small scattered communities and cities among large tracts of undeveloped land. Past and present projects occurring in the vicinity of the proposed Project area on private lands primarily include agricultural operations. Overall,

the Project area consists of undeveloped land used for agriculture, open space land, and desert. In addition, a large number of renewable projects (solar) have been proposed on both BLM-administered land and private land. However, not all projects listed would complete the environmental review process, and not all projects would be funded and constructed. Therefore, it is unlikely that all of the projects would be constructed.

Cumulative land use conflicts could arise as a result of the proposed Project's or an Alternative's short-term construction period in combination with multiple projects being under construction, creating nuisances such as dust, exhaust, and noise. The Project area is in a rural portion of the county devoted predominantly to agriculture with few sensitive receptors. However, there are a few small residential communities that could be impacted by increased traffic volumes on roadways. Impacts associated with dust, exhaust, and noise would be addressed through mitigation measures discussed in Section 4.2.3, *Air Quality*, and Section 4.2.11, *Noise*, which would likely be imposed on the other cumulative projects (impact LU-2). The gen-tie line traverses BLM-managed lands. Please refer to Section 4.2.12, *Recreation* for a discussion regarding temporary impacts to BLM-managed lands from the construction of the gen-tie line. Once construction is completed, temporary land use conflicts would cease. Therefore, temporary cumulative impacts to land use during construction would not be considered significant.

Some, if not all, of the cumulative projects described in Table 4.1-1 are anticipated to be operational during the operational life of the proposed Project or an Alternative. As part of the acreage of land is proposed for solar development in eastern Riverside County, the proposed Project or an Alternative could contribute to these cumulative impacts to land use during operations and maintenance. The conversion of rural agricultural and desert lands to solar facilities would preclude existing land uses including agriculture, rangeland, and open space from continuing on these sites during the operational life of the projects. Existing surrounding land uses such as agricultural fields are considered compatible with solar projects. Although solar projects can be affected by dust as well as particles from periodic spraying being carried by the wind and depositing on PV panels, these would not be considered incompatibilities or conflicts. With approval of a CUP for the proposed Project or an Alternative, there would be no conflicts with the RCGP, City of Blythe General Plan 2025, or zoning (impact LU-2). Therefore, the proposed Project or an Alternative would not contribute to any adverse direct or indirect cumulative impact to land use during operations and maintenance.

The decommissioning of the proposed Project or an Alternative is expected to result in temporary impacts similar to construction impacts, but lasting for a shorter period. Decommissioning of other solar energy projects would have the potential to combine with the proposed Project or an Alternative to result in temporary land use conflicts similar to construction (e.g., increases in traffic, disruptions in accessibility to surrounding lands). However, due to the short-term nature of decommissioning activities, and the unlikelihood that all such projects would go through the decommissioning process at exactly the same time, the cumulative land use impacts (i.e., temporary conflicts or incompatibilities) would occur for a limited duration and are therefore not expected to be significant.

Alternative 2: No Project Alternative

Under the No Project Alternative, gen-tie facilities would not be constructed on BLM-managed lands and solar facilities would not be constructed on private lands. The public lands in the Project area would continue to be managed by BLM in accordance with existing land use designations in the CDCA Plan, whereas the private lands would continue to be managed for agricultural production. Alternative 2 would not contribute to cumulative impacts on land use and planning.

Alternative 3: Northern 230 kV Gen-tie Line Location

Alternative 3 is similar to Alternative 1 (proposed Project), with the exception of the location of the Northern 230 kV gen-tie line, which would be approximately 700 feet north of Alternative 1's proposed 230 kV gen-tie line. The cumulative impacts associated with the construction, operation, maintenance, and decommissioning of the solar facility would be the same as Alternative 1. Similar to Alternative 1, impacts resulting from construction, operation, maintenance, and decommissioning of Alternative 3 could result in a cumulative effect on land use with other past, present, or reasonably foreseeable future

actions. Cumulative impacts to agriculture are addressed in Section 4.2.2, *Agriculture*. The geographic scope of the cumulative effects analysis for land use consists of eastern Riverside County. This is based on the jurisdictional boundaries within which the impacts of land use decisions of Alternative 3 and other projects described in Table 4.1-1 could be additive or synergistic.

Past development has increased human use of land in the area of Alternative 3. However, because of the limited availability of water, human development in the Alternative 3 area has been limited to small scattered communities and cities among large tracts of undeveloped land. Past and present projects occurring in the vicinity of the Alternative 3 site on private lands primarily include agricultural operations. Overall, the Project area consists of undeveloped land used for agriculture, open space land, and desert. In addition, a large number of renewable projects (solar) have been proposed on both BLM-administered land and private land. However, not all projects listed would complete the environmental review process, and not all projects would be funded and constructed. Therefore, it is unlikely that all of the projects would be constructed.

As with the proposed Project, cumulative land use conflicts could arise as a result of this Alternative's short-term construction period in combination with multiple projects being under construction creating nuisances such as dust, exhaust, and noise. Alternative 3 would also be in a rural portion of the county devoted predominantly to agriculture with few sensitive receptors. However, there are a few small residential communities that could be impacted by increased traffic volumes on roadways. Impacts associated with dust, exhaust, and noise would be addressed through mitigation measures discussed in Section 4.2.3, *Air Quality*, and Section 4.2.11, *Noise*, which would likely be imposed on the other cumulative projects (impact LU-2). Once construction is completed, temporary land use conflicts would cease. Therefore, temporary cumulative impacts to land use during construction are not considered significant.

Some, if not all, of the cumulative projects described in Table 4.1-1 are anticipated to be operational during the operational life of Alternative 3. As part of the acreage of land is proposed for solar development in eastern Riverside County, Alternative 3 could contribute to these cumulative impacts to land use during operations and maintenance. The conversion of rural agricultural and desert lands to solar facilities would preclude existing land uses including agriculture, rangeland, and open space from continuing on these sites. Existing surrounding land uses such as agricultural fields are considered compatible with solar projects. Although solar projects can be affected by dust as well as particles from periodic spraying being carried by the wind and depositing on PV panels, these would not be considered incompatibilities or conflicts. With approval of a CUP and compliance with Board of Supervisor's Policy B-29 for Alternative 3, there would be no conflicts with the RCGP, City of Blythe General Plan 2025, or zoning (impact LU-2). Therefore, Alternative 3 would not contribute to any adverse direct or indirect cumulative impact to land use during operations and maintenance.

The decommissioning of Alternative 3 is expected also to result in temporary impacts similar to construction impacts, but lasting for a shorter period. Decommissioning of other solar energy projects would have the potential to combine with this Alternative to result in temporary land use conflicts similar to construction (e.g., increases in traffic, disruptions in accessibility to surrounding lands). However, due to the short-term nature of decommissioning activities, and the unlikelihood that all such projects would go through the decommissioning process at exactly the same time, the cumulative land use impacts (i.e., temporary conflicts or incompatibilities) would occur for a limited duration and are therefore not expected to be significant.

Alternative 4: Southern 230 kV Gen-tie Line Location

Alternative 4 is similar to Alternative 1 (proposed Project), with the exception of the location of the Southern 230 kV gen-tie line, which would be approximately 0.8 mile south of Alternative 1's proposed 230 kV gen-tie line. The cumulative impacts associated with the construction, operation, maintenance, and decommissioning of the solar facility would be the same as Alternative 1. Similar to Alternative 1, impacts resulting from construction, operation, maintenance, and decommissioning of Alternative 4 could result in a cumulative effect on land use with other past, present, or reasonably foreseeable future actions. Cumulative impacts to agriculture are addressed in Section 4.2.2, *Agriculture*. The geographic

scope of the cumulative effects analysis for land use consists of eastern Riverside County. This is based on the jurisdictional boundaries within which the impacts of land use decisions of Alternative 4 and other projects described in Table 4.1-1 could be additive or synergistic.

Past development has increased human use of land in the area of Alternative 4. However, because of the limited availability of water, human development in the Alternative 4 area has been limited to small scattered communities and cities among large tracts of undeveloped land. Past and present projects occurring in the vicinity of the Alternative 4 site on private lands primarily include agricultural operations. Overall, the Project area consists of undeveloped land used for agriculture, open space land, and desert. In addition, a large number of renewable projects (solar) have been proposed on both BLM-administered land and private land. However, not all projects listed would complete the environmental review process, and not all projects would be funded and constructed. Therefore, it is unlikely that all of the projects would be constructed.

As with the proposed Project, cumulative land use conflicts could arise as a result of this Alternative's short-term construction period in combination with multiple projects being under construction creating nuisances such as dust, exhaust, and noise. Alternative 4 would also be in a rural portion of the county devoted predominantly to agriculture with few sensitive receptors. However, there are a few small residential communities that could be impacted by increased traffic volumes on roadways. Impacts associated with dust, exhaust, and noise would be addressed through mitigation measures discussed in Section 4.2.3, *Air Quality*, and Section 4.2.11, *Noise*, which would likely be imposed on the other cumulative projects (impact LU-2). Once construction is completed, temporary land use conflicts would cease. Therefore, temporary cumulative impacts to land use during construction are not considered significant.

Some, if not all, of the cumulative projects described in Table 4.1-1 are anticipated to be operational during the operational life of Alternative 4. As part of the acreage of land is proposed for solar development in eastern Riverside County, Alternative 4 could contribute to these cumulative impacts to land use during operations and maintenance. The conversion of rural agricultural and desert lands to solar facilities would preclude existing land uses including agriculture, rangeland, and open space from continuing on these sites. Existing surrounding land uses such as agricultural fields are considered compatible with solar projects. Although solar projects can be affected by dust as well as particles from periodic spraying being carried by the wind and depositing on PV panels, these would not be considered incompatibilities or conflicts. With approval of a CUP and compliance with Board of Supervisor's Policy B-29 for Alternative 4, there would be no conflicts with the RCGP, City of Blythe General Plan 2025, or zoning (impact LU-2). Therefore, Alternative 4 would not contribute to any adverse direct or indirect cumulative impact to land use during operations and maintenance.

The decommissioning of Alternative 4 is expected also to result in temporary impacts similar to construction impacts, but lasting for a shorter period. Decommissioning of other solar energy projects would have the potential to combine with this Alternative to result in temporary land use conflicts similar to construction (e.g., increases in traffic, disruptions in accessibility to surrounding lands). However, due to the short-term nature of decommissioning activities, and the unlikelihood that all such projects would go through the decommissioning process at exactly the same time, the cumulative land use impacts (i.e., temporary conflicts or incompatibilities) would occur for a limited duration and are therefore not expected to be significant.

Alternative 5: Reduced Acreage Alternative

Construction, Operation, Maintenance, and Decommissioning

Similar to Alternative 1, impacts resulting from construction, operation, maintenance, and decommissioning of Alternative 5 could result in a cumulative effect on land use with other past, present, or reasonably foreseeable future actions. Cumulative impacts to agriculture are addressed in Section 4.2.2, *Agriculture*; however, unlike Alternative 1, no agricultural lands would be developed north of I-10 under Alternative 5. The cumulative land use analysis under Alternative 1 would apply. Overall, and

similar to Alternative 1, the Alternative 5 area consists of undeveloped land used for agriculture, open space land, and desert.

Once construction is completed, temporary land use conflicts would cease. Therefore, temporary cumulative impacts to land use during construction are not considered significant.

Some, if not all, of the cumulative projects described in Table 4.1-1 are anticipated to be operational during the operational life of Alternative 5. Similar to Alternative 1, Alternative 5 could contribute to cumulative impacts to land use during operations and maintenance. The conversion of rural agricultural and desert lands to solar facilities would preclude existing land uses including agriculture, rangeland, and open space from continuing on these sites; however, under Alternative 5 there would be no agricultural lands impacted north of I-10 and current agricultural uses could continue. There would be no additional contribution towards cumulative impacts or conflicts during operations and maintenance outside of those previously discussed in the cumulative land use analysis under Alternative 1.

Similar to Alternative 1, the decommissioning of Alternative 5 is expected to result in temporary impacts similar to construction impacts, but lasting for a shorter period. Under Alternative 5, decommissioning efforts would be reduced in comparison to Alternative 1 due to less solar facility development. No additional impacts outside of those identified in the Alternative 1 cumulative analysis for decommissioning would result.

Mitigation Measures

The design features of the Project, as well as its compliance with applicable laws, ordinances, regulations, and standards, and the use of industry standard operating procedures (e.g., WECC) would avoid or reduce impacts related to construction and operation of the Project. Moreover, utility corridors have been designated by the BLM to accommodate such uses and to reduce overall environmental impacts that would result from the construction and operation of multiple linear facilities in multiple locations. In addition, the location of the Project in the Riverside East SEZ facilitates utility-scale production of solar energy and associated transmission infrastructure development. Accordingly, additional mitigation measures are not recommended.

Residual Impacts

There would be less-than-significant impacts to existing authorized uses as a result of development under the proposed Project, the action Alternatives, and the cumulative scenario. Existing conditions would continue under Alternative 2 and would not result in cumulative impacts to land use and planning.

NEPA Conclusions

The No Project Alternative would not have impacts, as the existing circumstances and operations would continue essentially unchanged. The Project and each of the action Alternatives would result in the direct and indirect impacts and contribution toward cumulative impacts that are described above, which would not be substantial. The Project and each of the action Alternatives would comply with all federal, State and local land use plans.

4.2.11 Noise

This section describes the impact analysis relating to noise for the proposed Project and Alternatives.

Methodology for Analysis

Noise and vibration impacts associated with the proposed Project and Alternatives would be created by short-term construction activities and by normal long-term operation of the solar facility, including noise from the tracker motors, electrical collection system, substation, and operation and maintenance activities.

Construction noise from the Project and Alternatives would include both on- and off-site noise sources. On-site noise sources would be generated by equipment associated with construction activities described in the proposed Project and Alternatives (see Chapter 2). Off-site construction noise would be generated by trucks delivering equipment and materials, as well as workers commuting to and from the proposed solar facility.

Operational noise associated with the Project would include off-site worker traffic; noise generated by the tracker motors, transformers, substation, and gen-tie line; and panel washing.

Noise associated with decommissioning would be similar to that of construction; however, it would be less intense and require a shorter duration.

For vibration impacts, human reactions and building damage potential have different thresholds depending on whether the vibration events are isolated discrete events or frequent/continuous events. Based on Caltrans' Transportation- and Construction-Induced Vibration Guidance Manual, building damage potential is based on cosmetic (not structural) damage to buildings or structures of various types and ages. Building damage categories are:

- Extremely Low: exceeds cosmetic damage threshold for extremely fragile historic buildings, ruins, or monuments
- Very Low: exceeds cosmetic damage threshold for fragile buildings
- Low: exceeds cosmetic damage threshold for historic buildings
- Moderate: exceeds cosmetic damage threshold for older residential buildings
- High: exceeds cosmetic damage threshold for newer residential buildings
- Very High: exceeds cosmetic damage thresholds for modern commercial and industrial buildings

A peak particle velocity (PPV) threshold of 0.20 inch per second (in/sec) was identified as the level of vibration impacts related to adverse human reaction and risk of architectural damage to normal buildings[7] (Caltrans 2004). This PPV threshold was used in this analysis to determine significant impacts associated with the proposed Project and Alternatives.

The purpose of this analysis is to identify and examine likely noise and vibration impacts from construction, operation and maintenance, and decommissioning of the Project and to recommend mitigation measures to minimize adverse affects. Though not an impact of the Project and thus not a subject encompassed under CEQA or NEPA, this section also discusses whether the Project (including its employees) would be exposed to substantial noise levels.

[7]Architectural damage could be structural damage, such as cracking of floor slabs, foundations, columns, beams, or wells, or cosmetic architectural damage, such as cracked plaster, stucco, or tile.

CEQA Significance Criteria

CEQA does not define what noise level increase would be considered substantial. Typically, an increase in noise level of at least 5 A-weighted decibels (dBA) is noticeable by most people and in a residential setting would not be a substantial adverse impact. An increase in noise level of 10 dBA is judged by most people as a doubling of the sound level, which would be considered a substantial adverse impact. Other factors that are considered in determining adverse noise impacts include: (1) the resulting combined noise level; (2) the duration and frequency of the noise; (3) the number of people affected; and (4) the land use designation of the affected receptor sites. Mitigation measures must be considered if potential adverse impacts to noise would occur from the construction, operation and maintenance, and decommissioning of the Project.

Typically, noise impacts due to construction activities are not considered substantial as long as construction activities are temporary, intermittently affect any one location, limit the use of heavy equipment and noise activities to daytime hours, implement all industry standard noise abatement measures for noise-producing equipment, and comply with any local construction noise ordinances.

Vibration-sensitive land uses would include high-precision manufacturing facilities or research facilities with optical and electron microscopes. None of these occur in the Project area. Therefore, a substantial impact resulting from excessive ground-borne vibration would depend on whether a nuisance, annoyance, or physical damage to any structure could occur.

The following was used to determine CEQA significance of impacts to noise and were derived from Appendix G of the CEQA Guidelines. Impacts of the proposed Project would be considered significant and would require mitigation if they result in:

NOI-1) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.

NOI-2) Substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

NOI-3) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels.

NOI-4) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, the exposure of people residing or working in the project area to excessive noise levels.

NOI-5) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project.

The following additional significance criterion from the County of Riverside Environmental Assessment form is used in the analysis. A project could have potentially significant impacts if it results in:

NOI-6) Impacts from railroad or highway noise.

CEQA significance conclusions are based on thresholds defined by local rules, standards, and/or ordinances. During operation of the Project, it is anticipated that noise levels would operate at or below the existing ambient noise levels.

NEPA Requirements

The federal role in regulating noise is mostly limited to transportation, workplace activities, and certain types of machinery. State and local governments determine the extent to which other sources of noise are controlled.

BLM does not have regulations specific to noise and the Riverside County noise ordinances are not applicable on public lands. However, the County General Plan and noise ordinance establishes sound-level limits applicable to residential properties that could be adversely affected by the Project. The noise ordinance is furthermore applicable to the non-federal connected action (the solar facility). The standards established in the County noise control measures accordingly provide applicable noise thresholds for evaluating the Project.

Applicable Best Management Practices

As part of the Project and Alternatives, the following applicable BMP would minimize the environmental impacts associated with noise. The full BMP has been detailed below (see also Table 2-4 in Chapter 2) and is further referenced (by number) within the impact discussion.

NUMBER	BMP DESCRIPTION
BMP-18	**Noise.** The Project would minimize construction- and operation-related noise levels to minimize impacts to wildlife and nearby residents.

Alternative 1: Proposed Project

Analysis of Direct and Indirect Impacts

Construction

Construction of the proposed Project would occur over a three-year period and construction workers would typically work Monday through Friday from 7:00 a.m. to 6:00 p.m. The peak of construction (construction of the solar field, O&M buildings, substations, and gen-tie line) would occur over a two-year period and require approximately 300 to 500 workers. Up to 400 workers would be at the site during array installation and assembly. The solar facility would be developed in six-month phases with six blocks constructed at a time (each block would be 100 acres, for a total of 600 acres at a time). Construction noises associated with each phase would accordingly move when construction activities move to the next phase.

Construction noise would be created from sources at the work sites and around staging areas or access routes. On-site noise generated during construction would occur primarily from heavy-duty diesel-powered construction equipment and other construction equipment. Off-site noise would be generated by trucks delivering materials and equipment to construction sites, as well as trucks hauling soil and vehicles used by workers commuting to and from the sites.

Noise from On-site Construction Activities

Construction equipment would include graders, bulldozers, backhoes, cranes, water trucks, generators, and delivery trucks. Table 4.2.11-1 provides the estimated noise that would be generated by each of the individual pieces of equipment, similar to what would be required to construct the Project, based on the Federal Highway Administration (FHWA) Roadway Construction Noise Model. Equipment and operation noise levels are expressed in terms of L_{max} (maximum sound level) noise levels. The acoustical usage factor estimates the fraction of time each piece of construction equipment is operating at full power (i.e., its loudest condition) during construction. Noise levels for each of the individual pieces of equipment would generate a maximum noise level ranging from 74 to 85 dBA L_{max} at 50 feet from the source, as shown in Table 4.2.11-1. With implementation of a Hearing Conservation Program and Personal Protective Equipment Program (Mitigation Measure Noise-3), impacts to construction workers would be reduced.

Table 4.2.11-1 Construction Equipment Noise Emission Levels

EQUIPMENT	ACOUSTICAL USAGE FACTOR (%)	MEASURED L_{max} (at 50 feet)
Backhoe	40	78
Compactor (ground)	20	83
Compressor (air)	40	78
Concrete Mixer Truck	40	79
Concrete Pump Truck	20	81
Dozer	40	82
Dump Truck	40	76
Excavator	40	81
Flat Bed Truck/Water Truck	40	74
Front End Loader	40	79
Truck-mounted crane	16	81
Generator	50	81
Grader	40	83
Paver	50	77
Pickup Truck	40	75
Pneumatic Tools	50	85
Pumps	50	81
Roller	20	80
Scraper	40	84
Welder/Torch	40	74

Source: FHWA 2006.

Based on similar solar projects, it is anticipated that the operation of heavy equipment for the construction of the Project would generate a combined maximum noise level of up to approximately 84 dBA L_{eq} (equivalent continuous noise level) at 75 feet from the construction activity (Aspen 2009). This noise level would diminish approximately 6 dBA per doubling of distance. At approximately 105 feet from the construction activity, noise levels would be approximately 78 dBA L_{eq} and at 300 feet, noise levels would be approximately 72 dBA L_{eq}. At approximately 1,200 feet from construction activity, it is anticipated that noise levels would be 60 dBA L_{eq}. Implementation of the Project would include BMP-18, which would minimize construction noise impacts to sensitive receptors and wildlife.

For the residents adjacent to the Project area, north of I-10 and west of the Project boundary, the assumed ambient noise level is 40 dBA L_{eq}. Projected ambient noise levels during construction are estimated to be 65 dBA L_{eq}. Within the County of Riverside, private construction projects located one-quarter of a mile or more from an inhabited dwelling or

The construction of the 230 kV gen-tie line, which is a long linear facility, would move along the length at a rapid pace and therefore would not subject any one sensitive noise receptor to noise impacts for more than a week. Furthermore, construction activities would be limited to daytime hours.

Off-site Noise

It is anticipated that most workers would be drawn from the Blythe/Palo Verde Valley region and the Desert Center region, with a smaller portion drawn from the Imperial Valley or Eastern Riverside County region. Anticipated average material deliveries would consist of about 20 truck deliveries per day for 24 months. Workers and delivery trucks would utilize the Neighbours Boulevard off ramp from I-10 and gain primary access to the site using Seeley Avenue and Riverside Drive. Typical on-site work hours would be from 7:00 a.m. to 6:00 p.m. During the installation period, construction workers are projected to be on-site five days per week, year-round. Due to weather or other major-type delays, times may shift to start as early as 5:00 a.m. and end as late as 8:00 p.m., as well as continue into the weekends. To minimize impacts to residents within 1,200 feet of construction activity to the maximum extent possible, non-typical construction hours would occur at a minimum of a quarter-mile (1,320 feet) from residents. Security would be on-site 24 hours per day.

Construction of the Project would cause off-site noise, primarily from commuting construction workers and materials and equipment deliveries to the construction sites. As shown in Table 4.2.11-1, the maximum pass-by noise levels from trucks would be 74 to 76 dBA L_{max} at 50 feet.

Vibration

Temporary sources of groundborne vibration and noise during construction would result from operation of conventional heavy construction equipment such as pile drivers, graders, bulldozers, and loaded haul trucks. Based on information from Caltrans' Transportation- and Construction-Induced Vibration Guidance Manual, Table 4.2.11-2 lists the anticipated ground vibration from typical construction equipment used to construct a solar facility. These pieces of equipment can generate vibration levels of up to 0.17 in/sec at a distance of 25 feet (Caltrans 2004).

Table 4.2.11-2 Ground Vibration Levels for Typical Construction Equipment

EQUIPMENT TYPE	VIBRATORY TYPE	PARAMETER	DISTANCE FROM OPERATING EQUIPMENT			
			25 feet	100 feet	200 feet	300 feet
Vibratory Pile Driver, Typical	Frequent or Continuous	PPV, in/sec	0.170	0.028	0.011	0.007
		Human Response	Mildly annoying	Barely perceptible	Barely perceptible	Not perceptible
		Building Damage Potential	Very low	None	None	None
Self-Loading Scraper	Frequent or Continuous	PPV, in/sec	0.089	0.015	0.006	0.004
		Human Response	Distinctly perceptible	Barely perceptible	Not perceptible	Not perceptible
		Building Damage Potential	Extremely low	None	None	None
Static Roller-Compactor	Frequent or Continuous	PPV, in/sec	0.089	0.015	0.006	0.004
		Human Response	Distinctly perceptible	Distinctly perceptible	Not perceptible	Not perceptible
		Building Damage Potential	Extremely low	None	None	none
Loaded Truck	Single Event	PPV, in/sec	0.076	0.013	0.005	0.003
		Human Response	Barely perceptible	Not perceptible	Not perceptible	Not perceptible
		Building Damage Potential	None	None	None	None
Small Bulldozer	Frequent or Continuous	PPV, in/sec	0.003	0.000	0.000	0.000
		Human Response	Not perceptible	Not perceptible	Not perceptible	Not perceptible
		Building Damage Potential	None	None	None	None
Excavator or Backhoe	Frequent or Continuous	PPV, in/sec	0.003	0.000	0.000	0.000
		Human Response	Not perceptible	Not perceptible	Not perceptible	Not perceptible
		Building Damage Potential	None	None	None	None
Wheeled Loader	Frequent or Continuous	PPV, in/sec	0.003	0.000	0.000	0.000
		Human Response	Not perceptible	Not perceptible	Not perceptible	Not perceptible
		Building Damage Potential	None	None	None	None

Source: BLM 2011.

For the construction of a solar facility, the vibratory pile driver would produce the highest PPV level of 0.17 in/sec at 50 feet, which would not exceed Caltrans' PPV threshold of 0.20 in/sec. The closest building, which is a residence, is approximately 260 feet from the proposed solar facility boundary and approximately 350 feet away from the closest solar panel. At a distance of 300 feet, ground vibration from a vibratory pile driver would not be perceptible by humans and would have no potential for damage to

buildings. Ground vibration from other construction equipment at 300 feet would not be perceptible to humans and would pose no risk of cosmetic damage to any existing buildings in the vicinity of the solar facility.

Operation and Maintenance

The primary noise sources associated with the operation and maintenance of the Project would be the tracker unit motors, substation transformers, modular power block inverters and medium voltage transformers, gen-tie line corona discharge, and maintenance activities.

Modular Power Blocks

The modular power blocks would each comprise four to six individual tracker units. Each tracker unit would include a drive unit that would consist of a 0.5-horsepower motor that would rotate the drive strut so that the solar PV panels would have the ability to maximize exposure to sunlight throughout the day. Based on specification of tracking motors for a similar PV project, the noise level of each proposed tracking motor is expected to be approximately 48 dBA at 50 feet (ICF 2010). Assuming that each of the six motors of a power block would operate simultaneously, the combined noise level would be as high as 50 dBA at 50 feet, which would equate to 44 dBA at 100 feet and 38 dBA at 200 feet.

The modular power blocks also include an inverter and medium voltage transformer. Inverters would be housed in containers that would attenuate any inverter noise to negligible levels. It is anticipated that the medium-voltage transformers would result in noise levels substantially less than the high-voltage transformers within the proposed substation (i.e., less than 53 dBA at 50 feet; see substation transformer discussion under *230 kV Gen-tie Line* below).

At 200 feet, the maximum power block combined motors and transformer noise would be less than 45 dBA. Although not typical, during the summer months, there may be days when the power block motors and medium transformers would operate slightly before 6:00 a.m. The closest residence is 260 feet from the Project boundary; noise attenuates with distance and would be less than 45 dBA, which is the County of Riverside's maximum decibel level limit allowed in rural residential areas for daytime and nighttime, as well as within the City of Blythe's acceptable noise levels.

O&M Buildings

After the construction phase, the O&M buildings would serve the Project's approximately 12 permanent full-time employees, which would include one plant manager, five engineers/technicians, and six security staff. Project facilities would be monitored during operating (daylight) hours, even though the Project facilities would be capable of automatic start up, shutdown, self-diagnosis, and fault detection. No heavy equipment would be used during normal operation.

Noise from the operation and maintenance of the Project would be created by security patrols, maintenance crews, wash crews, and the sound of electrical equipment, such as inverters and transformers. Security and maintenance staff would traverse the solar array field by utilizing lightweight vehicles along interior access roads. Panel washing crews would clean the panels up to twice a year with a lightweight to medium-duty truck. The truck would be fitted with a water tank and air compressor to operate a high-pressure sprayer and cleaning brush system.

230 kV Gen-tie Line

It is anticipated that the 230 kV gen-tie line would create a noise of approximately 20 dBA L_{eq} at 50 feet, and the transformers (within the substations) would create noise levels of approximately 40 dBA L_{eq} at 200 feet. The inverters would be housed in steel and concrete enclosures and are anticipated to create noise levels of approximately 58 dBA L_{eq} at the source.

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Decommissioning

Equipment used during decommissioning activities would be similar to those used during construction, including cranes, excavators, and air hammers. Decommissioning activities would generate a temporary, localized increase in ambient noise levels that would be similar, but less than, noise generated during construction. Decommissioning activities would be less intense and for a shorter duration.

Application of CEQA Significance Thresholds

NOI-1) Would the Project result in exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

Construction of the Project would occur over a three-year period, and the solar facility would be developed in six-month phases with six blocks (100 acres each) constructed at a time (approximately 600 acres at a time). Construction noises associated with each phase would accordingly move when construction activities move to the next phase. Construction activities would be temporary and only intermittently affect any one location. Typical construction hours would occur between 7:00 a.m. and 6:00 p.m., which would meet the criteria for exemption under provisions of Riverside County's Ordinance No. 847. Anticipated construction noise levels for the closest sensitive receptor, a residence approximately 260 feet away from the Project boundary, would not exceed the County of Riverside's and City of Blythe's noise policy thresholds (60 dB L_{dn}). However, noise levels for residents within 0.25 mile would increase greater than 10 dBA L_{eq} from the existing ambient noise level, which would result in an adverse impact. To minimize impacts to sensitive receptors, implementation of Mitigation Measure Noise-1 would restrict construction hours to comply with the County of Riverside's Noise Ordinance No. 847. In addition, implementation of BMP-18, as part of the Project, and Mitigation Measure Noise-2 to notify residents within 2,400 feet of the Project area would further minimize noise impacts. With implementation of Mitigation Measure Noise-3, impacts to workers that may be exposed to excessive noise levels would be reduced to less than significant levels. Impacts during operation and decommissioning would be less than significant. There are no sensitive receptors close to the proposed gen-tie line; therefore, no impacts would occur.

NOI-2) Would the Project result in substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?

Project construction would temporarily increase ambient noise levels in the Project vicinity above existing levels. However, construction would move along at a rapid pace throughout the Project area and would only intermittently affect any one location. Therefore, impacts would be considered less than significant.

NOI-3) Would the Project result in exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?

Project construction activities would require the use of heavy construction equipment that would result in ground-borne vibration. The vibratory post driver used for installation of the solar array piles would result in the highest vibration levels; however, it would be below PPV thresholds and would not result in adverse impacts to humans or physical damage to buildings in the vicinity of the Project area. Therefore, construction-related vibration impacts would be less than significant. Impacts related to decommissioning would be similar to construction, but the construction equipment utilized for decommissioning would result in lower levels of ground vibration. Project operation would not introduce any new sources of perceivable ground-borne vibration to sensitive receptors surrounding the Project area. Therefore, there would be no operation-related vibration levels.

NOI-4) Would the Project result in for a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use

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airport, the exposure of people residing or working in the project area to excessive noise levels?

The Project would be approximately 0.5 mile from the Blythe Airport, and the Project area also experiences considerable ambient noise from I-10. Construction activities from the Project would potentially exceed ambient levels for residents to the north of I-10 and east of the solar facility. Also, construction personnel working close to the Blythe Airport may be exposed to elevated noise levels from aircraft. With the implementation of Mitigation Measures Noise-1 and Noise-2, impacts would be reduced to a less than significant level. Noise impacts during operation and decommissioning would be less than significant.

NOI-5) Would the Project result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?

The Project would generate noise associated with the operation and maintenance of the tracker unit motors, substation transformers, modular power block inverters and medium voltage transformers, gen-tie line corona discharge, and maintenance activities. However, noise attenuates with distance and the Project would not result in a substantial permanent increase in ambient noise levels in the Project vicinity above levels existing without the Project. Impacts would be less than significant.

NOI-6) Would the Project result in impacts from railroad or highway noise?

The Project would not utilize railroad service for delivery of materials or workers; therefore, no impacts related to railroad noise would occur. During construction, workers commuting to the Project area and delivery of materials would result in a slight increase in traffic along I-10. However, the Project's construction traffic would result in a nominal increase in highway noise. Therefore, impacts related to highway noise would be less than significant. No impacts related to highway noise during operation of the Project would occur.

Alternative 2: No Project

Under the No Project Alternative, no Project-related action involving short-term construction activities and long-term operation of the Project would occur and the associated noise levels would not be generated. The No Project Alternative would result in the continuation of agricultural use-related noise levels at the site. No significant impacts would occur with the implementation of the No Project Alternative.

Alternative 3: Northern Alternative 230 KV Gen-tie Line Location

Alternative 3 would be very similar to the proposed Project, with the exception of the location of the proposed 230 kV gen-tie line. Although the gen-tie line would be shifted to the north relative to the proposed Project, it would impact the same noise-sensitive receptors. Therefore, noise-related impacts would be similar for Alternative 3 and the proposed Project.

Application of CEQA Significance Thresholds

NOI-1) Would Alternative 3 result in exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

Alternative 3 would meet the criteria under which the noise would be considered acceptable under Riverside County's Ordinance No. 847 and the City of Blythe's noise policies. However, noise levels for residents within 0.25 mile of the solar facility site would increase greater than 10 dBA L_{eq} from the existing ambient noise level, which would result in an adverse impact. Construction activities would be temporary and only intermittently affect any one location. To minimize impacts to sensitive receptors, implementation of Mitigation Measure Noise-1 would restrict construction hours. In addition, implementation of BMP-18, as part of Alternative 3, and Mitigation Measure Noise-2 to notify residents within 2,400 feet of the solar facility area would

further minimize noise impacts. With implementation of Mitigation Measure Noise-3, impacts to workers that may be exposed to excessive noise levels would be reduced to less than significant levels. Therefore, impacts during operation and decommissioning would be less than significant. There are no sensitive receptors within 0.25 mile of Alternative 3's gen-tie line that would extend outside the solar facility site; therefore, no impacts would occur.

NOI-2) Would Alternative 3 result in substantial temporary or periodic increase in ambient noise levels in the Alternative 3 vicinity above levels existing without Alternative 4?

Alternative 3 construction would temporarily increase ambient noise levels in the Alternative 3 vicinity above existing levels. However, construction would move along at a rapid pace throughout the Alternative 3 site and would only intermittently affect any one location. Therefore, impacts would be considered less than significant.

NOI-3) Would Alternative 3 result in exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?

Construction activities for Alternative 3 would require the use of heavy construction equipment that would result in ground-borne vibration. The vibratory post driver used for installation of the solar array piles would result in the highest vibration levels; however, it would be below PPV thresholds and would not result in adverse impacts to humans or physical damage to buildings in the vicinity of the Alternative 3. Therefore, construction-related vibration impacts would be less than significant. Impacts related to decommissioning would be similar to construction, but the construction equipment utilized for decommissioning would result in lower levels of ground vibration. Project operation would not introduce any new sources of perceivable ground-borne vibration to sensitive receptors within 0.25 mile of Alternative 3. Therefore, there would be no operation-related vibration levels.

NOI-4) Would Alternative 3 result in for a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, the exposure of people residing or working in Alternative 3 area to excessive noise levels?

Alternative 3 would be approximately 0.5 mile from the Blythe Airport, and the Alternative 3 area also experiences considerable ambient noise from I-10. Construction activities from Alternative 3 would potentially exceed ambient levels for residents to the north of I-10 and east of the Solar facility. With the implementation of Mitigation Measures Noise-1 and Noise-2, impacts would be reduced to a less than significant level. Noise impacts during operation and decommissioning would be less than significant.

NOI-5) Would Alternative 3 result in a substantial permanent increase in ambient noise levels in the Alternative 3 vicinity above levels existing without Alternative 3?

Alternative 3 would generate noise associated with the operation and maintenance of the tracker unit motors, substation transformers, modular power block inverters and medium voltage transformers, gen-tie line corona discharge, and maintenance activities. However, noise attenuates with distance and Alternative 3 would not result in a substantial permanent increase in ambient noise levels in the Alternative 3 vicinity above levels existing without Alternative 3. Impacts would be less than significant.

NOI-6) Would Alternative 3 result in impacts from railroad or highway noise?

Similar to Alternative 1, Alternative 3 would not result in impacts related to railroad noise. During construction, Alternative 3 would result in a nominal increase in highway noise, but operation of Alternative 3 would not increase highway noise. Impacts related to highway noise would be less than significant.

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Alternative 4: Southern Alternative 230 KV Gen-tie Line Location

Alternative 4 would be similar to the proposed Project, with the exception of the location of the proposed 230 kV gen-tie line. Alternative 4 would be shifted to the south of the proposed Project's gen-tie line. Alternative 4's gen-tie line would be slightly shorter than the proposed Project's gen-tie line and farther from sensitive receptors. However, the closest residents that may be impacted by the Project would be close to the solar facility, not the gen-tie line. Therefore, there would be no substantial difference between the Alternative 4 gen-tie line and the proposed Project's gen-tie line, and the same noise-sensitive receptors would be impacted.

Application of CEQA Significance Thresholds

NOI-1) Would Alternative 4 result in exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

Alternative 4 would meet the criteria under which the noise would be considered acceptable under Riverside County's Ordinance No. 847 and the City of Blythe's noise policies. However, noise levels for residents within 0.25 mile of the solar facility site would increase greater than 10 dBA L_{eq} from the existing ambient noise level, which would result in an adverse impact. Construction activities would be temporary and only intermittently affect any one location. To minimize impacts to sensitive receptors, implementation of Mitigation Measure Noise-1 would restrict construction hours. In addition, implementation of BMP-18, as part of Alternative 4, and Mitigation Measure Noise-2 to notify residents within 2,400 feet of the solar facility area would further minimize noise impacts. With implementation of Mitigation Measure Noise-3, impacts to workers that may be exposed to excessive noise levels would be reduced to less than significant levels. Therefore, impacts during operation and decommissioning would be less than significant. There are no sensitive receptors within 0.25 mile of Alternative 4's gen-tie line that would extend outside the solar facility site; therefore, no impacts would occur.

NOI-2) Would Alternative 4 result in substantial temporary or periodic increase in ambient noise levels in the Alternative 4 vicinity above levels existing without Alternative 4?

Alternative 4 construction would temporarily increase ambient noise levels in the Project vicinity above existing levels. However, construction would move along at a rapid pace throughout the Alternative 4 site and would only intermittently affect any one location. Therefore, impacts would be considered less than significant.

NOI-3) Would Alternative 4 result in exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?

Construction activities for Alternative 4 would require the use of heavy construction equipment that would result in ground-borne vibration. The vibratory post driver used for installation of the solar array piles would result in the highest vibration levels; however, it would be below PPV thresholds and would not result in adverse impacts to humans or physical damage to buildings in the vicinity of the Alternative 4. Therefore, construction-related vibration impacts would be less than significant. Impacts related to decommissioning would be similar to construction, but the construction equipment utilized for decommissioning would result in lower levels of ground vibration. Project operation would not introduce any new sources of perceivable ground-borne vibration to sensitive receptors within 0.25 mile of Alternative 4. Therefore, there would be no operation-related vibration levels.

NOI-4) Would Alternative 4 result in for a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, the exposure of people residing or working in Alternative 4 area to excessive noise levels?

Alternative 4 would be approximately 0.5 mile from the Blythe Airport, and the Project area also experiences considerable ambient noise from I-10. Construction activities from the Project would potentially exceed ambient levels for residents to the north of I-10 and east of the solar facility. With the implementation of Mitigation Measures Noise-1 and Noise-2, impacts would be reduced to a less than significant level. Noise impacts during operation and decommissioning would be less than significant.

NOI-5) Would Alternative 4 result in a substantial permanent increase in ambient noise levels in the Alternative 4 vicinity above levels existing without Alternative 4?

Alternative 4 would generate noise associated with the operation and maintenance of the tracker unit motors, substation transformers, modular power block inverters and medium voltage transformers, gen-tie line corona discharge, and maintenance activities. However, noise attenuates with distance, and the Project would not result in a substantial permanent increase in ambient noise levels in the Project vicinity above levels existing without the Project. Impacts would be less than significant.

NOI-6) Would Alternative 4 result in impacts from railroad or highway noise?

Similar to Alternatives 1 and 3, Alternative 4 would not result in impacts related to railroad noise. During construction, Alternative 4 would result in a nominal increase in highway noise, but operation of Alternative 4 would not increase highway noise. Impacts related to highway noise would be less than significant.

Alternative 5: Reduced Acreage Alternative

Similar to Alternative 1, Alternative 5 would include the construction, operation, maintenance, and decommissioning of a solar facility and associated infrastructure. The primary difference between Alternatives 1 and 5 is the absence of solar facility development north of I-10, which would reduce electrical output from a 485 MW down to a 315 MW alternating current solar PV facility. The Reduced Acreage Alternative would be on a reduced footprint of approximately 2,476 acres (from 3,660 acres for the proposed Project). Alternative 5 would include approximately 2,403 acres for the solar field. Similar to the proposed Project, 73 acres would be utilized for the 230 kV gen-tie line. In comparison to Alternative 1, Alternative 5 would eliminate one on-site substation and one O&M building and would have one access point (planned on Seeley Avenue). The Reduced Acreage Alternative would also no longer extend a 230 kV overhead gen-tie line from an on-site substation north of I-10, as this Alternative would not be developed on land north of I-10. Instead, this Alternative would construct an approximately 7.8-mile-long, 230 kV overhead gen-tie line from the proposed on-site substation south of I-10 to the approved Colorado River Substation. Approximately three miles of the gen-tie line would be within the solar facility. Alternative 5 would avoid impacts that would result from the construction, operation, maintenance, and decommissioning of a solar development north of I-10; however, the land on which Alternative 1 is proposed would continue with existing uses. Under Alternative 5, the work-related action involving short-term construction activities and long-term operation of a solar facility north of I-10 would not occur and the associated noise levels would not be generated. As a result, there would be a continuation of agricultural use-related noise levels north of I-10.

The Reduced Acreage Alternative solar facility and a portion of the gen-tie line would be within the jurisdiction of the County of Riverside but not within the City limits of Blythe in comparison to the proposed Project. Alternative 5 would need to comply with the RCGP (2003) and PVVAP (2008). The remaining portion of the gen-tie line would traverse lands managed by the BLM and would need to comply with the CDCA Plan. The construction, operation, maintenance, and decommissioning of Alternative 5 would not exceed those noise impacts identified under the Alternative 1 analysis. Therefore,

the Alternative 1 analysis would be applicable to Alternative 5, outside of those differences identified in the discussion below.

Analysis of Direct and Indirect Impacts

Construction

Construction of Alternative 5 would occur over a three-year period, similar to Alternative 1, and construction workers would typically work Monday through Friday from 7:00 a.m. to 6:00 p.m. The peak of construction (construction of the solar field, O&M building, substation, and gen-tie line) would occur over a two-year period and require a slightly reduced amount of workers (approximately 200 to 400 workers) due to a smaller development footprint. As no construction would occur north of I-10, the analysis under Alternative 1 would apply.

Noise from On-site Construction Activities

Alternative 5 would utilize the same construction equipment as Alternative 1. The analysis under Alternative 1 would apply. Unlike Alternative 1, there would be no residents adjacent to the solar facility footprint area, north of I-10 and west of the Project boundary, which would be impacted by ambient noise levels under Alternative 5.

Off-site Noise

Construction of Alternative 5 would be similar to Alternative 1, with the difference of no construction occurring north of I-10. Off-site noise to receptors north of I-10 would be reduced. Similar to Alternative 1, it is anticipated that most workers would be drawn from the Blythe/Palo Verde Valley region and the Desert Center region, with a smaller portion drawn from the Imperial Valley or Eastern Riverside County region. Anticipated average material deliveries would consist of about 20 truck deliveries per day for 24 months. However, under Alternative 5, workers and delivery trucks would utilize the Neighbours Boulevard off ramp from I-10 and gain primary access to the site using Seeley Avenue. Similar to Alternative 1, construction of Alternative 5 would cause off-site noise, primarily from commuting construction workers and materials and equipment deliveries to the construction sites. As shown in Table 4.2.11-1 in the Alternative 1 analysis, the maximum pass-by noise levels from trucks would be 74 to 76 dBA L_{max} at 50 feet.

Vibration

As construction of Alternative 5 would be similar to Alternative 1, the analysis under Alternative 1 for vibration would apply. Alternative 5 would not exceed Caltrans' PPV threshold of 0.20 in/sec, similar to Alternative 1. As no development would occur north of I-10 under Alternative 5, no construction activities would occur in proximity to a residence that would be approximately 260 feet from the Alternative 1 solar facility boundary. At a distance of 300 feet, however, ground vibration from a vibratory pile driver would not be perceptible by humans and would have no potential for damage to buildings. As such, similar to Alternative 1, ground vibration from other construction equipment at 300 feet would not be perceptible to humans and would pose no risk of cosmetic damage to any existing buildings in the vicinity of the Alternative 5 solar facility.

Operation and Maintenance

Similar to Alternative 1, the primary noise sources associated with the operation and maintenance of Alternative 5 would be the tracker unit motors, substation transformers, modular power block inverters and medium voltage transformers, gen-tie line corona discharge, and maintenance activities.

Modular Power Blocks

The closest residence to the Alternative 1 boundary would not experience solar development within 260 feet under Alternative 5, as the project limits would not extend north of I-10. However, even under Alternative 1, noise would be less than 45 dBA, which is the County of Riverside's maximum decibel level limit allowed in rural residential areas for daytime and nighttime. As such, Alternative 5 operation would also be within these acceptable limits.

O&M Buildings

After the construction phase of Alternative 5, the O&M building would serve the Project's approximately seven permanent full-time employees. Similar to Alternative 1, Alternative 5 facilities would be monitored during operating (daylight) hours, even though the facilities would be capable of automatic start up, shutdown, self-diagnosis, and fault detection. No heavy equipment would be used during normal operation. As no solar facilities (no O&M building) would be developed north of I-10, there would be no associated activity in this area. The impacts south of I-10 would be similar to those described under Alternative 1.

230 kV Gen-tie Line

The Reduced Acreage Alternative would no longer extend a 230 kV overhead gen-tie line from an on-site substation north of I-10, as this Alternative would eliminate all development north of I-10. Therefore, the approximately 8.4-mile-long line associated with the proposed Project would be reduced under this alternative. The Reduced Acreage Alternative would construct an approximately 7.8-mile-long, 230 kV overhead gen-tie line from the proposed on-site substation south of I-10 to the approved Colorado River Substation. Approximately three miles of the gen-tie line would be within the solar facility. The impacts described under the Alternative 1 analysis would apply to the 230 kV gen-tie line in the areas previously described.

Decommissioning

The analysis under Alternative 1 would apply to the area south of I-10 regarding decommissioning efforts.

Application of CEQA Significance Thresholds

NOI-1) Would Alternative 5 result in exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

The NOI-1 analysis for Alternative 1 would apply to Alternative 5 and the Reduced Acreage Alternative would not exceed the noise generation levels under the proposed Project. As no development would occur north of I-10 under Alternative 5, there would be no significant temporary or intermittent construction noise level effects on the closest sensitive receptor, a residence approximately 260 feet away from the Alternative 1 Project boundary. Impacts to workers that may be exposed to excessive noise levels would be less than significant impacts. Impacts during operation and decommissioning would be less than significant. There are no sensitive receptors close to the proposed gen-tie line; therefore, no significant impacts would occur.

NOI-2) Would Alternative 5 result in substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?

The NOI-2 analysis for Alternative 1 would apply to Alternative 5.

NOI-3) Would Alternative 5 result in exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?

The NOI-3 analysis for Alternative 1 would apply to Alternative 5. Alternative 5 would not exceed Caltrans' PPV threshold of 0.20 in/sec, similar to Alternative 1. As no development would occur north of I-10 under Alternative 5, no construction activities would occur in proximity to a residence that would be approximately 260 feet from the Alternative 1 solar facility boundary. At a distance of 300 feet, however, ground vibration from a vibratory pile driver would not be perceptible by humans and would have no potential for damage to buildings. As such, similar to Alternative 1, ground vibration from other construction equipment at 300 feet would not be perceptible to humans and would pose no risk of cosmetic damage to any existing buildings in the vicinity of the Alternative 5 solar facility. Construction-related vibration impacts would be less than significant. Impacts related to decommissioning would be similar to construction, but the construction equipment utilized for decommissioning would result in lower levels of ground vibration. Alternative 5 operations would not introduce any new sources of perceivable ground-borne vibration to sensitive receptors surrounding the Alternative 5 area. Therefore, there would be no operation-related vibration levels.

NOI-4) Would Alternative 5 result in for a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, the exposure of people residing or working in the project area to excessive noise levels?

The NOI-4 analysis for Alternative 1 would apply to Alternative 5. However, Alternative 5 would be south of I-10 and farther from the Blythe Airport in comparison to Alternative 1. Construction activities from Alternative 5 would not have the potential to exceed ambient levels for residents to the north of I-10 and east of the solar facility, as no development would occur north of the freeway. Noise impacts during operation and decommissioning would be less than significant.

NOI-5) Would Alternative 5 result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?

The NOI-5 analysis for Alternative 1 would apply to Alternative 5. Alternative 5 would not result in a substantial permanent increase in ambient noise levels in the vicinity above levels existing without the development. Impacts would be less than significant.

NOI-6) Would Alternative 5 result in impacts from railroad or highway noise?

The NOI-6 analysis for Alternative 1 would apply to Alternative 5.

Cumulative Impacts

Geographic Scope

Noise levels generally diminish quickly with distance from a source; therefore, the geographic scope for cumulative impacts associated with noise would be limited to projects within approximately 0.5 mile of the Project. The following projects were identified as reasonably foreseeable projects within 0.5 mile of the Project and Alternatives, and could be constructed and operated simultaneously with the Project: Palo Verde Mesa Solar Project, Blythe Airport Solar I Project, Blythe Energy Project II, Desert Quartzite, Sonoran West SEGS, Desert Southwest 500 kV Transmission Line, and Devers-Palo Verde #2 500 kV Transmission Line.

Temporal Scope

The temporal scope of the cumulative impacts associated with noise would include construction, operation and maintenance, and decommissioning phases of the Project. The timeframe refers to the duration over which an impact would occur: short-term or long-term. Short-term noise impacts would

occur during the construction and decommissioning periods in association with the addition of construction equipment.

Analysis of Direct and Indirect Impacts

Alternative 1: Proposed Project

Construction, Operation, Maintenance, and Decommissioning

The primary noise sources in the vicinity of the proposed Project and Alternatives area are traffic from I-10 and nearby roadways, airplane noise from the Blythe Airport, steam blowing from the Blythe Energy Center, and sounds from agricultural operations. The existing noise levels in the immediate Project vicinity are generally low, with the highest noise levels closest to I-10. I-10 bisects the proposed Project, and other proposed cumulative projects listed above would be farther away from the freeway. Project construction and decommissioning activities would result in short-term noise impacts at the nearest residence locations (impacts NOI-1 and NOI-2). Long-term operation- and maintenance-related impacts associated with the Project would not result in permanent impacts to noise (impact NOI-5). The Project would not have vibration- or ground-borne noise-related impacts.

Although unlikely, it is possible that construction and operation of the solar projects and electrical facilities listed above could occur at the same time as construction of the Project. However, the other cumulative projects would be at a greater distance from the existing sensitive receptors that would experience negligible noise levels from construction, operation, maintenance, and decommissioning of the Project. Additionally, the primary noise sources in the Project area are traffic from I-10 and airplane noise from the Blythe Airport.

Noise levels during decommissioning would be similar to those projected during Project construction since it is anticipated that the equipment used during decommissioning would be similar to that used during construction. The noise levels would be temporary and, similar to construction-related noise levels, would be expected to attenuate to a level of insignificance prior to reaching any sensitive noise receptors. In addition, decommissioning activities would be required to comply with local, State, and federal laws, regulations, and standards at the time of decommissioning. Thus, decommissioning activities would not be expected make a cumulative contribution to existing noise levels.

Therefore, it is unlikely that Project-related noise levels and other Project noise levels would result in a combined noise level that would cause an adverse effect.

Alternative 2: No Project Alternative

Under the No Project Alternative, gen-tie facilities would not be constructed on BLM-managed lands and solar facilities would not be constructed on private lands. The public lands in the Project area would continue to be managed by BLM in accordance with existing land use designations in the CDCA Plan, whereas the private lands would continue to be managed for agricultural production. Alternative 2 would not contribute to cumulative noise impacts.

Alternative 3: Northern Alternative 230 kV Gen-tie Line Location

Alternative 3 is similar to Alternative 1 (proposed Project), with the exception of the location of the Northern 230 kV gen-tie line, which would be approximately 700 feet north of Alternative 1's proposed 230 kV gen-tie line. The cumulative impacts associated with the construction, operation, maintenance, and decommissioning of the solar facility would be the same as Alternative 1.

As with the proposed Project, the primary noise sources in the vicinity of the Alternative 3 area are traffic from I-10 and nearby roadways, airplane noise from the Blythe Airport, steam blowing from the Blythe Energy Center, and sounds from agricultural operations. The existing noise levels in the immediate Project vicinity are generally low, with the highest noise levels closest to I-10. I-10 bisects the Alternative

development area, and other proposed cumulative projects listed above would be farther away from the freeway. Alternative 3 construction and decommissioning activities would result in short-term noise impacts at the nearest residence locations (impacts NOI-1 and NOI-2). Long-term operation- and maintenance-related impacts associated with Alternative 3 would not result in permanent impacts to noise (impact NOI-5). Alternative 3 would not have vibration- or ground-borne noise-related impacts.

Although unlikely, it is possible that construction and operation of the solar projects and electrical facilities listed above could occur at the same time as construction of Alternative 3. However, the other cumulative projects would be at a greater distance from the existing sensitive receptors that would experience negligible noise levels from construction, operation, maintenance, and decommissioning of Alternative 3. Additionally, the primary noise sources in the Alternative 3 area are traffic from I-10 and airplane noise from the Blythe Airport.

Noise levels during decommissioning would be similar to those projected during Alternative 3 construction since it is anticipated that the equipment used during decommissioning would be similar to that used during construction. The noise levels would be temporary and, similar to construction-related noise levels, would be expected to attenuate to a level of insignificance prior to reaching any sensitive noise receptors. In addition, decommissioning activities would be required to comply with local, State, and federal laws, regulations, and standards at the time of decommissioning. Thus, decommissioning activities would not be expected make a cumulative contribution to existing noise levels.

Alternative 4: Southern 230 kV Gen-tie Line Location

Alternative 4 is similar to Alternative 1 (proposed Project), with the exception of the location of the Southern 230 kV gen-tie line, which would be approximately 0.8 mile south of Alternative 1's proposed 230 kV gen-tie line. The cumulative impacts associated with the construction, operation, maintenance, and decommissioning of the solar facility would be the same as Alternative 1.

As with the proposed Project, the primary noise sources in the vicinity of the Alternative 4 area are traffic from I-10 and nearby roadways, airplane noise from the Blythe Airport, steam blowing from the Blythe Energy Center, and sounds from agricultural operations. The existing noise levels in the immediate Project vicinity are generally low, with the highest noise levels closest to I-10. I-10 bisects the Alternative development area, and other proposed cumulative projects listed above would be farther away from the freeway. Alternative 4 construction and decommissioning activities would result in short-term noise impacts at the nearest residence locations (impacts NOI-1 and NOI-2). Long-term operation- and maintenance-related impacts associated with Alternative 4 would not result in permanent impacts to noise (impact NOI-5). Alternative 4 would not have vibration- or ground-borne noise-related impacts.

Although unlikely, it is possible that construction and operation of the solar projects and electrical facilities listed above could occur at the same time as construction of Alternative 4. However, the other cumulative projects would be at a greater distance from the existing sensitive receptors that would experience negligible noise levels from construction, operation, maintenance, and decommissioning of Alternative 4. Additionally, the primary noise sources in the Alternative 4 area are traffic from I-10 and airplane noise from the Blythe Airport.

Noise levels during decommissioning would be similar to those projected during Alternative 4 construction since it is anticipated that the equipment used during decommissioning would be similar to that used during construction. The noise levels would be temporary and, similar to construction-related noise levels, would be expected to attenuate to a level of insignificance prior to reaching any sensitive noise receptors. In addition, decommissioning activities would be required to comply with local, State, and federal laws, regulations, and standards at the time of decommissioning. Thus, decommissioning activities would not be expected make a cumulative contribution to existing noise levels.

Alternative 5: Reduced Acreage Alternative

Construction, Operation, Maintenance, and Decommissioning

As development of Alternative 5 would occur within the same footprint as Alternative 1, the primary noise sources in the vicinity of the proposed Project and Alternatives area are traffic from I-10 and nearby roadways, airplane noise from the Blythe Airport, steam blowing from the Blythe Energy Center, and sounds from agricultural operations. The cumulative analysis under Alternative 1 would be applicable to Alternative 5; however, would have a smaller footprint in comparison to Alternative 1 and no development north of I-10 would result in a slightly reduced contribution towards noise impacts. Decommissioning activities would not be expected make a cumulative contribution to existing noise levels. It is unlikely that Alternative 5-related noise levels and other project noise levels would result in a combined noise level that would cause a significant adverse effect.

Mitigation Measures

Noise-1 Construction shall be prohibited in areas within 0.25 mile (1,320 feet) of residents, between the hours of 6:00 p.m. and 6:00 a.m. during the months of June through September, and the hours of 6:00 p.m. and 7:00 a.m. during the months of October through May. During construction, best efforts should be made to locate stockpiling and/or vehicle staging areas as far as practicable from existing noise sensitive receptors (residential dwellings) nearest the Project area.

Noise-2 Prior to and during construction, decommissioning, and ground disturbing activities, the Applicant shall provide at least two weeks advance notice of construction and decommissioning. Notices shall be mailed directly to land owners and residents within 2,400 feet of all portions of the Project boundary, and signs shall be posted at the solar facility in areas accessible to the public. Notices shall announce when and where construction would occur; provide tips on reducing noise intrusion (e.g., closing windows facing the planned construction); and provide contact information for the local public liaison for any noise complaints.

Noise-3 The Applicant would implement a Hearing Conservation Program and Personal Protective Equipment Program that would provide personal protective devices for specific jobs that would produce excessive noise levels. The Applicant shall comply with the OSHA regulations on occupational noise exposure.

Residual Impacts After Mitigation

With implementation of the Project BMPs and mitigation measures, noise-related impacts would be reduced to less than significant levels.

NEPA Conclusions

The No Project Alternative would not have impacts, as the existing circumstances and operations would continue essentially unchanged. The Project and each of the action Alternatives would result in the direct and indirect impacts and contribution toward cumulative impacts described above. Noise impacts, particularly those due to construction activities, are usually not considered to be significant as long as the activities are temporary and only intermittently affect any one location; the use of heavy equipment is limited to daytime hours; and all industry-standard noise abatement measures are implemented. The Project and any of the action Alternatives would comply with all federal, State, and local requirements in addition to the BMP and mitigation measures relating to noise and identified above. The Project and each of the action Alternatives would consequently not have significant noise impacts.

4.2.12 Paleontological Resources

This section describes the impact analysis relating to cultural and paleontological resources for the proposed Project and Alternatives.

Methodology for Analysis

As described in Chapter 3, the Project's paleontological investigation included: (1) review of available geologic and paleontologic literature pertinent to the site, including existing lists of fossils and fossil localities; (2) review of available environmental impact and/or geotechnical reports pertinent to development of the site; and (3) review of records at the San Bernardino County Museum and databases from the University of California, Berkeley Museum of Paleontology. The information in this section is based on the *Blythe Mesa Solar Project Paleontological Resources Survey Report*, prepared by John Minch and Associates, Inc. 2012 (provided in Appendix I of this Draft EIR/EA). The information was assigned a sensitivity classification (Society of Vertebrate Paleontology classification for private land, and Potential Fossil Yield Classification [PFYC] for BLM administered-lands). Based on those classifications, and in accordance with BLM protocol, potential impacts to paleontological resources by the proposed Project and Alternatives were determined.

CEQA Significance Criteria

The application of CEQA Significance Thresholds section describes the criteria used to determine which impacts should be considered potentially significant. Significance thresholds are based on criteria identified in Appendix G of the CEQA Guidelines (CCR, Title 14, Division 6, Chapter 3, Sections 1500-15387). A cultural resources impact is considered significant if implementation of the proposed Project would do any of the following:

- cause a substantial adverse change in the significance of a historical resource as defined in §15064.5;
- cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5;
- directly or indirectly destroy a unique paleontological resource or site or unique geologic feature; or
- disturb any human remains, including those interred outside of formal cemeteries.

As defined, significant paleontological resources are determined to be fossils or assemblages of fossils that are unique, unusual, rare, uncommon, or diagnostically important.

CEQA criteria indicate that a project could have potentially significant impacts to paleontological resources if it would:

PALEO-1) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature.

NEPA Requirements

As discussed in Chapter 3, the BLM adopted a paleontological resource assessment system known as the PFYC System. The PFYC system classifies geologic units based on the relative abundance of vertebrate fossils or scientifically significant invertebrate or plant fossils and their sensitivity to adverse impacts, with a higher class number indicating a higher potential. The requirements of NEPA are addressed under the direct and indirect impacts discussions below for the proposed Project and each Action Alternative.

Applicable Best Management Practices

As part of the Project and Alternatives, the following applicable BMPs would minimize the environmental impacts to cultural resources. The full BMPs have been detailed below (see also Table 2-4 in Chapter 2) and are further referenced (by number) within the impact discussion.

NUMBER	BMP DESCRIPTION
BMP-14	**Travel and traffic.** Vehicular traffic on-site shall be confined to existing or designated travel routes and designated work areas. Access to the construction site and staging areas shall be limited to authorized vehicles and only through the designated roads. The extent of habitat disturbance during construction shall be reduced by keeping vehicles on access roads and minimizing foot and vehicle traffic through undisturbed areas. To the extent practical, travel shall be limited to stabilized roads. Road maintenance activities shall avoid blading existing forbs and grasses in ditches and adjacent to roads. Abandoned roads and roads no longer needed shall be subsoiled to increase infiltration and reduce soil compaction, then recontoured and revegetated. Construction traffic shall avoid unpaved surfaces to the extent practical (to reduce the risk of compaction) and reduce speed to lessen fugitive dust emissions. On unpaved or unstabilized surfaces within the construction site, speed limits (e.g., 20 mph) shall be posted with visible signs and enforced to minimize airborne fugitive dust. Project vehicle speeds shall be limited in areas occupied by special-status animal species. Traffic shall stop to allow wildlife to cross roads. Shuttle vans or carpooling shall be used to reduce the amount of traffic on access roads. Workers shall be trained to comply with the speed limit, use good engineering practices, minimize the drop height of materials, and minimize the number and extent of disturbed areas. The Project developer shall enforce these requirements.
BMP-13	**Ground and surface disturbance.** Construction boundaries would be clearly delineated to minimize areas of ground and surface disturbance. Ground-disturbing activities shall be minimized, especially during the rainy season. To the maximum extent possible, construction-related activities (such as vehicle and foot traffic) would avoid areas with intact biological soil crusts. For cases in which impacts cannot be avoided, soil crusts would be salvaged and restored on the basis of recommendations by the County of Riverside and BLM once construction has been completed. Existing rocks, vegetation, and drainage patterns shall be preserved to the maximum extent possible. No paint or permanent discoloring agents shall be applied to rocks or vegetation (to indicate surveyor construction activity limits or for any other purpose). All stakes and flagging shall be removed from the construction area and disposed of in an approved facility. Where feasible, brush-beating, mowing, or use of protective surface matting rather than removing vegetation shall be employed. Clearing and disturbing of sensitive areas (e.g., steep slopes and natural drainages) and other areas shall be avoided outside the construction zone. Surface disturbance would be minimized by utilizing undulating surface disturbance edges; stripping, salvaging, and replacing topsoil; using contoured grading; controlling erosion; using dust suppression techniques; and restoring exposed soils to their original contour and vegetation.

Alternative 1: Proposed Project

Analysis of Direct and Indirect Impacts

Construction

Construction activities that may affect paleontological resources include excavation, heavy equipment usage and movement, drilling, and trenching for utilities. Grading for access roads could also directly impact paleontological resources. Known sedimentary units of Late Pleistocene to Recent age are exposed at the solar facility. Older alluvium (geologic unit Qpv), is known to contain significant paleontological resources in other parts of Southern California, and underlies the majority of the solar facility. Geologic unit Qpv is considered to be of high paleontological sensitivity under the Society of Vertebrate Paleontology classification, and has a PFYC of 3a (moderate). There is a high potential for significant paleontological resources on the portion of the site underlain by this geologic unit. Any grading and excavation during site preparation and construction would have high potential to impact significant nonrenewable paleontological resources that may be present within the boundaries of the solar facility.

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Excavation activities associated with construction of the Project's proposed 230 kV gen-tie line on previously undisturbed lands managed by the BLM could directly impact paleontologically sensitive geologic rock units with moderate fossil yield potential (PFYC 3a). Excavations of 20 to 30 feet in depth would be required in association with gen-tie structure construction and could also result in direct impacts to paleontological sensitive geologic rock units with a high fossil yield potential (only those portions of the ROW overlying Qpv).

Further, unauthorized collection of fossil materials, dislodging of fossils from their preserved environment, and/or physical damage of fossil specimens could also adversely affect paleontological resources. Implementation of mitigation measures Paleontology-1, Paleontology-2, and Paleontology-3 would reduce the potential for impacts to paleontological resources.

Operation and Maintenance

During operation and maintenance of the solar facility, no major ground disturbing activities or excavations would occur as part of routine maintenance, and impacts to paleontological resources would not occur.

Decommissioning

When the Project reaches the end of its operational life, the Project components could be decommissioned and dismantled. Since decommissioning activities would require the removal of existing structures, the ground disturbance associated with decommissioning would occur in areas previously disturbed during construction. Therefore, decommissioning would not impact additional paleontological resources.

Application of CEQA Significance Thresholds

PALEO-1) Would the Project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?

Grading and excavation during site preparation would have the potential to adversely impact significant nonrenewable paleontological resources that may be present within the boundaries of the solar facility. Known and unknown sensitivity of some of the formations and paleontological resources on the solar facility necessitates a conclusion that the impact is potentially significant. The potential for discovery of unknown significant paleontological resources exists throughout the Project area and therefore could not be avoided by reconfiguring the Project. The implementation of a Paleontological Mitigation Program/Plan (PMP) would minimize the impact of construction-related activities. With implementation of paleontological mitigation measures for known fossil sites and unknown subsurface fossil sites, potential adverse impacts on paleontological resources within the Project area during construction would be reduced to less than significant (refer to Mitigation Measure Paleontology-1).

Excavation activities associated with construction of the 230 kV gen-tie line on previously undisturbed lands managed by the BLM could result in direct impacts to paleontological resources, which would be considered potentially significant. These resources cannot feasibly be avoided because the potential is essentially the same throughout all proposed transmission corridors. Mitigation Measures Paleontology-1 through Paleontology-3 provide recommendations to reduce impacts to paleontological resources associated with the gen-tie line to a less than significant level.

Unauthorized collection of fossil materials, dislodging of fossils from their preserved environment, and/or physical damage of fossil specimens could also adversely affect paleontological resources. A pre-construction meeting to be held with key construction personnel to provide worker training regarding paleontological resource significance, visual

identification, and fossil discovery notification procedures is recommended (refer to Mitigation Measures Paleontology-2 and Paleontology-3).

No impacts to paleontological resources are anticipated during operation and maintenance activities; however, should discoveries of paleontological resources be made during the operation of the proposed Project, Mitigation Measures Paleontology-2 and Paleontology-3 would ensure that paleontological resources would be handled appropriately. Accordingly, the impact would be less than significant.

Decommissioning and restoration activities at the end of the Project life would be less likely to impact paleontological resources or unique geologic features since it is anticipated that any such resources or features would be identified during construction. Nevertheless, in order to avoid impacts to any resources that may not have been identified during construction and operation, decommissioning activities would be subject to a selected monitoring program (as specified in Mitigation Measure Paleontology-1), consistent with local, State, and federal laws and regulations applicable at the time of decommissioning.

Alternative 2: No Project Alternative

The No Project Alternative would avoid paleontological resources by eliminating all proposed construction, operations and maintenance, and decommissioning activities associated with the proposed Project, and no new direct or indirect impacts would occur.

Under the No Project Alternative, there would be no impacts to paleontological resources, since no construction or operations would occur. However, continued agricultural operations could result in disturbance to paleontological resources. Also, in the absence of this Project, other renewable energy projects may be constructed to meet State mandates at other locations, and those projects would likely have similar impacts as the proposed Project in those locations.

Alternative 3: Northern Alternative 230 kV Gen-tie Line Location

Alternative 3 is similar to Alternative 1, with the exception of the proposed location of the 230 kV gen-tie line. The Alternative 3 gen-tie line would be a few hundred feet north of the proposed 230 kV alignment and would have the same impact to paleontological resources as Alternative 1 with respect to construction in the Qpv geologic units. Implementation of mitigation measures Paleontology-1, Paleontology-2, and Paleontology-3 would reduce the potential for impacts to paleontological resources.

Application of CEQA Significance Thresholds

PALEO-1) Would Alternative 3 directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?

Alternative 3 is not expected to directly or indirectly destroy a unique paleontological resource or site or unique geologic feature, but the possibility of uncovering previously unknown resources presents a potentially significant impact. Implementation of Mitigation Measures Paleontology-1 through Paleontology-3 would reduce impacts to paleontological resources to a less than significant level.

Alternative 4: Southern Alternative 230 kV Gen-tie Line Location

Alternative 4 is similar to Alternative 1, with the exception of the location of the proposed 230 kV gen-tie line. It would be approximately 0.8 mile south of the proposed 230 kV alignment and would have the same impact as Alternative 1 with respect to construction in the Qpv geologic units.

Application of CEQA Significance Thresholds

PALEO-1) Would Alternative 4 directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?

Alternative 4 would not directly or indirectly destroy a unique paleontological resource or site or unique geologic feature. Implementation of Mitigation Measures Paleontology-1 through Paleontology-3 would reduce impacts to paleontological resources to less than significant.

Alternative 5: Reduced Acreage Alternative

Similar to Alternative 1, Alternative 5 would include the construction, operation, maintenance, and decommissioning of a solar facility and associated infrastructure. The primary difference between Alternatives 1 and 5 is the absence of solar facility development north of I-10, which would reduce electrical output from a 485 MW down to a 315 MW alternating current solar PV facility. The Reduced Acreage Alternative would be on a reduced footprint of approximately 2,476 acres (from 3,660 acres for the proposed Project). Similar to the proposed Project, 73 acres would be utilized for the 230 kV gen-tie line. In comparison to Alternative 1, Alternative 5 would eliminate one on-site substation and one O&M building north of the I-10 freeway. Alternative 5 would have one access point (planned on Seeley Avenue); no access proposed for Riverside Drive. This Alternative would not be developed on land north of I-10. Instead, this Alternative would construct an approximately 7.8-mile-long, 230 kV overhead gen-tie line from the proposed on-site substation south of I-10 to the approved Colorado River Substation. Approximately three miles of the gen-tie line would be within the solar facility. Alternative 5 would avoid solar development north of I-10 and the existing agricultural operations would continue in this area (approximately 1,184 acres); therefore, no impacts would occur to the existing cultural resources located in this area.

The Reduced Acreage Alternative solar facility and a portion of the gen-tie line would be within the jurisdiction of the County of Riverside but not within the City limits of Blythe in comparison to the proposed Project. Alternative 5 would need to comply with the RCGP (2003) and PVVAP (2008). The remaining portion of the gen-tie line would traverse lands managed by the BLM and would need to comply with the CDCA Plan. The construction, operation, maintenance, and decommissioning of Alternative 5 would not exceed impacts to paleontological resources identified under the Alternative 1 analysis. Therefore, the Alternative 1 analysis would be applicable to Alternative 5, outside of those differences identified in the discussion below.

Analysis of Direct and Indirect Impacts

Construction

Refer to the analysis under Alternative 1. The Reduced Acreage Alternative would occur within the same limits as Alternative 1, with the exception of development north of I-10. However, there is a moderate potential for significant paleontological resources on the portions of the site underlain by the geologic unit Qpv. Any grading and excavation during site preparation and construction would have high potential to adversely affect significant nonrenewable paleontological resources that may be present within the boundaries of the solar facility.

Excavation activities associated with construction of the proposed 230 kV gen-tie line on previously undisturbed lands managed by the BLM could directly impact significant paleontological resources within the geologic rock unit Qpv, which has a moderate fossil yield potential (PFYC 3a). Excavations of 20 to 30 feet in depth would be required in association with gen-tie structure construction and could also result in direct impacts to paleontological resources within the sensitive geologic rock unit with a moderate fossil yield potential (PFYC 3a) on only those portions of the ROW overlying geologic unit Qpv.

Further, unauthorized collection of fossil materials, dislodging of fossils from their preserved environment, and/or physical damage of fossil specimens could also adversely affect paleontological resources.

Implementation of mitigation measures Paleontology-1, Paleontology-2, and Paleontology-3 would reduce the potential for impacts to paleontological resources.

Operation and Maintenance

During operation and maintenance of the solar facility, no major ground-disturbing activities or excavations would occur as part of routine maintenance, and impacts to paleontological resources would not occur.

Decommissioning

When Alternative 5 reaches the end of its operational life, the Alternative 5 components could be decommissioned and dismantled. Since decommissioning activities would require the removal of existing structures, the ground disturbance associated with decommissioning would occur in areas previously disturbed during construction. Therefore, decommissioning would not impact additional paleontological resources.

Application of CEQA Significance Thresholds

PALEO-1) Would the Project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?

Similar to Alternative 1, the potential for discovery of unknown significant paleontological resources exists throughout the Project area and therefore could not be avoided by reconfiguring Alternative 5. The implementation of a PMP would minimize the impact of construction-related activities. As such, the PALEO-1 analysis for Alternative 1 would apply.

Cumulative Impacts

Geographic Scope

Cultural and Paleontological Resources

The past, present, and reasonably foreseeable projects considered to be the cumulative scenario for this Project are listed in Table 4.1-1. The geographic extent of these projects in relation to the BMSP is shown in Figure 4.1-1, which includes a number of the large-scale renewable energy projects and related transmission lines in the Riverside SEZ and also includes some small-scale land development projects. Each of these projects would result in ground disturbance, primarily during Project construction; however, ground-disturbing activities during operation and maintenance and decommissioning could also affect paleontological resources.

Temporal Scope

Paleontological resources are non-renewable, any loss or physical damage to these resources is permanent. They would be subject to direct impacts primarily during Project construction; however, impacts could occur during any ground-disturbing activities during operation and maintenance and decommissioning. For purposes of the cumulative analysis, the temporal impact scope is the life of the Project.

Analysis of Direct and Indirect Impacts

Alternative 1: Proposed Project

Cumulative development in eastern Riverside County in the Palo Verde Mesa region of Southern California within paleontologically-sensitive geologic units such as older alluvial formation Qpv, have the potential to directly or indirectly impact paleontological resources. As discussed above, there is a potential

for paleontological resources on the Project solar facility site and gen-tie ROW to be impacted during construction of the proposed Project. However, with the implementation of mitigation measures Paleontology-1 through Paleontology-3, paleontological resource impacts (impact PALEO-1) would be reduced to less than significant. The proposed Project, as well as other development projects, would be evaluated for paleontological impacts and would necessarily include mitigation to protect resource values. Cumulative projects would also comply with regulations of the County of Riverside and the proposed guidelines of the Society of Vertebrate Paleontology. Therefore, the proposed Project would not adversely affect paleontological resources under NEPA or contribute to significant cumulative paleontological resource impacts under CEQA.

Alternative 2: No Project Alternative

The No Project Alternative would not contribute to any new paleontological resource effects; however, continuation of the status quo would include continued use of a majority of the Project area for agricultural purposes and continued potential for inadvertent effects on known resources. The public lands in the Project area would continue to be managed by BLM in accordance with existing land use designations in the CDCA Plan, whereas the private lands would continue to be managed for agricultural production. Alternative 2 would not contribute to cumulative paleontological resource impacts.

Alternative 3: Northern 230 kV Gen-tie Line Location

Construction, Operation and Maintenance, and Decommissioning

Cumulative development in eastern Riverside County in the Palo Verde Mesa region of Southern California that occur within paleo-sensitive geologic units such as older alluvial formations Qpv has the potential to directly or indirectly destroy paleontological resources. As discussed above, there is a potential for Alternative 3 to impact paleontological resources on the solar facility site and the gen-tie ROW. However, with the implementation of Mitigation Measures Paleontology-1 through Paleontology-3, paleontological resource impacts (impact PALEO-1) would be reduced to less than significant. Cumulative projects would be evaluated for paleontological impacts and would necessarily include mitigation to protect resource values. Cumulative projects would also comply with regulations of BLM, the County of Riverside, and the proposed guidelines of the Society of Vertebrate Paleontology. Therefore, the proposed Project would not adversely affect paleontological resources under NEPA or contribute to significant cumulative paleontological resource impacts under CEQA.

Alternative 4: Southern 230 kV Gen-tie Line Location

Paleontological Resources

Construction, Operation and Maintenance, and Decommissioning

Cumulative development in eastern Riverside County in the Palo Verde Mesa region of Southern California that occur within paleo-sensitive geologic units such as older alluvial formation Qpv has the potential to directly or indirectly destroy paleontological resources. As discussed above, Alternative 4 has the potential for paleontological resources on the solar facility site and the gen-tie ROW to be impacted during construction. However, with the implementation of Mitigation Measures Paleontology-1 through Paleontology-3, paleontological resource impacts (impact PALEO-1) would be reduced to less than significant. The cumulative projects would be evaluated for paleontological impacts and would necessarily include mitigation to protect resource values. Cumulative projects would also comply with regulations of BLM, the County of Riverside, and the proposed guidelines of the Society of Vertebrate Paleontology. Therefore, the proposed Project would not adversely affect paleontological resources under NEPA or contribute to significant cumulative paleontological resource impacts under CEQA.

Alternative 5: Reduced Acreage Alternative

Cumulative development in eastern Riverside County in the Palo Verde Mesa region of Southern California within paleo-sensitive geologic units such as older alluvial formation Qpv has the potential to

directly or indirectly destroy paleontological resources. As discussed above, there is a potential for paleontological resources on the Alternative 5 solar facility site and gen-tie ROW to be impacted during construction of Alternative 5. However, Similar to Alternative 1, with the implementation of Mitigation Measures Paleontology-1 through Paleontology-3, paleontological resource impacts (impact PALEO-1) would be reduced to less than significant. Other development projects would be evaluated for paleontological impacts and if potentially significant impacts are identified, would necessarily include mitigation to protect resource values. Cumulative projects would also comply with regulations of the County of Riverside and the proposed guidelines of the Society of Vertebrate Paleontology. Therefore, Alternative 5 would not adversely affect paleontological resources or contribute considerably to significant cumulative paleontological resource impacts.

Mitigation Measures

Paleontology-1 Prior to issuing any grading or excavation permits for activities within any area of the Project area, and prior to any Project-related ground-disturbing activities of that area, the Applicant shall implement procedures to monitor, avoid, and/or recover unique paleontological resources discovered during ground-disturbing activities. These procedures, the Paleontological Resources Monitoring and Mitigation Plan (PRMMP), shall be developed by a qualified vertebrate paleontologist and submitted for approval by the County of Riverside for private lands, and the BLM for BLM-managed lands. The PRMMP shall specify how mitigation measures Paleontology-1, Paleontology-2, and Paleontology-3 shall be implemented. This PRMMP shall be consistent with the provisions of CEQA, as well as with regulations currently implemented by the County of Riverside, the BLM and the proposed guidelines of the Society of Vertebrate Paleontology. The PMP shall include, but not be limited to:

1) A requirement that, during excavations in areas underlain by geologic units identified as having a high paleontologic sensitivity under Society of Vertebrate Paleontology guidelines (or a PFYC rating of 3b or higher) and likely to contain paleontologic resources, a qualified vertebrate paleontologist, who is a Registered Professional Geologist, shall direct the paleontologic monitoring by a qualified paleontologic monitor. Areas of concern include all previously undisturbed paleontologic sensitive sediments of the fossiliferous Pleistocene Palo Verde Mesa Alluvium.
2) A requirement that paleontologic monitors be equipped to salvage fossils as unearthed to avoid construction delays and to remove samples of sediments likely to contain the remains of small fossil invertebrates and vertebrates. Monitors shall be empowered to temporarily halt or divert equipment to allow removal of abundant or large specimens.
3) Identification of the processes for preparation of recovered specimens to a point of identification. If the paleontologic monitor determines that the resource is unique, it shall be prepared for permanent preservation, including washing of sediments to recover small invertebrates and vertebrates.
4) A requirement that a report be prepared documenting all finds with permanent retrievable paleontologic storage for curation of specimens. The paleontologist should have a written repository agreement in hand prior to the initiation of mitigation activities. Mitigation of adverse impacts to unique paleontologic resources is not complete until such curation into an established museum repository has been fully completed and documented.
5) A requirement that a report be prepared documenting all finds with an appended itemized inventory of specimens. The report and inventory, when submitted to the County with respect to private lands, and to the BLM with respect to BLM-managed lands, along with confirmation of the curation of recovered unique paleontological specimens into an established, accredited museum repository, would signify completion of the PMP to mitigate impacts to paleontologic resources.

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Paleontology-2 Prior to issuance of the first grading permit, a worker training program shall be prepared and include information on the recognition of the types of paleontological resources that could be encountered within the Project area and referral of finds to the paleontologic monitor if they are found. This information shall be presented to Project construction personnel and Project operation and maintenance personnel by a qualified professional paleontologist.

Paleontology-3 If construction or other Project personnel discover any potential fossils during construction, operation and maintenance, or decommissioning, the fossils shall be left undisturbed and the paleontological monitor shall be notified immediately and shall then take appropriate actions to evaluate the find in accordance with the PMP.

Residual Impacts After Mitigation

Implementation of BMPs and Mitigation Measures Paleontology-1 through Paleontology-3 would, under both NEPA and CEQA, minimize potential impacts to paleontological resources and would reduce the impacts, including cumulative impacts, to less than significant.

NEPA Conclusions

The No Project Alternative would not have impacts, as the existing circumstances and operations would continue essentially unchanged. The Project and each of the action Alternatives would have the direct and indirect impacts and contribution toward cumulative impacts that are described above. Each would comply with applicable plans and laws, and the BMPs and Mitigation Measures described above, and would not result in significant adverse impacts.

4.2.13 Population, Housing, Public Services, Utilities, and Socioeconomics

This section analyzes the effects of the proposed Project and Alternatives related to population, housing, public services, utilities and socioeconomics, and describes the methods used to determine the effects of the proposed Project and Alternatives.

Methodology for Analysis

To determine how the proposed Project would induce population growth, the availability of the local workforce and population in the region was analyzed.

Physical impacts to public services are usually associated with population in-migration and growth in an area, which increase the demand for a particular service, leading to the need for expanded or new facilities. Public service providers serving the solar facility would be within Riverside County and the City of Blythe only and represent the local study area. Therefore, the study area for the public services analysis is limited to Riverside County and the City of Blythe. Construction is anticipated to occur over a three-year period, of which peak construction would occur over two years and require a workforce of approximately 300 to 500 daily workers present throughout the Project area.

The analysis of the impacts of the Project and Alternatives on environmental justice issues follows guidelines described in the CEQ's Environmental Justice Guidance under NEPA (CEQ 1997). To determine whether an adverse and significant impact has issues in environmental justice, the approach to the analysis considers two factors: 1) assessment of whether impacts associated with construction and operation of the proposed Project would result in a high potential for adverse environmental impacts; and 2) for impacts that are high and adverse, determination as to whether these impacts would disproportionately affect minority and low-income populations.

The purpose of this analysis, pursuant to Executive Order 12898, is to identify and address whether high and adverse human health or environmental effects are likely to fall disproportionately on minority and/or low-income populations of the community. Pursuant to the directive, the EPA issued guidelines that require all federal and state agencies receiving federal funds to develop strategies to address this issue. This analysis uses the federal guidelines to analyze potential environmental justice impacts. Federal guidelines for addressing environmental justice include a two-step screening process to determine whether a project could result in disproportionate impacts on low-income and minority populations. The first step is to evaluate whether the potentially affected community or area includes minority and low-income populations. If it contains these population groups, the second step is to determine whether the environmental impacts fall disproportionately on minority and low-income members of the community. The CEQ and the EPA use a 50 percent concentration of minorities or people with low-income as a cutoff to indicate that there is a potential issue in a given area.

CEQA Significance Criteria

The criteria used to determine the significance of the Project-related socioeconomic impacts are based on the criteria identified in the CEQA Guidelines, Appendix G. Project-related impacts would be considered significant if they:

SOC-1) Induce substantial population growth in an area, either directly or indirectly.

SOC-2) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere.

SOC-3) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere.

PS-1) Result in substantial adverse physical impacts associated with the provision of new or physically altered facilities to provide public services.

USS-1) Result in substantial adverse environmental impacts associated with the provision of utility services. Substantial adverse environmental impacts may occur if the Project would:

a. Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board.

b. Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects.

c. Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects.

d. Have insufficient water supplies available to serve the project from existing entitlements and resources, or require new or expanded entitlements.

e. Result in a determination by the wastewater treatment provider which serves or may serve the project that it has inadequate capacity to serve the project's projected demand in addition to the provider's existing commitments.

f. Be served by a landfill within insufficient permitted capacity to accommodate the project's solid waste disposal needs.

g. Fail to comply with federal, state, and local statutes and regulations related to solid waste.

The following additional significance criteria from the County of Riverside Environmental Assessment form are used in the analysis. A project could have potentially significant impacts if it would:

SOC-4) Create a demand for additional housing, particularly housing affordable to households earning 80% or less of the County's median income.

SOC-5) Affect a County Redevelopment Project Area.

SOC-6) Cumulatively exceed official regional or local population projections.

USS-2) Impact the following facilities requiring or resulting in the construction of new facilities or the expansion of existing facilities, the construction of which could cause significant environmental effects.

a. Electricity

b. Natural gas

c. Communications systems

d. Storm water drainage

e. Street lighting

f. Maintenance of public facilities, including roads

g. Other government services

USS-3) Conflict with any adopted energy conservation plans.

NEPA Requirements

According to NEPA, an EA must evaluate social and economic effects of a project if they are related to effects on the natural or physical environment.

Executive Order 12898 requires a proposed project's impacts on Environmental Justice be considered as part of the NEPA Process if a project would:

- Result in adverse effects or impacts that are appreciably more severe in magnitude or are predominantly borne by any segment of the population, for example, household population with low income or a minority population in comparison with a population that is not low income or minority.

Pursuant to NEPA, this analysis is intended to compare the Alternatives and identify any adverse effects to socioeconomic and environmental justice that cannot be avoided. Adverse effects may be direct, indirect, or cumulative. Potential direct and indirect effects of the proposed Project and Alternatives are analyzed below and discussed as construction-related, operation- and maintenance-related, and decommissioning effects.

Applicable Best Management Practices

As part of the Project and Alternatives, the following applicable BMPs would minimize the environmental impacts to public services and utilities. The full BMPs have been detailed below (see also Table 2-4 in Chapter 2) and are further referenced (by number) within the impact discussion.

NUMBER	BMP DESCRIPTION
BMP-1	**Drainage, Erosion, and Sedimentation Control Plan**. As part of the County of Riverside's Conditional Use Permit (CUP) requirements, a Drainage, Erosion, and Sedimentation Control Plan would be developed for the Project. The plan would address the drainage, erosion, and sediment control requirements to support all activities associated with construction, operation, maintenance, and decommissioning of the Project. For example, any stockpiles created would be kept on-site, with an upslope barrier in place to divert runoff. Stockpiles would be sprayed with water, covered with tarpaulins, and/or treated with appropriate dust suppressants, especially in preparation for high wind or storm conditions. Certified weed-free straw bale barriers would be installed to control sediment in runoff water; straw bale barriers would be installed only where sediment-laden water can pond, thus allowing the sediment to settle out. Topsoil from the site would be stripped, stockpiled, and stabilized before excavating earth for facility construction. Topsoil would be segregated and spread on freshly disturbed areas to reduce color contrast and aid rapid revegetation.
BMP-2	**Stormwater Pollution Prevention Plan.** In compliance with requirements of the National Pollutant Discharge Elimination System (NPDES) permit, a Stormwater Pollution Prevention Plan (SWPPP) would be developed and prepared for the Project to ensure that protection of water quality and soil resources is consistent with County and State regulations. The plan would identify site surface water runoff patterns and include measures that prevent excessive and unnatural soil deposition and erosion throughout and downslope of the Project area and Project-related construction areas, and would also include measures for non-stormwater discharge and waste management. The SWPPP would cover all activities associated with the construction of the Project, including clearing, grading, and other ground disturbance such as stockpiling or excavation erosion control. The plan would prevent off-site migration of contaminated stormwater, changes in pre-Project storm hydrographs, or increased soil erosion.
BMP-4	**Fire Management and Protection Plan.** As required by existing law (Title 8 California Code of Regulations [CCR] Section 3221), a Fire Management and Protection Plan would be developed in consultation with the Riverside County Fire Department to identify potential hazards and accident scenarios that would exist at the facility during construction, operation, maintenance, and decommissioning of the Project. The Plan would include the identification of the following: potential fire hazards and ignition sources; proper handling and storage of potential fire hazards; control of potential ignition sources; persons responsible for equipment and systems maintenance; location of portable fire extinguishers; automatic sprinkler fire suppression system; water-spray fire system; coordination with local fire department; and recordkeeping requirements.
BMP-11	**Project structures, gen tie line, and building surfaces.** Project facilities would be sited to ensure that there is adequate space (i.e., setbacks of no less than 100 feet) between solar facilities and natural washes. These setbacks would preserve and maintain the natural washes' hydrological functions. The color and finish of Project structure and building surfaces that are visible to the public will be designed to ensure minimal visual intrusion, contrast, and glare. Grouped structures will be painted the same color to reduce visual complexity and color contrast. Solar panel backs will be color-treated to reduce visual contrast with the landscape setting. Materials, coatings, or paints having little or no reflectivity will be used wherever possible. The visual color contrast of graveled surfaces will be reduced with approved color treatment practices.

NUMBER	BMP DESCRIPTION
BMP-13	**Ground and surface disturbance.** Construction boundaries would be clearly delineated to minimize areas of ground and surface disturbance. Ground-disturbing activities shall be minimized, especially during the rainy season. To the maximum extent possible, construction-related activities (such as vehicle and foot traffic) would avoid areas with intact biological soil crusts. For cases in which impacts cannot be avoided, soil crusts would be salvaged and restored on the basis of recommendations by the County of Riverside and BLM once construction has been completed. Existing rocks, vegetation, and drainage patterns shall be preserved to the maximum extent possible. No paint or permanent discoloring agents shall be applied to rocks or vegetation (to indicate surveyor construction activity limits or for any other purpose). All stakes and flagging shall be removed from the construction area and disposed of in an approved facility. Where feasible, brush-beating, mowing, or use of protective surface matting rather than removing vegetation shall be employed. Clearing and disturbing of sensitive areas (e.g., steep slopes and natural drainages) and other areas shall be avoided outside the construction zone. Surface disturbance would be minimized by utilizing undulating surface disturbance edges; stripping, salvaging, and replacing topsoil; using contoured grading; controlling erosion; using dust suppression techniques; and restoring exposed soils to their original contour and vegetation.
BMP-14	**Travel and traffic.** Vehicular traffic on-site shall be confined to existing or designated travel routes and designated work areas. Access to the construction site and staging areas shall be limited to authorized vehicles and only through the designated roads. The extent of habitat disturbance during construction shall be reduced by keeping vehicles on access roads and minimizing foot and vehicle traffic through undisturbed areas. To the extent practical, travel shall be limited to stabilized roads. Road maintenance activities shall avoid blading existing forbs and grasses in ditches and adjacent to roads. Abandoned roads and roads no longer needed shall be subsoiled to increase infiltration and reduce soil compaction, then recontoured and revegetated. Construction traffic shall avoid unpaved surfaces to the extent practical (to reduce the risk of compaction) and reduce speed to lessen fugitive dust emissions. On unpaved or unstabilized surfaces within the construction site, speed limits (e.g., 20 mph) shall be posted with visible signs and enforced to minimize airborne fugitive dust. Project vehicle speeds shall be limited in areas occupied by special-status animal species. Traffic shall stop to allow wildlife to cross roads. Shuttle vans or carpooling shall be used to reduce the amount of traffic on access roads. Workers shall be trained to comply with the speed limit, use good engineering practices, minimize the drop height of materials, and minimize the number and extent of disturbed areas. The Project developer shall enforce these requirements.
BMP-15	**New access roads and parking lots.** New access roads shall be designed and constructed to the appropriate road design standards, such as those described in BLM Manual 9113 or County standards, whichever is applicable. New access roads shall be designed to follow natural land contours in the Project area and avoid existing desert washes. The specifications and codes developed by the U.S. Department of Transportation (DOT) and County of Riverside Transportation Department are also to be taken into account. Primary access roads and parking lots shall be surfaced with aggregate that is hard enough that vehicles cannot crush it and thus cause dust or compacted soil conditions. Paving may also be used on access roads and parking lots. Alternatively, chemical dust suppressants or durable polymeric soil stabilizers would be used on these locations.
BMP-20	**Waste Recycling Plan**. Prior to issuance of a grading and building permit, A Waster Recycling Plan shall be submitted to the Riverside County Water Management Department for approval. The plan shall identify: materials (i.e., cardboard, concrete, asphalt, wood) that will be generated by construction and development; projected amounts of materials; measures/methods that will be taken to recycle, reuse, and/or reduce the amount of materials; the facilities and/or haulers; and the target recycling or reduction rate. During Project construction, the construction site shall have, at a minimum, two bins: one for waste disposal and the other for recycling of construction and demolition materials. An accurate record keeping system of recycling construction and demolition recyclable materials and solid waste disposal shall also be established.

Alternative 1: Proposed Project

Analysis of Direct and Indirect Impacts

Construction

Population and Housing

Implementation of the Project would require the removal of three residences within the Project area that are associated with the existing agricultural operations. These residents would likely relocate to vacant housing in the Blythe/Palo Verde Valley region.

Given the location of the Project area in eastern Riverside County, it is likely that most of the construction workforce would be derived from communities located within Riverside County, which has the largest concentration of construction workers in proximity to the Project area (refer to Table 3.2.12-4 and 3.2.14-5). The majority of the projected construction workforce would likely seek housing closer to the Project area (within an hour driving distance) or seek temporary housing (such as seasonal, recreational, or occasional use housing; long-term visitor areas; and hotel and motels) during the week and commute home over the weekend. During construction, the Project would temporarily increase the local population.

If construction workers stay in the Project area temporarily, it could affect the supply of temporary accommodations and rental housing nearest the local area, especially during the two-year peak construction period. As indicated in Table 3.2.13-3, *Study Area Housing Characteristics,* vacancy rates for housing throughout the study area are high, which range from 12 to 60 percent. The vacancy rates for Blythe Census County Division, Riverside County, Imperial County, and La Paz County are: 17 percent, 14 percent, and 12 percent respectively. There is sufficient housing to accommodate the Project's construction workforce.

Should construction workers drawn from beyond an hour commute require temporary housing accommodations closer to the Project area during the course of the construction period, or portion thereof, 14 hotels and motels with a total of 789 rooms were identified within an hour commute to the Project area. In addition, as described in Section 3.2.14, *Recreation,* the Midland LTVA and Mule Mountains LTVA provide long-term camping opportunities in the vicinity of the Project area. There are a sufficient number of hotels, motels, and long-term camping options to accommodate the Project's construction workforce. The Project would not induce substantial permanent growth to the regional population levels.

During construction, and for a shorter period of time during decommissioning, there would be a temporary increase in population that may utilize existing neighborhood or regional parks or other recreational facilities in the Project vicinity. Long-term camping areas in particular may experience physical deterioration of the facilities. However, the long-term camping areas are designed with minimal facilities given that campers must use self-contained RVs and there are no assigned or designated sites.

Economy and Employment

While Project construction has the potential to increase demand on local housing, it would alternatively have beneficial effects on the local economy, especially to hotels, motels, and rental housing, as vacant rooms would likely be filled.

Fiscal Resources

The construction phase of the Project is expected to have positive financial impacts through increased sales tax revenue.

Environmental Justice

The Project could potentially affect minority populations in census tracts 461.02 and 462, as the proportion of minority residents in those tracts exceeds 50 percent. Consequently, it is conservatively judged that Census tracts 461.02 and 462 represent two communities of concern for environmental justice effects. Census tracts 461.02 and 462 have a higher proportion of minority residents than that of the general population of the nearest community (Blythe).

Table 3.2.13-13 lists the census tracts within a six-mile radius of the solar facility living below the poverty line; there are no populations that exceed the 50 percent threshold. While the proportion of low-income residents does not exceed 50 percent, 23 percent of tract 459, 26 percent of tract 461.02, and 21 percent of tract 469 were living below the poverty line, according to the 2010 census. These represent percentages that are meaningfully greater than the nearby City of Blythe; 16 percent of tract 462 was also living below the poverty line, which is meaningfully greater than Riverside County. Census tracts 459, 461.02, and 469 could represent communities of concern for environmental justice effects based on persons living below the poverty line, as their percentages are meaningfully greater than the percentage of the population living below the poverty line in the City of Blythe, along with tract 462, compared to the County of Riverside.

In the context of constructing a solar facility, the primary environmental justice issues typically would be potential air or water issues that could adversely affect the health of nearby populations. Other issues could be any potential residential or business displacements and noise effects on populations near the solar facility or ancillary facilities. However, the Project would not result in significant air quality effects or effects to surrounding communities from emissions of toxic air contaminants. The Project would not involve wastewater discharges that could affect drinking water supplies or other water bodies.

As shown in Chapter 3, Figure 3.2.1-1, *Residences within One Mile of the Proposed Project*, three residences associated with the existing agricultural operation would be removed as part of this Project. However, the Project would not be within an existing residential community, and would not displace nearby residences.

Public Services

The construction workforce would temporarily increase the local population, but would not require construction or alteration of physical facilities to provide adequate education, law enforcement, parks and recreation, and hospital facilities and emergency response services.

The proposed Project would represent a land use change for the area from agricultural fields and vacant lands to a solar facility site and gen-tie lines. The operational capabilities to handle technical rescues at electrical facilities, such as confined space/trench rescue/high angle rescue, may require increased staffing, training, and equipment. New or upgraded fire facilities may be required in order to accommodate additional staffing and fire rescue apparatus for solar facilities. Specialized rescue equipment may also be required in order to service the proposed gen-tie lines, which will require proper storage and maintenance to ensure optimal performance in the event of an emergency.

Education

The majority of the projected construction workforce would likely seek housing closer to the Project area (within an hour-hour driving distance) or seek temporary housing during the week and commute home over the weekend. It would be unlikely that construction workers would relocate close to the Project area with their families due to the temporary nature of the construction period. Therefore, the temporary addition of construction workers to the Project area's population is not anticipated to increase school enrollment. No impact would occur and no mitigation recommended.

Law Enforcement

The temporary increase of construction workers could increase demands on police services. However, during construction, on-site security would include trained, uniformed, and unarmed personnel whose primary responsibility would be to control ingress and egress of personnel and vehicles, perform fire and security watch during off hours, and perform security badge administration, all of which would minimize the potential need for the City of Blythe Police Department's and the Riverside County Sheriff's Department assistance. The construction workforce is expected to be hired generally from within the available regional workforce.

Because Project construction is not anticipated to increase the local population, no new or expanded law enforcement facilities or increased staff levels within the Project regional or local study area would be required. Construction of the BMSP would generate truck and employee traffic along haul routes and at the Project area, which could temporarily increase the accident potential in these areas over the short-term construction period. However, the additional volume of traffic associated with workers commuting to the sites during construction would be temporary and it is anticipated that personnel and equipment from the City and the California Highway Patrol (CHP) would be sufficient to respond to incidents in the Project area. Project construction is not expected to adversely affect the CHP's ability to patrol the highways.

Fire Protection

During construction, there is the potential for both small fires and major structural fires. Electrical sparks, combustion of fuel oil, hydraulic fluid, mineral oil, or insulating fluid at substations, or flammable liquids, explosions, and over-heated equipment may cause small fires. The Project would result in an increase in demand for fire protection services over existing levels during construction. The proposed Project would represent a land use change for the area from agricultural fields and vacant lands to a solar facility site and gen-tie lines. The operational capabilities to handle technical rescues at electrical facilities, such as confined space/trench rescue/high angle rescue, may require increased staffing, training, and equipment. New or upgraded fire facilities may be required in order to accommodate additional staffing and fire rescue apparatus for solar facilities. Specialized rescue equipment may also be required in order to service the proposed gen-tie lines, which will require proper storage and maintenance to ensure optimal performance in the event of an emergency.

The Project area is located within the service area of the RCFD and City of Blythe Volunteer Fire Department. Based on the proposed Project's proximity to the nearest station (Station #45, Blythe Air Base, 17280 W. Hobson Way, Blythe, CA 92225), it falls within acceptable Total Response Time policy standards for an 'outlying' land use area and meets the seventeen minute and 30 second response time standard. Additionally, the solar facility site is approximately five miles away from the City of Blythe Volunteer Fire Department (210 North Commercial Street, Blythe, CA 92225).

Pursuant to Riverside County Ordinance 659, the Applicant would be required to pay a development impact fee for fire services "in order for the County to construction or acquire the needed facilities" (Riverside County 2006). If facilities are constructed or acquired using funds provided by the Project or if new or physically altered fire protection facilities are paid for with the money, the construction of such facilities could cause significant environmental impacts indirectly attributable to the Project. However, the location, size, nature, and other details of such facilities, if needed, or the environmental effects of their construction or alternation are not yet known. Because too little is known about whether, and if so what, facilities would be constructed with Project-related fees, any impact analysis and attempt to reach conclusions about the environmental effects they could cause would be speculative.

Parks and Recreation

As discussed above, the required construction workforce of the Project is expected to be hired generally from the available regional workforce. There would be temporary in-migration that would increase the local population during construction; however, it would not warrant the need for new or expanded parks and recreational facilities or staff levels within the Project regional or local study area.

Hospital Facilities and Emergency Response

In the event of an on-site accident during Project construction, the RCFD would provide first responder emergency medical care. The nearest RCFD fire stations are staffed full-time, 24 hours, 7 days a week, with a minimum three-person crew, including paramedics. Once a patient is transported, a number of local area hospitals are available to provide emergency medical care. While a high number of construction employees would be located on-site, local area emergency medical facilities are expected to adequately handle any worksite accidents requiring their attention. Minor injuries could be treated at Palo Verde Hospital in Blythe, California or La Paz Medical Services in Quartzsite, Arizona. Injuries resulting in significant trauma would be treated at the Desert Regional Medical Center (Cox 2011) in Palm Springs, California. Project construction would not require new or expanded hospital facilities or personnel or result in the increase in emergency responder staff levels within the Project regional or local study area.

Utilities

Project construction would not result in significant adverse demands on natural gas, electricity, water, sewer, or solid waste facilities.

Electricity and Natural Gas

Electricity within the vicinity of the Project area is provided by SCE. The Project would temporarily increase the population during construction. However, it is anticipated that construction workers would utilize existing housing (permanent and temporary) that is available in the study area; therefore, no new or expanded electrical and natural gas systems would be required. The Project would not induce substantial growth to the regional population levels; as such, demands on the electrical and natural gas systems would be nominal and there would be no need to alter these existing facilities in response.

The power produced by the Project would be conveyed to the local power grid via interconnection to the SCE Colorado River Substation, an approved new substation south of I-10 and west of the Project area boundary. The BMSP would use generators during the initial construction phase to supply electrical needs. The Project would not involve use of natural gas service. The Project would not involve communication systems, nor would it require new or expanded communication facilities. As such, current electrical and natural gas facilities could handle the demands of Project development and operation; thus, no new or altered facilities would be needed.

Water and Wastewater

Project development would not require construction or expansion of public water treatment and/or service systems or additional entitlements or resources. The Project would have limited water needs during construction (i.e., for dust suppression and other construction needs) and operation (for maintenance needs). While water would be utilized during Project construction activities, the construction of new or expansion of existing, public water facilities would not be required. Restroom facilities during Project construction would be provided by portable units to be serviced by licensed providers. The Project would not exceed wastewater treatment requirements during construction because the Project would not be connected to a public sewer system.

Solid Waste

Restroom facilities during Project construction would be provided by portable units to be serviced by licensed providers. Solid waste would include recyclable materials such as metals and plastics, as well as various construction materials and worker-generated waste that would include a combination of recyclable and non-recyclable materials. To the extent practicable, waste generated during construction and operation would be recycled. The non-recyclable, non-hazardous solid waste materials would be land filled in accordance with State and local regulations.

The Blythe landfill, which is closest to the Project area, has sufficient capacity to continue to provide solid waste disposal through 2047. Therefore, sufficient capacity is anticipated to be available for waste

disposal. The Project would comply with applicable federal, State, and local regulations related to solid waste.

Operation and Maintenance

Operation of the solar facility is expected to require approximately 12 permanent full-time employees, which would not be considered a substantial demand on the Project area's workforce.

Population and Housing

As shown in Figure 3.2.1-1, *Residences within One Mile of the Proposed Project* in Chapter 3, three residences exist within the solar facility Project boundary and would be removed as a result of Project implementation. While removal of these residences during construction of the proposed Project would result in the displacement of residential households, displacement and the removal of the three residences would not be substantial enough to warrant replacement housing.

Economy and Employment

Operation of the proposed Project would have positive impacts on the local economy through the creation of local employment opportunities and through local expenditures for supplies and services. In addition to the jobs directly related to operation of the Project, additional indirect and induced jobs would be provided by operation of the Project. These impacts would occur in Riverside County on an annual basis for the duration of Project operation.

Fiscal Resources

The Riverside County Assessor's Office would have jurisdiction over the valuation of the Project for property tax purposes. The Project would qualify for the exclusion of certain parts from valuation per the Revenue and Taxation Code, Section 73. Riverside County would start realizing annual property tax revenue once construction of the Project is complete.

The BLM has issued a policy by which it would determine the value of the lease for the gen-tie portion of the Project on its lands following approval of the Project.

Environmental Justice

Operation and maintenance activities would not adversely affect any particular population, including minority or low-income populations. The Project would not result in significant air quality impacts or impacts to surrounding communities from emissions of toxic air contaminants. The Project would not involve wastewater discharges that could affect drinking water supplies or other water bodies during operation and maintenance activities. As such, there would be no direct or indirect adverse health or environmental effects associated with operations and maintenance activities.

Public Services

Due to the temporary nature of Project construction activities, it is unlikely that construction workers would permanently relocate closer to the solar facility with their families. Additionally, operation of the Project would require a nominal workforce and is not anticipated to increase the local population. Therefore, the Project would not make significant demands on education, law enforcement, fire protection, parks and recreation, and hospital facilities and emergency response.

Fire Protection

During operations, the O&M buildings would include their own emergency power, fire suppression, and potable water systems. As part of the Project, implementation of BMP-4, Fire Management and Protection Plan, would ensure that emergency fire precautions are employed during Project construction.

The proposed Project would represent a land use change for the area from agricultural fields and vacant lands to a solar facility site and gen-tie lines. The operational capabilities to handle technical rescues at electrical facilities, such as confined space/trench rescue/high angle rescue, may require increased staffing, training, and equipment. New or upgraded fire facilities may be required in order to accommodate additional staffing and fire rescue apparatus for solar facilities. Specialized rescue equipment may also be required in order to service the proposed gen-tie lines, which will require proper storage and maintenance to ensure optimal performance in the event of an emergency.

Utilities

Operation of the Project would not result in substantial adverse demands on natural gas, electricity, water, and sewer facilities.

Electricity and Natural Gas

The power produced by the Project would be conveyed to the local power grid via interconnection to the SCE Colorado River Substation, an approved new substation south of I-10 and approximately 6.5 miles west of the Project area boundary. During operation, the solar facility's electrical needs would be supplied internally. The Project would not involve use of natural gas service. The Project would not involve communication systems, nor would it require new or expanded communication facilities. As such, current electrical and natural gas facilities could handle the demands of Project development and operation; thus, no new or altered facilities would be needed.

Water and Wastewater

The Project would have limited water needs during operation (for maintenance needs). During operation and maintenance, drinking water and process water would be supplied by the PVID. While water would be utilized during operation, construction of new or expansion of existing public water facilities would not be required. The O&M buildings would generate a minimum volume of wastewater as result of daily activities. Wastewater would be treated via a septic system permitted through the Riverside County Department of Environmental Health Services, and would be in compliance with Department requirements. The Project would not exceed wastewater treatment requirements during construction, operation, maintenance, and decommissioning because the Project would not be connected to a public sewer system.

Solid Waste

Restroom facilities would be provided in the O&M buildings and would be served by a private septic system to be developed on-site. The Project would generate solid waste during operation and maintenance. Solid waste would include recyclable materials such as metals and plastics, as well as various construction materials and worker-generated waste that would include a combination of recyclable and non-recyclable materials. To the extent practicable, waste generated during operation would be recycled. The non-recyclable, non-hazardous solid waste materials would be land filled in accordance with State and local regulations.

The Blythe landfill, which is closest to the Project area, has sufficient capacity to continue to provide solid waste disposal through 2047. Therefore, sufficient capacity is anticipated to be available for waste disposal. The Project would comply with applicable federal, State, and local regulations related to solid waste.

Decommissioning

Decommissioning of the proposed Project would require removal of the solar equipment and facilities and transportation of all components off-site. Equipment used for decommissioning would generally be similar to that used for construction; however, it is anticipated that the overall activity necessary during decommissioning would be much less than that of construction, and would not result in an increased need for fire and police protection services or other public services. As discussed above, temporary in-

migration would occur; however, it would not warrant the need for new or physically altered governmental facilities, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services. Decommissioning activities would not adversely affect any particular population, including minority or low-income populations. The Project would not result in significant air quality impacts or impacts to surrounding communities from emissions of toxic air contaminants. The Project would not involve wastewater discharges that could affect drinking water supplies or other water bodies during decommissioning activities. As such, there would be no direct or indirect adverse health or environmental or effects associated with decommissioning activities.

Application of CEQA Significance Thresholds

SOC-1) Would the Project induce substantial population growth in an area, either directly or indirectly?

Proposed Project construction would temporarily increase population growth in the area; however, it would not be substantial. As discussed above, the required construction and operational workforce is not projected to trigger the need for new housing. As illustrated in Table 3.2.13-3, vacancy rates in the population and housing study area are high (12 to 60 percent), which include seasonal, recreational, and occasional use units. Additionally, within an hour commute, there are a high number of seasonal, recreational, or occasional use housing units (vacancy rates one to 43 percent) and transient lodging opportunities to serve construction employees. Furthermore, vacancy rates within the study area offer ample available housing to operational employees wishing to relocate within the local study area. Therefore, no significant construction- or operation-related impacts are expected for the study area housing supply, availability, or demand. The Project would not displace populations or existing housing, and it would not necessitate construction of replacement housing elsewhere; impacts would be less than significant.

SOC-2) Would the Project displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?

While the proposed Project would displace three existing residences (two residences on APN 863060015 and one residence on APN 863100016) within the Project area, there is available housing within the Project area to relocate these residents elsewhere in the vicinity of the Project. Implementation of the proposed Project would not require the construction of replacement housing elsewhere. Impacts to existing housing as a result of Project implementation would be less than significant; no mitigation is recommended.

SOC-3) Would the Project displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?

The proposed Project would not displace substantial numbers of people, necessitating the construction of replacement housing elsewhere. No impacts would occur.

SOC-4) Would the Project create a demand for additional housing, particularly housing affordable to households earning 80% or less of the County's median income?

The proposed Project would not contain a residential component that would result in a permanent increase in the population. The proposed Project would temporarily increase demand for housing; however, vacancy rates are high for local communities in close proximity to the Project area. Due to the temporary nature of Project construction activities, it is unlikely that construction workers would permanently relocate closer to the Project area with their families. Operation of the Project would require a nominal workforce and is not anticipated to increase the local population. Therefore, the Project would not create a demand for additional housing. Less than significant impacts would occur; no mitigation measure recommended.

SOC-5) Would the Project affect a County Redevelopment Project Area?

The Project area and immediate vicinity would not be within a former County Redevelopment Project Area. No impact would occur and no mitigation is recommended.

SOC-6) Would the Project cumulatively exceed official regional or local population projections?

See SOC-4 above. The proposed Project would temporarily increase the population during construction; however, it would not include housing and would require a nominal operational workforce. The proposed Project would not permanently increase the local population, nor would it cumulatively exceed regional or local population projections. Impacts would be less than significant.

PS-1) Would the Project result in substantial adverse physical impacts associated with the provision of public services?

The Project's construction workforce would increase the local population temporarily, but would not result in significant demands on public services, such as education, law enforcement, fire protection, parks and recreation, and hospital facilities and emergency response. The Project would not result in substantial adverse physical impacts associated with the provision of public services.

As previously described, the majority of the projected construction workforce would likely seek housing closer to the Project area (within an hour driving distance) or seek temporary housing (such as seasonal, recreational, or occasional use housing; long-term visitor areas; and hotel and motels) during the week and commute home over the weekend. It would be unlikely that construction workers would relocate close to the Project area with their families due to the temporary nature of the construction period. Therefore, the temporary addition of construction workers to the Project area's population is not anticipated to increase school enrollment that could result in adverse physical impacts associated with the provision of school facilities. No impact would occur and no mitigation recommended.

As previously noted, construction of the Project could increase demands on police services. However, during construction, on-site security would be present, which would minimize the potential need for the City of Blythe Police Department's and the Riverside County Sheriff's Department's assistance. Because Project construction is not anticipated to permanently increase the local population, no new or expanded law enforcement facilities or increased staff levels within the Project regional or local study area would be required, nor would Project development result in substantial adverse physical impacts on law enforcement facilities.

During construction, there is the potential for both small fires and major structural fires. The Project would result in an increase in demand for fire protection services over existing levels during construction. However, it is anticipated that personnel and equipment from the City of Blythe Volunteer Fire Department, the RCFD, and the California Department of Forestry and Fire Protection (CAL FIRE) would be sufficient to respond to a fire at the Project area because the O&M buildings would include their own emergency power, fire suppression, and potable water systems. After the construction phase, the proposed Project would include emergency access and other safety features and plans for fire protection. The access roads within the solar facility site would be constructed in accordance with current adopted codes and standards by the RCFD. The fire suppression system will be installed in the O&M buildings and shall be in accordance with current adopted codes and standards established by the RCFD. Therefore, adverse physical impacts to fire protection services during construction and operation are considered to be less than significant and no mitigation is recommended.

There would be temporary in-migration that would increase the local population; however, it would not warrant the need for new or expanded parks and recreational facilities or staff levels within the Project regional or local study area. No physical adverse impacts would result to parks and recreational facilities and no mitigation is recommended.

While a high number of construction employees would be located on-site, local area emergency medical facilities are expected to adequately handle any worksite accidents requiring their attention. Minor injuries could be treated at Palo Verde Hospital in Blythe, California or La Paz Medical Services in Quartzsite, Arizona. Injuries resulting in significant trauma would be treated at the Desert Regional Medical Center (Cox 2011) in Palm Springs, California. Project construction would not result in adverse physical impacts to hospital facilities within the Project regional or local study area. No impact would occur and no mitigation recommended.

The Project would not make significant physical demands on education, law enforcement, fire protection, parks and recreation, and hospital facilities. The proposed Project would not eliminate any lands designated for recreational use. No physical impacts associated with the provision of parks and recreational facilities would occur and no mitigation is recommended. Operation of the Project would not result in physical adverse impacts on medical facilities in the area because minor injuries could be treated at Palo Verde Hospital in Blythe, California or La Paz Medical Services in Quartzsite, Arizona. Injuries resulting in significant trauma would be treated at the Desert Regional Medical Center in Palm Springs, California, which is approximately one hour and twenty minutes by Medevac (Cox 2011). No impact would occur and no mitigation is recommended.

USS-1) Would the Project result in substantial adverse environmental impacts associated with the provision of utility services?

The Project would not result in substantial adverse environmental impacts associated with the provision of utility services. The majority of the projected construction workforce would likely seek housing closer to the Project area (within an hour-hour driving distance) or seek temporary housing (such as seasonal, recreational, or occasional use housing; long-term visitor areas; and hotel and motels) during the week and commute home over the weekend. The Project would not induce substantial growth to the regional population levels. As such, there would be nominal demands on the existing facilities related to: electrical and natural gas systems; water and wastewater systems: solid waste; and drainage facilities. There would be no need to alter these existing facilities.

Electricity and Natural Gas

The BMSP would use generators during the initial construction phase to supply electrical needs. The Project would not involve use of natural gas service. The Project would not involve communication systems, nor would it require new or expanded communication facilities. As such, current electrical and natural gas facilities could handle the demands of Project development and operation; thus, no new or altered facilities would be needed, which could result in associated adverse environmental impacts. No impacts regarding these respective issues would occur.

Water and Wastewater

Project development would not require construction or expansion of public water treatment and/or service systems or additional entitlements or resources response, which could cause significant environmental effects. The Project would have limited water needs during construction (i.e., for dust suppression and other construction needs) and operation (for maintenance needs). While water would be utilized during Project construction activities, the construction of new or expansion of existing, public water facilities would not be required. Restroom facilities during Project construction would be provided by portable units to be serviced by licensed providers. The Project would not exceed wastewater treatment requirements during construction because the Project would not be connected to a public sewer system. In addition, the Project would not exceed wastewater treatment requirements of the applicable RWQCB.

Solid Waste

Restroom facilities during Project construction would be provided by portable units to be serviced by licensed providers. Solid waste would include recyclable materials such as metals and plastics, as well as various construction materials and worker-generated waste that would include a combination of recyclable and non-recyclable materials. To the extent practicable, waste generated during construction and operation would be recycled. The non-recyclable, non-hazardous solid waste materials would be land filled in accordance with State and local regulations.

The Blythe landfill, which is closest to the Project area, has sufficient capacity to continue to provide solid waste disposal through 2047. Therefore, sufficient capacity is anticipated to be available for waste disposal. The Project would comply with applicable federal, State, and local regulations related to solid waste. No impact would occur and no mitigation is recommended.

Drainage Facilities

Project facilities would be sited to provide adequate setbacks between solar facility components (solar panels, gen-tie lines, substations, access roads, and O&M buildings) and natural washes (BMP-11). These setbacks would preserve and maintain the natural washes' hydrological functions. Construction of the Project would require ground-disturbing activities, including solar array installation, substation and O&M building construction, and construction of access roads. Grading could potentially alter naturally occurring drainage patterns and result in soil erosion, sedimentation, long-term siltation, and increased stormwater runoff, which increases the potential for flooding off-site or downstream of the construction areas. However, the Project area is relatively flat and would not require mass grading for construction purposes. The majority of the original grades and natural drainage features at the Project area would be maintained and, therefore, no added storm drainage control would be required. Blading and other methods of vegetation removal for clearance of roads and construction areas decrease the ability of the soil to absorb water, which also increases stormwater runoff from such disturbed areas. As part of the Project, BMP-1 (Drainage, Erosion, and Sedimentation Control Plan) and BMP-2 (Stormwater Pollution Prevention Plan) would be implemented to ensure minimization of impacts from storm water runoff and existing drainage patterns. In addition, the minimization of ground and surface disturbance (BMP-13), limitation of vehicle travel and traffic (BMP-14), and construction of new access roads and parking lots (BMP-15) would minimize impacts to the existing drainage patterns. Therefore, the Project would not require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects.

USS-2) Would the Project impact the following facilities requiring or resulting in the construction of new facilities or the expansion of existing facilities, the construction of which could cause significant environmental effects?

a) Electricity
b) Natural gas
c) Communications systems
d) Storm water drainage
e) Street lighting
f) Maintenance of public facilities, including roads
g) Other government services

Project construction, operation and maintenance, and decommissioning activities would not require construction of new utility facilities or the expansion of existing facilities. Please refer to the previous discussions above under PS-1, USS-1, and Section 4.2.9 with regards to electricity, natural gas, and storm water drainage. As previously explained, electricity within the vicinity of the Project area is provided by SCE. The power produced by the Project would be conveyed to the local power grid via interconnection to the SCE Colorado River Substation, an approved new

substation south of I-10 and west of the Project area. The Project has secured a CAISO interconnection queue position sufficient for the size of the Project. The Project would produce enough energy to power approximately 180,000 households and progress the goals of the California RPS and other similar renewable programs in the state, which are designed to serve existing and already-projected population growth. Implementation of the proposed Project would support the goals of the RPS and other renewable energy programs and would not conflict with any adopted energy conservation plans.

With regards to the maintenance of public facilities, including public roads, portions of Seeley Avenue and Riverside Drive would be improved to ensure safe emergency access to the site and surrounding residential areas. However, Project development would not require or result in the construction of new street lighting or additional maintenance to public facilities or roads, as construction traffic would occur during daytime hours and only last short-term. The minimal amount of permanent employee vehicle trips on local roadways during Project operations would not necessitate the expansions or construction of street lighting or cause additional burdens on local roadways resulting in increased maintenance.

USS-3) Would the Project conflict with any adopted energy conservation plans?

As discussed in USS-2, the power produced by the Project would produce renewable energy and support the goals of the RPS and would not conflict with adopted energy conservation plans. No impact.

Alternative 2: No Project

Under Alternative 2, the solar facility and gen-tie line would not be constructed and the site would retain its current land uses. Therefore, no direct or indirect impacts would occur to population, housing, public services, utilities, and socioeconomics, nor would the Project result in direct or indirect effects to minority or low-income populations related to construction, operation, or decommissioning activities.

Alternative 3: Northern Alternative 230 kV Gen-tie Line Location

Alternative 3 would be similar to Alternative 1, with the exception of the location of the proposed 230 kV gen-tie line. Therefore, Alternative 3 would result in the same socioeconomic impacts, and it would not result in direct or indirect effects to minority or low-income populations related to construction, operation and maintenance, and decommissioning activities, similar to Alternative 1.

Application of CEQA Significance Thresholds

SOC-1) Would Alternative 3 induce substantial population growth in an area, either directly or indirectly?

Alternative 3 would temporarily increase the local population; however, it would not induce substantial permanent population growth in the area, either directly or indirectly. Less than significant impacts would occur.

SOC-2) Would Alternative 3 displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?

Alternative 3 would not displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere. Less than significant impacts would occur.

SOC-3) Would Alternative 3 displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?

Alternative 3 would not displace substantial numbers of people, necessitating the construction of replacement housing elsewhere. No impacts would occur.

SOC-4) Would Alternative 3 create a demand for additional housing, particularly housing affordable to households earning 80% or less of the County's median income?

As described in SOC-1, Alternative 3 would temporarily increase the local population; however, it would not contain a residential component that would result in a permanent increase in the population. Due to the temporary nature of Alternative 3 construction activities, it is unlikely that construction workers would permanently relocate closer to the Alternative 3 site with their families. Operation of Alternative 3 would require a nominal workforce and is not anticipated to increase the local population. Therefore, Alternative 3 would not create a demand for additional housing. Less than significant impact would occur and no mitigation is recommended.

SOC-5) Would Alternative 3 affect a County Redevelopment Project Area?

The Alternative 3 site and immediate vicinity would not be within a former County Redevelopment Project Area. No impact would occur and no mitigation is recommended.

SOC-6) Would Alternative 3 cumulatively exceed official regional or local population projections?

See SOC-4 above. Alternative 3 would temporarily increase the local population during construction; however, it would not include housing and would require a nominal operational workforce. Alternative 3 would not permanently increase the local population, nor would it cumulatively exceed regional or local population projections. Less than significant impact would occur.

PS-1) Would Alternative 3 result in substantial adverse physical impacts associated with the provision of public services?

Please refer to the discussion under Alternative 1, PS-1. Alternative 3's construction workforce would increase the local population temporarily, but would not result in significant demands on public services, such as education, law enforcement, fire protection, parks and recreation, and hospital facilities and emergency response. Alternative 3 would result in less than significant impacts to public services.

USS-1) Would Alternative 3 result in substantial adverse environmental impacts associated with the provision of utility services?

Please refer to the discussion under Alternative 1, USS-1. Alternative 3 would not result in substantial adverse environmental impacts associated with the provision of utility services. Impacts to utility services would be less than significant.

USS-2) Would Alternative 3 impact the following facilities requiring or resulting in the construction of new facilities or the expansion of existing facilities, the construction of which could cause significant environmental effects?

a) Electricity
b) Natural gas
c) Communications systems
d) Storm water drainage
e) Street lighting
f) Maintenance of public facilities, including roads
g) Other government services

Please refer to the discussion under Alternative 1, USS-2. Alternative 3 construction, operation and maintenance, and decommissioning activities would not require construction of new utility facilities or require the expansion of existing facilities. However, portions of Seeley Avenue and Riverside Drive would be improved to ensure safe emergency access to the site and surrounding residential areas.

Electricity within the vicinity of the Alternative 3 site is provided by SCE. The power produced by Alternative 3 would be conveyed to the local power grid via interconnection to the SCE Colorado River Substation, an approved new substation south of I-10 and approximately four miles west of the Alternative 3 site. Alternative 3 has secured a CAISO interconnection queue position sufficient for the size of Alternative 3. Alternative 3 would produce enough energy to power approximately 180,000 households and progress the goals of the RPS and other similar renewable programs in the state, which are designed to serve existing and already-projected population growth. Implementation of Alternative 3 would support the goals of the RPS and other renewable energy programs and would not conflict with any adopted energy conservation plans. No impact.

USS-3) Would Alternative 3 conflict with any adopted energy conservation plans?

As discussed in USS-2 above, Alternative 3 would not conflict with any adopted energy conservation plan. No impact and no mitigation recommended.

Alternative 4: Northern Alternative 230 kV Gen-tie Line Location

Alternative 4 would be similar to Alternative 1, with the exception of the location of the proposed 230 kV gen-tie line. Therefore, Alternative 4 would result in the same impacts to population, housing, public services, utilities, and socioeconomics; it would not result in direct or indirect effects to minority or low-income populations related to construction, operation and maintenance, or decommissioning activities.

Application of CEQA Significance Thresholds

SOC-1) Would Alternative 4 induce substantial population growth in an area, either directly or indirectly?

Alternative 4 would not induce substantial population growth in the area, either directly or indirectly. No impacts would occur.

SOC-2) Would Alternative 4 displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?

Alternative 4 would not displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere. Less than significant impacts would occur.

SOC-3) Would Alternative 4 displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?

Alternative 4 would not displace substantial numbers of people, necessitating the construction of replacement housing elsewhere. No impacts would occur.

SOC-4) Would Alternative 4 create a demand for additional housing, particularly housing affordable to households earning 80% or less of the County's median income?

Alternative 4 would not contain a residential component that would result in an increase in the population. Due to the temporary nature of Project construction activities, it is unlikely that construction workers would permanently relocate closer to Alternative 4 site with their families. Operation of Alternative 4 would require a nominal workforce and is not anticipated to increase the local population. Therefore, Alternative 4 would not create a demand for additional housing. No impact would occur and no mitigation is recommended.

SOC-5) Would Alternative 4 affect a County Redevelopment Project Area?

The Alternative 4 site and immediate vicinity would not be within a former County Redevelopment Project Area. No impact would occur and no mitigation is recommended.

SOC-6) Would Alternative 4 cumulatively exceed official regional or local population projections?

See SOC-4 above. Alternative 4 would not include housing and would require a nominal operational workforce. Alternative 4 would not increase the local population, nor would it cumulatively exceed regional or local population projections.

PS-1) Would Alternative 4 result in substantial adverse physical impacts associated with the provision of public services?

Please refer to the discussion under Alternative 1, PS-1. Alternative 4's construction workforce would increase the local population temporarily, but would not result in significant demands on public services, such as education, law enforcement, fire protection, parks and recreation, and hospital facilities and emergency response. Alternative 4 would result in less than significant impacts to public services.

USS-1) Would Alternative 4 result in substantial adverse environmental impacts associated with the provision of utility services?

Please refer to the discussion under Alternative 1, USS-1. Alternative 4 would not result in substantial adverse environmental impacts associated with the provision of utility services. Impacts to utility services would be less than significant.

USS-2) Would Alternative 4 impact the following facilities requiring or resulting in the construction of new facilities or the expansion of existing facilities, the construction of which could cause significant environmental effects?

a) Electricity
b) Natural gas
c) Communications systems
d) Storm water drainage
e) Street lighting
f) Maintenance of public facilities, including roads
g) Other government services

Please refer to the discussion under Alternative 1, USS-2. Alternative 4 construction, operation and maintenance, and decommissioning activities would not require construction of new utility facilities or require the expansion of existing facilities. However, portions of Seeley Avenue and Riverside Drive would be improved to ensure safe emergency access to the site and surrounding residential areas.

Electricity within the vicinity of the Alternative 4 site is provided by SCE. The power produced by Alternative 4 would be conveyed to the local power grid via interconnection to the SCE Colorado River Substation, an approved new substation south of I-10 and approximately four miles west of the Alternative 4 site. Alternative 4 has secured a CAISO interconnection queue position sufficient for the size of Alternative 4. Alternative 4 would produce enough energy to power approximately 180,000 households and progress the goals of the RPS and other similar renewable programs in the state, which are designed to serve existing and already-projected population growth. Implementation of Alternative 4 would support the goals of the RPS and other renewable energy programs and would not conflict with any adopted energy conservation plans.

USS-3) Would Alternative 4 conflict with any adopted energy conservation plans?

See USS-2 above.

Alternative 5: Reduced Acreage Alternative

Similar to Alternative 1, Alternative 5 would include the construction, operation, maintenance, and decommissioning of a solar facility and associated infrastructure. The primary difference between

Alternatives 1 and 5 is the absence of solar facility development north of I-10, which would reduce electrical output from a 485 MW down to a 315 MW alternating current solar PV facility. The Reduced Acreage Alternative would be on a reduced footprint of approximately 2,476 acres (from 3,660 acres for the proposed Project). Alternative 5 would have one on-site substation and one O&M building and would have one access point (planned on Seeley Avenue). The Reduced Acreage Alternative would construct an approximately 7.8-mile-long, 230 kV overhead gen-tie line from the proposed on-site substation south of I-10 to the approved Colorado River Substation. Approximately three miles of the gen-tie line would be within the solar facility. Approximately 400 daily workers (compared to 500 under the proposed Project) would be present on-site during peak construction. The O&M building would serve the Project's approximately seven permanent full-time employees.

The Reduced Acreage Alternative solar facility and a portion of the gen-tie line would be within the jurisdiction of the County of Riverside but not within the City limits of Blythe in comparison to the proposed Project. Alternative 5 would need to comply with the RCGP (2003) and PVVAP (2008). The remaining portion of the gen-tie line would traverse lands managed by the BLM and would need to comply with the CDCA Plan. The construction, operation, maintenance, and decommissioning of Alternative 5 would not exceed those population, housing, public services, utilities, and socioeconomic impacts identified under the Alternative 1 analysis. Therefore, the Alternative 1 analysis would be applicable to Alternative 5, outside of those differences identified in the discussion below.

Alternative 5 would have a reduced workforce in comparison to Alternative 1. However, this reduction is not substantial relative to population, housing, public services, utilities, and socioeconomics. Therefore, impacts from Alternative 5 are anticipated to be similar to that of Alternative 1 for population, housing, public services, utilities, and socioeconomics; it would not result in direct or indirect effects to minority or low-income populations related to construction, operation and maintenance, or decommissioning activities.

Application of CEQA Significance Thresholds

SOC-1) Would Alternative 5 induce substantial population growth in an area, either directly or indirectly?

Similar to Alternative 1, Alternative 5 construction would temporarily increase population growth in the area; however, it would not be substantial. The SOC-1 Alternative1 analysis would apply to Alternative 5. No significant construction- or operation-related impacts are expected for the regional and local study area housing supply, availability, or demand. Alternative 5 would not displace populations or existing housing, and it would not necessitate construction of replacement housing elsewhere.

SOC-2) Would Alternative 5 displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?

While Alternative 5 would displace three existing residences within the Alternative 5 development area south of I-10, there is available housing within the Alternative 5 area to relocate the residents of these residential units elsewhere. Similar to Alternative 1, implementation of Alternative 5 would not require the construction of replacement housing elsewhere. Impacts to existing housing as a result of Alternative 5 implementation would not be significant and no mitigation is recommended.

SOC-3) Would Alternative 5 displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?

Similar to Alternative 1, Alternative 5 would not displace substantial numbers of people, necessitating the construction of replacement housing elsewhere. No impacts would occur.

SOC-4) Would Alternative 5 create a demand for additional housing, particularly housing affordable to households earning 80% or less of the County's median income?

The SOC-4 analysis for Alternative 1 would apply to Alternative 5.

SOC-5) Would Alternative 5 affect a County Redevelopment Project Area?

The SOC-5 analysis for Alternative 1 would apply to Alternative 5.

SOC-6) Would Alternative 5 cumulatively exceed official regional or local population projections?

Alternative 5 would not include housing and would require a nominal operational workforce. Alternative 5 would not increase the local population, nor would it cumulatively exceed regional or local population projections.

PS-1) Would Alternative 5 result in substantial adverse physical impacts associated with the provision of public services?

The PS-1 analysis under Alternative 1 would apply to Alternative 5, as Alternative 5 development construction workforce would increase the local population temporarily, but would not result in significant demands on public services, such as education, law enforcement, fire protection, parks and recreation, and hospital facilities and emergency response. A reduced footprint would result in impacts no greater than those described under the Alternative 1 analysis. Alternative 5 would not result in substantial adverse physical impacts associated with the provision of public services. The temporary addition of construction workers to the area's population is not anticipated to increase school enrollment that could result in adverse physical impacts associated with the provision of school facilities. No impact would occur and no mitigation recommended. Because Alternative 5 construction is not anticipated to increase the local population, no new or expanded law enforcement facilities or increased staff levels within the Alternative 5 regional or local study area would be required, nor would Alternative 5 development result in substantial adverse physical impacts on law enforcement facilities. Adverse physical impacts to fire protection services during construction and operation are considered to be less than significant and no mitigation is recommended. No physical adverse impacts would result to parks and recreational facilities. Alternative 5 construction would not result in adverse physical impacts to hospital facilities within the Alternative 5 regional or local study area.

Similar to Alternative 1, due to the temporary nature of Alternative 5 construction activities, it is unlikely that construction workers would permanently relocate closer to the solar facility with their families. Additionally, operation of Alternative 5 would require a nominal workforce and is not anticipated to increase the local population. Therefore, Alternative 5 would not make significant physical demands on education, law enforcement, fire protection, parks and recreation, and hospital facilities. Alternative 5 would not eliminate any lands designated for recreational use. No physical impacts associated with the provision of parks and recreational facilities would occur and no mitigation is recommended. Operation of Alternative 5 would not result in physical adverse impacts on medical facilities in the area because minor injuries could be treated at Palo Verde Hospital in Blythe, California or La Paz Medical Services in Quartzsite, Arizona. Injuries resulting in significant trauma would be treated at the Desert Regional Medical Center in Palm Springs, California, which is approximately one hour and twenty minutes by Medevac (Cox 2011). No significant impact would occur and no mitigation is recommended.

USS-1) Would Alternative 5 result in substantial adverse environmental impacts associated with the provision of utility services?

Similar to Alternative 1, the Reduced Acreage Alternative would not result in substantial adverse environmental impacts associated with the provision of utility services. The USS-1 analysis for Alternative 1 would apply to Alternative 5.

Electricity and Natural Gas

As the Reduced Acreage Alternative would involve a reduced amount of development in comparison to what was considered under Alternative 1, Alternative 5 would not induce substantial growth to the regional population levels. Therefore, demands on the electrical and

natural gas systems would be nominal and there would be no need to alter these existing facilities in response, which could result in associated adverse environmental impacts.

Water and Wastewater

Similar to Alternative 1, Alternative 5 would not induce substantial growth to the regional population levels; as such, demands on water and wastewater systems would be nominal and there would be no need to alter these existing facilities in response, which could cause significant environmental effects.

Solid Waste

Similar to Alternative 1, Alternative 5 would not induce substantial growth to the regional population levels; as such, the associated generation of solid waste would be nominal and there would be no need to alter these existing solid waste facilities in response, which could result in associated adverse environmental impacts.

Drainage Facilities

The development of Alternative 5 would be identical to Alternative 1 south of I-10. As such, Project facilities would be sited to provide adequate setbacks between solar facility components (solar panels, gen-tie lines, substation, access roads, and O&M building) and natural washes. The Alternative 1 analysis would apply. As no development would occur north of the freeway, these lands would exist in their current state.

USS-2) Would Alternative 5 impact the following facilities requiring or resulting in the construction of new facilities or the expansion of existing facilities, the construction of which could cause significant environmental effects?

a) Electricity
b) Natural gas
c) Communications systems
d) Storm water drainage
e) Street lighting
f) Maintenance of public facilities, including roads
g) Other government services

The USS-2 analysis for Alternative 1 would apply to Alternative 5. Alternative 5 construction, operation and maintenance, and decommissioning activities would not require construction of new utility facilities or the expansion of existing facilities.

USS-3) Would Alternative 5 conflict with any adopted energy conservation plans?

See USS-2.

Cumulative Impacts

Geographic Scope

Temporary cumulative population and housing impacts could occur when overlapping construction schedules of multiple projects create a demand for workers that cannot be met by the local labor force, thereby inducing in-migration of non-local labor and their households. Operational cumulative population and housing impacts could occur when multiple projects cause a substantial increase in population in an area that leads to demand for housing that exceeds available capacity.

The BMSP would have substantial beneficial socioeconomic impacts during construction and operations in terms of job creation, expenditures, and tax revenues. In fact, the positive incremental impacts of the

Project, including job creation, expenditures, and tax revenues, would combine with the similar positive socioeconomic impacts from other present and reasonably foreseeable future projects in the Project vicinity (Table 4.1-1) to create even greater positive cumulative impacts to the local economy.

Temporal Scope

The timeframe refers to the duration over which an impact would occur: short-term or long-term. Short-term impacts to population and housing would occur during the construction and decommissioning periods when overlapping construction schedules of multiple projects create a demand for workers that cannot be met by the local labor force.

Analysis of Direct and Indirect Impacts

Alternative 1: Proposed Project

Construction, Operation, Maintenance, and Decommissioning

Temporary cumulative population and housing impacts could occur when overlapping construction schedules of multiple projects create a demand for workers that cannot be met by the local labor force, thereby inducing in-migration of non-local labor and their households. Operational cumulative population and housing impacts could occur when multiple projects cause a substantial increase in population in an area that leads to demand for housing that exceeds available capacity (Impact SOC-1).

The proposed Project would have substantial beneficial socioeconomic impacts during construction and operation in terms of job creation, expenditures, and tax revenues. In fact, the positive incremental impacts of the Project, including job creation, expenditures, and tax revenues, would combine with the similar positive socioeconomic impacts from other present and reasonably foreseeable future projects in the Project vicinity (Table 4.1-1) to create even greater positive cumulative impacts to the local economy.

Construction of the present and reasonably foreseeable future projects may overlap with construction of the proposed Project. Construction of the Devers-Palo Verde No. 2 transmission line, including the new SCE Colorado River Substation, is expected to be complete and in service by the third quarter of 2013, prior to anticipated commencement of Project construction in the fourth quarter of 2013. The CEC Decision for BSPP analyzed average and peak construction labor needs by construction craft for the BSPP, Palen Solar Power Project, Genesis Solar Energy Project, and Desert Sunlight Solar Farm and compared them to the available labor force for these projects. This analysis determined that these projects would have total peak monthly labor needs of 4,189 workers and total peak monthly local housing needs of 562 housing units. The proposed Project would have peak monthly labor needs of 500 workers.

Under the conservative assumption that peak construction periods overlap for all reasonably foreseeable projects, there would be an increased demand for temporary housing units in the cumulative area. As discussed in Section 4.2.13, *Population, Housing, Public Services, Utilities, and Socioeconomics*, the vacancy rates for housing units are high and there are number of temporary housing options available as well. Available housing supply in the study area far exceeds conservative estimates of cumulative demand. There is an ample supply of housing units to accommodate workers drawn from the study area. Therefore, the incremental effects of the Project, when considered together with other past, present, and reasonably foreseeable future projects, would not result in cumulatively significant, adverse impacts to housing supply during construction.

Operational labor needs of the reasonably foreseeable future projects and the Project are substantially smaller than construction labor needs and would not contribute to a cumulatively significant increase in demand for housing that exceeds available supply (impacts SOC-1 through SOC-4).

The proposed Project would not result in significant adverse environmental or public health impacts that could impact any human populations. Due to their nature as solar energy projects and their location in

relation to the proposed Project, reasonably foreseeable future projects would not compound or increase proposed Project effects in a manner that would result in significant adverse environmental or public health impacts (impact USS-1).

Environmental Justice

The Project would have no impacts related to environmental justice; therefore, it would not cause or contribute to any cumulative impacts in this regard.

Public Services and Utilities

Operational cumulative impacts to public service and utility providers could occur when multiple projects cause a substantial increase in population in an area that leads to demand for schools, public services, or utilities that exceeds available capacity (impacts PS-1 USS-1 and USS-2).

Construction of the present and reasonably foreseeable future projects (Table 4.1-1) may overlap with construction of the Project. The temporary placement of construction workers within existing housing units, motel and hotel rooms, RV parks, and campsites would not result in adverse impacts to schools, public services, or utilities, since these facilities have already been accounted for in existing plans for public services and utilities.

It is anticipated that the construction workforce for the proposed Project, in conjunction with those under the cumulative scenario, would be drawn from Riverside County, with a smaller portion drawn from the Imperial County and La Paz County. It would be unlikely that construction workers would relocate close to the various Project areas with their families due to the temporary nature of the construction periods associated with these projects. Therefore, the temporary addition of construction workers to the proposed Project area's population, along with those noted in Table 4.1-1, is not anticipated to increase school enrollment. In addition, the Palo Verde Unified School District is currently below enrollment capacity; enrollment capacity has been declining, and this trend is expected to continue. Therefore, any increased temporary demand within this district would potentially have beneficial effects.

Cumulative operational impacts to public services including police, fire, hazardous materials handling, and medical resources and facilities would not be cumulatively considerable due to compliance with existing agency regulations, including preparation of worker safety and fire prevention programs. Reasonably foreseeable future projects and the proposed Project would comply with agency regulations addressing operational impacts to public services. Construction of the proposed Project in conjunction with those under the cumulative scenario could increase demands on police services. However, during construction, on-site security would include trained, uniformed, and unarmed personnel whose primary responsibility would be to control ingress and egress of personnel and vehicles, perform fire and security watch during off hours, and perform security badge administration, all of which would minimize the potential need for the City of Blythe Police Department's and the Riverside County Sheriff's Department's assistance. As discussed above, the construction workforce for the Project would be hired generally from within the available regional workforce. Because proposed Project construction is not anticipated to increase the local population, no new or expanded law enforcement facilities or increased staff levels within the proposed Project regional or local study area would be required. Construction of the proposed Project would generate truck and employee traffic along haul routes and at the Project area, which could temporarily increase the accident potential in these areas over the short-term construction period. However, the additional volume of traffic associated with workers commuting to the sites during construction would be temporary and it is anticipated that personnel and equipment from the City and the CHP would be sufficient to respond to incidents in the Project area. Therefore, the proposed Project's direct and indirect contribution towards cumulative effects to law enforcement facilities or increased staff levels, including short-term effects during construction and long-term operation, would not be considerable (impact PS-1).

There are three existing residences within the Project area (see Figure 3.2.1-1, *Residences within One Mile of the Proposed Project*) that are associated with the existing agricultural operations. The proposed Project would displace those three residences; however, there is available housing within the vicinity of

the Project area to relocate these residents. Implementation of the proposed Project would not require the construction of replacement housing elsewhere. After the construction phase, the O&M buildings would serve as the proposed Project's facilities for a limited number of permanent full-time employees. The proposed Project would include emergency access and other safety features and plans for fire protection. Portions of Seeley Avenue and Riverside Drive would be improved to ensure safe emergency access to the site and surrounding residential areas.

The Project area is not within an area of very high or high fire hazard, as determined by CAL FIRE. During construction, there is the potential for both small fires and major structural fires. Electrical sparks, combustion of fuel oil, hydraulic fluid, mineral oil, or insulating fluid at substations, or flammable liquids, explosions, and over-heated equipment may cause small fires. The Project and cumulative projects listed on Table 4.1-1 would result in an increase in demand for fire protection services over existing levels during construction. However, it is anticipated that personnel and equipment from the City of Blythe Volunteer Fire Department, the RCFD, and CAL FIRE would be sufficient to respond to a fire at the Project area because the O&M buildings would include their own emergency power, fire suppression, and potable water systems. Implementation of BMP-4, Fire Management and Protection Plan, would ensure that emergency fire precautions are employed during Project construction. The construction of cumulative projects listed in Table 4.1-1 may result in cumulative impacts to fire protection services and may require upgrades to existing facilities and equipment. Similar to Alternative 1, all of the related projects in Riverside County listed in Table 4.1-1 would be required to pay development impact fees and property taxes that would assist the County of Riverside and City of Blythe with any potential facility upgrades for fire protection services (Impacts PS-1 and USS-1). Therefore, the proposed Project's direct and indirect contribution towards cumulative effects on fire protection, including short-term effects during construction and long-term effects during operation, would not be considerable regarding fire protection services.

The Project would produce enough energy to power approximately 180,000 households and progress the goals of the California RPS and other similar renewable programs in the state, which are designed to serve existing and already-projected population growth. Implementation of the proposed Project would support the goals of the RPS and other renewable energy programs and would not conflict with any adopted energy conservation plans. Therefore, the proposed Project's direct and indirect contribution towards cumulative effects on electricity would not be considerable.

In addition, cumulative operational impacts to utilities would not be cumulatively considerable (impacts USS-1 and USS-2). The Project would utilize on-site groundwater and treat wastewater on-site. There is no potential for the Project to contribute to cumulative impacts to water or wastewater systems. Cumulative impacts to groundwater are discussed in Section 4.2.9. The Project would not utilize natural gas, and the Project would not exceed existing capacity and require the construction of new facilities or infrastructure to meet demand. Cumulative impacts to electrical infrastructure would not occur.

Alternative 2: No Project Alternative

Under the No Project Alternative, gen-tie facilities would not be constructed on BLM-managed lands and solar facilities would not be constructed on private lands. The public lands in the Project area would continue to be managed by BLM in accordance with existing land use designations in the CDCA Plan, whereas the private lands would continue to be managed for agricultural production. Alternative 2 would not contribute to cumulative impacts on population, housing, public services, and utilities. This Alternative would also not contribute cumulatively towards growth-inducing and socioeconomics impacts.

Alternative 3: Northern 230 kV Gen-tie Line Location

Alternative 3 is similar to Alternative 1 (proposed Project), with the exception of the location of the Northern 230 kV gen-tie line, which would be approximately 700 feet north of Alternative 1's proposed 230 kV gen-tie line. The cumulative impacts associated with the construction, operation, maintenance, and decommissioning of the solar facility would be the same as Alternative 1. Therefore, the impacts associated with Alternative 3 would the same as those from Alternative 1.

Development of Alternative 3 would also result in substantial beneficial socioeconomic impacts during construction and operations in terms of job creation, expenditures, and tax revenues. There is an ample supply of housing units to accommodate workers within the Study area. Therefore, the incremental effects of Alternative 3, when considered together with other past, present, and reasonably foreseeable future projects, would not result in cumulatively significant, adverse impacts to housing supply during construction, operation, maintenance, and decommissioning (impacts SOC-1 through SOC-4).

Alternative 3 would also not result in significant adverse environmental or public health impacts that could impact any human populations. Due to their nature as solar energy projects and their location in relation to Alternative 3, reasonably foreseeable future projects would not compound or increase Alternative 3 effects in a manner that would result in significant adverse environmental or public health impacts (impact USS-1).

It would be unlikely that construction workers would relocate close to the various Project areas with their families due to the temporary nature of the construction periods associated with these projects. Therefore, the temporary addition of construction workers for the cumulative projects and Alternative 3 are not anticipated to increase school enrollment. In addition, the Palo Verde Unified School District is currently below enrollment capacity; enrollment capacity has been declining, and this trend is expected to continue. Therefore, any increased temporary demand within this district would potentially have beneficial effects.

The workforce required for operation would be similar or less than that of current agricultural operations; therefore, the Alternative 5 is not a cumulatively considerable contributor to cumulative impacts to public services including police, hazardous materials handling, and medical resources and facilities. Additionally, all cumulative projects, including Alternative 5, would be required to comply with existing agency regulations, including preparation of worker safety and fire prevention programs. Because Alternative 3 construction is not anticipated to permanently increase the local population, no new or expanded law enforcement facilities or increased staff levels within the proposed Project regional or local study area would be required. The additional truck and employee traffic along haul routes form construction of Alternative could temporarily increase the accident potential in these areas over the short-term construction period. However, the additional volume of traffic associated with workers commuting to the sites during construction would be temporary and it is anticipated that personnel and equipment from the City and the CHP would be sufficient to respond to incidents in the Alternative 3 area. Therefore, this alternatives direct and indirect contribution towards cumulative effects to law enforcement facilities or increased staff levels, including short-term effects during construction and long-term operation, would not be considerable (impact PS-1).

Alternative 3 would include emergency access and other safety features and plans for fire protection. Portions of Seeley Avenue and Riverside Drive would be improved to ensure safe emergency access to the site and surrounding residential areas.

It is anticipated that personnel and equipment from the RCFD and CAL FIRE would be sufficient to respond to a fire at the Alternative 3 site because the O&M buildings would include their own emergency power, fire suppression, and potable water systems. Implementation of BMP-4, Fire Management and Protection Plan, would ensure that emergency fire precautions are employed during Alternative 3 construction. The construction of cumulative projects listed in Table 4.1-1 may result in cumulative impacts to fire protection services and may required upgrades to existing facilities and equipment. Similar to Alternative 1, all of the related projects in Riverside County listed in Table 4.1-1 would be required to pay development impact fees and property taxes that would assist the County of Riverside and City of Blythe with any potential facility upgrades for fire protection services and equipment (Impacts PS-1 and USS-1). Therefore, this alternative's direct and indirect contribution towards cumulative effects on fire protection, including short-term effects during construction and long-term effects during operation, would not be considerable regarding fire protection services.

Cumulative operational impacts to utilities would not be cumulatively considerable (impacts USS-1 and USS-2). Alternative 3 would also utilize on-site groundwater and treat wastewater on-site. As with Alternative 1, there is no potential for Alternative 3 to contribute to cumulative impacts to water or

wastewater systems. Cumulative impacts to groundwater are discussed in Section 4.2.9. Alternative 3 would not utilize natural gas, and Alternative 3 would not exceed existing capacity and require the construction of new facilities or infrastructure to meet demand. Cumulative impacts to electrical infrastructure would not occur.

Alternative 4: Southern 230 kV Gen-tie Line Location

Alternative 4 is similar to Alternative 1 (proposed Project), with the exception of the location of the Southern 230 kV gen-tie line, which would be approximately 0.8 mile south of Alternative 1's proposed 230 kV gen-tie line. The cumulative impacts associated with the construction, operation, maintenance, and decommissioning of the solar facility would be the same as Alternative 1.

Development of Alternative 4 would also result in substantial beneficial socioeconomic impacts during construction and operations in terms of job creation, expenditures, and tax revenues. This could combine with the similar positive socioeconomic impacts from other present and reasonably foreseeable future cumulative projects in the Alternative 4 vicinity to create even greater positive cumulative impacts to the local economy.

Construction of the present and reasonably foreseeable future projects may overlap with construction of this Alternative as well, comparative to Alternative 1. There is an ample supply of housing units to accommodate workers drawn from outside the one-hour commute area. Therefore, the incremental effects of Alternative 4, when considered together with other past, present, and reasonably foreseeable future projects, would not result in cumulatively significant, adverse impacts to housing supply during construction (impacts SOC-1 through SOC-4).

Operational labor needs of the reasonably foreseeable future projects and Alternative 4 are substantially smaller than construction labor needs and would not contribute to a cumulatively significant increase in demand for housing that exceeds available supply (impacts SOC-1 through SOC-4).

Alternative 4 would also not result in significant adverse environmental or public health impacts that could impact any human populations. Due to their nature as solar energy projects and their location in relation to Alternative 4, reasonably foreseeable future projects would not compound or increase Alternative 4 effects in a manner that would result in significant adverse environmental or public health impacts (impact USS-1).

It would be unlikely that construction workers would relocate close to the various Project areas with their families due to the temporary nature of the construction periods associated with these projects. Therefore, the temporary addition of construction workers to the Alternative 4 area's population, along with those noted in Table 4.1-1, are not anticipated to increase school enrollment.

Cumulative operational impacts to public services including police, fire, hazardous materials handling, and medical resources and facilities would not be cumulatively considerable due to compliance with existing agency regulations, including preparation of worker safety and fire prevention programs. Construction of Alternative 4 in conjunction with those under the cumulative scenario could increase demands on police services. However, during construction, on-site security would remain on-site to minimize demands potential need for the City of Blythe Police Department's and the Riverside County Sheriff's Department's assistance. Because Alternative 4 construction is not anticipated to increase the local population, no new or expanded law enforcement facilities or increased staff levels within the proposed Project regional or local study area would be required. The additional volume of traffic associated with workers commuting to the sites during construction would be temporary and it is anticipated that personnel and equipment from the City and the CHP would be sufficient to respond to incidents in the Alternative 4 area. Therefore, this Alternative's direct and indirect contribution towards cumulative effects to law enforcement facilities or increased staff levels, including short-term effects during construction and long-term operation, would not be considerable (Impact PS-1).

Alternative 4 would include emergency access and other safety features and plans for fire protection. Portions of Seeley Avenue and Riverside Drive would be improved to ensure safe emergency access to the site and surrounding residential areas.

Alternative 4 would result in an increase in demand for fire protection services over existing levels during construction. To reduce the Project impacts to fire protection services, the O&M buildings would include their own emergency power, fire suppression, and potable water systems. Implementation of BMP-4, Fire Management and Protection Plan, would ensure that emergency fire precautions are employed during Alternative 4 construction. The construction of cumulative projects listed in Table 4.1-1 may result in cumulative impacts to fire protection services and may required upgrades to existing facilities and equipment. Alternative 4 and all of the related projects in Riverside County listed in Table 4.1-1 would be required to pay development impact fees and property taxes that would assist the County of Riverside and City of Blythe with any potential facility upgrades for fire protection services and equipment (Impacts PS-1 and USS-1).

Similar to Alternative 1, Alternative 4's cumulative operational impacts to utilities would not be cumulatively considerable (impacts USS-1 and USS-2). Alternative 4 would also utilize on-site groundwater and treat wastewater on-site. As with Alternative 1, there is no potential for Alternative 4 to contribute to cumulative impacts to water or wastewater systems. Cumulative impacts to groundwater are discussed in Section 4.2.9. Alternative 4 would not utilize natural gas, and Alternative 4 would not exceed existing capacity and require the construction of new facilities or infrastructure to meet demand. Cumulative impacts to electrical infrastructure would not occur.

Alternative 5: Reduced Acreage Alternative

The Reduced Acreage Alternative would also create beneficial socioeconomic impacts during construction and operation in terms of job creation, expenditures, and tax revenues. As development under this Alternative would be reduced relative to the footprint associated with Alternative 1, there would be a reduced slightly reduced workforce during construction and operations. However, the positive incremental impacts of Alternative 5, including job creation, expenditures, and tax revenues, would combine with the similar positive socioeconomic impacts from other present and reasonably foreseeable future projects in the Project vicinity to create even greater positive cumulative impacts to the local economy.

As determined in the cumulative analysis for Alternative 1, the available housing supply in the study area far exceeds conservative estimates of cumulative demand. There is an ample supply of housing units to accommodate workers drawn from outside the study area. Therefore, the incremental effects of Alternative 5, when considered together with other past, present, and reasonably foreseeable future projects, would not result in cumulatively significant, adverse impacts to housing supply during construction (impacts SOC-1 through SOC-4).

Operational labor needs of the reasonably foreseeable future projects and Alternative 5 are substantially smaller than construction labor needs and would not contribute to a cumulatively significant increase in demand for housing that exceeds available supply.

Alternative 5 would not result in significant adverse environmental or public health impacts that could impact any human populations. Due to their nature as solar energy projects and their location in relation to Alternative 5, reasonably foreseeable future projects would not compound or increase Alternative 5 effects in a manner that would result in significant adverse environmental or public health impacts (impact USS-1).

Operational cumulative impacts to public service and utility providers could occur when multiple projects cause a substantial increase in population in an area that leads to demand for schools, public services, or utilities that exceeds available capacity (impacts PS-1 USS-1 and USS-2).

Construction of the present and reasonably foreseeable future projects (Table 4.1-1) may overlap with construction of Alternative 5. Similar to Alternative 1, Alternative 5's temporary placement of construction

workers within existing housing units, motel and hotel rooms, RV parks, and campsites would not result in adverse impacts to schools, public services, or utilities.

It would be unlikely that construction workers would relocate close to the various Project areas with their families due to the temporary nature of the construction periods associated with these projects. Therefore, not anticipated increase school enrollment would occur.

Cumulative operational impacts to public services including police, fire, hazardous materials handling, and medical resources and facilities would not be cumulatively considerable due to compliance with existing agency regulations, including preparation of worker safety and fire prevention programs. Reasonably foreseeable future projects and Alternative 5 would comply with agency regulations addressing operational impacts to public services. The discussion under Alternative 1 would apply as no additional impacts to public services would occur under Alternative 5.

Alternative 5 would include emergency access and other safety features and plans for fire protection. Portions of Seeley Avenue would be improved to ensure safe emergency access to the site and surrounding residential areas.

Alternative 5 would result in an increase in demand for fire protection services over existing levels during construction. To reduce the Project impacts to fire protection services, the O&M buildings would include their own emergency power, fire suppression, and potable water systems. Implementation of BMP-4, Fire Management and Protection Plan, would ensure that emergency fire precautions are employed during Alternative 5 construction. The construction of cumulative projects listed in Table 4.1-1 may result in cumulative impacts to fire protection services and may required upgrades to existing facilities and equipment. Alternative 5 and all of the related projects in Riverside County listed in Table 4.1-1 would be required to pay development impact fees and property taxes that would assist the County of Riverside and City of Blythe with any potential facility upgrades for fire protection services and equipment (Impacts PS-1 and USS-1).

Similar to Alternative 1, Alternative 5's cumulative operational impacts to utilities would not be cumulatively considerable (impacts USS-1 and USS-2). Alternative 4 would also utilize on-site groundwater and treat wastewater on-site. As with Alternative 1, there is no potential for Alternative 5 to contribute to cumulative impacts to water or wastewater systems. Cumulative impacts to groundwater are discussed in Section 4.2.9. Alternative 5 would not utilize natural gas, and Alternative 5 would not exceed existing capacity and require the construction of new facilities or infrastructure to meet demand. Cumulative impacts to electrical infrastructure would not occur.

Mitigation Measures

All impacts would be less than significant; no mitigation measures are recommended.

Residual Impacts

With implementation of the above-listed BMPs as part of the Project, the Project would result in less than significant impacts to Population, Housing, Public Services, Utilities, and Socioeconomics.

NEPA Conclusions

The Project and each of the action Alternatives would involve the direct and indirect impacts and contribution toward cumulative impacts that are described above. The Project and the action Alternatives would not have an adverse environmental justice impact, would not create a new demand for housing, and could be adequately served by existing utilities and services without the need for new or altered facilities. The No Project Alternative would not have impacts, as the existing circumstances and operations would continue essentially unchanged.

4.2.14 Recreation

This section describes the impact analysis relating to recreation for the proposed Project and Alternatives.

Methodology for Analysis

This section analyzes potential effects of the proposed Project and Alternatives related to recreation and assesses the impacts to known recreational facilities and uses. The Riverside County Regional Park and Open-Space District also provides several recreational facilities in the Project vicinity. The City of Blythe has several parks that provide sporting opportunities in the area. The CDCA Plan recognizes that the California Desert is "a reservoir of open space and…a place for outdoor recreation" (BLM 1980, p. 69). The CDCA Plan notes that the diverse landscape of the California desert provides for a variety of physical settings. Further, the CDCA Plan identifies the wide variety of desert recreation uses, ranging from off-road vehicles to outdoor preservationists, and the increasing challenge to accommodate these varied and sometimes competing uses. The CDCA Plan and NECO Plan Amendment, which includes a detailed inventory and designation of open routes for motorized-vehicle use, were reviewed to determine impacts to open routes.

CEQA Significance Criteria

The criteria listed below were used to determine if the proposed Project would result in impacts to recreation. These criteria were obtained from the CEQA Environmental Checklist, Appendix G of the 2012 CEQA Guidelines. Under CEQA, the proposed Project and Alternatives would have a significant impact on recreation if they would:

REC-1) Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated.

REC-2) Include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment.

The following additional significance criterion from the County of Riverside Environmental Assessment form is used in the analysis. A project could have potentially significant impacts if it would be:

REC-3) Located within a Community Service Area (CSA) or recreation and park district with a Community Parks and Recreation Plan (Quimby fees).

NEPA Requirements

Pursuant to NEPA, this analysis is intended to compare the Alternatives and identify any adverse effects to recreational resources that cannot be avoided. Adverse effects may be direct, indirect, or cumulative. Potential direct and indirect effects of the proposed Project and Alternatives are analyzed below and discussed as construction-related, operation- and maintenance-related, and decommissioning effects.

Applicable Best Management Practices

No BMPs are recommended for Recreation.

Alternative 1: Proposed Project

Analysis of Direct and Indirect Impacts

Construction and Decommissioning

According to the Recreation Element of the CDCA Plan, "lands managed by the BLM are especially significant to recreationists. Therefore, actions which restrict vehicular access may affect opportunities for recreation depending on the specific activity pursued and/or the specific location at which such restrictions are imposed." As an indirect effect of the Project, recreationists could compensate for the loss of Class M public lands by utilizing other desert lands in the vicinity of the Project for their recreational experiences and benefits. This could result in more concentrated use of those areas, leading to loss of some native vegetation, wildlife habitat fragmentation or loss, elevated soil loss, increases in noise, and possible temporary declines in air quality from more concentrated vehicle use in a smaller available area. However, this impact would be minimal because, as discussed above, the land is privately owned and not available to the public, and high recreational use has not been observed within the Project area. As illustrated in Chapter 3, Figure 3.2.14-2, *NECO Plan Route Designations,* the proposed Project's gen-tie line that would extend outside the solar facility site would traverse NECO Plan Designated Open Routes 0660703, 660863 and 660862. During construction, these routes would closed and re-routed around construction zones; however, the NECO Plan Designated Open Routes would be open for use after construction.

Regional BLM recreational facilities described in Section 3.2.12 include long-term camping facilities (LTVAs) and supporting recreational uses. The Midland and Mule Mountains LTVA can each accommodate several hundred units, and current use is much lower than capacity. Some construction workers could reside in RV campers at the LTVAs, or possibly camp on public lands in the vicinity of the Project area during the construction phase of the Project; The Midland and Mule Mountains LTVAs allow camping up to seven months (September 14 to April 16) with a special use permit. Outside of these dates, the camping is limited to 14 days. Depending on the number of workers using the LTVAs, use could affect the social setting or the physical infrastructure of the LTVAs. However, the LTVAs are designed with minimal facilities given that campers must use self-contained RVs and there are no assigned or designated sites. Except for the designated campsites at Wiley's Well and Coon Hollow, each LTVA can accommodate several hundred RV units with a minimum distance of 15 feet between units. However, there are limitations to the campsites, such as seasonal availability, length of stay, and types of on-site facilities available. In addition, as discussed in Section 4.2.13, *Population, Housing, Public Services, Utilities, and Socioeconomics*, there are other temporary, affordable housing alternatives, such as seasonal or vacation home rentals, that are available in the vicinity of the Project area that don't have as many limitations and offer more facilities. Therefore, although some construction workers might decide to reside in LTVAs, it is anticipated that most workers intending to camp will select long-term camping facilities nearby that are sufficient to support the proposed Project. It is anticipated that the authorized use of LTVAs by temporary construction workers would result in a minimal increase. Therefore, minimal impacts would result to the social and recreational experience of winter users of the LTVAs; no increase in law enforcement patrols at the LTVAs is anticipated.

Although it is possible that unauthorized use of these LTVAs could occur when they are closed from April 16 to September 14, it is unlikely because this area experiences extremely hot weather during the closed season.

In addition to BLM recreational facilities, there are regional and local recreational resources in the Project vicinity. Because the regional and local recreational facilities described in Section 3.2.12, *Recreation*, consist primarily of long-term camping facilities and supporting recreational uses, impacts to these resources would be similar to impacts to LTVAs described above. Depending on the number of authorized workers using the long-term camping facilities, use could affect the social setting or the physical infrastructure of these sites and/or the availability of short-term recreational uses due to increased demand.

Operations

Operation of the solar facility site and gen-tie line would require 12 full-time employees; therefore, it is anticipated that use of recreational facilities would be similar to the existing conditions.

Application of CEQA Significance Thresholds

REC-1) Would the Project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?

The proposed Project would not involve the use of existing neighborhood or regional parks, or other recreational facilities. During construction, and for a shorter period of time during decommissioning, there would be a temporary increase in population that may utilize existing neighborhood or regional parks or other recreational facilities in the Project vicinity. The temporary (duration of construction) use of LTVAs may result in physical deterioration of the facilities. However, the LTVAs are designed with minimal facilities given that campers must use self-contained RVs and there are no assigned or designated sites. In addition, as described in Section 4.2.13, *Population, Housing, Public Services, Utilities, Growth-Inducing Impacts, and Socioeconomics*, it is assumed that most construction workers would utilize seasonal and vacation home rentals, which have high vacancy rates within the local study. Therefore, impacts to recreational facilities would be less than significant. During operation, the number of employees would be minimal and any potential impact on recreational facilities would be negligible; no impact would occur.

REC-2) Would the Project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?

The proposed Project would result in negligible long-term increases in population. As a result, the Project would not require the construction or expansion of recreational facilities; no impact would occur.

REC-3) Would the Project be located within a Community Service Area[8] or recreation and park district with a Community Parks and Recreation Plan (Quimby fees)?

The proposed Project would not be within a Community Service Area and would not include recreational facilities. The Project would not add significantly to the local population necessitating the construction or expansion of recreational facilities, nor would it cause or accelerate physical deterioration of recreational facilities. No impact would occur.

Alternative 2: No Project Alternative

The No Project Alternative would result in no recreation-related or public access impacts because the Project would not be implemented; therefore, there would be no change to the existing use and no impacts would result.

Alternative 3: Northern Alternative 230 kV Gen-tie Line Location

Alternative 3 would result in the same requirements for temporary and permanent workforce, which would temporarily increase the utilization of recreational facilities in the Project vicinity, as well as require temporary rerouting of BLM open routes during construction. Therefore, Alternative 3 would have the same direct and indirect impacts on recreation and public access as Alternative 1.

[8] The Community Service Area described in Section 4.2.9, *Hydrology and Water Quality,* has a different definition than described in Section 4.2.14, *Recreation,* and is unrelated.

Application of CEQA Significance Thresholds

REC-1) Would Alternative 3 increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?

Alternative 3 would not involve the use of existing neighborhood or regional parks, or other recreational facilities. During construction, and for a shorter period of time during decommissioning, there would be a temporary increase in population that may utilize existing neighborhood or regional parks or other recreational facilities in the Project vicinity. LTVAs in particular may experience physical deterioration of the facilities. However, the LTVAs are designed with minimal facilities given that campers must use self-contained RVs and there are no assigned or designated sites. In addition, the use of these recreational facilities would be a temporary (duration of construction) impact. Furthermore, as described in Section 4.2.13, *Population, Housing, Public Services, Utilities, Growth-Inducing Impacts, and Socioeconomics,* vacancy rates within the local study area offer ample available housing to operational employees wishing to relocate to within the local study area. Therefore, impacts to recreational facilities would be less than significant. During operation, the number of employees would be minimal and any potential impact on recreational facilities would be negligible; no impact would occur.

REC-2) Would Alternative 3 include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?

Alternative 3 would result in negligible long-term increases in population. As a result, Alternative 3 would not require the construction or expansion of recreational facilities; no impact would occur.

REC-3) Would Alternative 3 be located within a Community Service Area or recreation and park district with a Community Parks and Recreation Plan (Quimby fees)?

Alternative 3 would not be within a Community Service Area and would not include recreational facilities. Alternative 3 would not add significantly to the local population necessitating the construction or expansion of recreational facilities, nor would it cause or accelerate physical deterioration of recreational facilities. No impact would occur.

Alternative 4: Southern Alternative 230 kV Gen-tie Line Location

Alternative 4 would result in the same requirements for temporary and permanent workforce, which would temporarily increase utilization of recreational facilities in the Project vicinity, as well as require temporary rerouting of BLM open routes during construction. Alternative 4 would have the same direct and indirect impacts on recreation and public access as Alternative 1.

Application of CEQA Significance Thresholds

REC-1) Would Alternative 4 increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?

Alternative 4 would not involve the use of existing neighborhood or regional parks, or other recreational facilities. During construction, and for a shorter period of time during decommissioning, there would be a temporary increase in population that may utilize existing neighborhood or regional parks or other recreational facilities in the Project vicinity. LTVAs in particular may experience physical deterioration of the facilities. However, the LTVAs are designed with minimal facilities given that campers must use self-contained RVs and there are no assigned or designated sites. In addition, the use of these recreational facilities would be a temporary (duration of construction) impact. Furthermore, as described in Section 4.2.13,

Population, Housing, Public Services, Utilities, Growth-Inducing Impacts, and Socioeconomics, vacancy rates within the local study area offer ample available housing to operational employees wishing to relocate to within the local study area. Therefore, impacts to recreational facilities would be less than significant. During operation, the number of employees would be minimal and any potential impact on recreational facilities would be negligible; no impact would occur.

REC-2) Would Alternative 4 include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?

Alternative 4 would result in negligible long-term increases in population. As a result, Alternative 4 would not require the construction or expansion of recreational facilities; no impact would occur.

REC-3) Would Alternative 4 be located within a Community Service Area or recreation and park district with a Community Parks and Recreation Plan (Quimby fees)?

Alternative 4 would not be within a Community Service Area and would not include recreational facilities. Alternative 4 would not add significantly to the local population necessitating the construction or expansion of recreational facilities, nor would it cause or accelerate physical deterioration of recreational facilities. No impact would occur.

Alternative 5: Reduced Acreage Alternative

Similar to Alternative 1, Alternative 5 would include the construction, operation, maintenance, and decommissioning of a solar facility and associated infrastructure. The primary difference between Alternatives 1 and 5 is the absence of solar facility development north of I-10, which would reduce electrical output from a 485 MW down to a 315 MW alternating current solar PV facility. The Reduced Acreage Alternative would be on a reduced footprint of approximately 2,476 acres (from 3,660 acres for the proposed Project). Alternative 5 would include approximately 2,403 acres for the solar field. Similar to the proposed Project, 73 acres would be utilized for the 230 kV gen-tie line. In comparison to Alternative 1, Alternative 5 would eliminate one on-site substation and one O&M building and would have one access point (planned on Seeley Avenue). The Reduced Acreage Alternative would also no longer extend a 230 kV overhead gen-tie line from an on-site substation north of I-10, as this Alternative would not be developed on land north of I-10. Instead, this Alternative would construct an approximately 7.8-mile-long, 230 kV overhead gen-tie line from the proposed on-site substation south of I-10 to the approved Colorado River Substation. Approximately three miles of the gen-tie line would be within the solar facility. Alternative 5 would avoid impacts that would result from the construction, operation, maintenance, and decommissioning of a solar development north of I-10; however, the land on which Alternative 1 is proposed would continue with existing uses. Alternative 5 would not result in recreation-related or public access impacts caused by developments north of I-10 because Alternative 5 would not be implemented in this area; therefore, there would be no change to the existing use and no impacts would result north of I-10.

The Reduced Acreage Alternative solar facility and a portion of the gen-tie line would be within the jurisdiction of the County of Riverside but not within the City limits of Blythe in comparison to the proposed Project. Alternative 5 would need to comply with the RCGP (2003) and PVVAP (2008). The remaining portion of the gen-tie line would traverse lands managed by the BLM and would need to comply with the CDCA Plan. The construction, operation and decommissioning of Alternative 5 would not exceed those recreation impacts identified under the Alternative 1 analysis. Therefore, the Alternative 1 analysis would be applicable to Alternative 5, outside of those differences identified in the discussion below.

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Analysis of Direct and Indirect Impacts

Construction and Decommissioning

The Alternative 1 analysis for direct and indirect construction and decommissioning impacts would apply to Alternative 5. Similar to Alternative 1, the Alternative 5 gen-tie line that would extend outside the solar facility site would traverse NECO Plan Designated Open Routes 0660703, 660863, and 660862 and require temporary rerouting of BLM open routes during construction, but would not be fenced in during operation and maintenance. As the anticipated construction labor force would be slightly reduced under Alternative 5, there would be no additional impacts to regional BLM recreational facilities outside of those previously described under Alternative 1; as such, it is anticipated that there are sufficient long-term camping facilities nearby that could support the Alternative 5 workforce.

Operation and Maintenance

Operation and maintenance of the solar facility site and gen-tie line would require seven full-time employees; therefore, it is anticipated that use of recreational facilities would be similar to the existing conditions.

Application of CEQA Significance Thresholds

REC-1) Would Alternative 5 increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?

The REC-1 analysis for Alternative 1 would apply to Alternative 5. As the anticipated construction labor force would be slightly reduced under Alternative 5, there would be no additional impacts to regional BLM recreational facilities outside of those previously described under Alternative 1; as such, it is anticipated that there are sufficient long-term camping facilities nearby that could support the Alternative 5 workforce. Furthermore, as described in Section 4.2.13, *Population, Housing, Public Services, Utilities, Growth-Inducing Impacts, and Socioeconomics*, vacancy rates within the local study area offer ample available housing to operational employees wishing to relocate to within the local study area. Therefore, impacts to recreational facilities would be less than significant. During operation, the number of employees would be minimal and any potential impact on recreational facilities would be negligible; no impact would occur.

REC-2) Would Alternative 5 include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?

Alternative 5 would result in negligible long-term increases in population. As a result, the Project would not require the construction or expansion of recreational facilities; no impact would occur.

REC-3) Would Alternative 5 be located within a Community Service Area or recreation and park district with a Community Parks and Recreation Plan (Quimby fees)?

Similar to Alternative 1, Alternative 5 would not be within a Community Service Area and would not include recreational facilities. Alternative 5 would not add significantly to the local population necessitating the construction or expansion of recreational facilities, nor would it cause or accelerate physical deterioration of recreational facilities. No impact would occur.

Cumulative Impacts

Geographic Scope

The geographic scope for recreational facilities includes other projects in the cumulative scenario, and in particular the other renewable energy projects listed in Table 4.1-1. These projects could result in similar demand for and use of long-term camping and other recreational facilities. In combination, the increased use of these resources due to the presence of authorized workers for the Project and cumulative projects could affect the social setting or the physical infrastructure of these sites.

Temporal Scope

The Project's authorized workers could use long-term camping facilities and their associated recreational amenities, primarily during construction and decommissioning activities.

Analysis of Direct and Indirect Impacts

Alternative 1 (Proposed Project)

Construction and Decommissioning

Construction of the present and reasonably foreseeable future projects may overlap with construction of the BMSP. Construction of the Devers-Palo Verde No. 2 transmission line, including the new SCE Colorado River Substation, is expected to be complete and in service by the third quarter of 2013, prior to anticipated commencement of Project construction in the fourth quarter of 2013. Construction of the BSPP, McCoy Solar Project, Palen Solar Power Project, Genesis Solar Energy Project, and Desert Sunlight Solar Farm may contribute to cumulative recreation impacts.

During construction and decommissioning activities, the cumulative project mentioned above and the proposed Project would temporarily increase the population that may utilize existing neighborhood or regional parks or other recreational facilities in the Project vicinity. Additionally, increased demand for other types of recreation resources and the displacement of dispersed recreation from the other projects' development footprints could reduce the availability of short-term recreational uses for other visitors to the area. However, the effects related to displacing dispersed recreation would be minor due to the low observed recreation on the Project area and at other projects' locations (impacts REC-1 through REC-3).

As discussed in Section 4.2.13, *Population, Housing, Public Services, Utilities, and Socioeconomics*, the communities closest to the proposed solar facility had very high residential vacancy rates in 2010. RV parks and campsites also are available as temporary housing. Available housing supply in the study area far exceeds conservative estimates of cumulative demand. It is anticipated that only a portion of the construction workforce from all cumulative projects mentioned above would utilize LTVA; therefore, impacts to LTVAs would be less than significant. It is anticipated that cumulative impacts from decommissioning would be similar to construction.

Operation and Maintenance

Operational labor needs of the reasonably foreseeable future projects and the Project are substantially smaller than construction labor needs and would not contribute to a cumulatively significant increase in demand for housing that exceeds available supply.

Alternative 2: No Project Alternative

Under the No Project Alternative, gen-tie facilities would not be constructed on BLM-managed lands and solar facilities would not be constructed on private lands. The public lands on the Project area would continue to be managed by BLM in accordance with existing land use designations in the CDCA Plan,

whereas the private lands would continue to be managed for agricultural production. Alternative 2 would not contribute to cumulative recreational impacts.

Alternative 3: Northern Alternative 230 kV Gen-tie Line Location

Construction and Decommissioning

Alternative 3 is similar to Alternative 1 (proposed Project), with the exception of the location of the Northern 230 kV gen-tie line, which would be approximately 700 feet north of Alternative 1's proposed 230 kV gen-tie line. The cumulative impacts associated with the construction, operation, maintenance, and decommissioning of the solar facility would be the same as Alternative 1.

During construction and decommissioning activities, the cumulative project mentioned above and the Alternative 3 would temporarily increase the population that may utilize existing neighborhood or regional parks or other recreational facilities in the Project vicinity. Additionally, increased demand for other types of recreation resources and the displacement of dispersed recreation from the other projects' development footprints could reduce the availability of short-term recreational uses for other visitors to the area. However, the effects related to displacing dispersed recreation would be minor due to the low observed recreation on the Project area and at other projects' locations (impacts REC-1 through REC-3).

As discussed in Section 4.2.13, *Population, Housing, Public Services, Utilities, and Socioeconomics*, the communities closest to the proposed solar facility had very high residential vacancy rates in 2010. It is anticipated that only a portion of the construction workforce from all cumulative projects mentioned above would utilize LTVA; therefore, impacts to LTVAs would be less than significant. The anticipated incremental effects of the construction of Alternative 3, when considered together with other past, present, and reasonably foreseeable future projects, would result in less than significant cumulative impacts to recreation. It is anticipated that cumulative impacts from decommissioning would be similar to construction.

Operation and Maintenance

Operational labor needs of the reasonably foreseeable future projects and Alternative 3 are substantially smaller than construction labor needs and would not contribute to a cumulatively significant increase in demand for housing that exceeds available supply or population. Therefore, impacts to recreation would be less than significant.

Alternative 4: Southern Alternative 230 kV Gen-tie Line Location

Construction and Decommissioning

Alternative 4 is similar to Alternative 1 (proposed Project), with the exception of the location of the Southern 230 kV gen-tie line, which would be approximately 0.8 mile south of Alternative 1's proposed 230 kV gen-tie line. The cumulative impacts associated with the construction, operation, maintenance, and decommissioning of the solar facility would be the same as Alternative 1.

During construction and decommissioning activities, the cumulative project mentioned above and Alternative 4 would temporarily increase the population that may utilize existing neighborhood or regional parks or other recreational facilities in the Project vicinity. Additionally, increased demand for other types of recreation resources and the displacement of dispersed recreation from the other projects' development footprints could reduce the availability of short-term recreational uses for other visitors to the area. However, the effects related to displacing dispersed recreation would be minor due to the low observed recreation on the Project area and at other projects' locations (impacts REC-1 through REC-3).

The communities closest to the proposed solar facility had very high residential vacancy rates in 2010. It is anticipated that only a portion of the construction workforce from all cumulative projects mentioned above would utilize LTVA; therefore, impacts to LTVAs would be less than significant. It is anticipated that cumulative impacts from decommissioning would be similar to construction.

The anticipated incremental effects of the construction of Alternative 4, when considered together with other past, present, and reasonably foreseeable future projects, would result in less than significant cumulative impacts to recreation. It is anticipated that cumulative impacts from decommissioning would be similar to construction.

Operation and Maintenance

Operational labor needs of the reasonably foreseeable future projects and Alternative 4 are substantially smaller than construction labor needs and would not contribute to a cumulatively significant increase in demand for housing that exceeds available supply.

Alternative 5: Reduced Acreage Alternative

Construction and Decommissioning

The cumulative recreation analysis for Alternative 1 would apply to Alternative 5. In comparison to Alternative 1, Alternative 5 would have peak monthly labor needs of 400 workers. The effects related to displacing dispersed recreation would be minor due to the low observed recreation on the Alternative 5 site and at other projects' locations, and the fact that the Project area is private property not available to public recreational uses. Available housing supply in the study area far exceeds conservative estimates of cumulative demand. There is an ample supply of housing units to accommodate temporary construction workers drawn from outside the study area. Therefore, it is anticipated that only a portion of the construction workforce from all cumulative projects mentioned above would utilize LTVA. Impacts to LTVAs would be less than significant. It is anticipated that cumulative impacts from decommissioning would be similar to construction.

Operation and Maintenance

Operational labor needs of the reasonably foreseeable future projects and Alternative 5 are substantially smaller than construction labor needs and would not contribute to a cumulatively significant increase in demand for housing that exceeds available supply.

Mitigation Measures

No mitigation measures are recommended.

Residual Impacts

No BMPs or mitigation measures are recommended. Impacts to Recreation would be less than significant.

NEPA Conclusions

The No Project Alternative would not have impacts, as the existing circumstances and operations would continue essentially unchanged. The Project and each of the action Alternatives would involve only temporary impacts in terms of workers using recreational facilities during the three-year construction term and one-year decommissioning phase. Construction of the Project and Alternatives would include the use of LTVAs and may cause deterioration; however, they are designed with minimal facilities given that campers must use self-contained RVs and there are no assigned or designated sites. With minimal employees needed during the operational periods, impacts during operation would be negligible. The impacts, and contribution toward cumulative impacts, would be as described above (i.e., less than significant). The recreational uses would be subject to all laws, regulations, and policies covering desert recreation. Construction of utility-scale solar plants is anticipated in the CDCA Plan, and would also be consistent with the NECO Plan.

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4.2.15 Traffic and Transportation

This section describes conditions related to transportation and traffic and potential traffic impacts that would result from the construction, operation, maintenance, and decommissioning of the Project and Alternatives, as well as mitigation measures that would reduce or avoid adverse transportation and traffic effects. The analysis is based on the *Traffic Impact Study Report for the Blythe Mesa Solar Project* (KOA Corporation 2013) found in Appendix J.

Methodology for Analysis

The primary traffic and transportation impacts from the proposed Project and Alternatives are expected to occur during the short-term construction phase, as this phase would generate the greatest number of vehicle trips to the road network. Workers are expected to commute to work over local roads and I-10. Deliveries to and from the solar energy facilities are expected to be by truck; there are no intermodal facilities close to the Project area that would allow transport of materials by rail. This analysis focuses on potential impacts related to the construction, operation, maintenance, and decommissioning of the Project on the surrounding transportation systems and roadways. Impacts to local transportation systems were evaluated based on the level of service (LOS) determinations.

This assessment of transportation-related impacts is based on evaluations and technical analyses designed to compare the conditions without the Project and construction of the Project and Alternatives, as well as cumulative effects. Operation of the proposed Project would require 12 permanent full-time employees, which would not a substantial or considerable number of trips above those already generated by the exiting agricultural operations on the Project area. However, the construction phase of the Project would include trips generated by construction workers and supplies delivered by trucks to the Project area. Decommissioning activities are anticipated to be similar to construction, but less intense.

Project Construction Trip Generation Forecast

The Project is expected to generate a maximum of 20 truck deliveries per day for the 24-month peak construction period. Transport truck deliveries would include material deliveries and equipment. The calculations below account for heavier vehicle types (trucks) by converting truck trips to passenger car equivalents (PCEs), which are used in roadway capacity analysis to convert a mixed vehicle flow into an equivalent passenger car flow. This calculation is relevant to capacity and LOS determination, lane requirements, and determination of the effect of traffic on roadway operations.

In addition, the Project would employ a construction workforce of approximately 300 to 500 workers. Construction of the Project would take approximately 36 months, with peak construction occurring over a 24-month period. The Project would require an average construction workforce of 40 workers at the beginning of construction and a peak of 500 workers during the 24-month peak construction period of the solar array, substations, O&M buildings, and the 230 kV gen-tie line and fiber optic cable, with a tapering of fewer employees thereafter.

This Draft EIR/EA analysis considers that possibility that workers could travel about one hour in each direction to the Project area. It is likely that most of the construction workforce would be derived from communities located within Riverside County, which has the largest concentration of construction workers in proximity to the Project area. The majority of the projected construction workforce would likely seek housing closer to the Project area (within an hour driving distance) or seek temporary housing (such as seasonal, recreational, or occasional use housing; long-term visitor areas; and hotel and motels) during the week and commute home over the weekend. Therefore, based on the origin-location of construction workers commuting to and from the Project area, it is anticipated that 30 percent of the workers would originate from the west and 70 percent from the east. Although construction work hours would occur from 7:00 a.m. to 6:00 p.m., construction workers would commute to and from the Project area outside of the typical peak commute periods (7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m.). This analysis conservatively assumes all construction workers would commute during the aforementioned peak traffic periods.

Heavy equipment would be delivered via trucks, using Neighbours Boulevard from I-10 to the north and Riverside Drive and Seeley Avenue from the south. Based on the configuration of Project components within the solar facility site, it is anticipated that 60 percent of the traffic would use the Seeley Avenue access point and 40 percent of the traffic would use the Riverside Drive access point.

The Project would generate a total of 1,164 trips daily, including 429 trips during the a.m. peak hour and 429 trips during the p.m. peak hour. Table 4.2.14-1 lists the daily inbound and outbound trips that would result from peak construction during the a.m. and p.m. peak hours.

Table 4.2.14-1 Daily and Peak-Hour Trips During Peak Construction

	DAILY PCE	AM PEAK HOUR	PM PEAK HOUR
Employee Trips	884	400 inbound	400 outbound
Truck Trips	103	6 inbound	6 inbound
		5 outbound	5 outbound
Ancillary Trips	177	9 inbound	9 inbound
		9 outbound	9 outbound
Net Project Trips (PCEs)	**1,164**	**429 PCE**	**429 PCE**

Source: KOA 2013.
Note: peak hours do not coincide with the departure time of employees but, to be conservative, were included in the analysis

The identification of probable routes that would be utilized by the Project's construction traffic considered the originating location of the construction workforce, proposed land use, and surrounding regional access routes. The Project's regional construction traffic distribution on I-10 approaching Neighbours Boulevard is anticipated to include 70 percent approaching from the west and 30 percent approaching from the east. The Project's local traffic distribution would be approximately 60 percent of the construction traffic using the Seeley Avenue access point and 40 percent using the Riverside Avenue access point. As part of the proposed Project, the primary access routes (Seeley Avenue and Riverside Drive) would be improved for emergency vehicle access.

2015 Conditions

The Project's construction phase would produce the highest amount of traffic; the Project's operational traffic would be similar to existing conditions. Construction is anticipated to occur between 2013 and 2016, with the highest-intensity period occurring in 2014 and 2015. To ensure a conservative analysis that captures the Project's most intense traffic phase, and to ensure that the analysis does not understate the amount of traffic that would already be using the roadways at the time of that most intense phase, the year 2015 was selected as the traffic analysis year for purposes of measuring Project impacts.

In order to acknowledge regional traffic growth for the 2015 conditions, an ambient/background traffic growth rate was applied to the existing 2011 traffic volumes. Please refer to Chapter 3, Section 3.2.14, *Traffic and Transportation*, for a discussion regarding the existing (2011) traffic volumes. The ambient growth in the Project area is anticipated to increase at a rate of about two percent per year (see the County of Riverside's Scoping Agreement for the *Traffic Impact Study* found in Appendix J). Assuming a completion date within four years, these traffic counts were adjusted upward by eight percent to reflect area-wide growth expected to occur by 2015. Accordingly, the without-Project traffic referenced in the tables below includes the traffic measured in traffic counts, traffic generated by projects that are projected to be completed by 2015, and projects projected to be in construction by 2015. Traffic volumes may fluctuate from minute to minute within the peak periods. Therefore, a peak hour factor was added to the hourly traffic volumes and ambient growth, which simulates the higher 15-minute peak period volume for the entire peak period. The existing peak hour factor (ranging from 0.0 to 1.0) was obtained from existing traffic count information and applied to all intersections for the existing and 2015 Conditions.

CEQA Significance Criteria

The criteria used to determine the significance of the Project-related traffic and transportation impacts are based on the criteria identified in the CEQA Guidelines, Appendix G. Project-related impacts would be considered significant if they would:

TRA-1) Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit.

TRA-2) Exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways; conflict with an applicable congestion management program, including, but not limited to, level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways.

TRA-3) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks; result in a change in air traffic levels or a change in location and result in substantial safety risks.

TRA-4) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment).

TRA-5) Result in inadequate emergency access.

TRA-6) Conflict with adopted policies, plans, or programs regarding public transit, bicycle or pedestrian facilities, or otherwise decrease the performance or safety of such facilities.

The following additional significance criteria from the County of Riverside Environmental Assessment form are used in the analysis. A project could have potentially significant impacts if it would:

TRA-7) Alter waterborne, rail or air traffic.

TRA-8) Cause an effect, or a need for new or altered maintenance of roads.

TRA-9) Cause an effect upon circulation during the project's construction.

TRA-10) Affect bike trails.

Level of Service Criteria

In addition to the CEQA Thresholds, an intersection LOS analysis was conducted to assess operational performance of the traffic study area (defined in Chapter 3, Section 3.2.14, *Transportation and Traffic*) during construction. For LOS, the applicable significance thresholds were based on Caltrans requirements, Riverside County Transportation Commission's (RCTC) 2011 Congestion Management Program (CMP), County of Riverside requirements, and City of Blythe requirements.

Caltrans has identified a target LOS at the transition between LOS C and LOS D on State highway facilities; however, Caltrans acknowledges that this may not always be feasible and recommends that the lead agency consult with Caltrans to determine the appropriate target LOS.

Riverside County's CMP specifies that all CMP roadways operate at an LOS threshold of E. Within the traffic study area, which includes four intersections (described in Chapter 3, Section 3.2.14, *Traffic and Transportation*), Neighbours Boulevard (State Route 78) has been identified as a key element of the CMP system. Based on the CMP, a significant traffic impact occurs: (1) when existing pre-Project LOS A, B, C, and D become LOS E or F with the Project; or (2) when the existing pre-Project LOS E becomes LOS F with the Project.

The Riverside County Circulation Element Policy C2.1 states that the County must maintain a target LOS C along County-maintained roads and conventional state highways. Therefore, a significant local impact to the County would occur if the pre-Project (base) LOS A, B, or C roadway became LOS D, E, or F. LOS E may be allowed in designated community centers to the extent that it would support transit-oriented development and walkable communities.

The City of Blythe strives to maintain LOS B on residential streets and LOS C or better on arterial and collector streets, at all intersections, and on principal arterials in the CMP during peak hours.

NEPA Requirements

The NEPA evaluation herein provides an analysis of potential direct and indirect effects on traffic and transportation provided within the same context of the CEQA significance criteria described above.

Applicable Best Management Practices

As part of the Project and Alternatives, the following applicable BMPs would minimize the environmental impacts to traffic and transportation. The full BMPs have been detailed below (see also Table 2-4 in Chapter 2) and are further referenced (by number) within the impact discussion.

NUMBER	BMP DESCRIPTION
BMP-4	**Fire Management and Protection Plan.** As required by existing law (Title 8 California Code of Regulations [CCR] Section 3221), a Fire Management and Protection Plan would be developed in consultation with the Riverside County Fire Department to identify potential hazards and accident scenarios that would exist at the facility during construction, operation, maintenance, and decommissioning of the Project. The Plan would include the identification of the following: potential fire hazards and ignition sources; proper handling and storage of potential fire hazards; control of potential ignition sources; persons responsible for equipment and systems maintenance; location of portable fire extinguishers; automatic sprinkler fire suppression system; water-spray fire system; coordination with local fire department; and recordkeeping requirements.
BMP-5	**Emergency Action Plan.** As required by Title 8 CCR Section 3220, the Project would develop a site-specific operations phase Emergency Action Plan. The operations Emergency Action Plan would address potential emergency situations requiring emergency response and/or planned evacuation. The plan would describe accident scenarios, evacuation routes, alarm systems, points of contact, assembly areas, responsibilities, and other actions to be taken in the event of an emergency. In particular, the plan would describe arrangements with local emergency response agencies.
BMP-14	**Travel and traffic.** Vehicular traffic on-site shall be confined to existing or designated travel routes and designated work areas. Access to the construction site and staging areas shall be limited to authorized vehicles and only through the designated roads. The extent of habitat disturbance during construction shall be reduced by keeping vehicles on access roads and minimizing foot and vehicle traffic through undisturbed areas. To the extent practical, travel shall be limited to stabilized roads. Road maintenance activities shall avoid blading existing forbs and grasses in ditches and adjacent to roads. Abandoned roads and roads no longer needed shall be subsoiled to increase infiltration and reduce soil compaction, then recontoured and revegetated. Construction traffic shall avoid unpaved surfaces to the extent practical (to reduce the risk of compaction) and reduce speed to lessen fugitive dust emissions. On unpaved or unstabilized surfaces within the construction site, speed limits (e.g., 20 mph) shall be posted with visible signs and enforced to minimize airborne fugitive dust. Project vehicle speeds shall be limited in areas occupied by special-status animal species. Traffic shall stop to allow wildlife to cross roads. Shuttle vans or carpooling shall be used to reduce the amount of traffic on access roads. Workers shall be trained to comply with the speed limit, use good engineering practices, minimize the drop height of materials, and minimize the number and extent of disturbed areas. The Project developer shall enforce these requirements.

NUMBER	BMP DESCRIPTION
BMP-15	**New access roads and parking lots.** New access roads shall be designed and constructed to the appropriate road design standards, such as those described in BLM Manual 9113 or County standards, whichever is applicable. New access roads shall be designed to follow natural land contours in the Project area and avoid existing desert washes. The specifications and codes developed by the U.S. Department of Transportation (DOT) and County of Riverside Transportation Department are also to be taken into account. Primary access roads and parking lots shall be surfaced with aggregate that is hard enough that vehicles cannot crush it and thus cause dust or compacted soil conditions. Paving may also be used on access roads and parking lots. Alternatively, chemical dust suppressants or durable polymeric soil stabilizers would be used on these locations.

Alternative 1: Proposed Project

Direct and Indirect Effects

Construction

The primary transportation impacts anticipated from the proposed Project would occur from commuting worker traffic along I-10, a regional traffic corridor, and local roads within the Project vicinity. I-10 is a four-lane highway in the vicinity of the proposed Project with a capacity of 8,000 vehicles per hour (Caltrans 2012). I-10 currently operates at LOS C east and west of Neighbours Blvd, also referred to as State Route 78 (BrightSource 2011). In 2015, with and without Project construction, it is anticipated that the same segment of I-10 would operate at LOS C (BrightSource 2011).

The traffic study area includes four intersections that were identified as having the potential for impacts to occur from the construction, operation, maintenance, and decommissioning of the proposed Project. Table 4.2.14-2 documents the 2015 Conditions and anticipated delays and LOS at each of the intersections with and without Project construction. All four intersections during the 2015 without Project scenario during the a.m. and p.m. peak hours would operate at LOS A. With the exception of Intersection 1 (Riverside Drive and Neighbours Boulevard), during the 2015 Conditions with Project construction all intersections would operate at LOS B during the a.m. and p.m. peak hours. LOS B represents reasonably free-flow operation where the ability to maneuver within the traffic stream is slightly restricted but still an acceptable condition. Intersection 1 (Riverside Drive and Neighbours Boulevard) during the a.m. peak hour would operate at LOS C, which represents a traffic flow near or at free-flow speed where the ability to maneuver through lanes is noticeably restricted and lane changes require more driver awareness; during the p.m. peak hour it would operate at LOS B. The County of Riverside has identified LOS C as acceptable along County-maintained roads and conventional state highways. The City of Blythe strives to maintain LOS B on residential streets and LOS C or better on arterial and collector streets, at all intersections, and on principal arterials in the CMP during peak hours. Therefore, all four intersections within the study area would operate at an acceptable LOS without or with the Project.

Construction of the proposed Project would generate additional traffic on regional and local roadways. Construction worker commute trips and equipment and materials deliveries would increase existing traffic volumes in the Project area.

As described above, Riverside County Circulation Element Policy C2.1 states that the County must maintain a Countywide Target LOS C along County-maintained roads and conventional state highways, except that:

- LOS D may be allowed in Community Development area, only at intersections of any combination of Secondary Highways, Major Highways, Arterials, Urban Arterials, Expressways, conventional state highways or freeway ramp intersections.
- LOS E may be allowed in designated community centers to the extent that it would support transit-oriented development and walkable communities.

As such, impacts to roadways would occur when the addition of Project traffic causes roadway operations to degrade from an acceptable level (LOS C or better) to an unacceptable level (LOS D or worse). Intersections under joint jurisdiction with Caltrans may operate at an LOS of E.

As shown below in Table 4.2.14-2, the addition of Project construction-related traffic to the regional roadway network is expected to increase the delay at all intersections by 1.1 to 7.4 seconds and the LOS of these intersections would remain within the County target of LOS C or better. Drivers along these roadways would not be expected to experience substantial noticeable delays with the addition of Project-related construction traffic.

Table 4.2.14-2 2015 Conditions

INTERSECTION	WITHOUT PROJECT CONSTRUCTION		WITH PROJECT CONSTRUCTION		DELAY (SECONDS)	SIGNIFICANT UNDER CEQA
	Delay (seconds)	LOS	Delay (seconds)	LOS		
AM Peak Hour						
1. Riverside Dr & Neighbours Blvd*	9.0	A	16.4	C	7.4	No
2. I-10 WB Ramp & Neighbours Blvd*	9.0	A	11.1	B	2.1	No
3. I-10 EB Ramp & Neighbours Blvd*	9.2	A	11.2	B	2.0	No
4. Seeley Ave & Neighbours Blvd*	9.5	A	10.6	B	1.1	No
PM Peak Hour						
1. Riverside Dr & Neighbours Blvd*	8.6	A	10.2	B	1.6	No
2. I-10 WB Ramp & Neighbours Blvd*	9.5	A	12.5	B	3.0	No
3. I-10 EB Ramp & Neighbours Blvd*	9.6	A	13.8	B	4.2	No
4. Seeley Ave & Neighbours Blvd*	9.9	A	12.9	B	3.0	No

Source: KOA 2013.
Note: *Unsignalized Intersection; WB – westbound; EB – eastbound.

Project-generated traffic, especially heavy truck traffic, would accelerate the rate of deterioration of public roads traveled. The contribution of the proposed Project to road deterioration would be negligible on I-10 because Project-generated traffic would be a small portion of total traffic. However, effects on local roads could be more pronounced. Effects would be reduced with implementation of Mitigation Measure Traffic-2, which would require the Project owner to restore roads to pre-construction conditions. Levels of congestion (delay) at on- and off-ramps along I-10 could be adversely affected due to the temporary influx of construction-related traffic; however, even a worst-case scenario would not likely exceed the capacity of I-10, which in this area has two lanes in both directions to accommodate the anticipated increase in traffic while maintaining adequate traffic flow along the freeway.

Pedestrian and Bicycles

As described in Chapter 3, Section 3.2.14, *Traffic and Transportation,* pedestrian facilities and bicycle lanes do not exist throughout the proposed Project study area. The existing pedestrian network does not provide sidewalks connecting adjoining land uses along Neighbours Boulevard, Riverside Drive, and Seeley Avenue.

Transit and Rail

The Palo Verde Valley Transit Agency (PVVTA) operates Routes 3, 4, and 5 along Neighbours Boulevard north and south of I-10. Routes 3, 4, and 5 travel along Hobson Way, which passes through the Project location and heads west towards Mesa Verde. There is a stop adjacent to the Project at the intersection of Hobson Way and Buck Boulevard. Routes 3 and 5 run along Neighbours Boulevard towards Ripley, with stops on the corner of Hobson Way and 14th Avenue along Neighbours Boulevard. The Project would

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not directly affect the ability of the PVVTA to use any of their existing routes or stops since road closures and detours are not anticipated for this Project.

The Arizona and California Railroad is approximately five miles from the Project area; however, it does not service the Blythe area. Therefore, construction of the Project would not impact rail service.

Airport Service

Blythe Airport is a public airport, approximately 0.5 mile west of the proposed Project that serves Riverside County. The Blythe Airport does not have regularly scheduled passenger service, and delivery of construction materials is expected to occur by truck; therefore, construction of the Project would not result in an increase in airport service. Additionally, the Project would not utilize equipment that would create obstructions or impact operations at the Blythe Airport. For potential impacts to Blythe Airport operations regarding reflection and glare and hazards, please refer to Section 4.2.1, *Aesthetics*, and Section 4.2.8, *Hazards and Hazardous Materials*.

Parking

Construction workers would park personal vehicles on-site, where adequate parking space would be provided. The anticipated construction activities would not eliminate any existing parking spaces and result in parking deficiencies. Heavy equipment would be parked and maintained at construction sites, and all utility trucks would park in the construction yards. There would be sufficient parking for all employees, visitors, service vehicles, and contractors on-site during the construction, operation and maintenance, and decommissioning of the Project.

School

Construction truck traffic may have some effect on school children in the area (children being picked up or dropped off on local roads near the proposed Project area). Students utilizing the I-10, Neighbours Boulevard, and Hobson Way may experience delays. However, construction hours would be 7:00 a.m. to 6:00 p.m., and workers are projected to commute generally before and after normal school hours.

Emergency Access

The Project would not require any road closures or result in impacts to emergency vehicles; however, Seeley Avenue and Riverside Drive would be improved for emergency vehicle access. Construction traffic would be confined to designated travel routes (BMP-14). Interior access roads within the solar facility site would be constructed to allow sufficient access for fire trucks and emergency responders (BMP-15). A Fire Management and Protection Plan (BMP-4) and Emergency Action Plan (BMP-5) would be prepared in cooperation with the Riverside County Fire Department and emergency responders. Access gates and internal access roads within the solar facility site would be identified. Therefore, impacts to emergency vehicles would be minimized.

With the addition of Project construction traffic, all intersections and roadways segments analyzed would operate at acceptable service levels (LOS C or better). Therefore, construction traffic would not result in adverse effects to access to the proposed Project area (including movement of emergency vehicles) or nearby land uses.

Conflict with Applicable Congestion Management Program or other Plans and Policies

The Regional Transportation Plan (RTP) is a multi-modal, long-range planning document prepared by the Southern California Association of Governments (SCAG), in coordination with federal, State, and other regional, subregional, and local agencies in Southern California. The RTP includes programs and policies for congestion management, transit, bicycles and pedestrians, roadways, freight, and finances. The Riverside County CMP was established to more directly link land use, transportation, and air quality and to prompt reasonable growth management programs that would more effectively utilize new and existing transportation funds, alleviate traffic congestion and related impacts, and improve air quality. The

proposed Project involves construction of a renewable energy generation facility that would not involve construction of new transportation facilities or substantial alteration of existing transportation facilities. There are no pedestrian or public transit facilities in the vicinity of the proposed Project. As discussed above, Project construction traffic would not reduce the LOS of area facilities below LOS C. Therefore, the Project would not conflict with the applicable RTP or CMP.

Operation

Operation of the Project would require 12 permanent full-time employees, which would not generate a significant number of trips above existing agricultural operations on the Project area. Impacts to the existing transportation network are not anticipated.

The Project would be approximately 0.5 mile from the Blythe Airport and may create potential glare impacts and obstructions from the 230 kV gen-tie line to the Blythe Airport. Although solar panels are designed to absorb the sunlight, the panels have the potential to cause glare/reflection impacts to the Blythe Airport. Please refer to Section 4.2.1, *Aesthetics, Visual Resources, and Reflection*, for a discussion regarding glare impacts to the Blythe Airport operations. For a discussion regarding potential hazards and obstructions that would result from the operation of the 230 kV gen-tie line, please refer to Section 4.2.8, *Hazards and Hazardous Materials*.

Decommissioning

At the end of the Project's useful life, it would require decommissioning. Decommissioning activities would include removal of the solar facility and dismantling of the 230 kV gen-tie. These activities would require similar types of equipment and a workforce that is similar to construction, but would be less than that of peak construction. It is anticipated that traffic and transportation impacts from decommissioning activities would be similar but less intense to that of construction.

Application of CEQA Significance Thresholds

TRA-1) Would the Project conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?

The proposed Project would not conflict with the Riverside County CMP, Regional Comprehensive Plan and RTP, County of Riverside General Plan, and City of Blythe General Plan in regards to applicable plans, ordinances, or policies establishing measures of effectiveness for the performance of the circulation system. With construction of the proposed Project, I-10 would operate at LOS C and all study intersections would operate at LOS B or C, which does not exceed the thresholds established in the aforementioned plans. Implementation of BMPs -4, -5, -14, and -15 would minimize impacts to transportation and traffic. Implementation of Mitigation Measures Traffic-1 through Traffic-3 would reduce impacts to less than significant. The operational Project impacts are expected to be nominal. Project construction and decommissioning would not have long-term significant traffic impacts on the transportation network, since construction- and decommissioning-related impacts are considered temporary.

TRA-2) Would the Project exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways; conflict with an applicable congestion management program, including, but not limited to, level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways?

The RCTC's adopted minimum LOS threshold is LOS E. Therefore, when a CMP street or highway segment falls to LOS F, a deficiency plan must be required. Construction of the

proposed Project would reduce the existing LOS A to LOS B or C for the four study intersections. Therefore, the Project would not conflict with an applicable congestion management program including, but not limited to, LOS standards and travel demand measures or other standards established by the county congestion management agency for designated roads or highways. Operational Project impacts to traffic would be nominal. Impacts would be less than significant.

TRA-3) Would the Project result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks; result in a change in air traffic levels or a change in location and result in substantial safety risks?

The Project would not result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks. Construction equipment that would be utilized for the Project would not obstruct the navigable air space. No impacts would occur.

TRA-4) Would the Project substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?

The Project would not result in substantially increased hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment). Refer to Section 4.2.1, *Aesthetics, Visual Resources, and Reflection*, for a discussion regarding potential glare impacts related to the solar panels. For impacts related to potential hazards and obstructions to Blythe Airport operations that would result from the operation of the 230 kV gen-tie line, refer to Section 4.2.8, *Hazards and Hazardous Materials*. The Project would not result in incompatible uses with adjacent or nearby agricultural operations (refer to Section 4.2.2, *Agriculture*). Impacts would be less than significant.

TRA-5) Would the Project result in inadequate emergency access?

The Project would not result in inadequate emergency access. No road closures are anticipated for the Project; however, Seeley Avenue and Riverside Drive would be improved for emergency vehicle access. Construction traffic would be confined to designated travel routes (BMP-14). Interior access roads within the solar facility site would be constructed to allow sufficient access for fire trucks and emergency responders (BMP-15). A Fire Management and Protection Plan (BMP-4) and Emergency Action Plan (BMP-5) would be prepared in cooperation with the Riverside County Fire Department and emergency responders. Access gates and internal access roads within the solar facility site would be identified. Implementation of BMPs would minimize impacts to emergency access. Accordingly, impacts to emergency access would be less than significant.

TRA-6) Conflict with adopted policies, plans, or programs regarding public transit, bicycle or pedestrian facilities, or otherwise decrease the performance or safety of such facilities?

The Project would not conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities. The Project area does not contain bicycle or pedestrian facilities. Because it is in an area surrounding by agricultural uses, proposed and approved solar power plants, and the airport, which lie miles apart, bicycles and walking are not a major means of transportation and substantial bicycle or pedestrian use is not projected in the future. Accordingly, the Project would not interfere with bicycle or pedestrian safety. As shown in Table 4.2.14-2, construction traffic would increase delays at the four intersections (approximately 16.4 seconds at Intersection 1; 11.1 seconds at Intersection 2; and 11.2 seconds at Intersection 3). The PVVTA operates Routes 3, 4, and 5 along Neighbours Boulevard north and south of I-10and it is anticipated that buses would experience the delays mentioned above. Therefore, impacts to public transit would be less than significant.

TRA-7) Would the Project alter waterborne, rail or air traffic?

The Project would not alter waterborne, rail, or air traffic. The Project would not utilize waterborne, rail, or air services to transport materials or the workforce; therefore, no impacts to waterborne, rail or air traffic would occur.

TRA-8) Would the Project cause an effect, or a need for new or altered maintenance of roads?

The Project would improve Seeley Avenue and Riverside Drive; however, these roads are currently maintained by the County of Riverside and would not cause an effect or need for new or altered maintenance of roads. The construction and operation of the gen-tie line would utilize the existing transmission line access roads and maintenance of roads would be similar to existing conditions. No impacts would occur.

TRA-9) Would the Project cause an effect upon circulation during the project's construction?

The Project would adversely affect circulation during the Project's construction; however, such effects would be less than significant.

TRA-10) Would the Project affect bike trails?

The Project would not adversely affect bike trails.

Alternative 2: No Project Alternative

Under the No Project Alternative, gen-tie facilities would not be constructed on BLM-managed lands and solar facilities would not be constructed on private lands. The public lands in the Project area would continue to be managed by BLM in accordance with existing land use designations in the CDCA Plan, whereas the private lands would continue to be managed for agricultural production. Alternative 2 would not contribute to traffic and transportation impacts.

Alternative 3: Northern Alternative 230 kV Gen-tie Line Location

Alternative 3 would be similar to Alternative 1, with the exception of the location of the proposed 230 kV gen-tie line. Alternative 3 would shift the gen-tie line to the north relative to the proposed Project's gen-tie line. Although the Alternative 3 gen-tie line would be slightly longer than the proposed Project's gen-tie line, activities associated with construction, operation, maintenance, and decommissioning of this Alternative would have the same impacts as Alternative 1.

Application of CEQA Significance Thresholds

TRA-1) Would Alternative 3 conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?

Alternative 3 would not conflict with the Riverside County CMP, Regional Comprehensive Plan and RTP, County of Riverside General Plan, and City of Blythe General Plan in regards to applicable plans, ordinances, or policies establishing measures of effectiveness for the performance of the circulation system. With construction of Alternative 3, I-10 would operate at LOS C and all study intersections would operate at an LOS B or C, which does not exceed the thresholds established in the aforementioned plans. The operational Alternative 3 impacts are expected to be nominal. Alternative 3 construction and decommissioning would not have long-term significant traffic impacts on the transportation network, since construction- and decommissioning-related impacts are considered temporary. Implementation of BMPs would minimize impacts to traffic and transportation. With implementation of Mitigation Measures

Traffic-1 through Traffic-3, impacts to the circulation system and potential conflicts with applicable plans, ordinances, and policies would be less than significant.

TRA-2) Would Alternative 3 exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways; conflict with an applicable congestion management program, including, but not limited to, level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways?

For the four study intersections, construction of Alternative 3 would reduce the existing LOS A to LOS B or C, but would not exceed the RCTC's adopted threshold of LOS E. Therefore, Alternative 3 would not conflict with an applicable congestion management program including, but not limited to, LOS standards and travel demand measures or other standards established by the county congestion management agency for designated roads or highways. Operational Alternative 3 impacts to traffic would be nominal. Impacts would be less than significant.

TRA-3) Would Alternative 3 result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks; result in a change in air traffic levels or a change in location and result in substantial safety risks?

Alternative 3 would not result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks. Construction equipment that would be utilized for the Project would not obstruct the navigable air space. No impacts would occur.

TRA-4) Would Alternative 3 substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?

Alternative 3 would not result in substantially increased hazards due to a design feature or incompatible uses. No impacts would occur.

TRA-5) Would Alternative 3 result in inadequate emergency access?

Alternative 3 would not result in inadequate emergency access. No road closures are anticipated for the Project; however, Seeley Avenue and Riverside Drive would be improved for emergency vehicle access. Construction traffic would be confined to designated travel routes (BMP-14). Interior access roads within the solar facility site would be constructed to allow sufficient access for fire trucks and emergency responders (BMP-15). A Fire Management and Protection Plan (BMP-4) and Emergency Action Plan (BMP-5) would be prepared in cooperation with the Riverside County Fire Department and emergency responders. Access gates and internal access roads within the solar facility site would be identified. Therefore, impacts to emergency access would be minimized. Impacts would be less than significant.

TRA-6) Would Alternative 3 conflict with adopted policies, plans, or programs regarding public transit, bicycle or pedestrian facilities, or otherwise decrease the performance or safety of such facilities?

Alternative 3 would not conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities. The Project area does not contain bicycle or pedestrian facilities. Because it is in an area surrounding by agricultural uses, proposed and approved solar power plants, and the airport, which lie miles apart, bicycles and walking are not a major means of transportation and substantial bicycle or pedestrian use is not projected in the future. Accordingly, Alternative 3 would not interfere with bicycle or pedestrian safety. As shown in Table 4.2.14-2, construction traffic would increase delays at the four intersections (approximately 16.4 seconds at Intersection 1; 11.1 seconds at Intersection 2; and 11.2 seconds at Intersection 3). The PVVTA operates Routes 3, 4, and 5 along Neighbours Boulevard north and south of I-10and it is

anticipated that buses would experience the delays mentioned above. Therefore, impacts to public transit would be less than significant.

TRA-7) Would Alternative 3 alter waterborne, rail or air traffic?

Alternative 3 would not alter waterborne, rail, or air traffic. Alternative 3 would not utilize waterborne, rail, or air services to transport materials or the workforce; therefore, no impacts to waterborne, rail, or air traffic would occur.

TRA-8) Would Alternative 3 cause an effect, or a need for new or altered maintenance of roads?

Alternative 3 would not cause an effect or need for new or altered maintenance of roads. The construction and operation of the gen-tie line would utilize the existing transmission line access roads and maintenance of roads would be similar to existing conditions. No impacts would occur.

TRA-9) Would Alternative 3 cause an effect upon circulation during Alternative 3's construction?

Alternative 3 would adversely affect circulation during construction; however, impacts would be less than significant.

TRA-10) Would Alternative 3 affect bike trails?

Alternative 3 would not adversely affect bike trails.

Alternative 4: Southern Alternative 230 kV Gen-tie Line Location

Alternative 4 would be similar to Alternative 1, with the exception of the location of the proposed 230 kV gen-tie line. The Alternative 4 gen-tie line would be shifted to the south relative to the proposed Project's gen-tie line. The portion of the 230 kV gen-tie line that would extend from the solar facility to the Colorado River Substation, approximately three miles of the Southern 230 kV Alternative, would not parallel existing transmission lines and would require construction of new access roads for the construction and operation of the gen-tie line. Although the Alternative 4 gen-tie line would be slightly longer than the proposed Project's gen-tie line, activities associated with construction, operation, maintenance, and decommissioning of Alternative 4 would have similar impacts on traffic and transportation as Alternative 1 (proposed Project).

Application of CEQA Significance Thresholds

TRA-1) Would Alternative 4 conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?

Alternative 4 would not conflict with the Riverside County CMP, Regional Comprehensive Plan and RTP, County of Riverside General Plan, and City of Blythe General Plan in regards to applicable plans, ordinances, or policies establishing measures of effectiveness for the performance of the circulation system. With construction of Alternative 4, I-10 would operate at LOS C and all study intersections would operate at an LOS B or C, which does not exceed the thresholds established in the aforementioned plans. The operational Alternative 4 impacts are expected to be nominal. Alternative 4 construction and decommissioning would not have long-term significant traffic impacts on the transportation network, since construction- and decommissioning-related impacts are considered temporary. Implementation of BMPs would minimize impacts to traffic and transportation. Implementation of Mitigation Measures Traffic-1 through Traffic-3 would reduce impacts to less than significant levels.

TRA-2) Would Alternative 4 exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways; conflict with an applicable congestion management program, including, but not limited to, level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways?

For the four study intersections, construction of Alternative 4 would reduce the existing LOS A to LOS B or C, but would not exceed the RCTC's adopted threshold of LOS E. Therefore, Alternative 4 would not conflict with an applicable congestion management program including, but not limited to, LOS standards and travel demand measures or other standards established by the county congestion management agency for designated roads or highways. Operational Alternative 4 impacts to traffic would be nominal. Impacts would be less than significant.

TRA-3) Would Alternative 4 result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks; result in a change in air traffic levels or a change in location and result in substantial safety risks?

Alternative 4 would not result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks. Construction equipment that would be utilized for the Project would not obstruct the navigable air space. No impacts would occur.

TRA-4) Would Alternative 4 substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?

Alternative 4 would not result in substantially increased hazards due to a design feature or incompatible uses. No impacts would occur.

TRA-5) Would Alternative 4 result in inadequate emergency access?

Alternative 4 would not result in inadequate emergency access. No road closures are anticipated for the Project; however, Seeley Avenue and Riverside Drive would be improved for emergency vehicle access. Construction traffic would be confined to designated travel routes (BMP-14). Interior access roads within the solar facility site would be constructed to allow sufficient access for fire trucks and emergency responders (BMP-15). A Fire Management and Protection Plan (BMP-4) and Emergency Action Plan (BMP-5) would be prepared in cooperation with the Riverside County Fire Department and emergency responders. Access gates and internal access roads within the solar facility site would be identified. Implementation of BMPs would minimize impacts to emergency access. Impacts to emergency access would be less than significant.

TRA-6) Would Alternative 4 conflict with adopted policies, plans, or programs regarding public transit, bicycle or pedestrian facilities, or otherwise decrease the performance or safety of such facilities?

Alternative 4 would not conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities. The Project area does not contain bicycle or pedestrian facilities. Because it is in an area surrounding by agricultural uses, proposed and approved solar power plants, and the airport, which lie miles apart, bicycles and walking are not a major means of transportation and substantial bicycle or pedestrian use is not projected in the future. Accordingly, Alternative 4 would not interfere with bicycle or pedestrian safety. As shown in Table 4.2.14-2, construction traffic would increase delays at the four intersections (approximately 16.4 seconds at Intersection 1; 11.1 seconds at Intersection 2; and 11.2 seconds at Intersection 3). The PVVTA operates Routes 3, 4, and 5 along Neighbours Boulevard north and south of I-10and it is anticipated that buses would experience the delays mentioned above. Therefore, impacts to public transit would be less than significant.

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TRA-7) Would Alternative 4 alter waterborne, rail or air traffic?

Alternative 4 would not alter waterborne, rail, or air traffic. Alternative 4 would not utilize waterborne, rail, or air services to transport materials or the workforce; therefore, no impacts to waterborne, rail, or air traffic would occur.

TRA-8) Would Alternative 4 cause an effect, or a need for new or altered maintenance of roads?

Alternative 4 would require the construction of new access roads for the construction, operation, and maintenance of approximately three miles of the gen-tie line that would extend outside of the solar facility to the Colorado River Substation. The remaining portions of the 230 kV gen-tie line would parallel existing transmission lines and would utilize the existing access roads. Maintenance of these access roads would be similar to existing conditions. Impacts would be less than significant.

TRA-9) Would Alternative 4 cause an effect upon circulation during Alternative 3's construction?

Alternative 4 would temporarily impact circulation during construction; however, impacts would be less than significant.

TRA-10) Would Alternative 4 affect bike trails?

Alternative 4 would not adversely affect bike trails.

Alternative 5: Reduced Acreage Alternative

Similar to Alternative 1, Alternative 5 would include the construction, operation, maintenance, and decommissioning of a solar facility and associated infrastructure. The primary differences between Alternatives 1 and 5 are the absence of solar facility development north of I-10 and that Alternative 5 would be on a reduced footprint of approximately 2,476 acres (from 3,660 acres for the proposed Project). In comparison to Alternative 1, Alternative 5 would eliminate one on-site substation and one O&M building and would have one access point (planned on Seeley Avenue). The Reduced Acreage Alternative would construct an approximately 7.8-mile-long, 230 kV overhead gen-tie line from the proposed on-site substation south of I-10 to the approved Colorado River Substation. Alternative 5 would avoid impacts that would result from the construction, operation, maintenance, and decommissioning of a solar development north of I-10; however, the land on which Alternative 1 is proposed would continue with existing uses.

The Reduced Acreage Alternative solar facility and a portion of the gen-tie line would be within the jurisdiction of the County of Riverside but not within the City limits of Blythe in comparison to the proposed Project. Alternative 5 would need to comply with the RCGP (2003) and PVVAP (2008). The remaining portion of the gen-tie line would traverse lands managed by the BLM and would need to comply with the CDCA Plan. The daily PCEs for Alternative 5 would 953, which is less than that of Alternative 1's (Proposed Project) daily PCEs of 1,164, However, the study intersection of Riverside Drive and Neighbours Boulevard would not be by Alternative 5; therefore, the construction traffic directed south of I-10 rather than north of I-10traffic to remaining three study intersections and would slightly increases to traffic volumes during the construction and decommissioning phase under Alternative 5 in comparison to Alternative 1. Table 4.2.14-2, 2015 Conditions, illustrates that Intersection 2 through Intersection 4, during the a.m. and p.m. peak hours for Alternative 1 are operating at an LOS B with Project construction. It is assumed that this slight increase for Alternative 5 during the construction phase would not degrade traffic volumes from an acceptable level (LOS C or better) to an unacceptable level (LOS D or worse). The operation of Alternative 5 would not exceed those traffic impacts identified under the Alternative 1 analysis.

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Direct and Indirect Effects

Construction

Similar to Alternative 1, the primary transportation impacts anticipated from Alternative 5 would occur from commuting worker traffic along I-10, a regional traffic corridor, and local roads within the Alternative 5 vicinity. The Alternative 1 traffic study area included four intersections that were identified as having the potential for impacts to occur from the construction, operation, maintenance, and decommissioning of the proposed Project. Construction of the proposed Project as well as the Reduced Acreage Alternative would generate additional traffic on regional and local roadways. Construction worker commute trips and equipment and materials deliveries would increase existing traffic volumes in the area. Under Alternative 1, all intersections were anticipated to operate at LOS B or C during the a.m. peak hour (Table 4.2.14-1), which represents reasonably free-flow operation where the ability to maneuver within the traffic stream is slightly restricted but still an acceptable condition. In addition, under Alternative 1, during the p.m. peak hour, all four study intersections would operate at LOS B.

As detailed in the Alternative 1 analysis, the County of Riverside has identified LOS C as acceptable along County-maintained roads and conventional state highways. The City of Blythe strives to maintain LOS B on residential streets and LOS C or better on arterial and collector streets, at all intersections, and on principal arterials in the CMP during peak hours. As such, impacts to roadways would occur when the addition of Alternative 5 construction traffic causes roadway operations to degrade from an acceptable level (LOS C or better) to an unacceptable level (LOS D or worse). Intersections under joint jurisdiction with Caltrans may operate at an LOS of E.

Under the traffic analysis for Alternative 1, it was assumed that approximately 60 percent of construction workers would drive alone and 40 percent would carpool. Given this same assumption under Alternative 5, 240 would drive alone and 160 would carpool. Assuming truck deliveries stay same under Alternative 5 in comparison to the proposed Project, and ancillary trips are calculated the same way, the approximate temporary construction trip generation would be as follows.

Table 4.2.14-3 Alternative 5 Daily Construction Trip Generation

TYPES OF TRIPS	DAILY PCE	AM PEAK HOUR			PM PEAK HOUR		
		Total	In	Out	Total	In	Out
Employee Trips	708	320	320	0	320	0	400
Truck Trips	103	11	6	5	11	6	5
Ancillary Trips	142	15	7	8	15	7	8
Net Project Trips (PCEs)	**953**	**346**	**333**	**13**	**346**	**13**	**413**

Source: KOA 2013.

As no solar facility development would occur north of I-10 under Alternative 5, traffic would not impact study Intersection 1 (Riverside Drive and Neighbours Boulevard); however, Intersection 2 (Neighbours Boulevard and I-10 Westbound Ramp) would still be affected. The delay for the intersection would have the potential to increase under Alternative 5 development, as the increased turn volumes for left turns could increase the delay at this location. The westbound ramp would likely have a higher volume off the ramp during the a.m. peak hour at the stop, causing a higher delay as well as a higher queue build-up under Alternative 5. This would also occur for the eastbound ramp. Under Alternative 5, the intersection of Neighbours Boulevard and Seeley Avenue would have an increased delay compared to Alternative 1 due to an increase in construction traffic volume routed south. Although Alternative 5 construction-related traffic would result in comparatively increased traffic volumes and delays to the above-mentioned intersections, it is not expected to increase volumes and delay to unacceptable levels. Similar to Alternative 1, drivers along these roadways would not be expected to experience noticeable delays with the addition of Alternative 5-related construction traffic. With construction of Alternative 5, similar to the proposed Project, it is anticipated that I-10 would operate at LOS C.

Pedestrian and Bicycles

The Alternative 1 analysis would apply to Alternative 5, therefore construction activities associated with Alternative 5 would not adversely affect any pedestrian or bicycle facilities.

Transit and Rail

The PVVTA operates Routes 3, 4, and 5 along Neighbours Boulevard north and south of I-10. Although no development would occur north of I-10 under Alternative 5, the Alternative 1 analysis would apply to Alternative 5 and the Project would not directly affect the ability of the PVVTA to use any of their existing routes or stops since road closures and detours are not anticipated.

Airport Service

Although development would occur south of I-10, farther from Blythe Airport, the Alternative 1 analysis would apply to Alternative 5, and construction activities associated with Alternative 5 would have no affect on airport service.

Parking

The reduced footprint under Alternative 5 would not alter the conclusions found under Alternative 1; as such, the Alternative 1 analysis would apply to Alternative 5 and there would be sufficient parking for all employees, visitors, service vehicles, and contractors on-site during the construction, operation and maintenance, and decommissioning of Alternative 5.

School

As no development would occur north of I-10, the construction truck traffic would be diverted south under Alternative 5. Under the Reduced Acreage Alternative, students utilizing I-10, Neighbours Boulevard, and Hobson Way would not experience delays. In addition, construction hours would be 7:00 a.m. to 6:00 p.m., and workers are projected to commute generally before and after normal school hours.

Emergency Access

Similar to Alternative 1, Alternative 5 would not require any road closures or result in impacts to emergency vehicles; however, in contrast, Riverside Drive would not be improved for emergency vehicle access. Construction traffic would be confined to designated travel routes (BMP-14). Mesa Drive would not be utilized for the construction or operation of the Project, but for emergency access only. Interior access roads within the solar facility site would be constructed to allow sufficient access for fire trucks and emergency responders (BMP-15). A Fire Management and Protection Plan (BMP-4) and Emergency Action Plan (BMP-5) would be prepared in cooperation with the Riverside County Fire Department and emergency responders. Access gates and internal access roads within the solar facility site would be identified. Therefore, impacts to emergency vehicles would be minimized.

As previously concluded, although Alternative 5 construction-related traffic would result in comparatively increased traffic volumes and delays to the above-mentioned intersections, it is not expected to increase volumes and delay to unacceptable levels above those anticipated under Alternative 1. All intersections would operate at acceptable levels. Therefore, construction traffic would not result in adverse effects to access to the Alternative 5 site (including movement of emergency vehicles) or nearby land uses.

Conflict with Applicable Congestion Management Program or other Plans and Policies

The analysis under Alternative 1 would apply to Alternative 5.

Operation

Operation of Alternative 5 would require seven permanent full-time employees, which would not generate a significant number of trips above existing volumes. Impacts to the existing transportation network are not anticipated.

Alternative 5 would not create significant glare impacts and obstructions from the solar facility and the 230 kV gen-tie line to the Blythe Airport. Please refer to Section 4.2.1, *Aesthetics, Visual Resources, and Reflection*, for a discussion regarding glare impacts to the Blythe Airport operations. For a discussion regarding potential hazards and obstructions that would result from the operation of the 230 kV gen-tie line, please refer to Section 4.2.8, *Hazards and Hazardous Materials*.

Decommissioning

The analysis for Alternative 1 would apply to Alternative 5.

Application of CEQA Significance Thresholds

TRA-1) Would Alternative 5 conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?

Alternative 5 would not conflict with the Riverside County CMP, Regional Comprehensive Plan and RTP, or County of Riverside General Plan in regards to applicable plans, ordinances, or policies establishing measures of effectiveness for the performance of the circulation system. Since Alternative 5 would utilize a similar number of construction workers as Alternative 1, it is anticipated that I-10 would operate at LOS C, and all studied intersections would operate at acceptable levels and would not exceed the thresholds established in the aforementioned plans. Implementation of BMPs -4, -5, -14, and -15 would minimize impacts to traffic and transportation. With implementation of Mitigation Measures Traffic-1 through Traffic-3, impacts would be reduced to less than significant. Alternative 5 construction and decommissioning would not have long-term significant traffic impacts on the transportation network, since construction- and decommissioning-related impacts are considered temporary.

TRA-2) Would Alternative 5 exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways; conflict with an applicable congestion management program, including, but not limited to, level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways?

The RCTC's adopted LOS threshold is LOS E. Therefore, when a CMP street or highway segment falls to LOS F, a deficiency plan must be required. For the impacted intersections, construction of Alternative 5 would reduce the existing LOS. However, these reductions would not fall into unacceptable levels. Therefore, Alternative 5 would not conflict with an applicable congestion management program including, but not limited to, LOS standards and travel demand measures or other standards established by the county congestion management agency for designated roads or highways. Operational impacts to traffic would be nominal. Any potential impacts would be less than significant.

TRA-3) Would Alternative 5 result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks; result in a change in air traffic levels or a change in location and result in substantial safety risks?

Similar to Alternative 1, Alternative 5 would not result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks. Construction equipment that would be utilized for Alternative 5 would not obstruct the navigable air space. No impacts would occur.

TRA-4) Would Alternative 5 substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?

The TRA-4 analysis for Alternative 1 would apply to Alternative 5.

TRA-5) Would Alternative 5 result in inadequate emergency access?

Similar to Alternative 1, Alternative 5 would not require any road closures or result in impacts to emergency vehicles; however, in contrast, Riverside Drive would not be improved for emergency vehicle access. Construction traffic would be confined to designated travel routes (BMP-14). The Riverside County Operational Area Emergency Operations Plan (RCFD 2006) does not designate emergency evacuation routes; therefore, construction would not impair implementation of, or physically interfere with, an adopted emergency response or evacuation plan. Local roads are unlikely to be used as emergency routes because of the remote location of the site. The main access road to the solar plant would be designed to meet the RCFD requirements. Interior access roads within the solar facility site would be constructed to allow sufficient access for fire trucks and emergency responders (BMP-15). A Fire Management and Protection Plan (BMP-4) and Emergency Action Plan (BMP-5) would be prepared in cooperation with the RCFD and emergency responders. Access gates and internal access roads within the solar facility site would be identified. With implementation of BMPs, impacts to emergency access would be minimized; impacts would be less than significant.

TRA-6) Would Alternative 5 conflict with adopted policies, plans, or programs regarding public transit, bicycle or pedestrian facilities, or otherwise decrease the performance or safety of such facilities?

The TRA-6 analysis for Alternative 1 would apply to Alternative 5.

TRA-7) Would Alternative 5 alter waterborne, rail or air traffic?

The TRA-7 analysis for Alternative 1 would apply to Alternative 5.

TRA-8) Would Alternative 5 cause an effect, or a need for new or altered maintenance of roads?

Alternative 5 would improve Seeley Avenue, not Riverside Drive; however, these roads are currently maintained by the County of Riverside and would not cause an effect or need for new or altered maintenance of roads. Alternative 5 would require the construction of new access roads for the construction, operation, and maintenance of approximately three miles of the gen-tie line that would extend outside of the solar facility to the Colorado River Substation. The remaining portions of the gen-tie line would utilize the existing transmission line access roads and maintenance of roads would be similar to existing conditions. Impacts would be less than significant for maintenance of roads.

TRA-9) Would Alternative 5 cause an effect upon circulation during the project's construction?

Alternative 5 would impact circulation during construction; however, impacts would be less than significant.

TRA-10) Would Alternative 5 affect bike trails?

Alternative 5 not adversely affect bike trails; no impact.

Cumulative Impacts

Geographic Scope

Table 4.1-1 lists the cumulative projects within the vicinity of the Project area that were considered in this cumulative analysis. The geographic scope of the cumulative analysis for traffic and transportation includes the roadways and intersections in the vicinity of the Project area that may be directly or indirectly impacted by construction traffic generated by the proposed Project and Alternatives, which include I-10 and four study intersections. The City of Blythe did not identify any development projects that would add traffic to the intersections analyzed in the study. In coordination with a Riverside County Transportation Department representative, potential cumulative projects within the Project vicinity were identified. Approved traffic studies in the vicinity of the Project area were reviewed to eliminate projects that would not contribute traffic to the study area. The cumulative scenario accounts for construction of multiple large energy projects along the I-10 corridor and developments in the City of Blythe. The County of Riverside identified seven projects listed below that could conceivably be constructed during the year 2015. Table 4.2.14-4 lists cumulative projects that would have the potential to contribute to cumulative impacts.

Projects that would not contribute traffic trips to the four study intersections during the construction of the proposed Project and Alternatives were not analyzed. For example, the approved McCoy Solar Energy Project would utilize the Mesa Interchange; therefore, would not affect the four study intersections. The Blythe Solar Power Project has been suspended; as such, it is very unlikely that construction of this project and the proposed Project would occur simultaneously. It is anticipated that the Desert Quartzite project, which is similar in size and scope as the proposed Project, would require the preparation of an environmental document. To date, the Desert Quartzite project has not issued a Notice of Intent or Notice of Preparation. After issuance of a notice, the preparation of an environmental document may take approximately 12 to 18 months; therefore, peak construction of Desert Quartzite and the BMSP occurring simultaneously is very unlikely.

Should the peak construction schedules of the cumulative projects listed in Table 4.2.14-4 overlap, construction traffic from these projects would result in increased traffic within several miles or more along I-10 and regional roadways. As a conservative analysis, peak construction traffic from these cumulative projects was added to 2015 projected traffic (existing plus ambient growth). This resulted in a 2015-year Cumulative without Project scenario, to which the traffic of each action Alternative was added to the following study intersections:

- Intersection 1: Neighbours Boulevard and Riverside Drive
- Intersection 2: Neighbours Boulevard and I-10 Westbound Ramps
- Intersection 3: Neighbours Boulevard and I-10 Eastbound Ramps
- Intersection 4: Neighbours Boulevard and Seeley Avenue

Temporal Scope

The Project's and Alternatives' construction phases would produce the highest amount of traffic; the operational traffic would be similar to existing conditions. Therefore, the temporal scope of the cumulative impacts for the proposed Project and Alternatives would occur during the construction phase (between 2013 and 2016), with the highest-intensity period occurring in 2014 and 2015. As a conservative cumulative traffic analysis, the Year 2015 was determined to represent the highest traffic volumes for cumulative impacts as a result of the proposed Project and Alternatives.

Although it is very unlikely that the peak construction periods of multiple projects would coincide, as a conservative approach, the cumulative conditions represented below analyze the worst-case scenario. This addresses uncertainty about the timing of construction of other cumulative projects. It is very likely that the cumulative projects would track along different schedules from the proposed Project (and Alternatives) and peak construction would likely not occur at the same time.

Table 4.2.14-4 Cumulative Projects Included in Traffic Analysis

PROJECT NAME/APPLICANT	PROJECT DESCRIPTION	STATUS
Solar/Electric Generating Projects		
Blythe Airport Solar I Project • U.S. Solar EA # 42340	100 MW photovoltaic power plan on 640 acres in five- 20 MW phases that includes a 3,200 ft long 33 kV generation tie.	Approved November 2010
Blythe Energy Project II	520 MW combined-cycle power plant located entirely within the Blythe Energy Project area boundary. Blythe Energy Project II will interconnect with the Buck Substation constructed by the Western Area Power Administration as part of the Blythe Energy Project. Project is designed on 20 acres of a 76-acre site.	Approved 2005 Request for Construction commencement 2011-2016
Palo Verde Mesa Solar Project	437 MW PV solar plant that includes a 14-mile long transmission line to the Colorado River Substation.	Planned NOP issued August 2012
County of Riverside Projects		
PM33797	Schedule H: Divide 2.14 acres into 2 single family residential parcels	Planned
PM34400	Schedule H: Divide 80 acres into 2 single family residential	Planned
PM34759	Schedule H: Divide 34 acres into 3 parcels	Planned
PP23885	Church with accessory outdoor recreation/amphitheater 8,890 square feet Church	Planned

Source: KOA 2013.

Temporal Scope

The Project's and Alternatives' construction phases would produce the highest amount of traffic; the operational traffic would be similar to existing conditions. Therefore, the temporal scope of the cumulative impacts for the proposed Project and Alternatives would occur during the construction phase (between 2013 and 2016), with the highest-intensity period occurring in 2014 and 2015. As a conservative cumulative traffic analysis, the Year 2015 was determined to represent the highest traffic volumes for cumulative impacts as a result of the proposed Project and Alternatives.

Although it is very unlikely that the peak construction periods of multiple projects would coincide, as a conservative approach, the cumulative conditions represented below analyze the worst-case scenario. This addresses uncertainty about the timing of construction of other cumulative projects. It is very likely that the cumulative projects would track along different schedules from the proposed Project (and Alternatives) and peak construction would likely not occur at the same time.

Analysis of Direct and Indirect Impacts

Alternative 1: Proposed Project

Construction

This scenario accounts for construction of multiple large energy projects along the I-10 corridor and developments in the City of Blythe. Should the unlikely condition arise where peak construction of all the cumulative projects listed in Table 4.2.14-4 overlap, construction traffic from these projects would result in increased traffic within several miles or more along I-10 and regional roadways. It is very unlikely that the peak construction periods of multiple projects would coincide, as all projects are tracking on different schedules. For example, the Blythe Energy Project II was approved in 2005, the Blythe Airport Solar I Project was approved in 2010, and the Palo Verde Mesa Solar Project is in the initial stages of planning (Notice of Preparation issued in 2012). There may be some overlap in overall construction schedules (peak and non-peak) for a few cumulative projects and the LOS may decrease, but it would be temporary.

The worst-case scenario would involve peak construction of all the cumulative projects listed above. Table 4.2.14-5, *Cumulative Intersection Conditions*, lists the anticipated delays and LOS conditions that would result with peak construction of the cumulative projects (Cumulative 2015) with and without Project construction during the a.m. and p.m. peak hours. The Cumulative Scenario without Project would result in all study intersections operating at acceptable LOS levels with delays ranging from 9.5 to 16.6 seconds, except Intersection 3 (I-10 Eastbound Ramp and Neighbours Boulevard) during the p.m. peak hour would operate at LOS D and experience delays of 29.0 seconds. The Cumulative Scenario with Project would result in two intersections during the a.m. peak hour operating at unacceptable LOS levels (LOS D and E) and one intersection during the p.m. peak hour would operate at LOS F; delays would range from 10.0 to 126.5 seconds (2.1 minutes). Detailed impacts to each study intersection with the addition of the proposed Project are described below. Table 4.2.14-6, *Cumulative Contribution*, lists each project's contribution (trips and percentage) to the total cumulative trips at the study intersections during the a.m. and p.m. peak hours. Figures 4.2.14-1 and 4.2.14-2 illustrate the peak hour traffic movements for the Cumulative with and without Project Scenarios during the a.m. and p.m. peak hours.

- Intersection 1 (Neighbours Boulevard and Riverside Drive)
  - During the a.m. peak hour would degrade from LOS B to LOS E (unacceptable level) and delays would increase from 14.2 to 40.1 seconds. The major contributors to cumulative impacts at this intersection include the proposed Project (54%) and Palo Verde Mesa Solar Project (43%).
  - During the p.m. peak hour would degrade from LOS A to LOS B and delays would increase from 10 to 13.2 seconds.

- Intersection 2 (Neighbours Boulevard and I-10 Westbound Ramps)
  - During the a.m. peak hour would degrade from LOS C to LOS D (unacceptable level) and delays would increase from 16.6 to 26.2 seconds. The major contributors to cumulative impacts at this intersection include the proposed Project (40%) and Palo Verde Mesa Solar Project (49%).
  - During the p.m. peak hours would degrade from LOS B to LOS C and delays would increase from 13.1 to 20.0 seconds.

- Intersection 3 (Neighbours Boulevard and I-10 Eastbound Ramps)
  - During the a.m. peak hour would operate at LOS B and delays would increase from 11.2 to 14.6 seconds.
  - During the p.m. peak hour would degrade from LOS D (unacceptable level) to LOS F and delays would increase from 29.0 to 126.5 seconds (2.1 minutes).The major contributors to the cumulative impacts at this intersection include the proposed Project (49%) and Palo Verde Mesa Solar Project (38%).

- Intersection 4 (Neighbours Boulevard and Seeley Avenue)
  - During the a.m. peak hour would degrade from LOS A to LOS B and delays would increase from 9.5 to 10.6 seconds.
  - During the p.m. peak hour would degrade from LOS A to LOS B and delays would increase from 9.9 to 13.1 seconds.

Table 4.2.14-5 Cumulative Intersection Conditions (Year 2015)

INTERSECTION	WITHOUT PROJECT		WITH PROJECT CONSTRUCTION		DELAY (SECONDS)	CONSIDERABLE CONTRIBUTION TO CUMULATIVE IMPACT
	Delay (seconds)	LOS	Delay (seconds)	LOS		
AM Peak Hour						
1. Riverside Dr & Neighbours Blvd*	14.2	B	40.1	**E**	25.9	**Yes**
2. I-10 WB Ramp & Neighbours Blvd*	15.6	C	26.2	**D**	10.6	**Yes**
3. I-10 EB Ramp & Neighbours Blvd*	11.2	B	14.6	B	3.4	No
4. Seeley Ave & Neighbours Blvd*	9.5	A	10.6	B	1.1	No
PM Peak Hour						
1. Riverside Dr & Neighbours Blvd*	10.0	A	13.2	B	3.2	No
2. I-10 WB Ramp & Neighbours Blvd*	13.1	B	20	C	6.9	No
3. I-10 EB Ramp & Neighbours Blvd*	29.0	**D**	126.5	**F**	97.5	**Yes**
4. Seeley Ave & Neighbours Blvd*	9.9	A	13.1	B	3.2	No

Source: KOA 2013.
Note: *Unsignalized Intersection. WB = westbound; EB = eastbound. Bold font represents unacceptable LOS levels.

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Table 4.2.14-6 Cumulative Contribution (Year 2015)*

INTERSECTIONS	BLYTHE MESA		PALO VERDE		BLYTHE ENERGY		BLYTHE AIRPORT SOLAR		OTHER CUMULATIVE PROJECTS		AMBIENT GROWTH		TOTAL
	Trips	% of Total	Trips	% of Total	Trips	% of Total	Trips	% of Total	Trips	% of Total	Trips	% of Total	
AM Peak Hour													
1. Riverside Dr & Neighbours Blvd	172	54%	138	43%	0	0%	3	1%	8	2%	0	0%	321
2. I-10 WB Ramp & Neighbours Blvd	348	40%	429	49%	75	9%	2	0%	7	1%	13	1%	874
3. I-10 EB Ramp & Neighbours Blvd	312	67%	135	29%	3	1%	2	0%	5	1%	12	3%	469
4. Seeley Ave & Neighbours Blvd	257	93%	0	0%	0	0%	2	1%	5	2%	11	4%	275
PM Peak Hour													
1. Riverside Dr & Neighbours Blvd	172	53%	138	43%	0	0%	3	1%	10	3%	0	0%	323
2. I-10 WB Ramp & Neighbours Blvd	252	32%	429	55%	75	10%	3	0%	9	1%	15	2%	783
3. I-10 EB Ramp & Neighbours Blvd	376	49%	295	38%	72	9%	2	0%	5	1%	18	2%	768
4. Seeley Ave & Neighbours Blvd	257	92%	0	0%	0	0%	2	1%	5	2%	15	5%	279

Source: KOA 2013.
* The cumulative contribution percentages for the projects were rounded; therefore, the sum of the percentages may not equal 100 percent.

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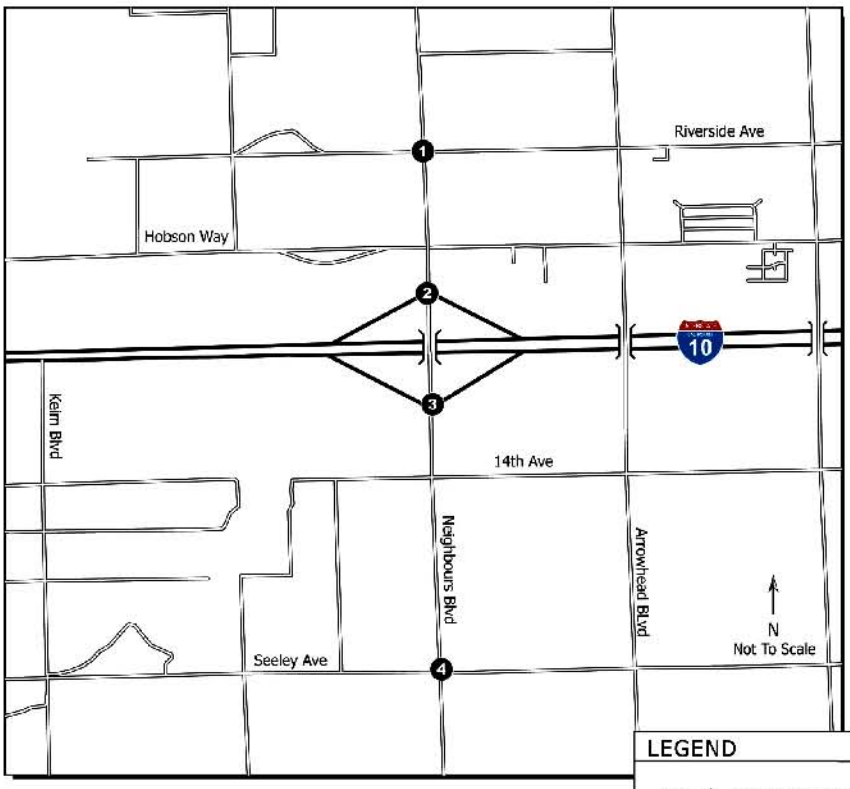
CUMULATIVE WITHOUT PROJECT



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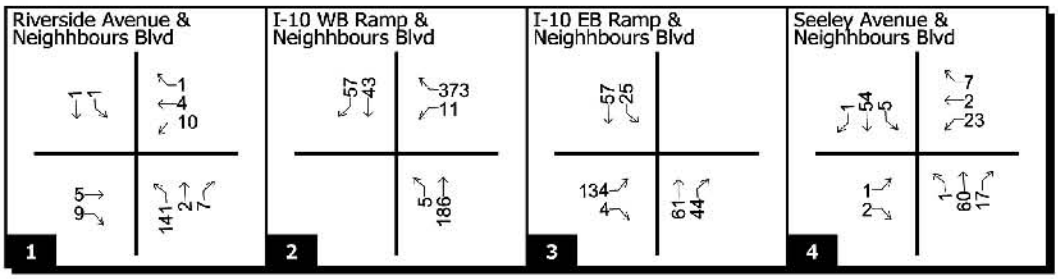

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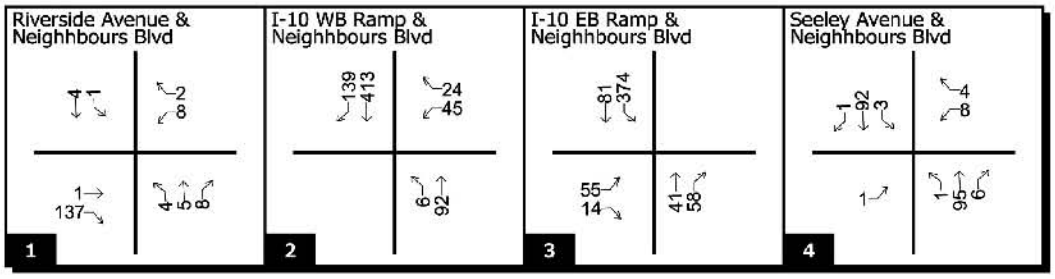



FIGURE 4.2.14-1
CUMULATIVE WITHOUT PROJECT

BLYTHE MESA SOLAR PROJECT

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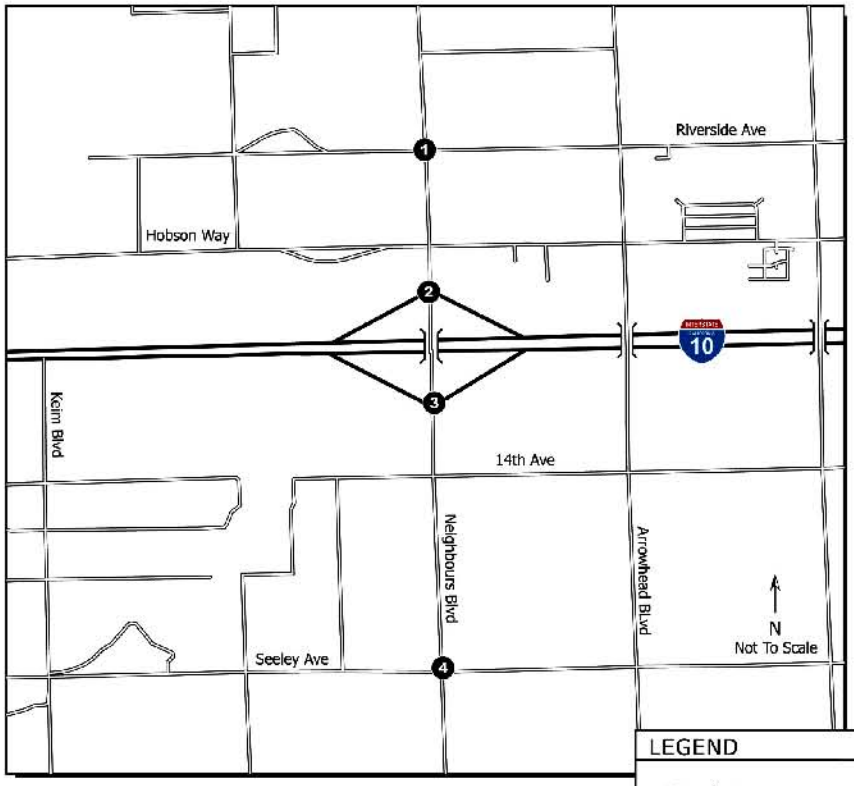
CUMULATIVE WITH PROJECT



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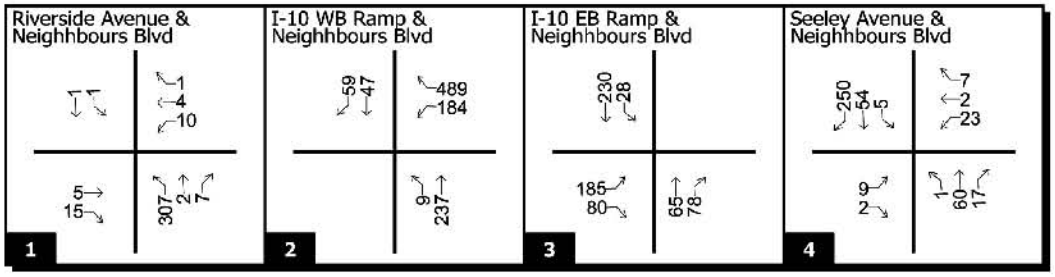

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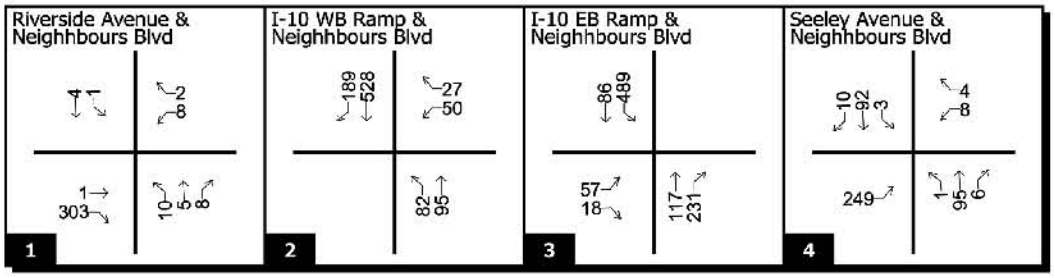



FIGURE 4.2.14-2
CUMULATIVE WITH PROJECT

BLYTHE MESA SOLAR PROJECT

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Comparison of Existing (2011), Anticipated 2015, and Cumulative (2015) Scenarios

The impacts discussed above are related to the construction of numerous solar projects, which is considered temporary; the operational trips (12 full-time employees) related to the solar projects are significantly less than construction. Therefore, it is anticipated that the LOS for all four study intersection would be restored back to preconstruction conditions once construction of these respective projects is completed.

With the addition of more cumulative Project trips, the LOS degrades further and delays increase at each of the four study intersections. Under the existing conditions (2011) scenario, all intersections are operating an LOS A, with intersection delays ranging from 8.6 seconds to 9.8 seconds. With the addition of ambient growth, the anticipated 2015 conditions without Project scenario would still operate at an LOS A and experience intersection delays raging from 8.6 to 9.9 seconds. The 2015 with Project scenario, which would add approximately 429 trips, would result in all study intersections operating at an LOS B, with the exception of the Riverside Drive and Neighbours Boulevard intersection, which would operate at an LOS C during the a.m. peak hour. The intersection delays would range from 10.2 seconds to 16.4 seconds. During the Cumulative without Project scenario (addition of up to 531 cumulative trips) all study intersections would operate at acceptable LOS levels (LOS A through C), except Intersection 3 (Neighbours Boulevard and I-10 Eastbound Ramp) during the p.m. peak hour would operate at LOS D with a delay of 29.0 seconds. During the Cumulative with Project scenario (addition of up to 531 cumulative trips), all intersections would operate at acceptable LOS (LOS B to C), with the exception of Intersection 1 (Neighbours Boulevard and Riverside Drive) and Intersection 2 (Neighbours Boulevard and I-10 Westbound Ramp) during the a.m. peak hour and Intersection 3 (Neighbours Boulevard and I-10 Eastbound Ramp) during the p.m. peak hour.

Of the four study intersections, Intersection 4 (Neighbours Boulevard and Seeley Avenue) would receive the slightest increase in cumulative traffic (275 trips during the a.m. peak hour and 279 trips during the p.m. peak hour). This intersection would also experience the least amount of cumulative impacts and delays, because the proposed Project would contribute 92 percent of the cumulative trips.

Intersection 2 (Neighbours Boulevard and I-10 Westbound Ramp) would experience the greatest increase in cumulative trips (874 trips during the a.m. peak hour and 783 trips during the p.m. peak hour). During the a.m. peak hour, traffic flow would degrade from LOS C to LOS D; delays at this intersection would increase from 16.6 to 26.2 seconds. The proposed Project would be a considerable contributor to cumulative traffic, adding approximately 40 percent of the cumulative traffic. This intersection would operate at acceptable LOS during the p.m. peak hour (degrade from LOS B to LOS C).

Of the four study intersections, Intersection 1 (Neighbours Boulevard and Riverside Drive) during the a.m. peak hour would experience the greatest decrease in LOS—it would degrade from LOS B to LOS E with peak construction of the Project. North and south movements on Neighbours Boulevard are free-flowing. Eastbound and westbound movements on Riverside Avenue are stop-controlled. It would operate at an acceptable LOS during the p.m. peak hour, because as illustrated in Figure 4.2.14-2, most of the traffic (approximately 303 vehicles) from Riverside Drive is headed southbound (right turn) onto Neighbours Boulevard. These vehicles would need to stop, but would experience minimal interruption from five northbound vehicles and four southbound vehicles on Neighbours Boulevard, and eight vehicles from Riverside Drive would head southbound (left turn) onto Neighbours Boulevard. Therefore, traffic during the p.m. peak hour would experience approximately 13.2-second delays. During the a.m. peak hour, Intersection 1 would experience greater delays, because most of the traffic (approximately 307 vehicles) from Neighbours Boulevard would make a left turn onto Riverside Drive. Westbound and eastbound vehicles on Riverside Drive are stop-controlled and need to wait for large gaps to make a movement. This results in greater delays for the ten vehicles from Riverside Drive headed southbound (left turn) onto Neighbours Boulevard and five vehicles traveling eastbound on Riverside Drive. At stop-controlled intersections, left-turn movements are considered critical movements. Neighbours Boulevard, a free-flowing street, would have a very high volume and the critical movements (vehicles from Riverside Boulevard heading southbound) would experience longer delays to find a suitable gap in the traffic to make their turns. Therefore, these vehicles would experience delays approximately 40.1 seconds long,

resulting in an LOS E (unacceptable level). The proposed Project would contribute approximately 54 percent of the cumulative traffic; it would be a considerable contributor to cumulative traffic impacts.

The cumulative scenario for Intersection 3 (I-10 Eastbound Ramp and Neighbours Boulevard) during the p.m. peak hour would experience the greatest delays of the four intersections; it would operate at acceptable LOS B during the a.m. peak hour. The 2015 Cumulative without Project scenario would add 392 trips to Intersection 3 during the p.m. peak hour and would operate at LOS D with intersection delays of 29.0 seconds. The Cumulative with Project scenario would add another 376 trips (768 total cumulative trips) and degrade to LOS F with intersection delays of 126.5 second (2.1 minutes). As illustrated in Figure 4.2.14-2, most vehicles (429) would be traveling southbound from Neighbours Boulevard and then eastbound (left turn) onto the I-10 eastbound ramp. These vehicles would yield to vehicles traveling northbound (117) on Neighbours Boulevard. In addition, 57 vehicles traveling from the I-10 ramp headed north would need to make a critical movement (left turn). These vehicles would experience the greatest delays, because they would need to find a suitable gap in the traffic to make their turns. Therefore, these vehicles would experience delays approximately 126.5 (2.1 minutes) long, resulting in LOS F (unacceptable level). The proposed Project would contribute approximately 49 percent during the p.m. peak hour and would be a considerable contributor to cumulative traffic impacts.

The proposed Project is a considerable contributor to cumulative traffic impacts at three study intersections (Intersection 1 and 2 during the a.m. peak hour and Intersection 3 during the p.m. peak hour); Intersection 4 during the a.m. and p.m. peak hours would not result in cumulatively considerable traffic impacts. I-10 west and east of Neighbours Boulevard (State Route 78) would operate at LOS C. With the construction of the cumulative projects and BMSP, it is anticipated that the freeway would operate within Caltrans' acceptable LOS level.

With implementation of BMPs and mitigation measures, impacts to traffic and transportation would be minimized. Implementation of Mitigation Measure Traffic-1 (Traffic Management Plan) would reduce impacts from the proposed Project. Temporary construction traffic impacts that are cumulatively considerable may be reduced by coordinating construction schedules and staggering the cumulative trips to non-peak hours. With implementation of Mitigation Measures Traffic-1 and Traffic-3, cumulative traffic impacts to Intersections 1 through 3 may be improved to acceptable LOS levels. Table 4.2.14-8 lists the anticipated delays and LOS levels at each of the study intersections with the implementation of staggered construction of all cumulative trips (no staggered trips, 25 percent, 30 percent, and 40 percent). If no trips are staggered, Intersections 1 and 2 would operate at unacceptable LOS during the a.m. peak hour and Intersection 3 would operate at unacceptable LOS during the p.m. peak hour. If 25 percent of the cumulative trips were staggered to off-peak hours, all study intersections would operate at acceptable LOS, except Intersection 3 (Neighbours Boulevard and I-10 Eastbound Ramp), which would operate at LOS E, but experience a reduction in delays from 126.5 to 37.2 seconds. For Intersection 3 to operate at an acceptable LOS, approximately 40 percent of the cumulative trips would need to be staggered. Therefore, the Project's contribution towards temporary, significant cumulative impacts during Project construction would be reduced to less-than-significant levels.

The proposed Project would not substantially increase hazards due to design features or incompatible uses (impact TRA-4). The solar arrays would be fenced in; however, no major arterial roads would be closed and internal access roads within the solar facility site would all have sufficient emergency access. Impacts would not be cumulatively considerable and would be less than significant (impact TRA-5).

Construction traffic would increase delays at intersections, which would impact public transit routes mentioned above during a.m. and p.m. peak hours (impact TRA-6); however, with implementation of Mitigation Measure Traffic-1, the Project's contribution to cumulative impacts would be less than significant.

Operation and Maintenance

Project operation would result in a nominal increase in traffic and would generate substantially less traffic than construction activities. Also, the cumulative projects that would utilize the same intersections would

similarly have a limited workforce for operations. Therefore, no adverse impacts would occur due to traffic generated during the operation phase.

No road closures are anticipated for the Project; however, Seeley Avenue and Riverside Drive would be improved for emergency vehicle access. Interior access roads within the solar facility site would be constructed to allow sufficient access for fire trucks and emergency responders (BMP-15). A Fire Management and Protection Plan (BMP-4) and Emergency Action Plan (BMP-5) would be prepared in cooperation with the Riverside County Fire Department and emergency responders. Access gates and internal access roads within the solar facility site would be identified. Therefore, impacts to emergency vehicles would not be cumulatively considerable significant impacts.

Decommissioning

Decommissioning impacts from the Project would be similar to construction. It is very unlikely that decommissioning of all cumulative projects would occur at the same time; however, it is assumed that decommissioning impacts from the cumulative projects would be similar to construction, but would be less intense and of a shorter duration. Therefore, the Project would not result in cumulatively considerable significant impacts.

Alternative 2: No Project Alternative

Under the No Project Alternative, gen-tie facilities would not be constructed on BLM-managed lands and solar facilities would not be constructed on private lands. The public lands in the Project area would continue to be managed by BLM in accordance with existing land use designations in the CDCA Plan, whereas the private lands would continue to be managed for agricultural production. Alternative 2 would not contribute to cumulative traffic and transportation impacts.

Alternative 3: Northern Alternative 230 kV Gen-tie Line Location

Alternative 3 is similar to Alternative 1 (proposed Project), with the exception of the location of the Northern 230 kV gen-tie line, which would be approximately 700 feet north of Alternative 1's proposed 230 kV gen-tie line. Construction of the solar facility would require the greatest workforce. Although Alternative 3's gen-tie line would be slightly longer than the proposed Project's (Alternative 1), it is anticipated that construction of both Alternatives would require the same workforce; however, Alternative 3 would require a slightly longer construction period. Therefore, the cumulative impacts associated with the construction, operation, maintenance, and decommissioning of the solar facility would be the same as Alternative 1.

Table 4.2.14-8 Cumulative Intersections and Staggered Trips

INTERSECTION	TRIPS	CUMULATIVE WITH PROJECT							
		No trips staggered		25% staggered trips		30% staggered trips		40% staggered trips	
		LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
AM Peak Hour									
1. Riverside Dr & Neighbours Blvd	321	**E**	40.1	C	22.9	C	20.7	C	17.6
2. I-10 WB Ramp & Neighbours Blvd	874	**D**	26.2	C	15.1	B	14.1	B	12.6
3. I-10 EB Ramp & Neighbours Blvd	469	B	14.6	B	12.5	B	12.1	B	11.5
4. Seeley Ave & Neighbours Blvd	274	B	10.6	B	10.3	B	10.2	B	10.1
PM Peak Hour									
1. Riverside Dr & Neighbours Blvd	323	B	13.2	B	11.5	B	11.2	B	10.7
2. I-10 WB Ramp & Neighbours Blvd	783	C	20.0	C	15.5	C	14.9	B	13.8
3. I-10 EB Ramp & Neighbours Blvd	768	**F**	126.5	**E**	37.2	**D**	30.8	C	23.4
4. Seeley Ave & Neighbours Blvd	278	B	13.1	B	12.0	B	11.8	B	11.4

Source: KOA 2013.
Note: Bold font represents unacceptable LOS levels.

Construction

It is anticipated that Alternative 3 would experience similar traffic impacts (delays and LOS) as Alternative 1 (see Table 4.2.14-5). The cumulative scenario with Alternative 3 would result in two intersections during the a.m. peak hour operating at unacceptable LOS (LOS D and E) and one intersection during the p.m. peak hour would operate at an LOS F; delays would range from 10.0 to 126.5 seconds (2.1 minutes). Detailed discussions regarding cumulative impacts to each study intersection with the addition of Alternative 3 is described below.

- Intersection 1 (Neighbours Boulevard and Riverside Drive)
    - During the a.m. peak hour would experience the greatest decrease in LOS [degrade from LOS B to LOS E (unacceptable level)] and delays would increase from 14.2 to 40.1 seconds. The major contributors to cumulative impacts at this intersection include Alternative 3 (54%) and Palo Verde Mesa Solar Project (43%).
    - During the p.m. peak hour would degrade from and LOS A to LOS B and delays would increase from 10 to 13.2 seconds.
- Intersection 2 (Neighbours Boulevard and I-10 Westbound Ramps)
    - This intersection would experience the greatest increase in cumulative trips (874 trips during the a.m. peak hour and 783 trips during the p.m. peak hour). During the a.m. peak hour would degrade from LOS C to LOS D (unacceptable level) and delays would increase from 16.6 to 26.2 seconds. The major contributors to cumulative impacts at this intersection include Alternative 3 (40%) and Palo Verde Mesa Solar Project (49%). Alternative 3 would be a considerable contributor to cumulative traffic.
    - During the p.m. peak hours would degrade from an LOS B to LOS C and delays would increase from 13.1 to 20.0 seconds.
- Intersection 3 (Neighbours Boulevard and I-10 Eastbound Ramps)
    - Of the four study intersection, Intersection 3 would experience the greatest delays (2.1 minutes).
    - During the a.m. peak hour would operate at LOS B and delays would increase from 11.2 to 14.6 seconds.
    - During the p.m. peak hour would degrade from an LOS D (unacceptable level) to LOS F and delays would increase from 29.0 to 126.5 seconds (2.1 minutes).The major contributors to the cumulative impacts at this intersection include the Alternative 3 (49%) and Palo Verde Mesa Solar Project (38%).
- Intersection 4 (Neighbours Boulevard and Seeley Avenue)
    - This intersection would also experience the least amount of cumulative impacts and delays, because Alternative 3 would contribute 92 percent of the cumulative trips.
    - During the a.m. and p.m. peak hour would degrade from LOS A to LOS B and delays would range from 9.5 to 13.1 seconds.

As discussed in Alternative 1, it is very unlikely that the peak construction periods of all cumulative projects would occur simultaneously. There may be some overlap in overall construction schedules (peak and non-peak) for a few cumulative projects and the LOS for I-10 may decrease to LOS D, but it would be temporary and within Caltrans' acceptable LOS level. With implementation of BMPs, impacts to traffic and transportation would be minimized. Implementation of Mitigation Measure Traffic-1 (Traffic Management Plan) would reduce impacts from the proposed Project, and the implementation of Mitigation Measure Traffic-3 to coordinate the construction traffic schedules from multiple large-scale generation projects would further reduce the impacts to traffic and transportation. Therefore, Alternative 3's contribution towards temporary significant cumulative impacts during Project construction would be reduced at the three intersections to less than significant levels.

Alternative 3 would not substantially increase hazards due to design features or incompatible uses (impact TRA-4). The solar arrays would be fenced in; however, no major arterial roads would be closed and internal access roads within the solar facility site would all have sufficient emergency access. Impacts would not be cumulatively considerable and would be less than significant (impact TRA-5).

Construction traffic would increase delays at intersections, which would impact public transit routes mentioned above during a.m. and p.m. peak hours (impact TRA-6); however, the with implementation of Mitigation Measure Traffic-1, Alternative 3's contribution to cumulative impacts would be less than significant.

Operation and Maintenance

Operations under Alternative 3 would result in a nominal increase in traffic and would generate substantially less traffic than construction activities. Also, the cumulative projects that would utilize the same intersections would similarly have a limited workforce for operations. Therefore, no adverse impacts would occur due to traffic generated during the operation phase.

No road closures are anticipated for Alternative 3; however, Seeley Avenue and Riverside Drive would be improved for emergency vehicle access. Interior access roads within the solar facility site would be constructed to allow sufficient access for fire trucks and emergency responders (BMP-15). A Fire Management and Protection Plan (BMP-4) and Emergency Action Plan (BMP-5) would be prepared in cooperation with the Riverside County Fire Department and emergency responders. Access gates and internal access roads within the solar facility site would be identified. Therefore, impacts to emergency vehicles would not be cumulatively considerable significant impacts.

Decommissioning

Decommissioning impacts from the Project would be similar to construction. It is very unlikely that decommissioning of all cumulative projects would occur at the same time; however, it is assumed that decommissioning impacts from the cumulative projects would be similar to construction, but would be less intense and of a shorter duration. Therefore, Alternative 3 would not result in cumulatively considerable significant impacts.

Alternative 4: Southern Alternative 230 kV Gen-tie Line Location

Alternative 4 is similar to Alternative 1 (proposed Project), with the exception of the location of the Southern 230 kV gen-tie line, which would be approximately 0.8 mile south of Alternative 1's proposed 230 kV gen-tie line. Although Alternative 4 would be slightly shorter than Alternative 1, it is anticipated that construction of both Alternatives would require the same workforce; however, Alternative 4 would require a slightly shorter construction period. Therefore, cumulative impacts associated with the construction, operation, maintenance, and decommissioning of the solar facility would be the same as Alternative 1.

Construction

It is anticipated that Alternative 4 would experience similar traffic impacts (delays and LOS) as Alternative 1 (see Table 4.2.14-5). The cumulative scenario with Alternative 4 would result in two intersections during the a.m. peak hour operating at unacceptable LOS (LOS D and E) conditions and one intersection during the p.m. peak hour would operate at an LOS F; delays would range from 10.0 to 126.5 seconds (2.1 minutes). Detailed discussions regarding cumulative impacts to each study intersection with the addition of Alternative 4 is described below.

- Intersection 1 (Neighbours Boulevard and Riverside Drive)
    - During the a.m. peak hour would experience the greatest decrease in LOS [degrade from LOS B to LOS E (unacceptable level)] and delays would increase from 14.2 to

40.1 seconds. The major contributors to cumulative impacts at this intersection include Alternative 4 (54%) and Palo Verde Mesa Solar Project (43%).
- During the p.m. peak hour would degrade from and LOS A to LOS B and delays would increase from 10 to 13.2 seconds.

- Intersection 2 (Neighbours Boulevard and I-10 Westbound Ramps)

  - This intersection would experience the greatest increase in cumulative trips (874 trips during the a.m. peak hour and 783 trips during the p.m. peak hour). During the a.m. peak hour would degrade from LOS C to LOS D (unacceptable level) and delays would increase from 16.6 to 26.2 seconds. The major contributors to cumulative impacts at this intersection include Alternative 4 (40%) and Palo Verde Mesa Solar Project (49%). Alternative 3 would be a considerable contributor to cumulative traffic.
  - During the p.m. peak hours would degrade from an LOS B to LOS C and delays would increase from 13.1 to 20.0 seconds.

- Intersection 3 (Neighbours Boulevard and I-10 Eastbound Ramps)

  - Of the four study intersection, Intersection 3 would experience the greatest delays (2.1 minutes).
  - During the a.m. peak hour would operate at LOS B and delays would increase from 11.2 to 14.6 seconds.
  - During the p.m. peak hour would degrade from an LOS D (unacceptable level) to LOS F and delays would increase from 29.0 to 126.5 seconds (2.1 minutes).The major contributors to the cumulative impacts at this intersection include the Alternative 4 (49%) and Palo Verde Mesa Solar Project (38%).

- Intersection 4 (Neighbours Boulevard and Seeley Avenue)

  - This intersection would also experience the least amount of cumulative impacts and delays, because Alternative 4 would contribute 92 percent of the cumulative trips.
  - During the a.m. and p.m. peak hour would degrade from LOS A to LOS B and delays would range from 9.5 to 13.1 seconds.

As discussed in Alternative 1, it is very unlikely that the peak construction periods of all cumulative projects would occur simultaneously. There may be some overlap in overall construction schedules (peak and non-peak) for a few cumulative projects and the LOS for I-10 may decrease to LOS D, but it would be temporary and within Caltrans' acceptable LOS level. With implementation of BMPs, impacts to traffic and transportation would be minimized. Implementation of Mitigation Measure Traffic-1 (Traffic Management Plan) would reduce impacts from the proposed Project, and the implementation of Mitigation Measure Traffic-3 to coordinate the construction traffic schedules from multiple large-scale generation projects would further reduce the impacts to traffic and transportation. Therefore, Alternative 4's contribution towards temporary significant cumulative impacts during Project construction would be reduced at the three intersections to less than significant levels.

Alternative 4 would not substantially increase hazards due to design features or incompatible uses (impact TRA-4). The solar arrays would be fenced in; however, no major arterial roads would be closed and internal access roads within the solar facility site would all have sufficient emergency access. Impacts would not be cumulatively considerable and would be less than significant (impact TRA-5).

Construction traffic would increase delays at intersections, which would impact public transit routes mentioned above during a.m. and p.m. peak hours (impact TRA-6); however, the with implementation of Mitigation Measure Traffic-1, Alternative 4's contribution to cumulative impacts would be less than significant.

Operation and Maintenance

Operations under Alternative 4 would result in a nominal increase in traffic and would generate substantially less traffic than construction activities. Also, the cumulative projects that would utilize the same intersections would similarly have a limited workforce for operations. Therefore, no adverse impacts would occur due to traffic generated during the operation phase.

No road closures are anticipated for Alternative 4; however, Seeley Avenue and Riverside Drive would be improved for emergency vehicle access. Interior access roads within the solar facility site would be constructed to allow sufficient access for fire trucks and emergency responders (BMP-15). A Fire Management and Protection Plan (BMP-4) and Emergency Action Plan (BMP-5) would be prepared in cooperation with the Riverside County Fire Department and emergency responders. Access gates and internal access roads within the solar facility site would be identified. Therefore, impacts to emergency vehicles would not be cumulatively considerable significant impacts.

Decommissioning

Decommissioning impacts from Alternative 4 would be similar to construction. It is very unlikely that decommissioning of all cumulative projects would occur at the same time; however, it is assumed that decommissioning impacts from the cumulative projects would be similar to construction, but would be less intense and of a shorter duration. Therefore, Alternative 4 would not result in cumulatively considerable significant impacts.

Alternative 5: Reduced Acreage Alternative

Construction

It is very unlikely that the peak construction periods of multiple projects would coincide; however, there may be some overlap in overall construction schedules (peak and non-peak) for a few cumulative projects and the LOS for the I-10 freeway may decrease to LOS D, but it would be temporary.

It is anticipated that Alternative 5 would experience similar traffic impacts (delays and LOS) as Alternative 1 (Table 4.2.14-8). However, the solar facility components north of I-10 would not be constructed; therefore, Alternative 5 would not impact Intersection 1 (Riverside Drive and Neighbours Boulevard). Even with a reduction of trips north of I-10, during the a.m. and p.m. peak hours, the addition of Alternative 5's construction traffic would increase delays at Intersections 2, 3, and 4. Intersection 2 during the a.m. peak hour and Intersection 3 during the p.m. peak hour would operate at unacceptable LOS.

In comparison to Alternative 1, development of Alternative 5 would create additional traffic contributions to Intersections 2, 3, and 4. As previously described, the increased turn volumes for left turns could increase the delay at this location for Intersection 2 under Alternative 5. The westbound ramp would likely have a higher volume off the ramp in the a.m. at the stop, causing a higher delay as well as a higher queue build-up under Alternative 5. This would also occur for the eastbound ramp. Under Alternative 5, Neighbours Boulevard and Seeley Avenue would have an increased delay compared to Alternative 1 due to an increase in construction traffic volumes diverted south. With the addition of numerous cumulative projects, the impacts at each of these intersections would be increased even further in comparison to development of Alternative 1.

Similar to the Alternative 1 cumulative scenario, under the Alternative 5 scenario, Intersection 3 during a.m. and p.m. peak hours, and Intersections 2, 3, and 4 during the p.m. peak hours, would not comply with the Riverside County CMP, RCGP, or City of Blythe General Plan (impacts TRA-1 and TRA-2).

The forecast traffic volumes plus cumulative projects plus Alternative 5 construction traffic would cause a deterioration of LOS at Intersections 2, 3, and 4. Alternative 5 would be a cumulatively considerable contributor to traffic congestion impacts at Intersections 2 and 3; Intersection 4 would operate at an acceptable LOS. However, with implementation of BMPs, impacts would be minimized and implementation of Mitigation Measures Traffic-1 and Traffic-3 would reduce Alternative 5's considerable

contribution towards temporary significant cumulative impacts during construction at the three intersections to less than significant levels; Intersection 1 would not contribute to considerable cumulative impacts under Alternative 5.

As described above, it is very unlikely that the cumulative contribution of construction traffic volumes from the Rio Mesa Solar Electric Generation Facility, Blythe Solar Power Project, and Desert Quartzite would occur during overlapping peak construction periods, as these projects are tracking along different schedules. With implementation of BMPs and Mitigation Measures Traffic-1 through Traffic-3, Alternative's 5 cumulative contributions to traffic and transportation impacts would be reduced to less than significant levels.

Alternative 5 would not substantially increase hazards due to design features or incompatible uses (impact TRA-4). The solar arrays would be fenced in; however, no major arterial roads would be closed and internal access roads within the solar facility site would all have sufficient emergency access. Impacts would not be cumulatively considerable and would be less than significant (impact TRA-5). Construction traffic would increase delays at intersections, which would impact public transit routes mentioned above during a.m. and p.m. peak hours (impact TRA-6); however, with implementation of Mitigation Measure Traffic-1, Alternative 5's contribution to cumulative impacts would be less than significant.

Operation and Maintenance

Similar to Alternative 1, Alternative 5 operation would result in a nominal increase in traffic and would generate substantially less traffic than construction activities. Also, the cumulative projects that would utilize the same intersections would similarly have a limited workforce for operations. Therefore, no adverse impacts would occur due to traffic generated during the operation phase.

No road closures are anticipated for Alternative 5; however, Seeley Avenue would be improved for emergency vehicle access. Interior access roads within the solar facility site would be constructed to allow sufficient access for fire trucks and emergency responders (BMP-15). A Fire Management and Protection Plan (BMP-4) and Emergency Action Plan (BMP-5) would be prepared in cooperation with the Riverside County Fire Department and emergency responders. Access gates and internal access roads within the solar facility site would be identified. Therefore, impacts to emergency vehicles would not be cumulatively considerable significant impacts.

Decommissioning

Decommissioning impacts from Alternative 5 would have similar impacts as construction. It is very unlikely that decommissioning of all cumulative projects would occur at the same time; however, it is assumed that decommissioning impacts from the cumulative projects would be similar to construction, but would be less intense and of a shorter duration. Therefore, Alternative 5 would not result in cumulatively considerable significant impacts.

Mitigation Measures

The following measures are proposed to minimize impacts during Project construction:

Traffic-1 A construction phase Traffic Management Plan would be prepared in consultation with Caltrans and Riverside County for the roadway network potentially affected by construction activities at the Project area and off-site gen-tie line facilities. In order to achieve acceptable LOS, the Traffic Management Plan would include a plan to split the workforce and stagger arrival times during peak construction periods along with a traffic LOS and queue monitoring program, as determined necessary by the County's Transportation Department staff. The plan would be based upon the analysis set forth in the Draft EIR/EA. Carpooling shall also be required of contractor employees during the construction phase to help achieve acceptable LOS levels. In addition to the above-mentioned measures, other approaches could be considered to reduce peak hour traffic, such as requiring contractors to arrange employee busing and/or employee participation in park and ride.

Traffic-2 The contractor would conduct construction activities in accordance with Caltrans' applicable limitations on vehicle sizes and weights, Construction Excavation Permits obtained from Riverside County, Encroachment Permits from Caltrans, and permits and licenses from the California Highway Patrol and Caltrans for the transport of hazardous substances.

Traffic-3 Construction traffic coordination shall be required to address potential cumulative traffic issues associated with concurrent construction of several large projects with large workforces, approximately from 2013 through 2015. The Applicant shall coordinate construction traffic with applicable traffic management (e.g., Caltrans, Riverside County, and City of Blythe) as well as BLM representatives, as determined appropriate and necessary by the listed agencies. The Applicant shall also coordinate construction traffic with other proponents of renewable energy projects in the I-10 corridor. Cumulatively considerable projects shall be identified and the appropriate staggered arrival times or other approaches (such as busing, park and ride, or carpooling) will be prescribed to achieve an acceptable LOS.

Residual Impacts After Mitigation

With implementation of the BMPs, impacts from the proposed Project and Alternatives would be minimized. Implementation of Mitigation Measures Traffic-1 though Traffic-3 would reduce cumulative traffic impacts to a less than significant level.

NEPA Conclusions

The Project and each of the action Alternatives would involve the direct and indirect impacts and contribution toward cumulative impacts that are described above. The Project and action Alternatives would comply with all applicable laws and regulations, and traffic generated by the Project or any of the action Alternatives would not interfere with present or planned uses on federally managed lands. With the implementation of BMPs and the traffic Mitigation Measures identified above, the Project and action Alternatives would not have a significant adverse impact on traffic conditions. The No Project Alternative would not have impacts, as the existing circumstances and operations would continue essentially unchanged.

CHAPTER 5: OTHER NEPA/CEQA CONSIDERATIONS

5.1 Significant and Unavoidable Environmental Impacts

Analysis of environmental impacts of the proposed Blythe Mesa Solar Project (Project) and Alternatives are discussed in Chapter 4 (Sections 4.2.1 through 4.2.15) of this Draft Environmental Impact Report/Environmental Assessment (Draft EIR/EA). As required by the California Environmental Quality Act (CEQA), potentially feasible mitigation measures have been proposed to reduce significant environmental impacts to a level of less than significant. As required by the National Environmental Policy Act (NEPA), where potential adverse environmental impacts have been identified, mitigation measures are proposed that, when implemented, would reduce the impact. Summaries of the impacts and mitigation measures for each subject area are provided in the Executive Summary. No unavoidable significant environmental impacts were identified for the Project or an Alternative.

5.2 Irreversible and Irretrievable Commitments of Resources

CEQA Guidelines Section 15126.2 and NEPA Regulations (40 Code of Federal Regulations [CFR] Part 1502.16, 1508.8(b)), the Bureau of Land Management (BLM) NEPA Handbook (H-1790-1 Section 9.2.9) require a discussion of irreversible or irretrievable commitments of resources that would be caused by implementation of a proposed project or alternative.

Resources irreversibly or irretrievably committed to a proposed project are those used on a long-term or permanent basis. This includes the use of nonrenewable resources such as metal, wood, fuel, paper, aggregate, and other natural resources. These resources are considered irretrievable in that they would be used for a proposed action when they could have been conserved or used for other purposes. Another irreversible or irretrievable commitment of resources is the unavoidable destruction of natural resources that could limit the range of potential uses of that particular environment.

Construction of the proposed Project or Alternatives would commit nonrenewable resources during Project construction and ongoing utility services during Project operations. During Project operations, oil, gas, and other nonrenewable resources would be consumed for maintenance purposes, although on a limited basis.

At the end of the Project's useful life (approximately 25 years), the Project could be decommissioned. The Project is a renewable energy project intended to generate solar energy to reduce reliance on fossil fuels. Over the 25-year life of the Project, this renewable energy project would contribute incrementally to the reduction in demand for fossil fuel used to generate electricity, thereby resulting in a positive effect counteracting the commitment of nonrenewable resources to the Project.

5.3 Short-term Uses and Long-term Productivity

The NEPA Guidelines (40 CFR Part 1502.16) and the BLM NEPA Handbook (H-1790-1 Section. 9.2.9) require a discussion of the relationship between short-term uses and long-term productivity of the environment from implementation of a proposed project or one of the action alternatives. "Short term" refers to the total duration of project construction, whereas "long-term" (in the case of this Project) refers to the life term of the Project beyond the construction phase. The specific impacts of the proposed Project vary in kind, intensity, and duration according to the activities occurring at any given time. The proposed Project would involve tradeoffs between long-term productivity and short-term uses of the environment.

The short-term uses of the environment as a result of the Project and its built action alternatives would include those typically found with solar energy development. Short-term impacts associated with construction activities described in Chapter 4, Environmental Consequences, include effects to the natural environment and cultural resources. These can be compared to the long-term benefits of the

proposed Project and action Alternatives, all of which would provide for the production of clean, renewable energy consistent with federal and State goals to increase production of renewable energy to help reduce dependence on fossil fuels.

The action Alternatives would all also provide a long-term benefit by generating electric power without any increase in the use of non-renewable resources, such as fossil fuels, which would result in a benefit to air quality and a reduction in carbon-based emissions.

5.4 Growth-inducing Impacts

A project is considered growth-inducing if it can foster economic or population growth or the construction of additional housing, either directly or indirectly, in the surrounding environment (CEQA Guidelines Section 15126.2(d)). This definition includes projects that would remove obstacles to population growth, such as by extending public services into areas not previously served. Growth inducement can also be defined as an action that would encourage an increase in density of development in surrounding areas or encourage adjacent development. According to CEQA Guidelines Section 15126.2(d), growth should not be assumed to be beneficial, detrimental, or of little significance to the environment.

Construction of the solar facility and 230 kilovolt (kV) gen-tie line is anticipated to occur over a three-year period, of which peak construction would occur over two years and require approximately 500 daily workers present on the site. After completion of construction, operation of the solar facility would require 12 full-time personnel. As noted in the discussion of population and housing impacts in Chapter 4, this population increase during construction would be temporary and is not projected to create a need for additional housing. The proposed Project is located mostly within an unincorporated area of Riverside County, with a small part in the City of Blythe, and does not involve the development of a residential component that would result in direct population growth in the area. Additionally, the Project would not involve the development of any new roadways, water systems, or sewer systems other than those designed specifically to serve the Project. Infrastructure improvements to serve the Project would be limited and would not be available to serve surrounding areas. As such, the proposed Project would not induce substantial population growth in the area.

Additionally, the proposed Project would not induce population growth because:

1) the additional energy would be used to ease the burdens of meeting existing energy demands within and beyond the area of the Project;
2) the energy would be used to support already-projected growth;
3) the energy produced would be used to offset the use of fossil fuels to meet California's Renewable Portfolio Standard and Executive Order S-14-08; and
4) the factors affecting growth are so multifarious that any potential connection between additional energy production and growth would necessarily be too speculative and tenuous to merit extensive analysis.

Thus, this level of analysis is sufficient to inform the public and decision-makers of the growth-inducing impacts of the Project.

CHAPTER 6: COORDINATION AND CONSULTATION

6.1 Introduction

This chapter summarizes the Bureau of Land Management's (BLM) and the County of Riverside's public and agency involvement and outreach activities related to the Blythe Mesa Solar Project (Project). California Environmental Quality Act (CEQA) Guidelines Section 15129 states that an "EIR [Environmental Impact Report] shall identify all federal, state, or local agencies, other organizations, and private individuals consulted in preparing the draft EIR." The National Environmental Policy Act (NEPA) requires that federal agencies encourage and facilitate public involvement in the NEPA process to the fullest extent possible (40 Code of Federal Regulations [CFR] Part 1500.2(d), 40 CFR Part 1506.6). In the context of the preparation an Environmental Assessment (EA), however, "while some public involvement is required, [the BLM has] the discretion to determine how much, and what kind of involvement, works best for each individual EA" (BLM NEPA Handbook, Section 8.2).

Consistent with CEQA and NEPA requirements, public participation and agency consultation for this Project have been accomplished through issuance of public notices, public scoping meetings, and formal and informal consultation with agencies, stakeholders, landowners, and Native American Tribes. The consultation and coordination process helped to determine and focus the scope of the Draft EIR/EA and identify a range of alternatives and mitigation measures. The County of Riverside is the CEQA Lead Agency and the BLM is the NEPA Lead Agency.

Section 6.2 of this document describes the scoping process for the proposed Project that was conducted by the County of Riverside. Sections 6.3 through 6.8 describe the coordination and consultation process for preparation of a joint CEQA/NEPA document by the BLM and County of Riverside.

6.2 Draft EIR/EA Scoping Process

The public, affected agencies, Native American Tribes, and other interested parties were invited to participate in the environmental review process. The following sections summarize the scoping process; details regarding the process are documented in the Scoping Report found in Appendix A.

6.2.1 Notice of Preparation

In compliance with Title 14 of the California Code of Regulations (CCR) Section 15082, the County of Riverside prepared a Notice of Preparation (NOP) of an EIR that described the proposed Project and location, environmental review process, the potential environmental effects, and contact information, as well as announced the time and location of the public scoping meeting. On November 16, 2011, the NOP was filed with the State Clearinghouse (SCH) (SCH No. 2011111056). The NOP was also filed with the County of Riverside's County Clerk on November 21, 2011, which commenced the public review period. The NOP was sent via certified mail to 51 agencies (federal, State, County, and city), 22 Native American Tribes, and two elected officials. A copy of the NOP and mailing labels may be found in Appendix A.

6.2.2 Public Scoping Meeting

In compliance with CCR Section 15082(c), Riverside County conducted a public scoping meeting to inform the public about the Project; describe the purpose and need of the Project; provide information regarding the environmental review process; and gather public input regarding the scope and content of the EIR. The public scoping meeting was held on the following date and location:

December 12, 2011; 5:30 to 7:00 pm
Blythe City Council Chambers
235 N. Broadway
Blythe, CA 92225

The scoping meeting date and location were announced in the NOP. The meeting was also advertised in the Desert Sun and Palo Verde Times on December 2, 2011. Copies of the newspaper advertisements, PowerPoint presentation, display boards, comment form, and meeting transcript are located in Appendix A.

Project team members were available to answer questions about the displays and other Project-related topics and to listen to feedback, concerns, and issues raised by the public. A total of six people signed in at the scoping meeting (December 12, 2011). Attendees were encouraged to comment by filling out a comment form.

6.2.3 Outreach

Notification of Scoping Session

A notice of a Scoping Session was mailed to 120 property owners within 2,400 feet of the Project boundary (Appendix A). The notice briefly discussed the proposed Project, and date, time, and location of the scoping meeting.

Notification to Native American Tribes

In April 2011, a letter was submitted to the Native American Heritage Commission (NAHC) requesting information regarding Native American groups that may have historic ties to, and interest in, the proposed Project area. In May 2011, 20 CEQA scoping letters were sent to the tribes identified by the NAHC. Responses were received from the Aqua Caliente Band of Cahuilla Indians Tribal Historic Preservation Officer and the Augustine Band of Cahuilla Indians.

Native American tribal consultation by the BLM is summarized in Section 6.6.2.

6.2.4 Scoping Topics of Concern

A total of 10 comments were received during the scoping period for the proposed Project, which took place from November 21, 2011 to December 21, 2011. All 10 comments were received from agencies, and copies of the original comments letters may be found in Appendix A. The issue topics raised by the commenters included:

- Air Quality
- Public Services and Utilities
- Socioeconomics
- Hazardous Materials/Soils
- Cultural Resources
- Water Resources

6.3 Draft EIR/EA Informational Meetings

On May 10, 2012, two informational meetings were conducted for the Project. In the morning, the BLM sponsored the pre-application meeting with several resource agencies who have interest in the Project. The afternoon meeting was sponsored by the Project Applicant to provide Project information to Native American groups. The purpose of these meetings was to present information about Project alternatives; describe the purpose and need of the Project; provide information regarding the environmental review process; and gather input regarding the preliminary alternatives. The meeting between the Project Applicant and Native American tribes was not part of the BLM's Section 106 and government-to-government consultation efforts, which are discussed in Section 6.6.2.

The meetings consisted of a combination of open house and formal presentations. Display boards and a large Project map were set up around the room. Project team members were available to answer

questions about the displays and other Project-related topics. A question and answer session was held after the presentation. At the conclusion of the question and answer session, the open house continued and staff members were available to answer questions and gather input.

Tables 6-1 and 6-2 list the agencies and Native American tribes that were invited to the meetings.

Table 6-1 Agency Representatives

AGENCY	REPRESENTATIVE
California Department of Fish and Game	M. Rodriguez
City of Blythe	Barbara Burrow
National Parks	Andrea Compton
Riverside County	Ken Baez
Riverside County	Jay Olivas
Riverside County Airport Land Use Commission (ALUC)	John Guerin
Riverside County ALUC	G. Neal
Riverside County ALUC	Simon Housman
U.S. Army Corps of Engineers (USACE)	Shannon Pankratz
USACE	James Mace
USACE	Crystel Doyle
U.S. Fish and Wildlife Service (USFWS)	Nisa Marks

Table 6.2 Native American Tribes and Tribal Organizations I

AFFILIATION	REPRESENTATIVE
Agua Caliente Band of Cahuilla Indians	Patricia Tuck, THPO
AhaMaKav Cultural Society, Fort Mojave Indian Tribe	Linda Otero, Director
Ah-Mut-Pipa Foundation (Quechan Kumeyaay)	Preston J. Arrow-weed
Augustine Band of Cahuilla Mission Indians (Cahuilla)	Mary Ann Green, Chairperson
Augustine Band of Cahuilla Mission Indians (Cahuilla)	Karen Kupcha
Cahuilla Band of Indians	Luther Salgado, Sr. Chairperson
Chemehuevi	Joseph R. Benitez (Mike)
Chemehuevi Reservation	Charles Wood, Chairperson
Cocopah Museum/Cultural resources Dept. (Cocopah)	Jill McCormick, Tribal Archaeologist
Colorado River Indian Tribe (Mojave, Chemehuevi)	Ginger Scott, Museum Curator; George Ray, Coordinator
Fort Mojave Indian Tribe (Mojave)	Mr. Tim Williams, Chairperson
Fort Mojave Indian Tribe (Mojave)	Nora McDowell, Cultural Resources Coordinator
Fort Yuma Quechan Indian Nation (Quechan)	Michael Jackson, President
Morongo Band of Mission Indians (Cahuilla, Serrano)	Michael Contreras, Cultural Heritage Program
Quechan Indian Nation	Bridget Nash-Chrabascz, THPO
Ramona Band of Cahuilla Mission Indians (Cahuilla)	Joseph Hamilton, Chairman
San Manuel Band of Mission Indians (Serrano)	Ann Brierty, Policy/Cultural Resources Dept.
Santa Rosa Band of Mission Indians (Cahuilla)	Mayme Estrada, Chairwoman
Torres-Martinez Desert Cahuilla Indians (Cahuilla)	Diana L. Chihuahua, Vice Chairperson, Cultural
Twenty-nine Palms Band of Mission Indians (Chemehuevi)	Darrell Mike, Chairperson

6.4 BLM Public Scoping Meeting

On October 4, 2012, the BLM conducted a scoping meeting in Blythe, California. The BLM and Applicant presented information about the Project, alternatives, environmental review process, and potential impacts. A question and answer session was held after the presentation. At the conclusion of the question and answer session, the open house continued and staff members were available to answer questions and gather input. A total of ten individuals attended the meeting.

6.4.1 Notification

A Public Meeting announcement was mailed to 139 recipients, which included agencies, Native American Tribes, organizations, and interested individuals. A newspaper advertisement in the *Palo Verde Valley Times* was published on September 28, 2012 that announced the public meeting date, time, and location.

6.4.2 BLM Scoping Meeting Topics of Concern

In addition to the oral comments received at the BLM scoping meeting on October 4, 2012, a total of three comments were received. One comment was made by a concerned citizen on a public comment card. The other two were both from the same individual from a Native American organization. All three copies of the original comments may be found in Appendix A. The issue topics raised by the commenters included:

- Public Services and Utilities
- Socioeconomics
- Cultural Resources
- Hazards

6.5 Agency Contacts

In compliance with CEQA Guidelines Section 15129 and NEPA requirements, Table 6-3 below identifies federal, State, or local agencies and other organizations contacted in preparation of this Draft EIR/EA.

6.6 Consultations

6.6.1 Informal

Endangered Species Act Section 7

The U.S. Fish and Wildlife Service (USFWS) has jurisdiction to protect threatened and endangered species under the Endangered Species Act (ESA) (16 United States Code [U.S.C.] § 1531 et seq.). Formal consultation with the USFWS under Section 7 of the ESA is required for any federal action that may adversely affect a federally listed species. On November, 19, 2012, the USFWS issued a determination letter that the Project would not likely adversely affect federally listed species (see Appendix L); therefore, an ESA Section 7 formal consultation is not required.

The California Department of Fish and Wildlife (CDFW) is the administer agency for the California Endangered Species Act (CESA). CESA includes a requirement for consultation “to ensure that any action authorized by a state lead agency is not likely to jeopardize the continued existence of any endangered or threatened species… or result in the destruction or adverse modification of habitat essential to the continued existence of the species” (§ 2090). The CDFW has been contacted and informally consulted with regarding the proposed Project. These informal consultations included several in-person meetings and email concurrence on the biological surveys and data collection.

Table 6-3 Agency Contact Summary

AFFILIATION	DEPARTMENT	NAME	TITLE
Federal Agencies			
Bureau of Land Management		Frank McMenimen	Project Manager
Bureau of Land Management		Jeff Childers	Project Manager
Bureau of Land Management		Kim Marsden	Natural Resource Specialist
Bureau of Land Management		Tiffany Thomas	Archaeologist
U.S. Fish and Wildlife Service		Nisa Marks	Biologist
Federal Aviation Administration	Western Pacific Region		
Bureau of Indian Affairs	Southern California Agency		
U.S. Army Corp of Engineers	Regulatory Branch, Carlsbad Field Office	Shanti Abichandani Santulli	Project Manager
State Agencies			
California Department of Fish & Game	Inland Deserts	Rodriguez, Magdalena	Staff Environmental Scientist
California Department of Fish & Game	Inland Deserts	Shamar, Shankar	Staff Environmental Scientist of Renewable Energy
California Department of Fish & Game	Eastern Sierra Inland Deserts Region	MacNair, Leslie	Staff Environmental Scientist
Mojave Desert Air Quality Management District			
Native American Heritage Commission		Singleton, Dave	Program Analyst
Regional Water Quality Control Board #7	Colorado River Basin		
Southern California Association of Governments		Roth, Erik H.	Manager
County Agencies			
Riverside County	Planning Department	Ross, Larry	Principal Planner
Riverside County	Planning Department	Harrison, Tamara	Urban and Regional Planner IV
Riverside County	Airport Land Use Commission	Guerin, John	Principal Planner
Riverside County	Building & Safety Department	Gonzalez, Sam	Principal Inspector - Building & Safety
Riverside County	Environmental Programs Department	Young, Chad	Senior Ecological Resource Specialist
Riverside County	Planning Department	Jones, David	Chief Engineering Geologist
Riverside County	Planning Department	Jones, David	County Archaeologist
Riverside County	Flood Control District	Tina Hanson	Associate Civil Engineer
Riverside County	Regional Parks & Open Space District	Brewer, Marc	Senior Planner
Riverside County Planning Commission		Zuppardo, Jan	Planning Commissioner
City/Local Agencies			
Palo Verde Irrigation District		Henning, Roger	Chief Engineer
Palo Verde Resource Conservation District			

6.7 Consultations

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Endangered Species Act Section 7

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6.7.2 Formal

National Historic Preservation Act Section 106

Section 106 of the National Historic Preservation Act (NHPA), as amended, through its implementing regulations codified in "Protection of Historic Properties" (36 Code of Federal Regulations [CFR] Part 800), requires federal agencies to take into account the effects of a proposed undertaking on historic properties and to afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment. It has been determined that the proposed Project and Alternatives would constitutes an "undertaking" as defined in 36 CFR Part 800.16(y) and involves the type of activity that could affect historic properties (36 CFR Part 800.3(a)), the BLM as lead federal agency for the Project, has the statutory responsibility for compliance with provisions of Section 106 of the NHPR (36 CFR Part 800.2(a)(2)). 36 CFR Part 800.1(a) states that the purpose and goal of the Section 106 process as follows:

> The Section 106 process commences at the early stages of project planning and seeks to accommodate historic preservation concerns with the needs of federal undertakings through consultation among the agency official and other parties with an interest in the effects of the undertaking on historic properties. The goal of consultation is to identify historic properties potentially affected by the undertaking, assess the undertaking's effects, and seek ways to avoid, minimize, or mitigate any adverse effects on historic properties.

The steps in the Section 106 process are briefly described below. Following the description of the step is a summary presenting the BLM's compliance with the process to date, including government-to-government consultation with Native American Tribes.

Step 1: Initiation of the Section 106 Process. The agency official shall determine whether the proposed federal action is an undertaking per 36 CFR Part 800.16 and whether it has the potential to cause effects on historic properties. The agency official shall coordinate the steps of the Section 106 process with other concurrent reviews for the Project and plan for involving the public in the Section 106 process. The agency official shall also identify the appropriate State Historic Preservation Office (SHPO), Native American tribes, and other consulting parties to be included in the consultation process.

Step 2: Identification and Evaluation of Historic Properties (Cultural Resources). Properties within a project's Area of Potential Effects (APE) are identified with input from the SHPO, Native American tribes and other consulting parties, and evaluated for eligibility to the National Register of Historic Places (NRHP) in consultation with the SHPO. See 36 CFR Part 800.4. BLM applies NRHP criteria for eligibility for listing found at 36 CFR Part 60.4, in conformance with the Secretary of the Interior's Standards and Guidelines for Evaluation (48 Federal Register 44723-44726). In general, NRHP eligibility criteria include:

"The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:

A) That are associated with events that have made a significant contribution to the broad patterns of our history; or
B) That are associated with the lives of persons significant in our past; or
C) That embody the distinctive characteristics or a type, period, method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
D) That have yielded, or may likely yield, information important in prehistory or history."

Step 3: Assessment of Effects. BLM determines whether or not the undertaking will affect historic properties listed in or eligible for the NRHP (36 CFR Part 800.4(d)). BLM must seek concurrence from the SHPO, or Tribal Historic Preservation Officer (THPO) when appropriate, if it determines that no historic properties will be affected. When BLM determines that historic properties will be affected, BLM must assess whether such effects will be adverse by applying the criteria outline at 36 CFR Part 800.5(a)(1). "Effect" is defined in the regulations as an "alternative to the characteristics of a historic property qualifying it for inclusion in or eligibility for the National Register" (36 CFR Part 800.16(i)). An effect is deemed to be adverse when the effect may "alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling or association" (36 CFR Part 800.5(a)(1)).

Step 4: Resolution of Adverse Effects. Through consultation with the SHPO, Native American Tribes, other consulting parties, and the ACHP, if they elect to participate in Section 106 consultation, BLM will seek to resolve potential adverse effects of the proposed undertaking through a Memorandum of Agreement (MOA) or Programmatic Agreement (PA) (36 CFR Part 800.6). The purpose of consultation at this phase of the process is to develop treatment measures to avoid, resolve, or minimize potential adverse effects to historic properties, which will be implemented through the MOA or PA. An MOA often includes a treatment plan that takes into account the effects on NRHP-eligible or listed resources, depicts the APE, discusses reporting requirements, addresses discoveries and unanticipated effects, specifies curation requirements, and provides several administrative provisions. Consulting parties, including Programmatic Agreement tribes, and other parties as appropriate, are invited to participate in this consultation and the development of the MOA, and would typically be invited to sign the MOA as concurring parties. BLM must notify the ACHP of its adverse effect determination and intention to resolve such adverse effects through an MOA or PA. The ACHP may elect to participate in consultation for the MOA or PA. Because the BLM has found that there would be no historic properties adversely affected by the undertaking, neither an MOA or a PA is required for the Blythe Mesa Solar Project. As part of its responsibilities under Section 106 of the NHPA, the BLM sent a letter on August 7, 2013 to the California SHPO regarding the proposed Project. The purpose of the letter was to notify the SHPO of the Project and to initiate formal consultation on the Blythe Mesa Solar Project. The letter also requested that the SHPO combine consultation on the identification efforts with consultation on the determinations of eligibility and findings of effects. The letter then described Identification Efforts, Evaluation Efforts, Analysis of Effects, Agency Determinations of Eligibility, and Agency Finding of Effect. The BLM found that there would be no historic properties adversely affected by the undertaking.

On October 21, 2013, the BLM received a response from the SHPO requesting more information on the BLM's determinations and findings on the Blythe Army Air Base and the remnant historic features located

within the APE (i.e., hospital facility, barracks, fire station, and warehouses). The BLM sent this additional information to the SHPO in January 2014.

The BLM sent a letter on August 7, 2013 to the ACHP regarding the proposed Project. In this letter, the BLM invited the ACHP to participate in the Section 106 process in accordance with 36 CFR Part 800.2(b)(1). On August 14, 2013, the ACHP sent a letter to the BLM electing not to participate in the Section 106 process.

Native American Tribal Consultation

The BLM consults with Native American tribes on a government-to-government basis in accordance with several authorities, including NEPA, the NHPA, the American Indian Religious Freedom Act, and Executive Order 13175. Under Section 106 of the NHPA, the BLM consults with Indian tribes as part of its responsibilities to identify, evaluate, and resolve adverse effects on historic properties affected by BLM undertakings. To date, the BLM has identified and invited 15 Indian tribes to consult on the Project, including the Aqua Caliente Band of Cahuilla Indians, Augustine Band of Cahuilla Indians, Cabazon Band of Mission Indians, Cahuilla Band of Mission Indians, Chemehuevi Indian Tribe, Cocopah Indian Tribe, Colorado River Indian Tribes, Fort Mojave Indian Tribe, Fort Yuma Quechan Tribe, Morongo Band of Mission Indians, Ramona Band of Mission Indians, San Manuel Band of Mission Indians, Soboba Band of Luiseno Indians, Torres-Martinez Desert Cahuilla Indians, and Twenty-Nine Palms Band of Mission Indians.

The BLM holds Section 106 consulting party group meetings that offer a forum for providing project updates, presenting the results of cultural resources studies, and openly discussing and sharing ideas about information and concerns about projects. Also, individual government-to-government meetings with Indian tribes provide a separate forum for tribes to share information and concerns openly and candidly in an individual context, apart from other consulting parties and about other issues not necessarily related to the Section 106 process. To supplement these activities, additional good faith efforts are made by the BLM pursuant to Section 106, as part of the government-to-government consultation process. These additional efforts are summarized in Table 6-4.

Information and concerns brought to light during the consultation process are summarized below. All written communications submitted to the BLM by tribal officials are available in their entirety as part of the formal administrative record for the Project.

The BLM invited Native American tribes to consult on the Project on a government-to-government basis. Letters from the BLM dated March 12, 2012 were sent informing them about the application submitted by Renewable Resources Group for a ROW grant, explaining the BLM's role in the environmental review process, and inviting them to consult in a government-to-government manner pursuant to Executive Order 13175, the Executive Memorandum of April 29, 1994, and other relevant laws and regulations including Section 106. The letters also requested assistance in identifying any issues or concerns about the proposed Project, including the identification of sacred sites and places of cultural significance that might be affected by the Project.

In a response letter dated March 26, 2012, the Chairperson of the Augustine Band of Cahuilla Indians reported no specific resources in the Project area, requested that tribal monitors be used during the cultural resource survey, and asked to be notified if cultural resources were identified.

The BLM sent follow up letters to Native American tribes on August 8, 2013, reiterating its invitation for them to enter into government-to-government and Section 106 consultation. This letter also: (1) provided an update on the environmental review process and cultural resources identification efforts; (2) offered to provide copies of the *Blythe Mesa Solar Project: Archaeological Resources and Built Environment Survey, Riverside County, California* and *Blythe Mesa Solar Project: Archaeological Resources and Built Environment Survey, Transmission Line Alternatives Supplemental Report, Riverside County, California*; (3) summarized the BLM's determinations of eligibility for cultural resources within the APE; and 4) summarized the BLM's findings of effect for historic properties.

Responses were received from two Native American tribes, the Aqua Caliente Band of Cahuilla Indian and the Cocopah Indian Tribe, requesting copies of the survey reports. Copies of the two reports were sent to both tribes on September 24, 2013.

The BLM also made a Project update call on October 21, 2012 with the Historic Preservation Officer of the Fort Yuma Quechan Tribe. This call was part of on-going staff coordination between the BLM and Quechan regarding all Palm Springs Field Office projects.

As part of its consultation under Section 106, American Indian Religious Freedom Act, and Executive Order 13175 the BLM acknowledges the traditional importance and value of TCPs and the surrounding landscape as an integral part of tribes' history and continuing culture. To date, the BLM has not received information about TCPs or landscapes in the Project area from the tribes. Based on the limited response, the BLM assumes there are no TCPs within the Project area eligible under Criterion A of the NRHP for their traditional and cultural significance. However, the BLM continues to seek information from tribes about TCPs, should they exist in the Project area.

Additionally, to address the concerns related to the discovery of previously unidentified cultural resources during construction, the BLM will impose a robust construction monitoring plan that provides for tribal participation and the proper treatment and protection of prehistoric human remains should any be found during construction. The BLM will also require the development and implementation of a long-term cultural resource management plan.

Table 6-4 Tribal Consultation in 2012 and 2013

DATE	TYPE	CONTENT
March 12, 2012	Initial letter from BLM.	Sent to chairpersons and other officials at 15 tribes listed in Section 6.4.4.
March 26, 2012	Response Letter from Augustine Band of Cahuilla Indians.	The letter reported that there were no specific resources of concern in the area, requested the use of tribal monitors, and asked to be notified if cultural resources were identified.
August 8, 2013	BLM Findings/ Determinations Letter.	Letter provided a Project update and summarized BLM's determinations of eligibility and findings of effect.
September 18, 2013	Response Letter from Aqua Caliente Band of Cahuilla Indians. Email from Cocopah Indian Tribe.	Both responses requested copies of the archaeological resource and built environment survey reports.
September 24, 2013	Reports sent by BLM, as requested.	Copies of the archaeological resource and built environment survey reports sent to the Agua Caliente Band of Cahuilla Indians and the Cocopah Indian Tribe.
October 13, 2013	Telephone call with Fort Yuman Quechan Tribe.	Provided Project update as part of on-going staff coordination between the BLM and Quechan regarding all Palm Springs Field Office projects.

6.8 Review and Certification Process

6.8.1 CEQA Process

Public Notice/Public Review

In accordance with CEQA Guidelines, Section 15087, the Draft EIR public review and comment period should be no less than 30 days and no longer than 60 days. In the case of the proposed Project, the review period will be 45 day minimum per CEQA.

On June 17, 2014 a Notice of Completion (NOC) was filed with the State Clearinghouse for the Draft EIR/EA, concurrently kicking off the 45-day public review period of the Draft EIR/EA document and

associated technical appendices. The public review period on the Draft EIR/EA begins on June 17, 2014 and ends on August 1, 2014 after which time all comments received will be responded to.

Concurrent with filing the NOC, the County is also required to provide notice to the public, agencies, organization and other interested parties of the availability of the Draft EIR/EA for review and comment. A Notice of Availability was published in the *Desert Sun* and *Palo Verde Times* newspapers as well as posted at the County's website and libraries. Public comment on the Draft EIR/EA will be accepted in written form.

CEQA Lead Agency:

Riverside County Planning Department
4080 Lemon Street, 12th Floor
P.O. Box 1409
Riverside, CA 92502-1409

Response to Comments/Final EIR

A Final EIR will be prepared following the public review and comment period for the Draft EIR/EA.

The Final EIR will respond to written comments received during the public review and comment period and to oral comments made at any public hearings.

Certification of the EIR

The Final EIR will be independently reviewed and considered by the County. If the Final EIR is deemed "adequate and complete," the County may certify the EIR at a public hearing. In general, the rule of adequacy holds that the EIR can be certified if it demonstrates a good faith effort at full disclosure of environmental information and provides sufficient analysis to allow decisions to be made regarding the Project in terms of its environmental consequences.

Following review and consideration of the Final EIR, the County may take action to approve, conditionally approve, revise, or reject the Project. Written findings would accompany a decision to approve or conditionally approve the Project (CCR Section 15091). Likewise a statement of overriding considerations would be prepared if necessary (CCR Section 15093). A Mitigation Monitoring and Reporting Program (MMRP), as described below, would also be adopted for mitigation measures that have been incorporated into or imposed upon the Project to reduce or avoid significant effects on the environment.

Mitigation Monitoring

The County must adopt an MMRP for mitigation measures that have been incorporated into or imposed upon the Project to reduce or avoid significant effects on the environment (CCR Section 15097). This program will be designed to ensure that these measures are carried out during Project implementation.

The specific reporting or monitoring program required by CEQA is not required to be included in the EIR. However, any mitigation measures adopted by the County as part of the certified Final EIR will be considered as conditions for approval of the Project and will be included in the MMRP to ensure and verify compliance.

6.8.2 NEPA Process

The EA with associated technical appendices will be circulated for public comment and review for 45 calendar days, which is consistent with the CEQA review period. Upon the completion of the 45-day public comment and review period, a determination from BLM will be made regarding the selected alternative in the form of either a: 1) Notice of Intent for the preparation of an Environmental Impact Statement if there are significant, unavoidable effects to the human environment; or 2) an unsigned

Finding of No Significant Impact (FONSI) will be circulated for review with the Final EIR/EA explaining the reasons why the selected action will not have a significant effect on the human environment.

NEPA Lead Agency:

Bureau of Land Management
22835 Calle San Juan De Los Lagos
Moreno Valley, CA 92553

6.9 List of Preparers

A list of persons responsible for the preparation of various sections of the Draft EIR/EA or preparation of significant background materials, or who participated to a significant degree in preparing the Draft EIR/EA, is presented below.

County of Riverside—CEQA Lead Agency

- Adam Rush, Principal Planner
- Larry Ross, Principal Planner
- Tamara Harrison, Urban Regional Planner IV
- Chad Young, Biological Sciences
- David Jones, Geology
- Ruth Rhoades, Cultural Resources

Bureau of Land Management—NEPA Lead Agency

- Frank McMenimen, Project Manager
- Tiffany Thomas, Archaeologist
- Kim Marsden, Natural Resource Specialist

Consultants responsible for the technical analysis and document production are listed below, along with their qualifications.

NAME	QUALIFICATIONS	PARTICIPATION
POWER Engineers, Inc.		
Thom Ryan	B.S., City and Regional Planning; M.S., Environmental Studies; 35 years experience	Project Manager
Karen Cadavona	B.S., Biological Sciences; 10 years experience	Project Coordinator; Noise; Traffic and Transportation; Land Use and Planning; Population and Housing
Christopher Knopp	B.A., Environmental Science, International Relations, Political Science, 12 years experience	Deputy Project Manager, Quality Assurance/Quality Control
Kim Quinn	B.A., Environmental Studies, Emphasis Land Use Management and Planning; 13 years experience	Cultural Resources and Paleontological Resources; Geology and Soils
Gina Fegler	B.S., Landscape Architecture; 10 years experience	Aesthetics and Visual Resources
Mark Schaffer	B.S., Geography; M.S., Industrial Hygiene; 31 years experience	Agriculture; Environmental Justice; Hazards and Hazardous Materials; Land Use and Planning; Recreation; Socioeconomics;
Vanessa Santistevan	B.S., Biological Sciences, M.S., Wildlife Biology; 9 years experience	Biological Resources
Jim Rudolph	B.A., Anthropology; M.S., Anthropology; Ph.D. Anthropology; 41 years experience	Cultural Resources
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NAME	QUALIFICATIONS	PARTICIPATION
Allison Carver	B.S. Biology, B.A., Environmental Studies; 12 years experience	Hydrology and Water Quality
Sarice Friedman	B.S. Biological Sciences, M.S., Environmental Studies; 3 years experience	Document Preparation
Saadia Byram	Document Control, Administrative Record, Technical Writing, Project Control; 19 years experience	Technical Editing and Production
Aaron Wolf	B.S., Environmental Science and Policy; 3 years experience	Geographic Information System
David Barrackman	B.A., Geography; 11 year experience	Geographic Information System
Jason Pfaff	MS.S Architecture; 20 years experience	Visual Analysis, Glare Analysis, Visualization Technology
Brian Lathrop	B.S. Virtual Technology & Design; M.S. Architecture; 7 years experience	Visual Analysis, Glare Analysis, Visualization Technology
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Greg Wittman	B.A Geology; M.S. Hydrogeology; 38 years experience.	Water Supply Assessment
Subcontractors		
Scientific Resources Associated *Valorie Thompson*	B.S. Chemistry, M.S. Chemical Engineering, PhD. Chemical Engineering; 25 years experience	Air Quality/Greenhouse Gas Emission
Ninyo and Moore *Gregory T. Farrand*	B.S., Geological Sciences; M.S., City Planning; 33 years of experience	Geology and Minerals
John Minch and Associates, Inc. *John A. Minch*	M.S., Paleontology and Geology; Ph.D., Paleontology and Biostratigraphy; 40 years of experience	Paleontological Resources
KOA Corporation *Mujib Ahmed, P.E.*	M.S., Transportation Engineering 28 years of experience	Transportation
KOA Corporation *George Ghossain*	B.S., Civil Engineering; 12 years experience	Transportation

CHAPTER 7: REFERENCES

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Transportation Research Board. 2000. Highway Capacity Manual. December 2000.

From: Baird, Tera
To: Gregory, Chris
Cc: Thomas Dietsch
Subject: Re: SPUT spreadsheet available?
Date: Wednesday, June 18, 2014 3:17:58 PM
Attachments: 20140604_attach_R8_SPUT_mortality report_DS.xlsx
20140603_ISEGS_R8_SPUT_mortality reporting.xlsx
Ocotillo_Express_Carcass_Summary_15Dec2013.xlsx

---

most recent for Desert Sunlight, ISEGS ....

I don't have a much on Ocotillo Express.

Tera Keeler Baird
Biologist
777 East Tahquitz Canyon Way, Suite 208
Palm Springs, California 92262
(760) 322-2070 extension 217

On Wed, Jun 18, 2014 at 2:46 PM, Gregory, Chris <chris_gregory@fws.gov> wrote:

> Hi Thom,
>
> Thanks for the update. Specifically, I'm looking for the raw data (the SPUT Excel sheet) so as to plot mortalities/injuries in a GIS. Trying to do so before our web/phone meeting next Tuesday as part of the Bird Strike Team. So if you have an older combined file, that's OK with me. Otherwise, Tera has just provided me with Genesis data, and I am still looking for files associated with ISEG/Ivanpah, Sunrise, and Ocotillo Express.
>
> Chris

On Wed, Jun 18, 2014 at 2:33 PM, Thomas Dietsch <thomas_dietsch@fws.gov> wrote:

> HI Chris,
>
> Since the SPUT reports come in independently, they have to be compiled into a single file. I do this intermittently when a summary is required. It takes quite a bit of work to combine the spreadsheets and then clean them up because the data entry is quite uneven. I'm presenting a summary at the AOU conference at the end of the summer, so the next time that I will probably do this will be in late July or August. I haven't been including Ocotillo Express in my summaries because this is a wind project. Also, the reported mortalities have been relatively low.

Here's the last summary that I did. Keep in mind that this is all incidental reporting. Is there something in particular that you are interested in?

Cheers, Tom

From: Gregory, Chris [mailto:chris_gregory@fws.gov]
Sent: Wednesday, June 18, 2014 2:21 PM
To: Thomas Dietsch
Cc: Tera Baird
Subject: SPUT spreadsheet available?

Hi Thom,

Was just speaking with Amedee, who suggested I contact you about a question dealing with SPUT mortality data. Do you have a relatively up-to-date SPUT workbook with data from all projects?

Our office has workbooks associated with a few individual projects, but am curious if a full, 'master' SPUT workbook exists. Even if you don't have a master, I am trying to track down injury/mortality information for (at least) Genesis, Sunlight, Ivanpah, and Ocotillo Express.

Thanks for any help you may have,

Chris

w) 760-322-2070, ext. 212

c) 760-413-8131

From:	brian sandstrom
To:	eduardo_nieves@fws.gov; jody_fraser@fws.gov; cperry@blm.gov; fmcmenimen@blm.gov; thomas_dietsch@fws.gov
Cc:	brooks hart; crissy slaughter; kathy simon; therese carpenter; pksharpgarcia@gmail.com; admin@corvusecological.com; amanda beck
Subject:	DSSF Avian Incident 06/18
Date:	Wednesday, June 18, 2014 5:33:58 PM
Attachments:	UNBI_061814_1.jpg UNBI_061814_4.jpg

Hello everyone,

While completing weekly equipment net checks at the Desert Sunlight Solar Farm the wing of an unidentified bird was found in the netting at ground level (10m from arrays, 5m from road). No other piece of the carcass was found. The wing was collected and is stored in the biology freezer.

If you have any questions please contact me.

Thanks,

Kelsi Black
949-423-8770
bjerome30@hotmail.com

From: Thomas Dietsch
To: Chris Gregory
Cc: Tera Baird
Subject: RE: SPUT spreadsheet available?
Date: Wednesday, June 18, 2014 5:57:54 PM
Attachments: Ocotillo_Express_Carcass_Summary_30April2014.xlsx

---

Hi Chris,

Here's the most recent spreadsheet for Ocotillo. I think Tera has sent you more recent SPUT reporting for the other projects than my summary spreadsheet.

Let me know if there is anything else you need.

Thanks, Tom

From: Gregory, Chris [mailto:chris_gregory@fws.gov]
Sent: Wednesday, June 18, 2014 2:47 PM
To: Thomas Dietsch
Cc: Tera Baird
Subject: Re: SPUT spreadsheet available?

Hi Thom,

Thanks for the update. Specifically, I'm looking for the raw data (the SPUT Excel sheet) so as to plot mortalities/injuries in a GIS. Trying to do so before our web/phone meeting next Tuesday as part of the Bird Strike Team. So if you have an older combined file, that's OK with me. Otherwise, Tera has just provided me with Genesis data, and I am still looking for files associated with ISEG/Ivanpah, Sunrise, and Ocotillo Express.

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Here's the last summary that I did. Keep in mind that this is all incidental reporting. Is there something in particular that you are interested in?

Cheers, Tom

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Sent: Wednesday, June 18, 2014 2:21 PM
To: Thomas Dietsch
Cc: Tera Baird
Subject: SPUT spreadsheet available?

Hi Thom,

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Our office has workbooks associated with a few individual projects, but am curious if a full, 'master' SPUT workbook exists. Even if you don't have a master, I am trying to track down injury/mortality information for (at least) Genesis, Sunlight, Ivanpah, and Ocotillo Express.

Thanks for any help you may have,

Chris
w) 760-322-2070, ext. 212
c) 760-413-8131

From: Baird, Tera
To: Thomas Dietsch
Subject: Operations contact for Genesis & loon information
Date: Friday, June 20, 2014 1:07:49 PM
Attachments: image001.png
image004.png
20140429_153314.jpg
20140429_153127.jpg

Tom : Here is the contact for Genesis. Operations staff has taken over and I don't think they have a "DB" on site. I've forwarded the loon report that they submitted on May 1, 2014 --- I think you may be interested in collecting this one....

---------- Forwarded message ----------
From: **Mosley, Charlyn** <Charlyn.Mosley@nexteraenergy.com>
Date: Thu, May 1, 2014 at 4:27 PM
Subject: RE: loon
To: Thomas Dietsch <thomas_dietsch@fws.gov>, Tera Baird <tera_baird@fws.gov>
Cc: "Field, Jennifer" <JENNIFER.FIELD@nexteraenergy.com>

Hi Tera and Tom,

Per our telephone conversation, here is the information on the loon.

The loon was discovered on Monday April 28, 2014 at Unit 2 Solar field on the southeast side of the solar field. The exact location was WB 23. Please see the attached photo of the loon.

While performing his normal daily inspections, the field technician saw the loon and reported its location.

Our Production Leader bagged the loon and logged it on our Avian Log.

It is now in our freezer on site.

Regards,

Charlyn Mosley-Trump

Sr PGD Environmental Specialist

Email: charlyn.mosley@nexteraenergy.com

office phone: 760-921-1401

Cell phone: 760-831-2651

FAX: 760-921-1168



From: Thomas Dietsch [mailto:thomas_dietsch@fws.gov]
Sent: Thursday, May 01, 2014 4:15 PM
To: Tera Baird; Mosley, Charlyn
Subject: RE: loon

Hi Tera,

Great. That will be quite helpful.

Thanks, Tom

From: Baird, Tera [mailto:tera_baird@fws.gov]
Sent: Thursday, May 01, 2014 4:12 PM
To: Mosley, Charlyn
Cc: Thomas Dietsch
Subject: Re: loon

Tom- I just spoke with Charlyn and they have collected the (loon) bird and it is stored in the freezer. I've asked her to send on some photos and info collected.

Tera Keeler Baird

Biologist

777 East Tahquitz Canyon Way, Suite 208

Palm Springs, California 92262

(760) 322-2070 extension 217

On Tue, Apr 29, 2014 at 4:48 PM, Mosley, Charlyn <Charlyn.Mosley@nexteraenergy.com> wrote:

Hello Tera,

Today we found a dead common loon in the solar field on Unit 2. Please advise as to what you would like us to do with the corpse. I left you a voice message at your office number, disregard the call if you get this notification first.

Respectfully,

Charlyn Mosley-Crump

Sr PGD Environmental Specialist

Email: charlyn.mosley@nexteraenergy.com

office phone: 760-921-1401

Cell phone: 760-831-2651

FAX: 760-921-1168



From: Fraser, Jody
To: Pete Sorensen; Tera Baird; Ken Corey
Subject: Fwd: DSL Avian Mortality 6/23
Date: Tuesday, June 24, 2014 10:04:02 PM
Attachments: WEGR_062314_1.JPG
WEGR_062314_4.JPG

---------- Forwarded message ----------
From: **brian sandstrom** <bjerome30@hotmail.com>
Date: Mon, Jun 23, 2014 at 1:54 PM
Subject: DSL Avian Mortality 6/23
To: "eduardo_nieves@fws.gov" <eduardo_nieves@fws.gov>, "jody_fraser@fws.gov" <jody_fraser@fws.gov>, "cperry@blm.gov" <cperry@blm.gov>, "fmcmenimen@blm.gov" <fmcmenimen@blm.gov>, "thomas_dietsch@fws.gov" <thomas_dietsch@fws.gov>
Cc: brooks hart <brooks@corvusecological.com>, crissy slaughter <criffy@hotmail.com>, kathy simon <kathy@ironwoodconsultinginc.com>, therese carpenter <therese.carpenter@firstsolar.com>, "pksharpgarcia@gmail.com" <pksharpgarcia@gmail.com>, "admin@corvusecological.com" <admin@corvusecological.com>, amanda beck <abeck@firstsolar.com>

Hello everyone,

The carcass of a Western Grebe was found in Block 9 Array 3. The block where the WEGR was located has solar array framework installed but no panels. The bird was fully in tact and was collected and is stored in the biology freezer.

If you have any questions please contact me.

Thanks,

Brian Sandstrom
949-423-8770
bjerome30@hotmail.com

--
Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
U.S. Fish and Wildlife Service
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
760.322.4648 fax
jody_fraser@fws.gov

From: Fraser, Jody
To: Pete Sorensen; Tera Baird; Joel Pagel
Subject: Fwd: DSL Avian Mortality 6/25
Date: Monday, June 30, 2014 9:55:01 AM
Attachments: WEGR2_062314_1.JPG
WEGR2_062314_2.JPG
WEGR2_062314_3.JPG

---------- Forwarded message ----------
From: **brian sandstrom** <bjerome30@hotmail.com>
Date: Wed, Jun 25, 2014 at 3:14 PM
Subject: DSL Avian Mortality 6/25
To: "eduardo_nieves@fws.gov" <eduardo_nieves@fws.gov>, "jody_fraser@fws.gov" <jody_fraser@fws.gov>, "cperry@blm.gov" <cperry@blm.gov>, "fmcmenimen@blm.gov" <fmcmenimen@blm.gov>, "thomas_dietsch@fws.gov" <thomas_dietsch@fws.gov>
Cc: brooks hart <brooks@corvusecological.com>, crissy slaughter <criffy@hotmail.com>, kathy simon <kathy@ironwoodconsultinginc.com>, therese carpenter <therese.carpenter@firstsolar.com>, "pksharpgarcia@gmail.com" <pksharpgarcia@gmail.com>, "admin@corvusecological.com" <admin@corvusecological.com>, amanda beck <abeck@firstsolar.com>

Hello everyone,

I am sending this update about a Western Grebe mortality that occurred on 6/23 but wasn't reported. I didn't know about the carcass until today when I went through our photos from the remote cameras at the on site kit fox den. Photos show the Western Grebe was carried from on site to the kit fox den. There were no remains of the bird carcass at the den site.

If you have any questions please contact me.

Thanks,

Brian Sandstrom
949-423-8770
bjerome30@hotmail.com

--
Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
U.S. Fish and Wildlife Service
777 E. Tahquitz Canyon Way, Suite 208
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760.322.2070 ph x207
760.322.4648 fax
jody_fraser@fws.gov

From:	brian sandstrom
To:	eduardo_nieves@fws.gov; jody_fraser@fws.gov; cperry@blm.gov; fmcmenimen@blm.gov; thomas_dietsch@fws.gov
Cc:	brooks hart; crissy slaughter; kathy simon; therese carpenter; pksharpgarcia@gmail.com; admin@corvusecological.com; amanda beck
Subject:	DSL Avian Mortality 7/1
Date:	Tuesday, July 01, 2014 2:54:13 PM
Attachments:	MODO_070114_2.JPG MODO_070114_5.JPG

Hello everyone,

Today at Desert Sunlight Solar Farm the carcass of a mourning dove was found in block 15, array 25, row 8. The carcass was dried out and had been dismembered. Only a wing and thorax were found. It was collected and stored in the biology freezer.

If you have any questions please contact me.

Thanks,

Brian Sandstrom
949-423-8770
bjerome30@hotmail.com

From:	Fraser, Jody
To:	Pete Sorensen; Tera Baird; Joel Pagel
Subject:	Fwd: DSL Avian Incidents 7/2
Date:	Thursday, July 03, 2014 7:57:16 AM
Attachments:	REDH_070214_2.JPG REDH_070214_4.JPG ROAD1.JPG ROAD2.JPG ROAD3.JPG

---------- Forwarded message ----------
From: **brian sandstrom** <bjerome30@hotmail.com>
Date: Wed, Jul 2, 2014 at 6:18 PM
Subject: DSL Avian Incidents 7/2
To: "thomas_dietsch@fws.gov" <thomas_dietsch@fws.gov>, "eduardo_nieves@fws.gov" <eduardo_nieves@fws.gov>, "cperry@blm.gov" <cperry@blm.gov>, "fmcmenimen@blm.gov" <fmcmenimen@blm.gov>, "jody_fraser@fws.gov" <jody_fraser@fws.gov>
Cc: brooks hart <brooks@corvusecological.com>, therese carpenter <therese.carpenter@firstsolar.com>, amanda beck <abeck@firstsolar.com>, kathy simon <kathy@ironwoodconsultinginc.com>, "pksharpgarcia@gmail.com" <pksharpgarcia@gmail.com>, "admin@corvusecological.com" <admin@corvusecological.com>, crissy slaughter <criffy@hotmail.com>

Hello everyone,

Today at Desert Sunlight Solar Farm the carcass of a male Redhead was found on the perimeter fenceline east of block 8, array 9. The carcass was fresh and had been decapitated. The carcass appeared to have been carried to the location, likely by a bird of prey, and dropped from the top of the fence. Kit foxes had tried digging under the fence to get at the carcass but were unsuccessful getting under the tortoise fence.

There was also an incident with a Roadrunner today that was found exhausted and running back and forth along the south perimeter fenceline, south of Block 10. A First Solar environmental worker was doing work in the area and the bird jumped under the wheel well of his cart. I caught the bird, offered it water, and released it outside of the south perimeter fence. The bird took a lot of water from a puddle on the ground, it crushed and ate pieces of ice, and rested in the cool water on the ground for about 20 minutes before running off and resting under a nearby creosote. The bird's energy appeared back to normal as it ran across the desert.

If you have any questions please contact me.

Thanks,

Brian Sandstrom

949-423-8770
bjerome30@hotmail.com

--
Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
U.S. Fish and Wildlife Service
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
760.322.4648 fax
jody_fraser@fws.gov

From: Thomas Dietsch
To: Jody Fraser
Subject: Desert Sunlight Fatality Monitoring Plan CLEAN 20140611_TVD.docx
Date: Thursday, July 03, 2014 3:57:01 PM
Attachments: Desert Sunlight Fatality Monitoring Plan CLEAN 20140611_TVD.docx

---

Hi Jody,

Here's my comments. There are several areas where I could have gone deeper, particularly in their justification of the % coverage and I only skimmed over their analytical methods. I hope this helps! If you have time, I'd also look at their responses to our comments, particularly where they seemed to drop comments because they were "beyond the scope" of the monitoring plan. Let me know if you have any questions.

Have a Happy 4th!

Tom

From: Fraser, Jody
To: Chris Gregory
Subject: Fwd: Desert Sunlight Fatality Monitoring revisions
Date: Monday, July 07, 2014 4:20:26 PM
Attachments: Desert Sunlight Fatality Monitoring Plan 20140611.docx
Desert Sunlight Fatality Monitoring Plan CLEAN 20140611.docx

Dammit! Sorry I didn't forward this to you sooner. I'm going through comments now and would appreciate your thoughts on their responses (in the track changes version). I know you're busy, but any time you can throw at this would be appreciated.
Sorry again...

---------- Forwarded message ----------
From: **Fraser, Jody** <jody_fraser@fws.gov>
Date: Thu, Jun 12, 2014 at 7:54 AM
Subject: Fwd: Desert Sunlight Fatality Monitoring revisions
To: Pete Sorensen <Pete_Sorensen@fws.gov>, Tera Baird <Tera_Baird@fws.gov>, Joel Pagel <joel_pagel@fws.gov>

fyi

---------- Forwarded message ----------
From: **Paul Rabie** <prabie@west-inc.com>
Date: Wed, Jun 11, 2014 at 5:07 PM
Subject: Desert Sunlight Fatality Monitoring revisions
To: "Brickey, Amedee" <amedee_brickey@fws.gov>, "Fraser, Jody" <jody_fraser@fws.gov>, Amanda Beck <ABeck@firstsolar.com>, "Perkins, Winifred" <Winifred.Perkins@nexteraenergy.com>, "Field, Jennifer" <JENNIFER.FIELD@nexteraenergy.com>, "Nagy, Laura" <Laura.Nagy@tetratech.com>, Wally Erickson <werickson@west-inc.com>, thomas_dietsch@fws.gov

All,

Please find a revised copy of the fatality monitoring plan for the Desert Sunlight Solar Farm attached, in both redline and clean versions. We have responded to USFWS comments from February either with edits or within the comments themselves (redline version). In addition, we have incorporated more recent guidance that has been transmitted by the Service.

We would like to emphasize that the goal of this document is to get an interim monitoring program in place, and so it is strictly a monitoring protocol. As such, it lacks some features that one might expect in a BBCS, most notably, an adaptive management section.

Thank you for your input and guidance on previous versions of the plan.

Regards,

Paul Rabie, PhD.

Biometrician

Environmental & Statistical Consultants
415 W 17th, Ste. 200
Cheyenne, WY 82001
(307) 634-1756
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Cell - (612) 860-0415
www.west-inc.com

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AVIAN INJURY AND MORTALITY REPORT FORM

Data Sheet Instructions and Information

***Please contact**

[INSERT APPROPRIATE R8 CONTACT INFORMATION] with any questions, problems, or suggestions for improvements to this form.

Instructions for Eagle Injuries/Mortalities

ABOUT THIS SPREADSHEET:

-Priority fields are indicated by an astericks and columns are shaded in grey. **At the very least, please try to populate all these fields, and any other applicable fields where possible, if that information is available.**

-**Drop down boxes are provided with several of the fields for your convenience, and to support greater consistency of data for these fields.**

-Please try to use one of the options provided within the drop down boxes for these fields. However, if you can not find the appropriate match in the drop down, you may enter your own text in the field as well.

-**If the option you select is "other" or contains the word "other" or you have additional details about your choice:** please try to provide additional details with your selection (again, all data entry cells in this spreadsheet will allow the entry of free text).

-**If you have been permitted to relocate a nest**, you may also report that relocation in this spreadsheet. This activity can be reported by use of the following fields: "Species Common Name", "Condition of Bird/Carcass (or if Active Nest Relocation, please indicate that here)", "Number of individuals found or number of nests relocated (if active nest relocation) " and "Disposition" (select the "Nest relocated" option).

IF YOU DISCOVER AN EAGLE:

If the eagle is dead, please complete the following steps:

1. Call your USFWS Office of Law Enforcement (OLE) point-of-contact Resident Agent in Charge (RAC) identified in your Special Purpsoe Utility (SPUT) permit conditions for instructions and approval before collecting or moving the carcass or its parts. You must contact OLE as soon as possible, but no later than 24 hours after discovery, to report the mortality.
2. Fill out as many of the fields in this sheet as possible regarding the incident, and send the report to your Regional USFWS Migratory Bird Permit Office as soon as possible.

If the eagle is alive, please complete the following steps:

1. Do not handle the eagle. Call your local migratory bird rehabilitation facility or a licensed veterinarian immediately for assistance.

2. Call your Regional USFWS OLE RAC identitied in your SPUT permit as soon as possible, but no later than 24 hours after discovery, to report the injury.

3. Fill out as many of the fields in this sheet as possible regarding the incident, and send the report to your Regional USFWS Migratory Bird Permit Office as soon as possible.

CORE INFORMATION	
***Report Year (yyyy):**	2014
***Project Proponent:**	Post-construction monitoring
***Project Name:**	Sunrise Powerlink
***Project Type:**	Transmission Line
***USFWS Salvage Permit # (If Applicable):**	MB13710B-0
***USFWS Eagle Permit # (If Applicable):**	

HIDE	HIDE	HIDE	HIDE	HIDE	HIDE	n Collection Information			HIDE			
Report Year (yyyy) *	Project Proponent *	Project Name *	Project Type *	Salvage Permit # (if applicable)*	Eagle Permit # (if applicable)*	Specimen Number *	How to Use the Search Box: You may either start typing your choice or click on the arrow on the right hand side of the search bar to view all choices. Once you locate the appropriate choice, you can Unknown SPECIES COMMON NAME SEARCH Species Common Name (AOU English Name) *	Scientific Name (include subspecies, if known) *	SPITS Code	Number of individuals found or number of nests relocated (if active nest relocation) *	Adult	Sex
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7007	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7008	Pigeons & Doves	Columbidae species	CO$$	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7009	Unknown	avian species	0	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7012	Savannah Sparrow	Passerculus sandwichensis	SASP	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7014	Unknown	avian species	0	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7015	Red-Tailed Hawk	Buteo jamaicensis	RTHA	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6000	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6001	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6002	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6003	Lincoln's Sparrow	Melospiza lincolnii	LISP	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6004	Western Meadowlark	Sturnella neglecta	WEME	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6006	unknown warbler	Parulidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6008	Rock Pigeon	Columba livea	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6011	Passerine Birds	Passeriformes species	PA$$	1	Unknown	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6012	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6013	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6016	Rock Pigeon	Columba livea	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6018	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7019	Yellow-Rumped Warbler	Setophaga coronata	YRWA	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7022	Yellow-Rumped Warbler	Setophaga coronata	YRWA	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7025	Passerine Birds	Passeriformes species	PA$$	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7026	unknown sparrow	Emberizidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7027	Passerine Birds	Passeriformes species	PA$$	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6019	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6020	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7036	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7038	House Wren	Troglodytes aedon	HOWR	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7029	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7030	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7031	White-Crowned Sparrow	Zonotrichia leucophrys	WCSP	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7039	unknown sparrow	Emberizidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7041	Pigeons & Doves	Columbidae species	CO$$	1	Unknown	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6028	Rock Pigeon	Columba livea	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6031	unknown warbler	Parulidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7042	Brewer's Sparrow	Spizella breweri	BRSP	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7043	Brewer's Sparrow	Spizella breweri	BRSP	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7044	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7046	unknown warbler	Parulidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7053	unknown warbler	Parulidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7054	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7055	Pigeons & Doves	Columbidae species	CO$$	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6042	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Unknown	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6044	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7057	Common Yellowthroat	Geothlypis trichas	YELL	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7058	unknown sparrow	Emberizidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7059	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7060	Common Yellowthroat	Geothlypis trichas	YELL	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6046	Black-Throated Gray Warbler	Setophaga nigrescens	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6047	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6049	Common Yellowthroat	Geothlypis trichas	YELL	1	Adult	Female

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6051	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7064	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7066	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7067	Passerine Birds	Passeriformes species	PA$$	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6053	Pigeons & Doves	Columbidae species	CO$$	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6055	unknown sparrow	Emberizidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6057	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7070	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7071	Common Yellowthroat	Geothlypis trichas	YELL	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7073	Yellow-Rumped Warbler	Setophaga coronata	YRWA	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7074	Black-Chinned Sparrow	Spizella atrogularis	BCSP	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6064	Black-Headed Grosbeak	Pheucticus melanocephalus	BHGR	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7076	Black-Chinned Sparrow	Spizella atrogularis	BCSP	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6068	Black-Headed Grosbeak	Pheucticus melanocephalus	BHGR	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7081	Northern Flicker	Colaptes auratus	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6073	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6075	Unidentified dove	Columbidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6076	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Male

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6077	Mourning Dove	Zenaida macroura	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6082	Black-Throated Gray Warbler	Setophaga nigrescens	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6084	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6085	Black-Headed Grosbeak	Pheucticus melanocephalus	BHGR	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6086	Black-Chinned Sparrow	Spizella atrogularis	BCSP	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7088	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7093	Unidentified dove	Columbidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7098	American Coot	Fulica americana	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7099	Lincoln's Sparrow	Melospiza lincolnii	LISP	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7100	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7101	House Wren	Troglodytes aedon	HOWR	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7102	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6093	Black-Headed Grosbeak	Pheucticus melanocephalus	BHGR	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6095	Sora	Porzana carolina	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6096	Mourning Dove	Zenaida macroura	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6097	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6098	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6099	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6100	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6102	unknown sparrow	Emberizidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6103	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7108	Yellow-Rumped Warbler	Setophaga coronata	YRWA	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7111	Western Meadowlark	Sturnella neglecta	WEME	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7112	Unidentified dove	Columbidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6104	Unidentified dove	Columbidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6105	Unidentified duck	Anseriform species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6108	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6112	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6114	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6116	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6117	Common Yellowthroat	Geothlypis trichas	YELL	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6118	Nashville Warbler	Vermivora ruficapilla	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7115	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7116	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7117	Nashville Warbler	Vermivora ruficapilla	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7118	Hermit Warbler	Dendroica occidentalis	#N/A	1	Adult	Male

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6121	Nashville Warbler	Vermivora ruficapilla	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6122	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6125	Nashville Warbler	Vermivora ruficapilla	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6129	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6130	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6131	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6132	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6133	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6134	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6137	Black-Throated Gray Warbler	Setophaga nigrescens	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6138	Nashville Warbler	Vermivora ruficapilla	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6147	Western Kingbird	Tyrannus verticalis	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6148	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6149	Nashville Warbler	Vermivora ruficapilla	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6150	Black-Throated Gray Warbler	Setophaga nigrescens	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6154	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6158	Black-Throated Gray Warbler	Setophaga nigrescens	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7125	White-Crowned Sparrow	Zonotrichia leucophrys	WCSP	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6142	Mourning Dove	Zenaida macroura	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6144	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6145	Western Meadowlark	Sturnella neglecta	WEME	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7126	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7127	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7128	Nashville Warbler	Vermivora ruficapilla	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7129	Lincoln's Sparrow	Melospiza lincolnii	LISP	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7130	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7131	Unidentified dove	Columbidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7132	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7137	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7139	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7142	Rock Pigeon	Columba livea	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7143	Unidentified dove	Columbidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7144	Bullock's Oriole	Icterus bullockii	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6162	Unidentified oriole	Icteridae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6163	Unidentified oriole	Icteridae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6165	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6166	Black-Headed Grosbeak	Pheucticus melanocephalus	BHGR	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6170	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6172	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6173	Black-Headed Grosbeak	Pheucticus melanocephalus	BHGR	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7147	Bullock's Oriole	Icterus bullockii	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7148	Common Yellowthroat	Geothlypis trichas	YELL	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6177	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6180	Common Yellowthroat	Geothlypis trichas	YELL	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6182	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6186	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6187	unknown sparrow	Emberizidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6188	unknown sparrow	Emberizidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6189	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6193	Nashville Warbler	Vermivora ruficapilla	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6194	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6199	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6203	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6204	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6205	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6206	Yellow-Rumped Warbler	Setophaga coronata	YRWA	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6207	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7153	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7155	Nashville Warbler	Vermivora ruficapilla	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7156	Black-Chinned Sparrow	Spizella atrogularis	BCSP	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7162	Unidentified oriole	Icteridae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6208	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6216	Brewer's Sparrow	Spizella breweri	BRSP	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6218	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6220	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6222	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6223	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6232	Unidentified dove	Columbidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6233	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6235	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6236	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6237	Mourning Dove	Zenaida macroura	#N/A	1	Unknown	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6238	unknown sparrow	Emberizidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6243	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6244	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6245	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6251	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6253	Unidentified raptor	Faconiform species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7171	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7172	Townsend's Warbler	Dendroica townsendi	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7173	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7175	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7177	Common Yellowthroat	Geothlypis trichas	YELL	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7178	Brewer's Sparrow	Spizella breweri	BRSP	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7179	Brant	Branta bernicla	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7180	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7183	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7184	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7185	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7186	Unidentified oriole	Icteridae species	#N/A	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7188	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7195	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7197	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7198	Black-Throated Gray Warbler	Setophaga nigrescens	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7201	Mourning Dove	Zenaida macroura	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7203	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7204	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7205	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7208	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6257	Unidentified dove	Columbidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6259	White-winged Dove	Zenaida asiatica	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6262	Unidentified dove	Columbidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6263	Townsend's Warbler	Dendroica townsendi	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6265	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6267	Common Yellowthroat	Geothlypis trichas	YELL	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6269	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6271	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6272	Unidentified oriole	Icteridae species	#N/A	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6275	Unidentified oriole	Icteridae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6278	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6279	Nashville Warbler	Vermivora ruficapilla	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7209	Eurasian Collared-Dove	Streptopelia decaoto	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7210	Mourning Dove	Zenaida macroura	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7212	Black-Headed Grosbeak	Pheucticus melanocephalus	BHGR	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7217	Black-Throated Gray Warbler	Setophaga nigrescens	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6280	Lazuli Bunting	Passerina amoena	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6281	Townsend's Warbler	Dendroica townsendi	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6283	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6285	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6286	Mourning Dove	Zenaida macroura	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6288	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7222	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7227	Black-Throated Gray Warbler	Setophaga nigrescens	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6293	Mourning Dove	Zenaida macroura	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6294	Black-Throated Gray Warbler	Setophaga nigrescens	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6295	Black-Throated Gray Warbler	Setophaga nigrescens	#N/A	1	Adult	Female

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6296	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6297	Townsend's Warbler	Dendroica townsendi	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6298	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6299	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6300	Nashville Warbler	Vermivora ruficapilla	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6301	Nashville Warbler	Vermivora ruficapilla	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6302	Savannah Sparrow	Passerculus sandwichensis	SASP	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6304	Black-Headed Grosbeak	Pheucticus melanocephalus	BHGR	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6305	Pacific-slope Flycatcher	Empidonax difficilis	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6307	White-winged Dove	Zenaida asiatica	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6310	White-winged Dove	Zenaida asiatica	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6311	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6312	Mourning Dove	Zenaida macroura	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6313	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6314	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6330	Mourning Dove	Zenaida macroura	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6317	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6319	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6320	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6321	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6324	Nashville Warbler	Vermivora ruficapilla	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6329	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7236	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7237	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7238	Black-Throated Gray Warbler	Setophaga nigrescens	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7239	Mourning Dove	Zenaida macroura	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7245	Mourning Dove	Zenaida macroura	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7246	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7251	unknown sparrow	Emberizidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7254	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7259	Common Yellowthroat	Geothlypis trichas	YELL	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7260	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7267	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7270	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7271	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7272	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6331	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6334	Black-Headed Grosbeak	Pheucticus melanocephalus	BHGR	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6335	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6337	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6339	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6341	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6342	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6345	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6346	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6347	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6349	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6352	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6353	Townsend's Warbler	Dendroica townsendi	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6359	Unidentified dove	Columbidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6360	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6361	Nashville Warbler	Vermivora ruficapilla	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6364	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6365	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6366	Townsend's Warbler	Dendroica townsendi	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7275	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7276	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7278	Townsend's Warbler	Dendroica townsendi	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7279	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7281	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7283	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7284	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7285	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7286	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7287	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7289	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7290	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7292	Lazuli Bunting	Passerina amoena	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7293	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7294	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6368	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7297	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7298	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7303	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7304	Lazuli Bunting	Passerina amoena	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7310	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7312	Townsend's Warbler	Dendroica townsendi	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7313	Lazuli Bunting	Passerina amoena	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7314	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7315	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7317	Townsend's Warbler	Dendroica townsendi	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7318	Townsend's Warbler	Dendroica townsendi	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7321	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7325	Black-Headed Grosbeak	Pheucticus melanocephalus	BHGR	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6370	Townsend's Warbler	Dendroica townsendi	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6372	Hermit Warbler	Dendroica occidentalis	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6373	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6374	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6375	Townsend's Warbler	Dendroica townsendi	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6377	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6378	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6379	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6380	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6382	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6383	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6384	Unidentified dove	Columbidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6385	Western Tanager	Piranga ludoviciana	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6387	Townsend's Warbler	Dendroica townsendi	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6388	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6389	Swainson's Thrush	Catharus ustulatus	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6391	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6392	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6395	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6396	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6397	Unidentified dove	Columbidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6398	Lazuli Bunting	Passerina amoena	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6399	Townsend's Warbler	Dendroica townsendi	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7328	Townsend's Warbler	Dendroica townsendi	#N/A	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7330	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7331	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7334	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7335	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7336	Black-Headed Grosbeak	Pheucticus melanocephalus	BHGR	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7337	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6400	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6401	Swainson's Thrush	Catharus ustulatus	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6402	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6403	Black-Headed Grosbeak	Pheucticus melanocephalus	BHGR	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6404	Lazuli Bunting	Passerina amoena	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6406	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6408	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6411	MacGillivray's Warbler	Oporornis tolmiei	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6412	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6413	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6415	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6417	Unknown	avian species	0	1	Unknown	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6418	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6419	Unidentified empid	Empidonax species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6420	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6421	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7340	Wild Turkey	Meleagris gallopavo	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7342	Black-Chinned Sparrow	Spizella atrogularis	BCSP	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7343	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7349	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7350	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7352	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7353	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7354	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7355	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6425	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6427	unknown sparrow	Emberizidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6429	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6431	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6433	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6434	Unidentified dove	Columbidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7357	Mourning Dove	Zenaida macroura	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7358	Western Grebe	Aechmophorus occidentalis	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7360	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7361	Unidentified dove	Columbidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6436	Western Tanager	Piranga ludoviciana	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6444	White-winged Dove	Zenaida asiatica	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6446	Black-Throated Gray Warbler	Setophaga nigrescens	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6447	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6449	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6450	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6451	Western Tanager	Piranga ludoviciana	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6452	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6453	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6455	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6456	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6458	Black-Headed Grosbeak	Pheucticus melanocephalus	BHGR	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6459	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6463	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6464	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7362	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7363	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7364	Townsend's Warbler	Dendroica townsendi	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7365	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7366	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7368	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7369	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7372	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7373	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7375	Unidentified oriole	Icteridae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7376	Townsend's Warbler	Dendroica townsendi	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7377	Great Horned Owl	Bubo viginianus	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7378	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6465	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6466	Swainson's Thrush	Catharus ustulatus	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6467	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6468	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6469	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6470	Black-Headed Grosbeak	Pheucticus melanocephalus	BHGR	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6471	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6473	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6474	Townsend's Warbler	Dendroica townsendi	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6476	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6478	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6481	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6483	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6491	White-winged Dove	Zenaida asiatica	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6492	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6493	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6495	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6497	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6498	Warbling Vireo	Vireo gilvus	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6499	MacGillivray's Warbler	Oporornis tolmiei	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6500	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Female

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6501	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6502	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6503	Western Tanager	Piranga ludoviciana	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6504	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6505	Western Tanager	Piranga ludoviciana	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6506	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6507	Western Tanager	Piranga ludoviciana	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6508	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6511	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6514	Western Tanager	Piranga ludoviciana	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6515	Western Tanager	Piranga ludoviciana	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6516	Western Tanager	Piranga ludoviciana	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6517	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6518	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6519	Western Tanager	Piranga ludoviciana	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6520	unknown sparrow	Emberizidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6521	Black-Headed Grosbeak	Pheucticus melanocephalus	BHGR	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6522	Warbling Vireo	Vireo gilvus	#N/A	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6523	unknown sparrow	Emberizidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6524	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6525	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6526	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6527	Swainson's Thrush	Catharus ustulatus	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6529	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6531	Unidentified dove	Columbidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6532	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7391	Townsend's Warbler	Dendroica townsendi	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7393	Swainson's Thrush	Catharus ustulatus	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7395	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7397	Swainson's Thrush	Catharus ustulatus	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7398	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7399	Warbling Vireo	Vireo gilvus	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7404	Swainson's Thrush	Catharus ustulatus	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7405	MacGillivray's Warbler	Oporornis tolmiei	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7406	Western Tanager	Piranga ludoviciana	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7407	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7408	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7409	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7410	Townsend's Warbler	Dendroica townsendi	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7412	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7413	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7414	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7415	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7416	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7417	Western Tanager	Piranga ludoviciana	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7418	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7419	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7420	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7421	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7422	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7423	Swainson's Thrush	Catharus ustulatus	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7424	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7425	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6535	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Female

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6536	White-winged Dove	Zenaida asiatica	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6537	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6539	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6540	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6542	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6543	Western Tanager	Piranga ludoviciana	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6544	White-winged Dove	Zenaida asiatica	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6545	White-winged Dove	Zenaida asiatica	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6546	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6548	Townsend's Warbler	Dendroica townsendi	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6549	Warbling Vireo	Vireo gilvus	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6551	Unidentified dove	Columbidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6552	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6553	MacGillivray's Warbler	Oporornis tolmiei	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7428	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7431	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7432	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7433	Black-Throated Gray Warbler	Setophaga nigrescens	#N/A	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7435	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7440	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7445	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7446	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7448	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7449	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7451	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7458	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7460	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7463	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6559	Unidentified dove	Columbidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6560	Swainson's Thrush	Catharus ustulatus	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7464	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7468	Unidentified dove	Columbidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7470	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7471	Warbling Vireo	Vireo gilvus	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7476	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7478	Western Tanager	Piranga ludoviciana	#N/A	1	Adult	Female

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7479	Warbling Vireo	Vireo gilvus	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7482	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7485	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7490	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7491	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7493	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7495	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7498	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7499	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7500	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7501	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7503	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7506	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7507	Unidentified dove	Columbidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7510	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7511	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7512	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7513	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7514	Swainson's Thrush	Catharus ustulatus	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7515	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7516	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7517	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6570	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6571	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6573	Mourning Dove	Zenaida macroura	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6574	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6576	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6577	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6580	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6581	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6583	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6584	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6585	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6586	Unidentified dove	Columbidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6587	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6588	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6589	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6590	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6591	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6592	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6593	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6594	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6595	MacGillivray's Warbler	Oporornis tolmiei	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6596	White-winged Dove	Zenaida asiatica	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6607	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6608	Western Tanager	Piranga ludoviciana	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6609	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6612	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6613	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6614	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6615	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6616	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6617	Swainson's Thrush	Catharus ustulatus	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6619	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6620	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6621	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6622	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7518	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7520	MacGillivray's Warbler	Oporornis tolmiei	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7521	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7522	Unidentified dove	Columbidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7524	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7525	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7526	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7527	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7528	Unidentified dove	Columbidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7529	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7532	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7533	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7534	Unidentified dove	Columbidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6630	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6632	Unknown	avian species	0	1	Unknown	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6633	Blue Grossbeak	Guiraca caerulea	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6634	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6635	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6636	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6638	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6639	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6641	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6643	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6644	Swainson's Thrush	Catharus ustulatus	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6645	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6646	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6649	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6651	Common Raven	Corvus corax	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6652	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6654	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6655	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6659	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6660	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6662	Unidentified oriole	Icteridae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6663	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6665	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6667	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6668	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6670	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6671	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6672	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6673	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6674	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6675	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6676	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6677	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6679	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6680	Swainson's Thrush	Catharus ustulatus	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6681	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6684	Swainson's Thrush	Catharus ustulatus	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6685	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6686	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6687	Swainson's Thrush	Catharus ustulatus	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6690	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6691	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6693	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7536	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7537	Warbling Vireo	Vireo gilvus	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7539	Unidentified dove	Columbidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7541	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7542	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7543	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7544	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7545	Pacific-slope Flycatcher	Empidonax difficilis	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7546	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7547	Swainson's Thrush	Catharus ustulatus	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7548	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7549	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7550	Townsend's Warbler	Dendroica townsendi	#N/A	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7551	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7553	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7554	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7555	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7557	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7558	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7559	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7561	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7563	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7564	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7565	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7566	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7567	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7568	Swainson's Thrush	Catharus ustulatus	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6694	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6696	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6697	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6699	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6700	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6701	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6702	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6704	Black-Headed Grosbeak	Pheucticus melanocephalus	BHGR	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6705	Black-Headed Grosbeak	Pheucticus melanocephalus	BHGR	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6706	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6707	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6708	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6709	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6710	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7569	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7571	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7572	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7573	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7574	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7575	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7577	Mourning Dove	Zenaida macroura	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7578	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7579	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7580	Common Raven	Corvus corax	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7581	White-winged Dove	Zenaida asiatica	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7583	Orange-Crowned Warbler	Oreothlypis celata	OCWA	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7584	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7585	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7586	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7590	Warbling Vireo	Vireo gilvus	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7592	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7593	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7594	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7595	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7596	Lesser Nighthawk	Chordeiles acutipennis	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6714	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6715	Hermit Warbler	Dendroica occidentalis	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6716	Mourning Dove	Zenaida macroura	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6717	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6721	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6722	Common Raven	Corvus corax	#N/A	1	Hatch Year	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6723	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6724	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6726	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6727	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6728	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6729	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6730	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6731	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6732	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6733	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6734	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6735	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6736	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6737	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6738	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6740	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6741	Unidentified dove	Columbidae species	#N/A	1	Unknown	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6742	Common Raven	Corvus corax	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6743	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6744	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6745	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6746	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6747	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6750	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6751	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6752	Eared Grebe	Podiceps auritus	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6753	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6754	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6755	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6758	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6759	Unidentified dove	Columbidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6760	Warbling Vireo	Vireo gilvus	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6761	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7598	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7599	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Female

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7600	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7606	Swainson's Thrush	Catharus ustulatus	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7607	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7608	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7609	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7610	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7611	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7614	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7615	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7616	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7617	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7618	Unidentified dove	Columbidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7619	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7620	Swainson's Thrush	Catharus ustulatus	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7621	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7624	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7625	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7626	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7627	Unidentified dove	Columbidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7628	Black-Headed Grosbeak	Pheucticus melanocephalus	BHGR	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6764	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6765	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6766	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6767	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6768	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6769	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6770	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6771	Black-Throated Gray Warbler	Setophaga nigrescens	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6773	Black-Headed Grosbeak	Pheucticus melanocephalus	BHGR	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6774	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6775	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6776	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6777	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6778	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6779	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6780	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6781	Swainson's Thrush	Catharus ustulatus	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6782	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6783	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7630	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7631	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7633	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7634	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7636	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6786	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6787	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6788	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6789	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6792	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6795	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6796	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6797	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6798	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6801	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6803	Willow Flycatcher	Empidonax traillii	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6804	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6805	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6806	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6807	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6809	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6811	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6812	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6813	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6814	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6817	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6818	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6819	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6820	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7640	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7642	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7644	Red-Tailed Hawk	Buteo jamaicensis	RTHA	1	Hatch Year	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7647	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7650	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7651	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7653	Unidentified dove	Columbidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7655	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7656	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7657	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7658	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7659	Black-Headed Grosbeak	Pheucticus melanocephalus	BHGR	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7660	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7661	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7662	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7663	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7664	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7666	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7668	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7670	Mourning Dove	Zenaida macroura	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7671	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7672	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7673	Swainson's Thrush	Catharus ustulatus	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7675	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7676	Swainson's Thrush	Catharus ustulatus	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7677	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7678	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7679	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7681	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7682	Common Raven	Corvus corax	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7683	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6821	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6822	Wilson's Warbler	Wilsonia pusilla	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6823	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6824	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6825	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6826	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6827	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7687	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7688	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7692	Common Yellowthroat	Geothlypis trichas	YELL	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7696	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7697	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7698	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6830	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6831	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6832	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6833	Unidentified dove	Columbidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6834	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Male
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6835	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6838	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6839	Grasshopper Sparrow	Ammodramus savannarum	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6840	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6841	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6842	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6843	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6844	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6845	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7700	Unidentified dove	Columbidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7710	Unknown	avian species	0	1	Hatch Year	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7712	Yellow-Rumped Warbler	Setophaga coronata	YRWA	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7717	Swainson's Thrush	Catharus ustulatus	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7719	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7720	Common Raven	Corvus corax	#N/A	1	Hatch Year	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6848	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6849	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6851	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6852	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6853	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6854	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6855	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7721	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7722	Unidentified dove	Columbidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6857	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6859	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6860	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6861	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6864	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6865	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6866	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6867	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6868	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6869	Common Raven	Corvus corax	#N/A	1	Hatch Year	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7726	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7727	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Female
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7730	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7731	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7732	Red-Tailed Hawk	Buteo jamaicensis	RTHA	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7733	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7734	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7736	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6870	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6872	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6873	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6874	Sora	Porzana carolina	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6877	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6879	Lazuli Bunting	Passerina amoena	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6880	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6881	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6882	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6884	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6885	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6886	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6887	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6888	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6889	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6890	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7739	Willow Flycatcher	Empidonax traillii	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7741	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7742	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7743	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7744	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7745	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7746	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7747	Unknown	avian species	0	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7748	Unidentified dove	Columbidae species	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7749	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6891	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7751	Mourning Dove	Zenaida macroura	#N/A	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6892	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6893	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6894	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7752	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7768	Unknown	avian species	0	1	Unknown	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6914	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6915	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6917	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6918	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6920	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6921	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown

2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6922	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7778	Yellow Warbler	Dendroica petechia	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	7779	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6923	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6924	unknown warbler	Parulidae species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0	6925	Unidentified passerine	Passeriformes species	#N/A	1	Adult	Unknown
2014	Post-construction monitoring	Sunrise Powerlink	Transmission Line	MB13710B-0	0				#N/A			

			Bird/Carcass Informatic									
How found? (Carcass survey, incidental detection) *	**Discovery Date ***	**Name of individual discovering injury/mortality**	**Collection Date ***	**Condition of Bird/Carcass (or if Active Nest Relocation, please indicate that here)***	**Estimated time dead/injured before discovery**	**Description of Carcass/Injury (noticeable injuries, entire, partial, feather, scavanged, disarticulation, emaciated)***	**Suspected cause of injury/mortality (field determination)***	**Level of certainty for suspected cause * Observed - 100% Valid - >90% certainty Probable - >50% certainty Possible - <50%, but > 0% certainty Not Applicable - 0% certainty or unknown**	icial cause of de	**Who determined official cause of death? (Lab Name)**	**Necropsy?** Y/N
Carcass Survey	3/14/2014	JFD	NA	Dead, semi-fresh (eyes desiccated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	3/14/2014	JFD	NA	Broken up	Unknown	Scavenged	Collision with wire	Possible (<50%, >0)	NA	NA	N
Carcass Survey	3/14/2014	JFD	NA	Broken up	Unknown	Scavenged	Collision with wire	Possible (<50%, >0)	NA	NA	N
Carcass Survey	3/14/2014	BOC	NA	Mummified	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	3/14/2014	JFD	NA	Broken up	Unknown	Scavenged	Collision with wire	Possible (<50%, >0)	NA	NA	N
Carcass Survey	3/14/2014	JFD	NA	Broken up	Unknown	Scavenged	Collision with wire	Possible (<50%, >0)	NA	NA	N
Carcass Survey	3/14/2014	JFD	NA	Dead, semi-fresh (eyes desiccated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	3/14/2014	TPP	NA	Dead, semi-fresh (eyes desiccated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	3/14/2014	TPP	NA	Dead, semi-fresh (eyes desiccated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	3/14/2014	TPP	NA	Dead, semi-fresh (eyes desiccated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	3/14/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Possible (<50%, >0)	NA	NA	N
Carcass Survey	3/14/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Possible (<50%, >0)	NA	NA	N
Carcass Survey	3/14/2014	SMG/KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Possible (<50%, >0)	NA	NA	N
Carcass Survey	3/14/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Possible (<50%, >0)	NA	NA	N

Carcass Survey	3/14/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Possible (<50%, >0)	NA	NA	N
Carcass Survey	3/15/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Possible (<50%, >0)	NA	NA	N
Carcass Survey	3/15/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Possible (<50%, >0)	NA	NA	N
Carcass Survey	3/15/2014	SMG	NA	Dead, semi-fresh (eyes desiccated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	3/15/2014	JFD	NA	Dead, semi-fresh (eyes desiccated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	3/15/2014	JFD	NA	Dead, semi-fresh (eyes desiccated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	3/15/2014	JFD	NA	Broken up	Unknown	Scavenged	Collision with wire	Possible (<50%, >0)	NA	NA	N
Carcass Survey	3/15/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Possible (<50%, >0)	NA	NA	N
Carcass Survey	3/15/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Possible (<50%, >0)	NA	NA	N
Carcass Survey	3/17/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Possible (<50%, >0)	NA	NA	N
Carcass Survey	3/17/2014	JCF	NA	Dead, semi-fresh (eyes desiccated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	3/17/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Possible (<50%, >0)	NA	NA	N
Carcass Survey	3/17/2014	SMG	NA	Alive, injured	Unknown	Injured	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	3/17/2014	BOC	NA	Dead, semi-fresh (eyes desiccated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	3/17/2014	BOC	NA	Dead, semi-fresh (eyes desiccated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	3/17/2014	SMG	NA	Dead, semi-fresh (eyes desiccated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	3/17/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Possible (<50%, >0)	NA	NA	N
Carcass Survey	3/18/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Possible (<50%, >0)	NA	NA	N

Carcass Survey	3/19/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Possible (<50%, >0)	NA	NA	N
Carcass Survey	3/19/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Possible (<50%, >0)	NA	NA	N
Carcass Survey	3/19/2014	BOC	NA	Dead, semi-fresh (eyes desiccated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	3/19/2014	TPP	NA	Dead, semi-fresh (eyes desiccated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	3/19/2014	SMG	NA	Dead, semi-fresh (eyes desiccated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	3/19/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Possible (<50%, >0)	NA	NA	N
Carcass Survey	3/21/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Possible (<50%, >0)	NA	NA	N
Carcass Survey	3/21/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Possible (<50%, >0)	NA	NA	N
Carcass Survey	3/21/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Possible (<50%, >0)	NA	NA	N
Carcass Survey	3/21/2014	KLI	NA	Dead, semi-fresh (eyes desiccated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	3/21/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Possible (<50%, >0)	NA	NA	N
Carcass Survey	3/22/2014	TPP	NA	Dead, semi-fresh (eyes desiccated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	3/22/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Possible (<50%, >0)	NA	NA	N
Carcass Survey	3/22/2014	BOC	NA	Dead, semi-fresh (eyes desiccated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	3/22/2014	TPP	NA	Dead, semi-fresh (eyes desiccated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	3/22/2014	JCF	NA	Dead, semi-fresh (eyes desiccated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	3/22/2014	JCF	NA	Dead, semi-fresh (eyes desiccated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	3/22/2014	DPO	NA	Dead, semi-fresh (eyes desiccated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N

Carcass Survey	3/22/2014	JCF	NA	Dead, semi-fresh (eyes desiccated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	3/24/2014	SMG	NA	Dead, semi-fresh (eyes desiccated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	3/24/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Possible (<50%, >0)	NA	NA	N
Carcass Survey	3/24/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Possible (<50%, >0)	NA	NA	N
Carcass Survey	3/24/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Possible (<50%, >0)	NA	NA	N
Carcass Survey	3/24/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Possible (<50%, >0)	NA	NA	N
Carcass Survey	3/24/2014	BOC	NA	Dead, semi-fresh (eyes desiccated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	3/25/2014	JCF	NA	Dead, semi-fresh (eyes desiccated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	3/25/2014	DPO	NA	Dead, semi-fresh (eyes desiccated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	3/25/2014	SMG	NA	Dead, semi-fresh (eyes desiccated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	3/26/2014	JCF	NA	Dead, semi-fresh (eyes desiccated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	3/26/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Possible (<50%, >0)	NA	NA	N
Carcass Survey	3/27/2014	JCF	NA	Dead, semi-fresh (eyes desiccated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	3/27/2014	TPP	NA	Dead, semi-fresh (eyes desiccated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	3/31/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	3/31/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	3/31/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	3/31/2014	BOC	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N

Carcass Survey	3/31/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/1/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/1/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/1/2014	KLI	NA	Alive, injured	Unknown	Injured	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/1/2014	KLI	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/2/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/2/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/2/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/2/2014	JCF	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/2/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/2/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/2/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/2/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/2/2014	KLI	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/2/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/2/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/2/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/2/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	4/2/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/2/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/2/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/3/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/3/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/3/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/3/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/3/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/3/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/3/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/3/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/3/2014	BOC	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/3/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/3/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/4/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/4/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/4/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/4/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N

Carcass Survey	4/4/2014	BOC	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/4/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/4/2014	BOC	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/4/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/4/2014	KLI	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/4/2014	KLI	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/4/2014	KLI	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/4/2014	KLI	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/4/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/5/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/5/2014	BOC	NA	Alive, injured	Unknown	Injured	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/5/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/5/2014	BOC	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/5/2014	BOC	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/5/2014	BOC	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/5/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/5/2014	BOC	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/5/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N

Carcass Survey	4/5/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/5/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/5/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/5/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/5/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/5/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/5/2014	KLI	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/5/2014	TPP	NA	Alive, injured	Unknown	Injured	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/5/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/5/2014	JCF	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/8/2013	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/9/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/9/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/9/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/9/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/9/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/9/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/9/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	4/9/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/10/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/10/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/10/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/10/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/10/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/14/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/14/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/14/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/14/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/14/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/14/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/14/2014	TPP/BOC	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/14/2014	JCF	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/14/2014	TPP/BOC	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/14/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/14/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/14/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	4/14/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/14/2014	BOC	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/14/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/14/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/14/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/14/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/15/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/15/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/15/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/15/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/15/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/15/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/15/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/16/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/16/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/16/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/16/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/16/2014	TPP/JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	4/16/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/16/2014	JCF	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/16/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/16/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/16/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/16/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/16/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/16/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/16/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/16/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/16/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/16/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/16/2014	KLI	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/16/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/16/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/16/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/16/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/17/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	4/17/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/17/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/17/2014	KLI	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/17/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/17/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/17/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/17/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/17/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/17/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/17/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/17/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/17/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/17/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/17/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/21/2014	KLI	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/21/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/21/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/21/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	4/21/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/21/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/21/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/21/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/21/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/21/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/21/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/22/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/22/2014	KLI	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/22/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/22/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/22/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/22/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/22/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/22/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/23/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/23/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/23/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N

Carcass Survey	4/23/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/23/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/23/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/23/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/23/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/23/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/23/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/23/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/23/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/23/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/23/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/23/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/23/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/23/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/23/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/23/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/23/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/23/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	4/23/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/23/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/23/2014	KLI	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/23/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/23/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/23/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/23/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/23/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/23/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/23/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/23/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/23/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/23/2014	JCF	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/23/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/24/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/24/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/24/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/24/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	4/24/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/24/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/24/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/24/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/24/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/24/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/24/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/24/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/24/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/24/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/24/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/25/2014	KLI	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/25/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/25/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/25/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/25/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/25/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/25/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	4/25/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/25/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/25/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/25/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/25/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/25/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/25/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/25/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/25/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/25/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/25/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/25/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/25/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/25/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/25/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/25/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/26/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/26/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	4/26/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/26/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/26/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/28/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/28/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/28/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/28/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/28/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/28/2014	BOC	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/28/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/28/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/28/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/28/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/28/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/28/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/28/2014	TPP	NA	Alive, injured	Unknown	Injured	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/28/2014	BOC	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/28/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	4/28/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/28/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/28/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/28/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/28/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/28/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/28/2014	BOC	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/28/2014	BOC	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/28/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/28/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/28/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/28/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/28/2014	KLI	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/28/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/28/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/28/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/28/2014	JCF	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/29/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	4/29/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/29/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/29/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/29/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/29/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/29/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/29/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/29/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/29/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/29/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/29/2014	KLI	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/29/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/29/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/30/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/30/2014	JCF	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	4/30/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	4/30/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/1/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	5/1/2014	KLI	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/1/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/1/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/1/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/1/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/1/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/2/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/2/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/2/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/2/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/2/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/2/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/2/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/2/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/2/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/2/2014	JCF	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/2/2014	JCF	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/2/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	5/2/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/3/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/3/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/3/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/3/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/3/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/3/2014	KLI	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/3/2014	KLI	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/3/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/3/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/5/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/5/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/5/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/5/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/5/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/5/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/5/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/5/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	5/5/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/5/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/5/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/5/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/5/2014	KLI	NA	Alive, injured	Unknown	Injured	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/5/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/5/2014	JCF	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/5/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/5/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/6/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/6/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/6/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/6/2014	BOC	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/6/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/6/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/6/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/6/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/6/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	5/6/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/6/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/6/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/6/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/6/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/6/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/6/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/6/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/6/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/6/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/7/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/7/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/7/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/7/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/7/2014	JCF	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/7/2014	JCF	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/7/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/7/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N

Carcass Survey	5/7/2014	JCF	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/7/2014	JCF	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/7/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/7/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/7/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/7/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/7/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/7/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/7/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/7/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/7/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/7/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/7/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/7/2014	TPP/JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/7/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/7/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/7/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	5/7/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/7/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/7/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/7/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/7/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/7/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/7/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/7/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/7/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/7/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/7/2014	KLI/DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/7/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/7/2014	BOC	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/7/2014	BOC	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/7/2014	KLI	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/7/2014	KLI	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/7/2014	BOC	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/7/2014	BOC	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N

Carcass Survey	5/7/2014	BOC	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/7/2014	BOC	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/7/2014	KLI	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/7/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/7/2014	KLI	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/7/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/7/2014	BOC	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/7/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/7/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/7/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/7/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/7/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/7/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/7/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/7/2014	KLI	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/7/2014	KLI	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/8/2014	JCF	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N

Carcass Survey	5/8/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/8/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/8/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/8/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/8/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/8/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/8/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/8/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/8/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/8/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/8/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/8/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/8/2014	SMG/JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/8/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/8/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/8/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/8/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/8/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	5/8/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/8/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/8/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/8/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/8/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/8/2014	JFD	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/8/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/8/2014	JFD	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/8/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/8/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/12/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/12/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/12/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/12/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/12/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/12/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/13/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/13/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N

Carcass Survey	5/13/2014	KLI	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/14/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/14/2014	KLI	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/14/2014	DPO/TPP/KLI	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/14/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/14/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	5/14/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/14/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/14/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/14/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	5/14/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/14/2014	JCF	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/14/2014	BOC	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/14/2014	BOC	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/14/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/14/2014	SMG/BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	5/14/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/14/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/15/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/15/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/15/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/15/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/15/2014	KLI	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/15/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/15/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/15/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/15/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/15/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/15/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/15/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/15/2014	JCF	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/15/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	5/15/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/15/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/15/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/15/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/15/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/15/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/15/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	BOC/SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	5/16/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	JCF/SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	BOC	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/16/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	5/16/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/16/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/16/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	5/16/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	DPO/KLI/TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/16/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/17/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/17/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/17/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/17/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	5/17/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/17/2014	JCF	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/17/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/17/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/17/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/17/2014	BOC	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/17/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/17/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/17/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/17/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/17/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/17/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/17/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/17/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/17/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/17/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/17/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/17/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	5/17/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/19/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/19/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/19/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/19/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/19/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/19/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/19/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/19/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/19/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/19/2014	KLI	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/19/2014	KLI	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/19/2014	JCF	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/19/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/19/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/19/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/19/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/19/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	5/19/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/19/2014	JCF	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/19/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/19/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/19/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/19/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/19/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/19/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/19/2014	JCF	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/19/2014	JCF	NA	Alive, injured	Unknown	Injured	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/19/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/19/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/19/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/19/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/19/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/20/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/20/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/20/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	5/20/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/20/2014	JCF	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/20/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/20/2014	JCF	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/20/2014	JCF	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/20/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/20/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/20/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/20/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/20/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/20/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/20/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/20/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/20/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/20/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/20/2014	BOC	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/20/2014	KLI	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N

Carcass Survey	5/20/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/20/2014	BOC	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/20/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/20/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/20/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/20/2014	BOC	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/20/2014	KLI	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/20/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/20/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/20/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/20/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/21/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/21/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/21/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/21/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/21/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/21/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/21/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	5/21/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/21/2014	BOC/KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/21/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/21/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/21/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/21/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/21/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/21/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/21/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/21/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/21/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/21/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/21/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/21/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/21/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/21/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/21/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/21/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	5/21/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/21/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/21/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/22/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/22/2014	DPO	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/22/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/22/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/22/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/22/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/22/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/22/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/22/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	5/26/2014	KLI	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/26/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	5/26/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	SMG	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/26/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	BOC	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/26/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	JCF/BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	5/26/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/26/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/27/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/27/2014	KLI	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/27/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/27/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/27/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/27/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/27/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/27/2014	JCF	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/27/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	5/27/2014	JCF	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	5/27/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/27/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/27/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/28/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/28/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/28/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/28/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/28/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/28/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/28/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/28/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/28/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/28/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/28/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/28/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/28/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	5/28/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/28/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/29/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/30/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/30/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/30/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/30/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/30/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/31/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/31/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/31/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/31/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/31/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/31/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	5/31/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/2/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/2/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/2/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	6/2/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/2/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/2/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/2/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/2/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/2/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/2/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/2/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/2/2014	JCF	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	6/2/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/2/2014	JCF	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/2/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/2/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/2/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/2/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/3/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/3/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/3/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	6/3/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/3/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/3/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/3/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/3/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/3/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/3/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/3/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/3/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/3/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/3/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/3/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/3/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/3/2014	TPP	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	6/3/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/3/2014	DPO	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/3/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/3/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	6/3/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/3/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/3/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/3/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/3/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/4/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/4/2014	DPO/JCF	NA	Dead, semi-fresh (eyes dessicated, rigor mortis)	Unknown	Intact	Collision with wire	Probable (>50%)	NA	NA	N
Carcass Survey	6/5/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/5/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/5/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/5/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/10/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/11/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/11/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/11/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/11/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/11/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/11/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

Carcass Survey	6/11/2014	TPP	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/11/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/11/2014	SMG	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/12/2014	BOC	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/12/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N
Carcass Survey	6/12/2014	KLI	NA	Broken up	Unknown	Scavenged	Collision with wire	Probable (<50%, >0)	NA	NA	N

		Location											ject Feature information	Pro
Disposition (Where did carcass end up?)*	Injured animal outcome? (Died, euthanized, released, rehab center, zoo)	Transect/Subplot Number *	Where found: GPS Latitude (decimal degrees)*	Where found: GPS Longitude (decimel degrees)*	Habitat surrounding carcass	County (Note: Please list only primary name e.g. Grant Parish would be "Grant", and Alameda County would be "Alameda")	State	Estimated weather conditions at time of mortality/injury	Wind speed (Day of death, estimated)	Max wind gust speed (Day of death, estimated)	Wind direction (Day of death, estimated)	Moonphase (Julian calendar phase)	Project feature where injured bird/carcass was found*	Project feature where injured bird/carcass was found* (use if more than one feature found)
Left in place	Dead	NA	32.74258283	-115.7760267	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76075445	-115.8150519	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72081394	-115.7285427	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72226451	-115.731051	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73017891	-115.7484826	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73017891	-115.7484826	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73233874	-115.7534147	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73702469	-115.7638936	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73724882	-115.7646696	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73801125	-115.7660679	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73856854	-115.7667859	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74540455	-115.7823494	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76342988	-115.8232899	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.71739738	-115.7216451	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72620311	-115.7396813	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.72984528	-115.7475909	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73560887	-115.760274	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72033861	-115.7270343	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72697064	-115.7415593	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74145823	-115.7735553	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7591225	-115.8132161	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72996406	-115.7486457	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73087466	-115.749508	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73357874	-115.756567	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77399672	-115.8460632	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77620936	-115.8512664	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79138512	-115.8948121	Desert	Imperial	CA						Transmission Tower	
Other	Rehab center	NA	32.7913537	-115.8973861	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77149954	-115.8403515	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77767867	-115.855102	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78021436	-115.8601627	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79144906	-115.8989975	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79162665	-115.9027863	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.7190193	-115.7214832	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73603223	-115.7620397	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72142154	-115.7288648	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72452787	-115.7363436	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74172709	-115.7742987	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75279618	-115.7996157	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74979674	-116.0360422	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74555079	-116.0387244	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74557211	-116.0391511	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75114449	-116.0353552	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73889678	-116.0426381	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76322853	-116.0279654	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76318053	-116.0275923	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76447767	-116.0273647	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76508718	-116.026867	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75043335	-116.0355444	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75090162	-116.0354433	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75824566	-116.0309766	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.73596076	-116.0444197	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77030542	-115.8380289	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78833477	-115.8763973	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78957445	-115.8788485	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76740353	-115.832483	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77443937	-115.8471145	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78237086	-115.8652072	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77970249	-115.8594218	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78879205	-115.8770963	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78968392	-115.8789859	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76923487	-116.0243449	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75760512	-116.0309622	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76446641	-116.0270765	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75216884	-116.0348425	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.89680645	-116.8424156	mixed chaparral	San Diego	CA						Transmission Tower	
Left in place	Dead	NA	32.75452726	-115.8033071	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75892965	-115.8138057	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76043735	-115.8158567	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.76284603	-115.8216322	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75403259	-115.8025132	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75739242	-115.8095989	Desert	Imperial	CA						Transmission Tower	
Other	Rehab center	NA	32.75735574	-115.8104854	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76094297	-115.8168642	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79157287	-115.9007686	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79181021	-115.9031471	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77050709	-115.8393501	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77148151	-115.8403517	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77687096	-115.8525925	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77706358	-115.8529424	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7777628	-115.8544389	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.765816	-115.8286178	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.767514	-115.8317556	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77260774	-115.8441166	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77385655	-115.8465134	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77530041	-115.8495271	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77531326	-115.8499433	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.77587233	-115.8509077	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78349253	-115.8675528	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78371169	-115.867849	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7913923	-115.8915443	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78663623	-115.8730763	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7882703	-115.8762486	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7913245	-115.9053636	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79150923	-115.9079243	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76571139	-115.8280426	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77408016	-115.8463077	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77440201	-115.8469762	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77562392	-115.8503771	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78285476	-115.8658524	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78454785	-115.8695469	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72204277	-115.7305313	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72301937	-115.7325555	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72320912	-115.7334811	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73238383	-115.7534141	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.71752767	-115.722038	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.71818027	-115.7223488	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72054788	-115.7272127	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73812809	-115.7669414	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73851306	-115.7666479	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73857892	-115.7669245	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73888105	-115.7673792	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73921664	-115.7675667	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74637494	-115.7847484	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.71662011	-115.719725	Desert	Imperial	CA						Transmission Tower	
Other	Rehab center	NA	32.71737162	-115.7208879	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73760683	-103.7643872	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73802385	-103.7664305	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73858941	-103.7670738	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74415391	-103.7798902	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74858502	-103.7894254	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76340692	-103.8227671	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72261618	-103.7319316	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.7295283	-103.7465602	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72957425	-103.7466449	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72958198	-103.7465167	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7299995	-103.7485811	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73223943	-103.7534054	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73258607	-103.7537955	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73256326	-103.7542226	Desert	Imperial	CA						Transmission Tower	
Other	Rehab center	NA	32.74367093	-103.7793845	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75984994	-103.8147863	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76137633	-103.8178619	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74575338	-104.2737385	Semi-desert chaparral	San Diego	CA						Transmission Tower	
Left in place	Dead	NA	32.76437085	-104.0275473	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74676097	-116.0377401	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7460827	-116.0386866	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74535122	-116.0385771	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75664092	-116.0322536	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76119354	-116.0295889	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74158226	-116.0411258	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.74163785	-116.0413173	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75459388	-116.0334927	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74037075	-116.0419392	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72884231	-116.0489671	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76179097	-116.0286963	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76236681	-116.0285086	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.71688979	-115.7196358	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7186537	-115.7236651	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7190278	-115.7240866	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72998387	-115.7479197	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73006664	-115.7480786	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72999005	-115.7485386	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73514917	-115.7593946	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73870644	-115.7670508	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73848213	-115.7671713	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74635732	-115.7847913	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75504449	-115.8036311	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75623113	-115.8060491	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.75605595	-115.8065958	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76224141	-115.8196866	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76278478	-115.8208751	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72120304	-115.7286652	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73381629	-115.7568732	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73416673	-115.7576474	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7302326	-115.7484392	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.71833468	-115.7233389	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73818461	-115.7662682	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74624059	-115.7848462	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74660381	-115.7860261	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75507532	-115.8040257	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75503934	-115.8040368	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76542551	-115.8273738	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76588135	-115.827891	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76585989	-115.8284891	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76599358	-115.8283165	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76616081	-115.8288374	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.7732252	-115.8455393	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7760234	-115.8506602	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78151359	-115.8631786	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78266101	-115.8653743	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79157787	-115.9054566	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79175915	-115.9076223	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76870625	-115.8338646	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76864026	-115.8345274	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77150357	-115.8417607	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77938359	-103.8580805	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78075164	-103.8617148	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78688128	-103.8732441	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78767966	-103.874761	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78978236	-103.8788993	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79162512	-103.8995292	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79114867	-103.901767	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79143141	-103.9031518	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77728688	-103.853687	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.77745323	-103.8541226	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77992874	-103.8595043	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78033617	-103.860663	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78042772	-103.8608113	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79162681	-103.8997214	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79158311	-103.9009073	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79158311	-103.9009073	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79156676	-103.9010998	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7910675	-103.901768	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7910675	-103.901768	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77270862	-103.8442968	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78382774	-115.8687124	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79109356	-115.9037112	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79106463	-115.903498	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79184936	-115.908657	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75132315	-116.0351292	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75713476	-116.03196	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75699791	-116.0317587	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7575711	-116.0312294	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.73985738	-116.0420408	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73438089	-116.0454291	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72883256	-116.0488712	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7466096	-116.0379979	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74617019	-116.0383335	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74554875	-116.0384575	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7494281	-116.0361957	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75163735	-116.0349336	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75261693	-116.0344641	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7558487	-116.0324543	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75853263	-116.03076	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75974464	-116.0300209	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73742532	-116.0436677	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76824582	-116.0247507	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7327738	-116.0464174	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73528829	-115.7588697	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73533578	-115.7600217	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73558372	-115.7604665	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.73642905	-115.7620342	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73702665	-115.7631786	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73716846	-115.7638383	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73711677	-115.7640845	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73733374	-115.7641348	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73722836	-115.7644244	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73774403	-115.7654952	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73858437	-115.7665616	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73939597	-115.7683754	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74429566	-115.7814786	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74638801	-115.7833073	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74640605	-115.783307	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74642429	-115.7833281	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7463199	-115.784653	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74739586	-115.7877124	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76308994	-115.8216717	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76308323	-115.8219174	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.71735532	-115.7210589	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.71804782	-115.7226281	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.71848006	-115.7234435	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72008481	-115.7260242	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73001984	-115.7479086	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74857858	-115.7896924	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74875725	-115.7904478	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7492473	-115.79169	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74959866	-103.7925818	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7586505	-103.811952	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75882934	-103.8127396	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73012576	-103.7485794	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73247551	-103.7535622	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73463866	-103.7579396	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73445128	-103.758145	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76139773	-103.8191747	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72315022	-103.7321162	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73271084	-103.7536443	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73368069	-103.756843	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.73606799	-103.7620072	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74632943	-103.7847063	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74843335	-103.7895983	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75628121	-103.8065714	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75661555	-103.8075811	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76186933	-103.819446	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76350824	-103.82299	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72630757	-103.7393063	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72786054	-115.7430514	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72791976	-115.7444591	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73014284	-115.7484831	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78340788	-115.8671694	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78515129	-115.8704469	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79186953	-115.9089024	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76495085	-115.8258107	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77269244	-115.8425461	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77498347	-115.8484101	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77547912	-115.8493433	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.77585871	-115.8504061	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79145892	-115.9001186	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79127241	-115.9014771	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79141906	-115.9017423	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79138513	-115.9019884	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79138594	-115.9031096	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76890578	-115.834951	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76911234	-115.8358237	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76938886	-115.8364607	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77078905	-115.8396027	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77110619	-115.8397587	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77647608	-115.8528112	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77699231	-115.8530394	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77973857	-115.8594214	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77972926	-115.8593894	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78075435	-115.8620137	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7763361	-115.8523004	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76779999	-115.8334067	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.76815252	-115.8334875	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7713248	-115.8409623	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77733405	-115.8529283	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76330871	-116.0278364	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76364226	-116.0278115	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76463811	-116.0271174	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76774422	-116.0252046	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76832799	-116.0248779	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73385126	-116.0457656	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73363821	-116.0462161	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73247737	-116.0465807	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79160501	-115.8972442	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75071509	-116.0358189	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75200567	-116.0347375	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75231118	-116.0345848	Desert	Imperial	CA						Transmission Tower	
Other	Rehab center	NA	32.75307503	-116.0342136	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75360422	-116.0338236	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75565142	-116.0326059	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.75682786	-116.0319313	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75774553	-116.0316225	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7607352	-116.0298073	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74166229	-116.0409755	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74174518	-116.0411987	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74079173	-104.0415505	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74039691	-104.0418215	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73652655	-104.0440935	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72559823	-104.0505809	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72549404	-104.0511156	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79099592	-103.8865194	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79147981	-103.88819	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79112093	-103.8894225	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79158661	-103.9033635	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79187671	-103.9035308	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79162517	-103.9077734	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79189641	-103.9088807	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74889915	-104.0366176	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.74602637	-104.038399	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74513827	-104.0390383	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73118408	-104.0473201	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79125963	-103.8959243	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7916386	-103.902092	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79127972	-103.90231	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75696414	-116.032058	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75714378	-116.03196	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75706849	-116.0315551	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75952784	-116.0299806	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74021603	-116.0417594	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72611291	-116.0506502	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79117639	-115.8885568	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73524432	-115.7598949	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73808382	-115.7661095	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73863808	-115.767436	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74004803	-115.7704796	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73519275	-115.7601517	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.7367265	-115.7629266	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73680417	-115.7643983	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7398126	-115.7703868	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74074662	-115.7727326	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.88547816	-116.8170017	mixed chaparral	San Diego	CA						Transmission Tower	
Left in place	Dead	NA	32.88988155	-116.8242522	mixed chaparral	San Diego	CA						Transmission Tower	
Left in place	Dead	NA	32.77011434	-115.8378498	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79156724	-115.900128	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79144454	-115.9005353	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79148584	-115.902158	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79146902	-115.902297	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79148188	-115.9027347	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79146431	-115.9027883	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76485805	-115.8264952	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7665302	-115.8307222	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77454683	-115.84801	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78453575	-115.8692053	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79112692	-115.8890807	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.79146964	-115.9033969	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76937409	-115.8358417	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77721571	-115.8537946	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78788076	-115.8750575	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78841114	-115.8768662	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76432805	-115.8257655	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77267964	-115.8431121	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77650492	-115.8520207	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79103807	-115.8882168	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79152348	-115.9033642	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75234668	-116.0345097	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75415152	-116.0334441	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75550835	-116.0327676	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75619814	-116.0321517	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75677349	-116.0318999	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75697316	-116.0320579	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75878344	-116.0305331	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75952221	-116.0304183	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.73988386	-116.0419658	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72560798	-116.0506769	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76196118	-116.028545	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76235754	-104.0284766	Desert	Imperial	CA						Transmission Tower	
Other	Rehab center	NA	32.76333519	-104.0277614	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74932503	-104.0368692	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74860962	-104.0365033	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74865784	-104.0369084	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73127468	-104.0473725	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74714815	-104.0376505	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74645775	-104.0381916	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7449856	-104.0391254	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73232298	-104.0464436	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73231965	-104.0471906	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73151805	-104.0473486	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75472572	-104.0330429	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75648908	-104.0324474	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75646062	-104.0322662	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.75667519	-104.0320184	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75689355	-104.0322616	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75685747	-104.032262	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75860545	-104.0308446	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74186966	-116.0409626	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74180464	-116.0407178	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74094612	-116.0416876	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74105583	-116.0418785	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73615919	-116.0444176	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72754641	-116.0493651	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73001402	-115.7482288	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73003184	-115.7482072	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73004331	-115.7484525	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72998963	-115.7484959	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73487481	-115.7590142	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7360048	-115.7610903	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7359258	-115.7622226	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73621556	-115.762336	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.73676163	-115.7628301	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73673426	-115.7627984	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73719488	-115.7637739	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73721271	-115.7637523	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73728855	-115.7641248	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7380726	-115.7658856	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73828402	-115.7662882	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73878751	-115.767039	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73954278	-115.7686295	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74633825	-115.7846848	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74864773	-115.7893819	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75455197	-115.8030613	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75599607	-115.8069382	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75600529	-115.8069594	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76215786	-115.8203923	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76229174	-115.8202411	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76295657	-115.8218763	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76300156	-115.8218651	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.76315619	-115.8220018	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76304927	-115.822142	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76311461	-115.822376	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76340742	-115.8228205	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76352577	-115.8229364	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.71604627	-115.7191783	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7197269	-115.7254211	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.71996518	-115.7257912	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73033798	-115.7490566	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73033798	-115.7490566	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73127856	-115.7520208	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73173894	-115.7529642	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7333345	-115.7555886	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73467759	-115.7582272	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7344641	-115.758529	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73968079	-115.7689051	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73980569	-115.7696825	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73989377	-115.7703856	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73994285	-115.7707905	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.74011472	-115.7708415	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7409615	-103.7725696	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74167088	-103.774086	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74184126	-103.7749055	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74195063	-103.7750214	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74915433	-103.791403	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74965541	-103.7919193	Desert	Imperial	CA						Transmission Tower	
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Left in place	Dead	NA	32.75226358	-103.7976908	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75213045	-103.7979167	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75266777	-103.7993932	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75725978	-103.8098782	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75878708	-103.813039	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75913506	-103.8135895	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76033804	-103.8158473	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72101682	-103.7280916	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72130725	-103.7282689	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72854354	-103.7445998	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.73006536	-103.7479506	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7370941	-103.7636152	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74502472	-115.7813192	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74502461	-115.7813086	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74728474	-115.7874151	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75295791	-115.7995494	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75276093	-115.7997015	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75373072	-115.8011295	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75403181	-115.8014884	Desert	Imperial	CA						Transmission Tower	
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Left in place	Dead	NA	32.75662063	-115.8081147	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76297131	-115.8224846	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76357157	-115.8230105	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7636816	-115.8232012	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73165257	-115.7524425	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73284262	-115.7541974	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73307583	-115.7549732	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73465032	-115.7582063	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.73919557	-115.7690932	Desert	Imperial	CA						Transmission Tower	
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Left in place	Dead	NA	32.7508018	-115.7948178	Desert	Imperial	CA						Transmission Tower	
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Left in place	Dead	NA	32.75295013	-115.7987383	Desert	Imperial	CA						Transmission Tower	
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Left in place	Dead	NA	32.72141851	-115.7285661	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72343081	-115.7331045	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7254989	-115.7378238	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73519759	-116.2703128	Semi-desert chaparral	San Diego	CA						Transmission Tower	
Left in place	Dead	NA	32.74114574	-116.2724951	Semi-desert chaparral	San Diego	CA						Transmission Tower	
Left in place	Dead	NA	32.71055891	-116.2589048	Semi-desert chaparral	San Diego	CA						Transmission Tower	
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Left in place	Dead	NA	32.7266808	-116.2669673	Semi-desert chaparral	San Diego	CA						Transmission Tower	
Left in place	Dead	NA	32.72935081	-116.2685035	Semi-desert chaparral	San Diego	CA						Transmission Tower	

Left in place	Dead	NA	32.74850875	-116.2744527	Semi-desert chaparral	San Diego	CA						Transmission Tower	
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Left in place	Dead	NA	32.73215413	-115.7538975	Desert	Imperial	CA						Transmission Tower	
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Left in place	Dead	NA	32.72252751	-103.7320823	Desert	Imperial	CA						Transmission Tower	
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Left in place	Dead	NA	32.7298982	-103.7492762	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73017384	-103.7488775	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73067181	-103.7499697	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73259636	-103.7539234	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73398913	-103.7570202	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73437352	-103.7575805	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75052096	-103.7937542	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75154024	-103.7965691	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75767565	-103.8099794	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72135299	-103.7283323	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72218533	-103.7303585	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72335942	-103.7331802	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73531415	-103.7596591	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73552038	-115.760446	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73552929	-115.7604352	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73672096	-115.7632788	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74504878	-115.781938	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.7453919	-115.781976	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74558058	-115.7828273	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74587508	-115.7834317	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74791912	-115.7886553	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74791912	-115.7886553	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74791912	-115.7886553	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74791912	-115.7886553	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74791912	-115.7886553	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74854188	-115.7896288	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75345075	-115.8001513	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75345075	-115.8001513	Desert	Imperial	CA						Transmission Tower	
Other	Rehab center	NA	32.75363542	-115.8005971	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75492959	-115.8038782	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75597478	-115.8065969	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75629399	-115.8069662	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76372459	-115.8229765	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.71830024	-115.7234995	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72745227	-115.7419153	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72999513	-115.7481437	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7301391	-115.7481096	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.73012107	-115.7481099	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7354092	-115.7601487	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73587448	-115.7615937	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73698339	-115.7642784	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73754341	-115.7652739	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73774948	-115.7651323	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75376145	-115.8015134	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75468766	-115.8031022	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75563555	-115.8050749	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75600587	-115.8060734	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75613386	-115.8062532	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75650285	-115.8071129	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.71724178	-115.7214233	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.71725222	-115.7215618	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.71906355	-115.7240541	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72082962	-115.7274221	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73248983	-115.7540956	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73357036	-115.755724	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.73433118	-115.7578585	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74086431	-115.7718558	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74102986	-115.7731023	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74254415	-115.7757604	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74291924	-115.7762996	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74404371	-115.7796889	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75104307	-115.795519	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76000495	-115.8159158	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7615775	-115.8191082	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7219731	-115.7307777	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72520159	-115.7369637	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76327363	-104.0279649	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77163198	-104.0228987	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77217098	-104.0226152	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74795801	-104.0373963	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74720161	-104.0375645	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74722063	-104.0376924	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74625997	-104.0382791	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.74617954	-104.0383761	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74423115	-104.0395497	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75599251	-104.0323887	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75634336	-104.0322675	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75635395	-104.0324702	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75636305	-104.0324808	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75655769	-104.0319876	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7566396	-104.0320828	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75687312	-104.0319522	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75686492	-104.032059	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75715605	-104.0312126	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75764813	-104.0318584	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75761992	-116.0317093	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75785228	-116.0314292	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75891343	-116.0310121	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75918112	-116.0306355	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76041994	-116.0298641	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76063417	-116.0295736	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.76067	-116.0295412	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74223101	-116.0410334	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74137685	-116.0413948	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76351533	-116.0277274	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76501419	-116.026761	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74516337	-116.0387819	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74302753	-116.0402137	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73202753	-116.0467349	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7574934	-116.0316786	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75783036	-116.0309277	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75903557	-116.030477	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73951904	-116.0426207	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76493511	-115.8260565	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.765375	-115.8277588	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76556939	-115.8282901	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76557851	-115.8283006	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76583373	-115.8285855	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77492729	-115.8481866	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.7750668	-115.8486439	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.775874	-115.8510892	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77630102	-115.8514254	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78380926	-115.8676662	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79121323	-115.8876273	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79140232	-115.8896219	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79152292	-115.9053612	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79197029	-115.907011	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79199744	-115.9070213	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79197076	-115.9070644	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79167872	-115.9077087	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79168765	-115.9076979	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79193321	-115.9079298	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79199672	-115.9079718	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76818356	-115.8339141	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76854511	-115.8339948	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76935288	-115.8364718	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7711399	-115.839502	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.77698457	-115.8531783	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77737326	-115.8532694	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77726002	-115.8537087	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77723326	-115.853741	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77813941	-115.8551815	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.779235	-115.8576126	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77935643	-115.8580702	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77981721	-115.8591427	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78001166	-115.8596955	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78010409	-103.8599399	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78034402	-103.8605348	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78048088	-103.8616969	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78649883	-103.8728431	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78752365	-103.874464	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7907894	-103.8927264	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79081632	-103.8937299	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79119411	-103.8946329	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7913318	-103.8969485	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.79158528	-103.8980774	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79140931	-103.9006318	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79112115	-103.9017139	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79112124	-103.9017246	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7911933	-103.9017131	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79147448	-103.9018911	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79129117	-103.9025875	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79129126	-103.9025982	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79148525	-103.9031191	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76689046	-103.8306641	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77348212	-115.8450342	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77572724	-115.8498419	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7825428	-115.8652691	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79086717	-115.8852289	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79141524	-115.8890451	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79185223	-115.9048553	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77043584	-115.8384756	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77672439	-115.8533311	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.78700189	-115.8736163	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79123661	-115.9015096	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79149211	-115.9028734	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79146543	-115.9029164	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72546444	-115.7379844	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72544651	-115.7379953	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72552757	-115.7379835	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72785174	-115.7430728	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72768103	-115.7431393	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7276647	-115.7433102	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72786525	-115.7435208	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72955696	-115.7467198	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.72985505	-115.7476654	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73021573	-115.7485568	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73031157	-115.749121	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73131589	-115.7512413	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73245079	-115.7537973	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.73242362	-115.753787	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.88724096	-116.8196174	mixed chaparral	San Diego	CA						Transmission Tower	
Left in place	Dead	NA	32.89677998	-116.8428861	mixed chaparral	San Diego	CA						Transmission Tower	
Left in place	Dead	NA	32.88452953	-116.8159987	mixed chaparral	San Diego	CA						Transmission Tower	
Left in place	Dead	NA	32.76281347	-116.0279486	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74764094	-116.0372182	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74284714	-116.0402156	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75569825	-116.0328296	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75607064	-116.0319929	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75449949	-116.0329493	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75688379	-116.0321656	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75745501	-116.0313801	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75988986	-116.0301368	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76131485	-116.028947	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7637313	-116.027661	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74277392	-116.0400777	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76506398	-115.8263323	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76587816	-115.8275494	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77336926	-115.8445339	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.77384986	-115.8457875	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77506788	-115.8487613	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77566225	-115.8496399	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77625219	-115.8520026	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78300429	-115.8664271	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78314778	-115.8673329	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79136862	-115.8848168	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76981602	-103.8368074	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77017152	-103.8381801	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78608519	-103.8719834	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78808791	-103.8760266	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78840376	-103.876044	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79117057	-103.9011794	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79107661	-103.9017786	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79182816	-103.9031362	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76504882	-103.827603	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76558753	-103.8283005	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76648908	-103.8292175	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.76680863	-103.8296297	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76694277	-103.8304713	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77546903	-103.8502082	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77569411	-103.8501626	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77597468	-103.8502658	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77576136	-103.8515925	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78235098	-103.8650045	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78304101	-103.8674944	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78304072	-115.8674624	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78329244	-115.8683668	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78373842	-115.8688096	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78491192	-115.8709091	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79196798	-115.9077799	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77729903	-115.8540285	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77949379	-115.8592857	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79146098	-115.897278	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79166485	-115.8999452	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79162726	-115.9008	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.79162764	-115.9008427	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79153705	-115.9018263	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79184679	-115.9021749	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79195483	-115.9021522	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79196441	-115.9022162	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75527277	-116.0326314	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.74925919	-116.0365177	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75748281	-116.0314759	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75746271	-116.0312092	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.75891816	-116.0304569	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7668308	-116.0260579	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.70646545	-116.259216	Semi-desert chaparral	San Diego	CA						Transmission Tower	
Left in place	Dead	NA	32.76578305	-115.8279883	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76651939	-115.8305302	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76701901	-115.830908	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76763977	-115.8317006	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.7728921	-115.8436539	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77625308	-115.8520986	Desert	Imperial	CA						Transmission Tower	

Left in place	Dead	NA	32.79130864	-115.8882135	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.78843677	-115.8757019	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79146977	-115.9023824	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.76492938	-115.8273697	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.77508552	-115.8487184	Desert	Imperial	CA						Transmission Tower	
Left in place	Dead	NA	32.79172633	-115.9079964	Desert	Imperial	CA						Transmission Tower	

ject Feature information

Project feature where injured bird/carcass was found* (use if more than 2 features found)	Distance to Project Feature (Feet) *	Azimuth of carcass to project feature	Flight diverters on transmission line? (Y/N)	Type of flight diverter? (List various types)	Transmission compliant with APLIC 2012? (Y/N)	Type and configuration of structure (e.g. structure type, nameplate information, manufacturer information, model number, height, presence/absence of guy wires, structure ID#, line name, circuit number, circuit name, etc.)	Biometric Data on bird (Optional, but could include weight, wing chord, tarsus, tail molt, fat level, brood patch, etc.)	Additional Information and Notes (Band information, other identifying numbers, mitigating conditions)
	608		Y	68 yellow SFDs at 10 m spacing		EP352		no bands
	318		Y	98 gray SFDs at 5 m spacing		EP344		no bands
	90		Y	59 gray SFDs at 10 m spacing		EP361		no bands
	751		Y	59 gray SFDs at 10 m spacing		EP360		no bands
	10		Y	114 gray SFDs at 5 m spacing		EP357		no bands
	123		Y	114 gray SFDs at 5 m spacing		EP356		no bands
	114		Y	118 yellow SFDs at 5 m spacing		EP354		no bands
	366		Y	118 yellow SFDs at 5 m spacing		EP354		no bands
	869		Y	118 yellow SFDs at 5 m spacing		EP354		no bands
	710		Y	118 yellow SFDs at 5 m spacing		EP353		no bands
	806		Part	4 SFDs adjacent to one tower		EP350		no bands
	40		Y	43 gray SFDs at 10 m spacing		EP342		no bands
	692		Y	56 yellow SFDs at 10 m spacing		EP362		no bands
	512		Y	111 yellow SFDs at 5 m spacing		EP359		no bands

	284		Part	4 SFDs adjacent to one tower		EP357		no bands
	582		Y	58 yellow SFDs at 10 m spacing		EP355		no bands
	404		N	none		EP361		no bands
	644		Y	111 yellow SFDs at 5 m spacing		EP358		no bands
	242		Y	122 gray SFDs at 5 m spacing		EP352		no bands
	431		Y	114 yellow SFDs at 5 m spacing		EP344		no bands
	18		Y	114 gray SFDs at 5 m spacing		EP357		no bands
	395		Y	114 gray SFDs at 5 m spacing		EP357		no bands
	763		Y	59 gray SFDs at 10 m spacing		EP355		no bands
	425		Y	56 yellow SFDs at 10 m spacing		EP357		no bands
	395		Y	56 gray SFDs at 10 m spacing		EP336		no bands
	804		Y	62 gray SFDs at 10 m spacing		EP327		no bands
	16		Y	62 gray SFDs at 10 m spacing		EP327		Delivered to Project Wildlife in San Diego, CA; no bands
	651		Y	105 yellow SFDs at 5 m spacing		EP338		no bands
	891		Y	108 yellow SFDs at 5 m spacing		EP336		no bands
	872		Part	4 SFDs adjacent to one tower		EP335		no bands
	476		Part	4 SFDs adjacent to one tower		EP327		no bands
	157		Part	4 SFDs adjacent to one tower		EP326		no bands

	489		Y	56 yellow SFDs at 10 m spacing		EP362		no bands
	562		Y	58 yellow SFDs at 10 m spacing		EP354		no bands
	269		Y	59 gray SFDs at 10 m spacing		EP361		no bands
	679		Y	110 gray SFDs at 5 m spacing		EP359		no bands
	3		Y	122 gray SFDs at 5 m spacing		EP352		no bands
	4		Y	64 gray SFDs at 10 m spacing		EP347		no bands
	61		Y	SFDs adjacent to each tower, 11 aviation balls		EP295		no bands
	69		Part	4 SFDs adjacent to one tower		EP294		no bands
	23		Part	4 SFDs adjacent to one tower		EP294		no bands
	605		Y	SFDs adjacent to each tower, 11 aviation balls		EP295		no bands
	232		N	none		EP292		no bands
	708		N	none		EP298		no bands
	730		N	none		EP298		no bands
	495		N	none		EP299		no bands
	230		N	none		EP299		no bands
	335		Y	SFDs adjacent to each tower, 11 aviation balls		EP295		no bands
	505		Y	SFDs adjacent to each tower, 11 aviation balls		EP295		no bands
	430		N	none		EP297		no bands

	706		Part	4 SFDs adjacent to one tower		EP291		no bands
	291		Y	105 yellow SFDs at 5 m spacing		EP339		no bands
	41		Y	SFDs adjacent to each tower, 11 aviation balls		EP331		no bands
	609		Y	SFDs adjacent to each tower, 11 aviation balls		EP330		no bands
	165		Y	84 gray SFDs at 5 m spacing		EP340		no bands
	67		Y	56 yellow SFDs at 10 m spacing		EP337		no bands
	767		Y	93 grey SFDs at 5 m spacing		EP333		no bands
	620		Part	4 SFDs adjacent to one tower		EP335		no bands
	310		Y	SFDs adjacent to each tower, 11 aviation balls		EP331		no bands
	552		Y	SFDs adjacent to each tower, 11 aviation balls		EP330		no bands
	170		Y	SFDs adjacent to one tower, 11 aviation balls		EP300		no bands
	192		N	none		EP297		no bands
	468		N	none		EP299		no bands
	511		Y	SFDs adjacent to each tower, 11 aviation balls		EP296		no bands
	1487		N	none		CP65		no bands
	428		Y	64 gray SFDs at 10 m spacing		EP346		no bands
	284		Y	114 yellow SFDs at 5 m spacing		EP344		no bands
	502		Y	98 gray SFDs at 5 m spacing		EP344		no bands

	590		Y	43 gray SFDs at 10 m spacing		EP342		no bands
	730		Y	64 gray SFDs at 10 m spacing		EP346		no bands
	118		Y	114 yellow SFDs at 5 m spacing		EP345		no bands
	358		Y	114 yellow SFDs at 5 m spacing		EP345		Delivered to Project Wildlife in San Diego, CA; no bands
	771		Y	98 gray SFDs at 5 m spacing		EP343		no bands
	784		Part	4 SFDs adjacent to one tower		EP326		no bands
	39		Part	4 SFDs adjacent to one tower		EP326		no bands
	685		Y	105 yellow SFDs at 5 m spacing		EP339		no bands
	648		Y	105 yellow SFDs at 5 m spacing		EP338		no bands
	65		Y	108 yellow SFDs at 5 m spacing		EP336		no bands
	184		Y	108 yellow SFDs at 5 m spacing		EP336		no bands
	734		Y	108 yellow SFDs at 5 m spacing		EP336		no bands
	98		Y	84 gray SFDs at 5 m spacing		EP341		no bands
	335		Y	84 gray SFDs at 5 m spacing		EP340		no bands
	566		Y	56 yellow SFDs at 10 m spacing		EP338		no bands
	331		Y	56 yellow SFDs at 10 m spacing		EP337		no bands
	734		Y	56 gray SFDs at 10 m spacing		EP337		no bands
	845		Y	56 gray SFDs at 10 m spacing		EP337		no bands

	555		Y	56 gray SFDs at 10 m spacing		EP336		no bands
	56		Y	52 yellow SFDs at 10 m spacing		EP333		no bands
	174		Y	52 yellow SFDs at 10 m spacing		EP333		no bands
	24		Y	62 gray SFDs at 10 m spacing		EP328		no bands
	495		Part	4 SFDs adjacent to one tower		EP332		no bands
	11		Part	4 SFDs adjacent to one tower		EP331		no bands
	626		N	none		EP326		no bands
	306		N	none		EP325		no bands
	78		Y	SFDs adjacent to each tower, 11 aviation balls		EP341		no bands
	355		Y	56 yellow SFDs at 10 m spacing		EP337		no bands
	108		Y	56 yellow SFDs at 10 m spacing		EP337		no bands
	742		Y	56 gray SFDs at 10 m spacing		EP336		no bands
	507		Y	93 grey SFDs at 5 m spacing		EP333		no bands
	787		Y	52 yellow SFDs at 10 m spacing		EP333		no bands
	844		Y	59 gray SFDs at 10 m spacing		EP361		no bands
	207		Y	59 gray SFDs at 10 m spacing		EP360		no bands
	73		Y	110 gray SFDs at 5 m spacing		EP360		no bands
	111		Y	114 gray SFDs at 5 m spacing		EP356		no bands

	568		Y	56 yellow SFDs at 10 m spacing		EP362		no bands
	360		Y	56 yellow SFDs at 10 m spacing		EP362		no bands
	314		N	none		EP361		no bands
	733		Y	118 yellow SFDs at 5 m spacing		EP353		no bands
	742		Y	118 yellow SFDs at 5 m spacing		EP353		no bands
	651		Y	118 yellow SFDs at 5 m spacing		EP353		no bands
	469		Y	118 yellow SFDs at 5 m spacing		EP353		no bands
	358		Y	118 yellow SFDs at 5 m spacing		EP353		no bands
	20		Y	60 gray SFDs at 10 m spacing		EP350		no bands
	323		Y	56 yellow SFDs at 10 m spacing		EP363		no bands
	768		Y	56 yellow SFDs at 10 m spacing		EP363		Delivered to Project Wildlife in San Diego, CA; no bands
	358		Y	118 yellow SFDs at 5 m spacing		EP354		no bands
	889		Y	118 yellow SFDs at 5 m spacing		EP353		no bands
	615		Y	118 yellow SFDs at 5 m spacing		EP353		no bands
	55		Part	4 SFDs adjacent to one tower		EP351		no bands
	55		Y	60 gray SFDs at 10 m spacing		EP349		no bands
	189		Y	43 gray SFDs at 10 m spacing		EP342		no bands
	449		Y	59 gray SFDs at 10 m spacing		EP360		no bands

	615		Part	4 SFDs adjacent to one tower		EP357		no bands
	581		Part	4 SFDs adjacent to one tower		EP357		no bands
	627		Part	4 SFDs adjacent to one tower		EP357		no bands
	9		Y	114 gray SFDs at 5 m spacing		EP357		no bands
	140		Y	114 gray SFDs at 5 m spacing		EP356		no bands
	24		Y	59 gray SFDs at 10 m spacing		EP356		no bands
	140		Y	59 gray SFDs at 10 m spacing		EP356		no bands
	158		Y	68 yellow SFDs at 10 m spacing		EP351		Delivered to Project Wildlife in San Diego, CA; no bands
	116		Y	98 gray SFDs at 5 m spacing		EP344		no bands
	420		Y	98 gray SFDs at 5 m spacing		EP343		no bands
	5		Part	4 SFDs adjacent to one tower		EP190		no bands
	554		N	none		EP299		no bands
	583		Part	4 SFDs adjacent to one tower		EP294		no bands
	251		Part	4 SFDs adjacent to one tower		EP294		no bands
	8		Part	4 SFDs adjacent to one tower		EP294		no bands
	259		Part	4 SFDs adjacent to one tower		EP297		no bands
	166		N	none		EP298		no bands
	15		N	none		EP293		no bands

	11		N	none		EP293		no bands
	464		Part	4 SFDs adjacent to one tower		EP296		no bands
	488		N	none		EP293		no bands
	676		Y	SFDs adjacent to each tower, 13 aviation balls		EP290		no bands
	127		N	none		EP298		no bands
	364		N	none		EP298		no bands
	345		Y	56 yellow SFDs at 10 m spacing		EP363		no bands
	74		N	none		EP362		no bands
	256		N	none		EP362		no bands
	169		Part	4 SFDs adjacent to one tower		EP357		no bands
	102		Part	4 SFDs adjacent to one tower		EP357		no bands
	3		Part	4 SFDs adjacent to one tower		EP357		no bands
	271		Y	58 yellow SFDs at 10 m spacing		EP355		no bands
	590		Y	118 yellow SFDs at 5 m spacing		EP353		no bands
	614		Y	118 yellow SFDs at 5 m spacing		EP353		no bands
	28		Y	60 gray SFDs at 10 m spacing		EP350		no bands
	247		Y	64 gray SFDs at 10 m spacing		EP346		no bands
	603		Y	54 yellow SFDs at 10 m spacing		EP346		no bands

	724		Y	54 yellow SFDs at 10 m spacing		EP346		no bands
	223		Y	43 gray SFDs at 10 m spacing		EP343		no bands
	633		Y	43 gray SFDs at 10 m spacing		EP343		no bands
	188		Y	59 gray SFDs at 10 m spacing		EP361		no bands
	642		Y	59 gray SFDs at 10 m spacing		EP355		no bands
	369		Y	59 gray SFDs at 10 m spacing		EP355		no bands
	10		Y	114 gray SFDs at 5 m spacing		EP357		no bands
	68		Y	56 yellow SFDs at 10 m spacing		EP362		no bands
	916		Y	118 yellow SFDs at 5 m spacing		EP353		no bands
	24		Y	60 gray SFDs at 10 m spacing		EP350		no bands
	404		Y	60 gray SFDs at 10 m spacing		EP350		no bands
	141		Y	64 gray SFDs at 10 m spacing		EP346		no bands
	140		Y	64 gray SFDs at 10 m spacing		EP346		no bands
	306		Y	SFDs adjacent to each tower, 11 aviation balls		EP341		no bands
	72		Y	SFDs adjacent to each tower, 11 aviation balls		EP341		no bands
	66		Y	84 gray SFDs at 5 m spacing		EP341		no bands
	43		Y	84 gray SFDs at 5 m spacing		EP341		no bands
	208		Y	84 gray SFDs at 5 m spacing		EP341		no bands

	700		Y	56 yellow SFDs at 10 m spacing		EP337		no bands
	590		Y	56 gray SFDs at 10 m spacing		EP336		no bands
	170		Y	93 grey SFDs at 5 m spacing		EP334		no bands
	668		Y	93 grey SFDs at 5 m spacing		EP333		no bands
	678		N	none		EP326		no bands
	389		N	none		EP325		no bands
	413		Part	4 SFDs adjacent to one tower		EP340		no bands
	590		Part	4 SFDs adjacent to one tower		EP340		no bands
	256		Y	105 yellow SFDs at 5 m spacing		EP338		no bands
	196		Part	4 SFDs adjacent to one tower		EP335		no bands
	356		Part	4 SFDs adjacent to one tower		EP334		no bands
	577		Part	4 SFDs adjacent to one tower		EP332		no bands
	496		Part	4 SFDs adjacent to one tower		EP331		no bands
	557		Y	SFDs adjacent to each tower, 11 aviation balls		EP330		no bands
	646		Part	4 SFDs adjacent to one tower		EP327		no bands
	476		Part	4 SFDs adjacent to one tower		EP326		no bands
	52		Part	4 SFDs adjacent to one tower		EP326		no bands
	436		Y	108 yellow SFDs at 5 m spacing		EP336		no bands

	592		Y	108 yellow SFDs at 5 m spacing		EP336		no bands
	675		Part	4 SFDs adjacent to one tower		EP335		no bands
	719		Part	4 SFDs adjacent to one tower		EP334		no bands
	659		Part	4 SFDs adjacent to one tower		EP334		no bands
	700		Part	4 SFDs adjacent to one tower		EP327		no bands
	738		Part	4 SFDs adjacent to one tower		EP326		no bands
	738		Part	4 SFDs adjacent to one tower		EP326		no bands
	676		Part	4 SFDs adjacent to one tower		EP326		no bands
	477		Part	4 SFDs adjacent to one tower		EP326		no bands
	633		Y	56 yellow SFDs at 10 m spacing		EP338		no bands
	422		Y	52 yellow SFDs at 10 m spacing		EP333		no bands
	121		N	none		EP326		no bands
	44		N	none		EP326		no bands
	70		N	none		EP325		no bands
	685		Y	SFDs adjacent to each tower, 11 aviation balls		EP295		no bands
	58		Part	4 SFDs adjacent to one tower		EP297		no bands
	74		Part	4 SFDs adjacent to one tower		EP297		no bands
	174		N	none		EP297		no bands

	623		N	none		EP292		no bands
	51		Part	4 SFDs adjacent to one tower		EP291		no bands
	666		Y	SFDs adjacent to each tower, 13 aviation balls		EP290		no bands
	509		Part	4 SFDs adjacent to one tower		EP294		no bands
	318		Part	4 SFDs adjacent to one tower		EP294		no bands
	97		Part	4 SFDs adjacent to one tower		EP294		no bands
	69		Part	4 SFDs adjacent to one tower		EP295		no bands
	698		Y	SFDs adjacent to each tower, 11 aviation balls		EP296		no bands
	315		Y	SFDs adjacent to each tower, 11 aviation balls		EP296		no bands
	548		Part	4 SFDs adjacent to one tower		EP297		no bands
	557		N	none		EP297		no bands
	700		N	none		EP298		no bands
	384		Part	4 SFDs adjacent to one tower		EP292		no bands
	549		Y	SFDs adjacent to one tower, 11 aviation balls		EP300		no bands
	599		Y	SFDs adjacent to each tower, 11 aviation balls		EP291		no bands
	139		Y	58 yellow SFDs at 10 m spacing		EP355		no bands
	473		Y	58 yellow SFDs at 10 m spacing		EP355		no bands
	632		Y	58 yellow SFDs at 10 m spacing		EP355		no bands

	493		Y	58 yellow SFDs at 10 m spacing		EP354		no bands
	72		Y	58 yellow SFDs at 10 m spacing		EP354		no bands
	110		Y	118 yellow SFDs at 5 m spacing		EP354		no bands
	179		Y	118 yellow SFDs at 5 m spacing		EP354		no bands
	228		Y	118 yellow SFDs at 5 m spacing		EP354		no bands
	293		Y	118 yellow SFDs at 5 m spacing		EP354		no bands
	671		Y	118 yellow SFDs at 5 m spacing		EP354		no bands
	757		Y	118 yellow SFDs at 5 m spacing		EP353		no bands
	115		Y	118 yellow SFDs at 5 m spacing		EP353		no bands
	493		Part	4 SFDs adjacent to one tower		EP351		no bands
	368		Part	4 SFDs adjacent to one tower		EP350		no bands
	354		Part	4 SFDs adjacent to one tower		EP350		no bands
	369		Part	4 SFDs adjacent to one tower		EP350		no bands
	11		Part	4 SFDs adjacent to one tower		EP350		no bands
	726		Y	60 gray SFDs at 10 m spacing		EP349		no bands
	545		Y	43 gray SFDs at 10 m spacing		EP342		no bands
	474		Y	43 gray SFDs at 10 m spacing		EP342		no bands
	813		Y	56 yellow SFDs at 10 m spacing		EP363		no bands

	307		Y	56 yellow SFDs at 10 m spacing		EP362		no bands
	11		Y	56 yellow SFDs at 10 m spacing		EP362		no bands
	720		N	none		EP361		no bands
	163		Part	4 SFDs adjacent to one tower		EP357		no bands
	10		Y	111 yellow SFDs at 5 m spacing		EP349		no bands
	248		Y	111 yellow SFDs at 5 m spacing		EP349		no bands
	673		Y	111 yellow SFDs at 5 m spacing		EP349		no bands
	784		Y	111 yellow SFDs at 5 m spacing		EP348		no bands
	858		Y	114 yellow SFDs at 5 m spacing		EP344		no bands
	606		Y	114 yellow SFDs at 5 m spacing		EP344		no bands
	30		Y	114 gray SFDs at 5 m spacing		EP357		no bands
	51		Y	114 gray SFDs at 5 m spacing		EP356		no bands
	212		Y	59 gray SFDs at 10 m spacing		EP355		no bands
	187		Y	59 gray SFDs at 10 m spacing		EP355		no bands
	50		Y	98 gray SFDs at 5 m spacing		EP343		no bands
	305		Y	59 gray SFDs at 10 m spacing		EP360		no bands
	5		Y	59 gray SFDs at 10 m spacing		EP356		no bands
	669		Y	59 gray SFDs at 10 m spacing		EP355		no bands

	558		Y	58 yellow SFDs at 10 m spacing		EP354		no bands
	2		Y	60 gray SFDs at 10 m spacing		EP350		no bands
	38		Y	60 gray SFDs at 10 m spacing		EP349		no bands
	747		Y	54 yellow SFDs at 10 m spacing		EP346		no bands
	569		Y	54 yellow SFDs at 10 m spacing		EP345		no bands
	95		Y	43 gray SFDs at 10 m spacing		EP343		no bands
	106		Y	43 gray SFDs at 10 m spacing		EP342		no bands
	417		Y	111 yellow SFDs at 5 m spacing		EP359		no bands
	81		Y	111 yellow SFDs at 5 m spacing		EP358		no bands
	308		Part	4 SFDs adjacent to one tower		EP358		no bands
	6		Y	114 gray SFDs at 5 m spacing		EP357		no bands
	49		Y	93 grey SFDs at 5 m spacing		EP333		no bands
	475		Y	52 yellow SFDs at 10 m spacing		EP332		no bands
	2		N	none		EP325		no bands
	830		Y	SFDs adjacent to each tower, 11 aviation balls		EP341		no bands
	140		Y	56 yellow SFDs at 10 m spacing		EP338		no bands
	371		Y	56 gray SFDs at 10 m spacing		EP337		no bands
	694		Y	56 gray SFDs at 10 m spacing		EP337		no bands

	705		Y	56 gray SFDs at 10 m spacing		EP336		no bands
	819		Part	4 SFDs adjacent to one tower		EP327		no bands
	564		Part	4 SFDs adjacent to one tower		EP326		no bands
	482		Part	4 SFDs adjacent to one tower		EP326		no bands
	408		Part	4 SFDs adjacent to one tower		EP326		no bands
	62		Part	4 SFDs adjacent to one tower		EP326		no bands
	744		Part	4 SFDs adjacent to one tower		EP340		no bands
	513		Part	4 SFDs adjacent to one tower		EP339		no bands
	293		Part	4 SFDs adjacent to one tower		EP339		no bands
	799		Y	105 yellow SFDs at 5 m spacing		EP339		no bands
	878		Y	105 yellow SFDs at 5 m spacing		EP338		no bands
	73		Y	108 yellow SFDs at 5 m spacing		EP336		no bands
	207		Y	108 yellow SFDs at 5 m spacing		EP336		no bands
	627		Part	4 SFDs adjacent to one tower		EP335		no bands
	615		Part	4 SFDs adjacent to one tower		EP335		no bands
	268		Part	4 SFDs adjacent to one tower		EP334		no bands
	92		Y	56 gray SFDs at 10 m spacing		EP336		no bands
	153		Part	4 SFDs adjacent to one tower		EP340		no bands

	225		Part	4 SFDs adjacent to one tower		EP340		no bands
	501		Y	105 yellow SFDs at 5 m spacing		EP338		no bands
	219		Y	108 yellow SFDs at 5 m spacing		EP336		no bands
	754		N	none		EP298		no bands
	830		N	none		EP299		no bands
	404		N	none		EP299		no bands
	777		Y	SFDs adjacent to one tower, 11 aviation balls		EP300		no bands
	549		Y	SFDs adjacent to one tower, 11 aviation balls		EP300		no bands
	161		Y	SFDs adjacent to each tower, 11 aviation balls		EP291		no bands
	290		Y	SFDs adjacent to each tower, 11 aviation balls		EP291		no bands
	731		Y	SFDs adjacent to each tower, 11 aviation balls		EP291		no bands
	51		Y	62 gray SFDs at 10 m spacing		EP327		no bands
	394		Y	SFDs adjacent to each tower, 11 aviation balls		EP295		no bands
	559		Y	SFDs adjacent to each tower, 11 aviation balls		EP296		no bands
	433		Y	SFDs adjacent to each tower, 11 aviation balls		EP296		no bands
	131		Y	SFDs adjacent to each tower, 11 aviation balls		EP296		Delivered to Project Wildlife in San Diego, CA; no bands
	87		Part	4 SFDs adjacent to one tower		EP296		no bands
	638		Part	4 SFDs adjacent to one tower		EP297		no bands

	157		Part	4 SFDs adjacent to one tower		EP297		no bands
	184		N	none		EP297		no bands
	354		N	none		EP298		no bands
	56		N	none		EP293		no bands
	61		N	none		EP293		no bands
	302		N	none		EP293		no bands
	462		N	none		EP293		no bands
	731		Part	4 SFDs adjacent to one tower		EP292		no bands
	80		Y	SFDs adjacent to each tower, 13 aviation balls		EP281		no bands
	49		Y	SFDs adjacent to each tower, 13 aviation balls		EP281		no bands
	97		Y	103 gray SFDs at 5 m spacing		EP329		no bands
	614		Y	103 gray SFDs at 5 m spacing		EP329		no bands
	628		Y	103 gray SFDs at 5 m spacing		EP328		no bands
	14		N	none		EP326		no bands
	67		N	none		EP326		no bands
	344		N	none		EP325		no bands
	3		N	none		EP325		no bands
	310		Part	4 SFDs adjacent to one tower		EP295		no bands

	265		Part	4 SFDs adjacent to one tower		EP294		no bands
	110		N	none		EP294		no bands
	310		Y	SFDs adjacent to each tower, 11 aviation balls		EP290		no bands
	465		Y	62 gray SFDs at 10 m spacing		EP327		no bands
	374		Part	4 SFDs adjacent to one tower		EP326		no bands
	306		Part	4 SFDs adjacent to one tower		EP326		no bands
	130		Part	4 SFDs adjacent to one tower		EP297		no bands
	56		Part	4 SFDs adjacent to one tower		EP297		no bands
	34		Part	4 SFDs adjacent to one tower		EP297		no bands
	776		N	none		EP298		no bands
	522		N	none		EP293		no bands
	254		Y	SFDs adjacent to each tower, 13 aviation balls		EP281		no bands
	735		Y	103 gray SFDs at 5 m spacing		EP329		no bands
	423		Y	58 yellow SFDs at 10 m spacing		EP355		no bands
	894		Y	118 yellow SFDs at 5 m spacing		EP354		no bands
	512		Y	118 yellow SFDs at 5 m spacing		EP353		no bands
	548		Y	122 gray SFDs at 5 m spacing		EP353		no bands
	487		Y	58 yellow SFDs at 10 m spacing		EP355		no bands

	196		Y	58 yellow SFDs at 10 m spacing		EP354		no bands
	220		Y	118 yellow SFDs at 5 m spacing		EP354		no bands
	488		Y	122 gray SFDs at 5 m spacing		EP353		no bands
	596		Y	122 gray SFDs at 5 m spacing		EP352		no bands
	276		Y	SFDs adjacent to each tower, 13 aviation balls		CP70		no bands
	984		Y	SFDs adjacent to one tower, 13 aviation balls		CP69		no bands
	203		Y	105 yellow SFDs at 5 m spacing		EP339		no bands
	829		Part	4 SFDs adjacent to one tower		EP327		no bands
	855		Part	4 SFDs adjacent to one tower		EP326		no bands
	354		Part	4 SFDs adjacent to one tower		EP326		no bands
	312		Part	4 SFDs adjacent to one tower		EP326		no bands
	178		Part	4 SFDs adjacent to one tower		EP326		no bands
	161		Part	4 SFDs adjacent to one tower		EP326		no bands
	646		Y	SFDs adjacent to each tower, 11 aviation balls		EP341		no bands
	782		Y	84 gray SFDs at 5 m spacing		EP341		no bands
	192		Y	56 gray SFDs at 10 m spacing		EP337		no bands
	695		Y	52 yellow SFDs at 10 m spacing		EP333		no bands
	724		Y	103 gray SFDs at 5 m spacing		EP328		no bands

	25		N	none		EP326		no bands
	460		Part	4 SFDs adjacent to one tower		EP339		no bands
	456		Y	108 yellow SFDs at 5 m spacing		EP336		no bands
	391		Part	4 SFDs adjacent to one tower		EP331		no bands
	176		Y	SFDs adjacent to each tower, 11 aviation balls		EP331		no bands
	786		Y	SFDs adjacent to each tower, 11 aviation balls		EP342		no bands
	294		Y	56 yellow SFDs at 10 m spacing		EP338		no bands
	141		Y	56 gray SFDs at 10 m spacing		EP336		no bands
	633		Y	103 gray SFDs at 5 m spacing		EP329		no bands
	16		N	none		EP326		no bands
	416		Y	SFDs adjacent to each tower, 11 aviation balls		EP296		no bands
	320		Part	4 SFDs adjacent to one tower		EP296		no bands
	703		Part	4 SFDs adjacent to one tower		EP297		no bands
	395		Part	4 SFDs adjacent to one tower		EP297		no bands
	173		Part	4 SFDs adjacent to one tower		EP297		no bands
	127		Part	4 SFDs adjacent to one tower		EP297		no bands
	669		N	none		EP297		no bands
	826		N	none		EP298		no bands

	645		N	none		EP292		no bands
	79		Y	SFDs adjacent to each tower, 13 aviation balls		EP281		no bands
	208		N	none		EP298		no bands
	354		N	none		EP298		no bands
	774		N	none		EP298		Delivered to Project Wildlife in San Diego, CA; no bands
	193		Part	4 SFDs adjacent to one tower		EP295		no bands
	385		Part	4 SFDs adjacent to one tower		EP295		no bands
	421		Part	4 SFDs adjacent to one tower		EP295		no bands
	335		Y	SFDs adjacent to each tower, 11 aviation balls		EP290		no bands
	728		Part	4 SFDs adjacent to one tower		EP294		no bands
	438		Part	4 SFDs adjacent to one tower		EP294		no bands
	172		N	none		EP294		no bands
	753		Y	SFDs adjacent to each tower, 11 aviation balls		EP291		no bands
	695		Y	SFDs adjacent to each tower, 11 aviation balls		EP290		no bands
	417		Y	SFDs adjacent to each tower, 11 aviation balls		EP290		no bands
	567		Part	4 SFDs adjacent to one tower		EP296		no bands
	330		Part	4 SFDs adjacent to one tower		EP297		no bands
	325		Part	4 SFDs adjacent to one tower		EP297		no bands

	219		Part	4 SFDs adjacent to one tower		EP297		no bands
	176		Part	4 SFDs adjacent to one tower		EP297		no bands
	189		Part	4 SFDs adjacent to one tower		EP297		no bands
	571		N	none		EP297		no bands
	131		N	none		EP293		no bands
	130		N	none		EP293		no bands
	268		N	none		EP293		no bands
	253		N	none		EP293		no bands
	778		Part	4 SFDs adjacent to one tower		EP291		no bands
	882		Y	SFDs adjacent to each tower, 13 aviation balls		EP281		no bands
	80		Part	4 SFDs adjacent to one tower		EP357		no bands
	84		Part	4 SFDs adjacent to one tower		EP357		no bands
	17		Part	4 SFDs adjacent to one tower		EP357		no bands
	15		Part	4 SFDs adjacent to one tower		EP357		no bands
	119		Y	58 yellow SFDs at 10 m spacing		EP355		no bands
	822		Y	58 yellow SFDs at 10 m spacing		EP354		no bands
	522		Y	58 yellow SFDs at 10 m spacing		EP354		no bands
	445		Y	58 yellow SFDs at 10 m spacing		EP354		no bands

	222		Y	58 yellow SFDs at 10 m spacing		EP354		no bands
	235		Y	58 yellow SFDs at 10 m spacing		EP354		no bands
	115		Y	118 yellow SFDs at 5 m spacing		EP354		no bands
	106		Y	118 yellow SFDs at 5 m spacing		EP354		no bands
	219		Y	118 yellow SFDs at 5 m spacing		EP354		no bands
	830		Y	118 yellow SFDs at 5 m spacing		EP354		no bands
	889		Y	118 yellow SFDs at 5 m spacing		EP353		no bands
	597		Y	118 yellow SFDs at 5 m spacing		EP353		no bands
	31		Y	118 yellow SFDs at 5 m spacing		EP353		no bands
	3		Part	4 SFDs adjacent to one tower		EP350		no bands
	41		Y	60 gray SFDs at 10 m spacing		EP349		no bands
	495		Y	64 gray SFDs at 10 m spacing		EP346		no bands
	808		Y	54 yellow SFDs at 10 m spacing		EP346		no bands
	809		Y	54 yellow SFDs at 10 m spacing		EP346		no bands
	401		Y	43 gray SFDs at 10 m spacing		EP343		no bands
	380		Y	43 gray SFDs at 10 m spacing		EP343		no bands
	509		Y	43 gray SFDs at 10 m spacing		EP342		no bands
	502		Y	43 gray SFDs at 10 m spacing		EP342		no bands

	444		Y	43 gray SFDs at 10 m spacing		EP342		no bands
	421		Y	43 gray SFDs at 10 m spacing		EP342		no bands
	346		Y	43 gray SFDs at 10 m spacing		EP342		no bands
	174		Y	43 gray SFDs at 10 m spacing		EP342		no bands
	122		Y	43 gray SFDs at 10 m spacing		EP342		no bands
	75		Y	56 yellow SFDs at 10 m spacing		EP363		no bands
	737		N	none		EP362		no bands
	802		N	none		EP361		no bands
	196		Y	114 gray SFDs at 5 m spacing		EP357		no bands
	663		Y	114 gray SFDs at 5 m spacing		EP356		no bands
	338		Y	114 gray SFDs at 5 m spacing		EP356		no bands
	636		Y	59 gray SFDs at 10 m spacing		EP356		no bands
	111		Y	59 gray SFDs at 10 m spacing		EP355		no bands
	77		Y	59 gray SFDs at 10 m spacing		EP355		no bands
	56		Y	122 gray SFDs at 5 m spacing		EP353		no bands
	289		Y	122 gray SFDs at 5 m spacing		EP353		no bands
	502		Y	122 gray SFDs at 5 m spacing		EP353		no bands
	623		Y	122 gray SFDs at 5 m spacing		EP353		no bands

	663		Y	122 gray SFDs at 5 m spacing		EP353		no bands
	603		Y	122 gray SFDs at 5 m spacing		EP352		no bands
	66		Y	122 gray SFDs at 5 m spacing		EP351		no bands
	182		Y	68 yellow SFDs at 10 m spacing		EP352		no bands
	233		Y	68 yellow SFDs at 10 m spacing		EP352		no bands
	575		Y	111 yellow SFDs at 5 m spacing		EP349		no bands
	792		Y	111 yellow SFDs at 5 m spacing		EP349		no bands
	616		Y	111 yellow SFDs at 5 m spacing		EP348		no bands
	619		Part	4 SFDs adjacent to one tower		EP347		no bands
	572		Part	4 SFDs adjacent to one tower		EP347		no bands
	73		Part	4 SFDs adjacent to one tower		EP347		no bands
	169		Y	114 yellow SFDs at 5 m spacing		EP345		no bands
	533		Y	114 yellow SFDs at 5 m spacing		EP344		no bands
	326		Y	114 yellow SFDs at 5 m spacing		EP344		no bands
	491		Y	98 gray SFDs at 5 m spacing		EP344		no bands
	5		Y	59 gray SFDs at 10 m spacing		EP361		no bands
	97		Y	59 gray SFDs at 10 m spacing		EP361		no bands
	440		Part	4 SFDs adjacent to one tower		EP358		no bands

	152		Part	4 SFDs adjacent to one tower		EP357		no bands
	42		Y	118 yellow SFDs at 5 m spacing		EP354		no bands
	598		Part	4 SFDs adjacent to one tower		EP351		no bands
	596		Part	4 SFDs adjacent to one tower		EP351		no bands
	828		Y	60 gray SFDs at 10 m spacing		EP349		no bands
	10		Y	64 gray SFDs at 10 m spacing		EP347		no bands
	20		Y	64 gray SFDs at 10 m spacing		EP347		no bands
	573		Y	64 gray SFDs at 10 m spacing		EP347		no bands
	713		Y	64 gray SFDs at 10 m spacing		EP347		no bands
	238		Y	64 gray SFDs at 10 m spacing		EP346		no bands
	412		Y	54 yellow SFDs at 10 m spacing		EP345		no bands
	343		Y	43 gray SFDs at 10 m spacing		EP342		no bands
	91		Y	43 gray SFDs at 10 m spacing		EP342		no bands
	11		Y	43 gray SFDs at 10 m spacing		EP342		no bands
	498		Y	114 gray SFDs at 5 m spacing		EP356		no bands
	177		Y	59 gray SFDs at 10 m spacing		EP356		no bands
	429		Y	59 gray SFDs at 10 m spacing		EP356		no bands
	131		Y	59 gray SFDs at 10 m spacing		EP355		no bands

	32		Y	122 gray SFDs at 5 m spacing		EP353		no bands
	796		Y	68 yellow SFDs at 10 m spacing		EP352		no bands
	28		Part	4 SFDs adjacent to one tower		EP348		no bands
	29		Part	4 SFDs adjacent to one tower		EP348		no bands
	626		Part	4 SFDs adjacent to one tower		EP348		no bands
	211		Part	4 SFDs adjacent to one tower		EP347		no bands
	163		Y	114 yellow SFDs at 5 m spacing		EP345		no bands
	201		Y	59 gray SFDs at 10 m spacing		EP361		no bands
	9		Y	110 gray SFDs at 5 m spacing		EP360		no bands
	100		Y	110 gray SFDs at 5 m spacing		EP359		no bands
	117		N	none		EP193		no bands
	366		N	none		EP191		no bands
	283		N	none		EP202		no bands
	176		Part	4 SFDs adjacent to one tower		EP199		no bands
	538		Part	4 SFDs adjacent to one tower		EP194		no bands
	187		Part	4 SFDs adjacent to one tower		EP193		no bands
	506		Part	4 SFDs adjacent to one tower		EP196		no bands
	266		Part	4 SFDs adjacent to one tower		EP195		no bands

	114		Part	4 SFDs adjacent to one tower		EP189		no bands
	31		Y	114 gray SFDs at 5 m spacing		EP357		no bands
	18		Y	114 gray SFDs at 5 m spacing		EP356		no bands
	379		Y	122 gray SFDs at 5 m spacing		EP353		no bands
	416		Y	122 gray SFDs at 5 m spacing		EP353		no bands
	25		Y	122 gray SFDs at 5 m spacing		EP352		no bands
	217		Y	68 yellow SFDs at 10 m spacing		EP352		no bands
	63		Y	68 yellow SFDs at 10 m spacing		EP351		no bands
	101		Y	111 yellow SFDs at 5 m spacing		EP349		no bands
	310		Y	111 yellow SFDs at 5 m spacing		EP349		no bands
	298		Y	111 yellow SFDs at 5 m spacing		EP349		no bands
	629		Y	111 yellow SFDs at 5 m spacing		EP348		no bands
	37		Y	111 yellow SFDs at 5 m spacing		EP348		no bands
	27		Y	111 yellow SFDs at 5 m spacing		EP348		no bands
	92		Part	4 SFDs adjacent to one tower		EP348		no bands
	697		Y	114 yellow SFDs at 5 m spacing		EP344		no bands
	526		Y	114 yellow SFDs at 5 m spacing		EP344		no bands
	7		Y	114 yellow SFDs at 5 m spacing		EP344		no bands

	657		Y	98 gray SFDs at 5 m spacing		EP343		no bands
	358		Y	98 gray SFDs at 5 m spacing		EP343		no bands
	416		Y	59 gray SFDs at 10 m spacing		EP360		no bands
	58		Y	110 gray SFDs at 5 m spacing		EP359		no bands
	11		Y	111 yellow SFDs at 5 m spacing		EP359		no bands
	700		Y	111 yellow SFDs at 5 m spacing		EP359		no bands
	129		Y	111 yellow SFDs at 5 m spacing		EP358		no bands
	123		Y	111 yellow SFDs at 5 m spacing		EP358		no bands
	13		Y	111 yellow SFDs at 5 m spacing		EP358		no bands
	190		Part	4 SFDs adjacent to one tower		EP358		no bands
	101		Part	4 SFDs adjacent to one tower		EP357		no bands
	81		Part	4 SFDs adjacent to one tower		EP357		no bands
	3		Y	114 gray SFDs at 5 m spacing		EP357		no bands
	53		Y	58 yellow SFDs at 10 m spacing		EP355		no bands
	273		Y	58 yellow SFDs at 10 m spacing		EP355		no bands
	297		Y	58 yellow SFDs at 10 m spacing		EP355		no bands
	642		Y	58 yellow SFDs at 10 m spacing		EP355		no bands
	626		Y	58 yellow SFDs at 10 m spacing		EP354		no bands

	591		Y	58 yellow SFDs at 10 m spacing		EP354		no bands
	191		Y	58 yellow SFDs at 10 m spacing		EP354		no bands
	453		Y	118 yellow SFDs at 5 m spacing		EP354		no bands
	704		Y	118 yellow SFDs at 5 m spacing		EP353		no bands
	656		Y	118 yellow SFDs at 5 m spacing		EP353		no bands
	655		Y	118 yellow SFDs at 5 m spacing		EP353		no bands
	187		Y	118 yellow SFDs at 5 m spacing		EP353		no bands
	196		Y	118 yellow SFDs at 5 m spacing		EP353		no bands
	583		Y	64 gray SFDs at 10 m spacing		EP346		no bands
	564		Y	64 gray SFDs at 10 m spacing		EP346		no bands
	523		Y	54 yellow SFDs at 10 m spacing		EP346		no bands
	227		Y	54 yellow SFDs at 10 m spacing		EP345		no bands
	72		Y	54 yellow SFDs at 10 m spacing		EP345		no bands
	174		Y	43 gray SFDs at 10 m spacing		EP343		no bands
	412		Y	43 gray SFDs at 10 m spacing		EP343		no bands
	417		Y	43 gray SFDs at 10 m spacing		EP343		no bands
	649		Y	43 gray SFDs at 10 m spacing		EP342		no bands
	509		Y	43 gray SFDs at 10 m spacing		EP342		no bands

	124		Y	43 gray SFDs at 10 m spacing		EP342		no bands
	44		Y	43 gray SFDs at 10 m spacing		EP342		no bands
	28		N	none		EP362		no bands
	160		Y	114 gray SFDs at 5 m spacing		EP357		no bands
	667		Y	59 gray SFDs at 10 m spacing		EP356		no bands
	675		Y	59 gray SFDs at 10 m spacing		EP356		no bands
	691		Y	122 gray SFDs at 5 m spacing		EP353		no bands
	339		Y	122 gray SFDs at 5 m spacing		EP352		no bands
	785		Y	68 yellow SFDs at 10 m spacing		EP352		no bands
	370		Y	111 yellow SFDs at 5 m spacing		EP349		no bands
	748		Y	98 gray SFDs at 5 m spacing		EP344		no bands
	555		Y	98 gray SFDs at 5 m spacing		EP343		no bands
	548		Y	98 gray SFDs at 5 m spacing		EP343		no bands
	57		Y	110 gray SFDs at 5 m spacing		EP360		no bands
	670		Y	110 gray SFDs at 5 m spacing		EP360		no bands
	136		Y	110 gray SFDs at 5 m spacing		EP359		no bands
	497		Y	118 yellow SFDs at 5 m spacing		EP354		no bands
	317		Part	4 SFDs adjacent to one tower		EP350		no bands

	115		Part	4 SFDs adjacent to one tower		EP350		no bands
	134		Part	4 SFDs adjacent to one tower		EP350		no bands
	20		Part	4 SFDs adjacent to one tower		EP350		no bands
	13		Part	4 SFDs adjacent to one tower		EP350		no bands
	305		Y	60 gray SFDs at 10 m spacing		EP349		no bands
	44		Y	64 gray SFDs at 10 m spacing		EP347		no bands
	38		Y	56 yellow SFDs at 10 m spacing		EP363		no bands
	66		Y	SFDs adjacent to each tower, 11 aviation balls		EP342		no bands
	569		Y	SFDs adjacent to each tower, 11 aviation balls		EP342		no bands
	538		Y	SFDs adjacent to each tower, 11 aviation balls		EP342		no bands
	833		Y	SFDs adjacent to each tower, 11 aviation balls		EP342		no bands
	828		Y	SFDs adjacent to each tower, 11 aviation balls		EP341		no bands
	572		Y	SFDs adjacent to each tower, 11 aviation balls		EP341		no bands
	567		Y	SFDs adjacent to each tower, 11 aviation balls		EP341		no bands
	531		Y	84 gray SFDs at 5 m spacing		EP341		no bands
	761		Y	84 gray SFDs at 5 m spacing		EP340		no bands
	865		Y	56 yellow SFDs at 10 m spacing		EP338		no bands
	583		Y	56 yellow SFDs at 10 m spacing		EP337		no bands

	81		Y	56 yellow SFDs at 10 m spacing		EP337		no bands
	75		Y	56 yellow SFDs at 10 m spacing		EP337		no bands
	54		Y	56 gray SFDs at 10 m spacing		EP337		no bands
	328		Y	56 gray SFDs at 10 m spacing		EP337		no bands
	692		Y	56 gray SFDs at 10 m spacing		EP337		no bands
	731		Y	56 gray SFDs at 10 m spacing		EP337		no bands
	837		Y	56 gray SFDs at 10 m spacing		EP336		no bands
	809		Y	56 gray SFDs at 10 m spacing		EP336		no bands
	809		Y	56 gray SFDs at 10 m spacing		EP336		no bands
	779		Y	93 grey SFDs at 5 m spacing		EP333		no bands
	514		Y	93 grey SFDs at 5 m spacing		EP333		no bands
	462		Y	93 grey SFDs at 5 m spacing		EP333		no bands
	513		Y	52 yellow SFDs at 10 m spacing		EP333		no bands
	454		Y	52 yellow SFDs at 10 m spacing		EP332		no bands
	43		Y	52 yellow SFDs at 10 m spacing		EP332		no bands
	737		Part	4 SFDs adjacent to one tower		EP329		no bands
	697		Y	103 gray SFDs at 5 m spacing		EP328		no bands
	579		Y	103 gray SFDs at 5 m spacing		EP328		no bands

	369		Y	103 gray SFDs at 5 m spacing		EP328		no bands
	310		Y	103 gray SFDs at 5 m spacing		EP328		no bands
	547		N	none		EP325		no bands
	353		N	none		EP325		no bands
	7		N	none		EP325		no bands
	635		Part	4 SFDs adjacent to one tower		EP340		no bands
	637		Part	4 SFDs adjacent to one tower		EP339		no bands
	796		Y	105 yellow SFDs at 5 m spacing		EP339		no bands
	201		Y	108 yellow SFDs at 5 m spacing		EP336		no bands
	384		Y	108 yellow SFDs at 5 m spacing		EP336		no bands
	702		Y	108 yellow SFDs at 5 m spacing		EP335		no bands
	605		Y	108 yellow SFDs at 5 m spacing		EP335		no bands
	491		Y	108 yellow SFDs at 5 m spacing		EP335		no bands
	197		Y	108 yellow SFDs at 5 m spacing		EP335		no bands
	6		Part	4 SFDs adjacent to one tower		EP332		no bands
	103		Part	4 SFDs adjacent to one tower		EP332		no bands
	392		Part	4 SFDs adjacent to one tower		EP331		no bands
	820		Y	62 gray SFDs at 10 m spacing		EP328		no bands

	904		Y	62 gray SFDs at 10 m spacing		EP327		no bands
	515		Y	62 gray SFDs at 10 m spacing		EP327		no bands
	146		Y	62 gray SFDs at 10 m spacing		EP327		no bands
	54		Y	62 gray SFDs at 10 m spacing		EP327		no bands
	62		Y	62 gray SFDs at 10 m spacing		EP327		no bands
	254		Part	4 SFDs adjacent to one tower		EP327		no bands
	720		Part	4 SFDs adjacent to one tower		EP327		no bands
	725		Part	4 SFDs adjacent to one tower		EP327		no bands
	495		Part	4 SFDs adjacent to one tower		EP326		no bands
	500		Part	4 SFDs adjacent to one tower		EP326		no bands
	307		Part	4 SFDs adjacent to one tower		EP326		no bands
	265		Part	4 SFDs adjacent to one tower		EP326		no bands
	120		Part	4 SFDs adjacent to one tower		EP326		no bands
	28		Part	4 SFDs adjacent to one tower		EP326		no bands
	359		Y	SFDs adjacent to each tower, 11 aviation balls		EP342		no bands
	820		Y	SFDs adjacent to each tower, 11 aviation balls		EP341		no bands
	721		Y	SFDs adjacent to each tower, 11 aviation balls		EP341		no bands
	10		Y	84 gray SFDs at 5 m spacing		EP341		no bands

	687		Y	84 gray SFDs at 5 m spacing		EP340		no bands
	325		Y	84 gray SFDs at 5 m spacing		EP340		no bands
	7		Y	56 yellow SFDs at 10 m spacing		EP338		no bands
	528		Y	93 grey SFDs at 5 m spacing		EP334		no bands
	545		Y	93 grey SFDs at 5 m spacing		EP334		no bands
	499		Y	93 grey SFDs at 5 m spacing		EP333		no bands
	794		Y	52 yellow SFDs at 10 m spacing		EP332		no bands
	456		Y	103 gray SFDs at 5 m spacing		EP328		no bands
	89		N	none		EP326		no bands
	458		N	none		EP325		no bands
	229		Part	4 SFDs adjacent to one tower		EP339		no bands
	272		Y	108 yellow SFDs at 5 m spacing		EP336		no bands
	489		Y	108 yellow SFDs at 5 m spacing		EP336		no bands
	475		Y	108 yellow SFDs at 5 m spacing		EP336		no bands
	564		Y	108 yellow SFDs at 5 m spacing		EP336		no bands
	378		Y	108 yellow SFDs at 5 m spacing		EP335		no bands
	859		Y	62 gray SFDs at 10 m spacing		EP327		no bands
	392		Y	62 gray SFDs at 10 m spacing		EP327		no bands

	361		Y	62 gray SFDs at 10 m spacing		EP327		no bands
	178		Y	114 gray SFDs at 5 m spacing		EP357		no bands
	119		Y	114 gray SFDs at 5 m spacing		EP357		no bands
	500		Y	114 gray SFDs at 5 m spacing		EP357		no bands
	54		Y	59 gray SFDs at 10 m spacing		EP356		no bands
	566		Y	59 gray SFDs at 10 m spacing		EP355		no bands
	359		Y	59 gray SFDs at 10 m spacing		EP355		no bands
	306		Y	111 yellow SFDs at 5 m spacing		EP348		no bands
	628		Part	4 SFDs adjacent to one tower		EP348		no bands
	269		Y	114 yellow SFDs at 5 m spacing		EP345		no bands
	112		Y	59 gray SFDs at 10 m spacing		EP361		no bands
	808		Y	59 gray SFDs at 10 m spacing		EP361		no bands
	21		Y	110 gray SFDs at 5 m spacing		EP360		no bands
	368		Y	58 yellow SFDs at 10 m spacing		EP355		no bands
	617		Y	58 yellow SFDs at 10 m spacing		EP355		no bands
	617		Y	58 yellow SFDs at 10 m spacing		EP355		no bands
	103		Y	58 yellow SFDs at 10 m spacing		EP354		no bands
	765		Part	4 SFDs adjacent to one tower		EP351		no bands

	815		Part	4 SFDs adjacent to one tower		EP351		no bands
	640		Part	4 SFDs adjacent to one tower		EP350		no bands
	421		Part	4 SFDs adjacent to one tower		EP350		no bands
	383		Y	60 gray SFDs at 10 m spacing		EP349		no bands
	383		Y	60 gray SFDs at 10 m spacing		EP349		no bands
	383		Y	60 gray SFDs at 10 m spacing		EP349		no bands
	383		Y	60 gray SFDs at 10 m spacing		EP349		no bands
	10		Y	60 gray SFDs at 10 m spacing		EP349		no bands
	254		Y	64 gray SFDs at 10 m spacing		EP347		no bands
	399		Y	64 gray SFDs at 10 m spacing		EP347		Delivered to Project Wildlife in San Diego, CA; no bands
	205		Y	64 gray SFDs at 10 m spacing		EP346		no bands
	707		Y	54 yellow SFDs at 10 m spacing		EP346		no bands
	788		Y	54 yellow SFDs at 10 m spacing		EP345		no bands
	53		Y	43 gray SFDs at 10 m spacing		EP342		no bands
	32		Y	56 yellow SFDs at 10 m spacing		EP362		no bands
	461		Y	111 yellow SFDs at 5 m spacing		EP358		no bands
	109		Part	4 SFDs adjacent to one tower		EP357		no bands
	94		Part	4 SFDs adjacent to one tower		EP357		no bands

	99		Part	4 SFDs adjacent to one tower		EP357		no bands
	516		Y	58 yellow SFDs at 10 m spacing		EP355		no bands
	705		Y	58 yellow SFDs at 10 m spacing		EP354		no bands
	213		Y	118 yellow SFDs at 5 m spacing		EP354		no bands
	579		Y	118 yellow SFDs at 5 m spacing		EP354		no bands
	581		Y	118 yellow SFDs at 5 m spacing		EP354		no bands
	680		Y	64 gray SFDs at 10 m spacing		EP347		no bands
	461		Y	64 gray SFDs at 10 m spacing		EP346		no bands
	240		Y	54 yellow SFDs at 10 m spacing		EP346		no bands
	572		Y	54 yellow SFDs at 10 m spacing		EP346		no bands
	645		Y	54 yellow SFDs at 10 m spacing		EP346		no bands
	712		Y	54 yellow SFDs at 10 m spacing		EP345		no bands
	775		Y	56 yellow SFDs at 10 m spacing		EP362		no bands
	740		Y	56 yellow SFDs at 10 m spacing		EP362		no bands
	263		N	none		EP362		no bands
	201		N	none		EP361		no bands
	90		Y	59 gray SFDs at 10 m spacing		EP356		no bands
	713		Y	59 gray SFDs at 10 m spacing		EP356		no bands

	283		Y	59 gray SFDs at 10 m spacing		EP355		no bands
	819		Y	122 gray SFDs at 5 m spacing		EP352		no bands
	447		Y	122 gray SFDs at 5 m spacing		EP352		no bands
	534		Y	68 yellow SFDs at 10 m spacing		EP352		no bands
	742		Y	68 yellow SFDs at 10 m spacing		EP352		no bands
	16		Y	68 yellow SFDs at 10 m spacing		EP351		no bands
	260		Part	4 SFDs adjacent to one tower		EP348		no bands
	457		Y	98 gray SFDs at 5 m spacing		EP344		no bands
	46		Y	98 gray SFDs at 5 m spacing		EP343		no bands
	868		Y	59 gray SFDs at 10 m spacing		EP360		no bands
	382		Y	110 gray SFDs at 5 m spacing		EP359		no bands
	729		N	none		EP298		no bands
	804		Part	4 SFDs adjacent to each tower		EP300		no bands
	718		Part	4 SFDs adjacent to each tower		EP301		no bands
	715		Part	4 SFDs adjacent to one tower		EP295		no bands
	761		Part	4 SFDs adjacent to one tower		EP294		no bands
	748		Part	4 SFDs adjacent to one tower		EP294		no bands
	359		Part	4 SFDs adjacent to one tower		EP294		no bands

	320		Part	4 SFDs adjacent to one tower		EP294		no bands
	478		N	none		EP294		no bands
	492		Part	4 SFDs adjacent to one tower		EP297		no bands
	361		Part	4 SFDs adjacent to one tower		EP297		no bands
	385		Part	4 SFDs adjacent to one tower		EP297		no bands
	386		Part	4 SFDs adjacent to one tower		EP297		no bands
	255		Part	4 SFDs adjacent to one tower		EP297		no bands
	239		Part	4 SFDs adjacent to one tower		EP297		no bands
	146		Part	4 SFDs adjacent to one tower		EP297		no bands
	161		Part	4 SFDs adjacent to one tower		EP297		no bands
	47		N	none		EP297		no bands
	115		N	none		EP297		no bands
	138		N	none		EP297		no bands
	245		N	none		EP297		no bands
	646		N	none		EP297		no bands
	786		N	none		EP297		no bands
	461		N	none		EP298		no bands
	351		N	none		EP298		no bands

	337		N	none		EP298		no bands
	71		N	none		Z1-34		no bands
	85		N	none		EP293		no bands
	842		N	none		EP298		no bands
	244		N	none		EP299		no bands
	72		N	none		EP294		no bands
	124		N	none		Z1-34		no bands
	665		Y	SFDs adjacent to each tower, 11 aviation balls		EP290		no bands
	94		N	none		EP297		no bands
	298		N	none		EP297		no bands
	760		N	none		EP298		no bands
	438		N	none		EP292		no bands
	753		Y	SFDs adjacent to each tower, 11 aviation balls		EP341		no bands
	210		Y	SFDs adjacent to each tower, 11 aviation balls		EP341		no bands
	32		Y	SFDs adjacent to each tower, 11 aviation balls		EP341		no bands
	35		Y	SFDs adjacent to each tower, 11 aviation balls		EP341		no bands
	219		Y	84 gray SFDs at 5 m spacing		EP341		no bands
	306		Y	56 gray SFDs at 10 m spacing		EP337		no bands

	450		Y	56 gray SFDs at 10 m spacing		EP337		no bands
	505		Y	56 gray SFDs at 10 m spacing		EP336		no bands
	341		Y	56 gray SFDs at 10 m spacing		EP336		no bands
	155		Y	52 yellow SFDs at 10 m spacing		EP333		no bands
	444		Y	103 gray SFDs at 5 m spacing		EP329		no bands
	575		Y	103 gray SFDs at 5 m spacing		EP328		no bands
	629		N	none		EP326		no bands
	572		N	none		EP325		no bands
	573		N	none		EP325		no bands
	561		N	none		EP325		no bands
	364		N	none		EP325		no bands
	367		N	none		EP325		no bands
	297		N	none		EP325		no bands
	279		N	none		EP325		no bands
	346		Part	4 SFDs adjacent to one tower		EP340		no bands
	424		Part	4 SFDs adjacent to one tower		EP340		no bands
	299		Part	4 SFDs adjacent to one tower		EP339		no bands
	832		Y	105 yellow SFDs at 5 m spacing		EP339		no bands

	251		Y	108 yellow SFDs at 5 m spacing		EP335		no bands
	333		Y	108 yellow SFDs at 5 m spacing		EP336		no bands
	442		Y	108 yellow SFDs at 5 m spacing		EP336		no bands
	444		Y	108 yellow SFDs at 5 m spacing		EP336		no bands
	800		Y	108 yellow SFDs at 5 m spacing		EP335		no bands
	37		Part	4 SFDs adjacent to one tower		EP335		no bands
	185		Part	4 SFDs adjacent to one tower		EP335		no bands
	564		Part	4 SFDs adjacent to one tower		EP335		no bands
	745		Part	4 SFDs adjacent to one tower		EP335		no bands
	822		Part	4 SFDs adjacent to one tower		EP335		no bands
	733		Part	4 SFDs adjacent to one tower		EP334		no bands
	409		Part	4 SFDs adjacent to one tower		EP334		no bands
	398		Part	4 SFDs adjacent to one tower		EP332		no bands
	622		Part	4 SFDs adjacent to one tower		EP331		no bands
	390		Y	62 gray SFDs at 10 m spacing		EP328		no bands
	692		Y	62 gray SFDs at 10 m spacing		EP328		no bands
	865		Y	62 gray SFDs at 10 m spacing		EP327		no bands
	148		Y	62 gray SFDs at 10 m spacing		EP327		no bands

	197		Part	4 SFDs adjacent to one tower		EP327		no bands
	824		Part	4 SFDs adjacent to one tower		EP326		no bands
	499		Part	4 SFDs adjacent to one tower		EP326		no bands
	496		Part	4 SFDs adjacent to one tower		EP326		no bands
	493		Part	4 SFDs adjacent to one tower		EP326		no bands
	437		Part	4 SFDs adjacent to one tower		EP326		no bands
	224		Part	4 SFDs adjacent to one tower		EP326		no bands
	221		Part	4 SFDs adjacent to one tower		EP326		no bands
	59		Part	4 SFDs adjacent to one tower		EP326		no bands
	758		Y	84 gray SFDs at 5 m spacing		EP340		no bands
	810		Y	56 yellow SFDs at 10 m spacing		EP337		no bands
	879		Y	56 gray SFDs at 10 m spacing		EP336		no bands
	728		Y	93 grey SFDs at 5 m spacing		EP333		no bands
	304		Part	4 SFDs adjacent to one tower		EP329		no bands
	749		Y	103 gray SFDs at 5 m spacing		EP328		no bands
	477		N	none		EP326		no bands
	429		Y	105 yellow SFDs at 5 m spacing		EP339		no bands
	249		Y	108 yellow SFDs at 5 m spacing		EP336		no bands

	696		Part	4 SFDs adjacent to one tower		EP332		no bands
	555		Part	4 SFDs adjacent to one tower		EP326		no bands
	135		Part	4 SFDs adjacent to one tower		EP326		no bands
	121		Part	4 SFDs adjacent to one tower		EP326		no bands
	73		Y	110 gray SFDs at 5 m spacing		EP359		no bands
	69		Y	110 gray SFDs at 5 m spacing		EP359		no bands
	64		Y	110 gray SFDs at 5 m spacing		EP359		no bands
	83		Y	111 yellow SFDs at 5 m spacing		EP358		no bands
	91		Y	111 yellow SFDs at 5 m spacing		EP358		no bands
	48		Y	111 yellow SFDs at 5 m spacing		EP358		no bands
	41		Part	4 SFDs adjacent to one tower		EP358		no bands
	577		Part	4 SFDs adjacent to one tower		EP357		no bands
	268		Part	4 SFDs adjacent to one tower		EP357		no bands
	35		Y	114 gray SFDs at 5 m spacing		EP357		no bands
	209		Y	114 gray SFDs at 5 m spacing		EP357		no bands
	883		Y	114 gray SFDs at 5 m spacing		EP356		no bands
	3		Y	114 gray SFDs at 5 m spacing		EP356		no bands
	6		Y	114 gray SFDs at 5 m spacing		EP356		no bands

	725		Part	2 SFDs adjacent to one tower		CP69		no bands
	314		N	none		CP65		no bands
	731		Y	SFDs adjacent to each tower, 13 aviation balls		CP70		no bands
	576		N	none		EP298		no bands
	802		Part	4 SFDs adjacent to one tower		EP295		no bands
	68		N	none		Z1-34		no bands
	647		Part	4 SFDs adjacent to one tower		EP297		no bands
	427		Part	4 SFDs adjacent to one tower		EP297		no bands
	494		Part	4 SFDs adjacent to one tower		EP296		no bands
	166		Part	4 SFDs adjacent to one tower		EP297		no bands
	113		N	none		EP297		no bands
	672		N	none		EP298		no bands
	52		N	none		EP298		no bands
	784		N	none		EP299		no bands
	55		N	none		Z1-34		no bands
	722		Y	SFDs adjacent to each tower, 11 aviation balls		EP341		no bands
	173		Y	SFDs adjacent to each tower, 11 aviation balls		EP341		no bands
	933		Y	56 yellow SFDs at 10 m spacing		EP338		no bands

	651		Y	56 yellow SFDs at 10 m spacing		EP337		no bands
	541		Y	56 gray SFDs at 10 m spacing		EP337		no bands
	949		Y	56 gray SFDs at 10 m spacing		EP337		no bands
	281		Y	56 gray SFDs at 10 m spacing		EP336		no bands
	333		Y	93 grey SFDs at 5 m spacing		EP333		no bands
	61		Y	93 grey SFDs at 5 m spacing		EP333		no bands
	403		Part	4 SFDs adjacent to one tower		EP329		no bands
	123		Part	4 SFDs adjacent to one tower		EP339		no bands
	306		Y	105 yellow SFDs at 5 m spacing		EP339		no bands
	97		Part	4 SFDs adjacent to one tower		EP332		no bands
	103		Part	4 SFDs adjacent to one tower		EP331		no bands
	33		Part	4 SFDs adjacent to one tower		EP331		no bands
	663		Part	4 SFDs adjacent to one tower		EP326		no bands
	487		Part	4 SFDs adjacent to one tower		EP326		no bands
	51		Part	4 SFDs adjacent to one tower		EP326		no bands
	306		Y	SFDs adjacent to each tower, 11 aviation balls		EP341		no bands
	34		Y	SFDs adjacent to each tower, 11 aviation balls		EP341		no bands
	369		Y	84 gray SFDs at 5 m spacing		EP341		no bands

	527		Y	84 gray SFDs at 5 m spacing		EP341		no bands
	789		Y	84 gray SFDs at 5 m spacing		EP341		no bands
	816		Y	56 gray SFDs at 10 m spacing		EP336		no bands
	793		Y	56 gray SFDs at 10 m spacing		EP336		no bands
	721		Y	56 gray SFDs at 10 m spacing		EP336		no bands
	392		Y	56 gray SFDs at 10 m spacing		EP336		no bands
	810		Y	93 grey SFDs at 5 m spacing		EP334		no bands
	31		Y	93 grey SFDs at 5 m spacing		EP333		no bands
	40		Y	93 grey SFDs at 5 m spacing		EP333		no bands
	228		Y	52 yellow SFDs at 10 m spacing		EP333		no bands
	433		Y	52 yellow SFDs at 10 m spacing		EP333		no bands
	412		Y	52 yellow SFDs at 10 m spacing		EP332		no bands
	340		N	none		EP325		no bands
	536		Y	108 yellow SFDs at 5 m spacing		EP336		no bands
	551		Part	4 SFDs adjacent to one tower		EP335		no bands
	45		Y	62 gray SFDs at 10 m spacing		EP327		no bands
	774		Part	4 SFDs adjacent to one tower		EP327		no bands
	772		Part	4 SFDs adjacent to one tower		EP326		no bands

	759		Part	4 SFDs adjacent to one tower		EP326		no bands
	456		Part	4 SFDs adjacent to one tower		EP326		no bands
	348		Part	4 SFDs adjacent to one tower		EP326		no bands
	354		Part	4 SFDs adjacent to one tower		EP326		no bands
	337		Part	4 SFDs adjacent to one tower		EP326		no bands
	759		Part	4 SFDs adjacent to one tower		EP297		no bands
	170		Part	4 SFDs adjacent to one tower		EP295		no bands
	120		N	none		EP297		no bands
	141		N	none		EP297		no bands
	727		N	none		EP298		no bands
	441		Y	SFDs adjacent to one tower, 11 aviation balls		EP299		no bands
	226		Part	4 SFDs adjacent to one tower		EP203		no bands
	84		Y	SFDs adjacent to each tower, 11 aviation balls		EP341		no bands
	736		Y	84 gray SFDs at 5 m spacing		EP341		no bands
	666		Y	84 gray SFDs at 5 m spacing		EP340		no bands
	332		Y	84 gray SFDs at 5 m spacing		EP340		no bands
	487		Y	56 yellow SFDs at 10 m spacing		EP338		no bands
	167		Y	56 gray SFDs at 10 m spacing		EP336		no bands

	619		Y	103 gray SFDs at 5 m spacing		EP329		no bands
	114		Part	4 SFDs adjacent to one tower		EP331		no bands
	285		Part	4 SFDs adjacent to one tower		EP326		no bands
	395		Y	SFDs adjacent to each tower, 11 aviation balls		EP341		no bands
	472		Y	56 gray SFDs at 10 m spacing		EP337		no bands
	275		N	none		EP325		no bands

Species	SPITS Code
Unknown	
Bald Eagle	BAEA
Golden Eagle	GOEA
Albert's Towhee	ABTO
Acadian Flycatcher	ACFL
Accipiters	AC$$
Acorn Woodpecker	ACWO
Adelaide's Warbler	ADWA
Akekee	AKEK
Akepa	LOXC
Akiapola'Au	HEWI
Akikiki	AKIK
Albatrosses	DI$$
Alder Flycatcher	ALFL
Aleutian Tern	ALTE
Allen's Hummingbird	ALHU
Alpine Swift	ALSW
Altamira Oriole	LIOR
American Avocet	AMAV
American Bittern	AMBI
American Black Duck	BLDU
American Coot	AMCO
American Crow	CROW
American Dipper	DIPP
American Golden-Plover	AGPL
American Goldfinch	AMGO
American Kestrel	AMKE
American Oystercatcher	AMOY
American Pipit	AMPI
American Redstart	AMRE
American Robin	AMRO
American Three-Toe Woodpecker	ATTW
American Tree Sparrow	TRSP
American White Pelican	WHPE
American Wigeon	AMWI
American Woodcock	AMWO
Ancient Murrelet	ANMU
Anhinga	AMAN
Anianiau	ANIA
Anna's Hummingbird	ANHU
Antillean Crested Hummingbird	CRHU
Antillean Euphonia	BHUE
Antillean Mango	ANMA
Antillean Nighthawk	CHGU
Antillean Palm-Swift	TAPH
Apapane	HISA
Aplomado Falcon	APFA
Arctic Loon	ARLO
Arctic Tern	ARTE
Arctic Warbler	AWAR
Arizona Woodpecker	ARWO
Ash-Throated Flycatcher	ATFL
Ashy Storm-Petrel	ASPE
Atlantic Puffin	COPU
Audubon's Oriole	BHOR
Audubon's Shearwater	AUSH
Auks, Murres, Puffins	AL$$
Aztec Thrush	RIPI
Azure Gallinule	AZGA
Bachman's Sparrow	BASP
Bachman's Warbler	BAWA
Baer's Pochard	BAPO
Bahama Mockingbird	BMOC
Bahama Swallow	BHSW
Bahama Woodstar	BAWS
Bahama Woodstar	PEVE
Baikal Teal	BATE
Baird's Sandpiper	BASA
Baird's Sparrow	BAJU
Baltimore Oriole	BAOR
Band-Rumped Storm-Petrel	HAST

Project Type
Geothermal
Other
Solar Power Tower
Solar PV
Solar Trough
Transmission Line
Transmission Sub-station or Switching Station
Wind

How found?
Carcass Survey
Incidental

Estimated time dead/injured before discovery
0-8 hours
8-24 hours
2 days
3-6 days
7 days
2 weeks
3 weeks
1 month +
Unknown

Project feature where carcass was found
Brine Pond
Communications Tower
Evaporation Pond
Fencing
Guy Wires
Heliostat
Other
Other Machinery
Pond Net
Project Building
PV Panel
Road
Solar Concentrating Tower
Solar Trough
Transmission Line
Transmission Tower
Vehicle
Water Supply Pond
Wind Turbine

Condition of Bird/Carcass
Active Nest Relocation
Alive, injured
Alive, sick
Articulated skeletal
Broken up
Dead, fresh (eyes moist)
Dead, semi-fresh (eyes desiccated, rigor mortis)
Feather spot
Mummified

Suspected cause of injury/mortality (field determination)
Barotrauma
Blinded/optical damage (radiant flux)
Collision (other)
Collision with solar panel/heliostat
Collision with wind turbine
Collision with wire
De-oiled
Disease
Drowned (evaporation pond)
Drowned (stock tank)
Drowned (other)
Electrocution
Entangled (net)
Other
Poisoned (lead)
Poisoned (other)
Poisoned (pesticide)
Predated
Predated while entangled
Scorched or singed
Unknown

Band-Tailed Pigeon	BTPI
Bank Swallow	BKSW
Barbary Falcon	FAPE
Barn Owl	BAOW
Barn Swallow	BASW
Barnacle Goose	BRGO
Barred Owl	BDOW
Barrow's Goldeneye	BAGO
Bar-Tailed Godwit	BTGO
Bay-Breasted Warbler	BBWA
Belcher's Gull	BEGU
Bell's Vireo	BEVI
Belted Kingfisher	BEKI
Bendire's Thrasher	BETH
Berylline Hummingbird	BCHU
Bewick's Wren	BEWR
Bicknell's Thrush	BITH
Black Bittern	IXFL
Black Catbird	BLCA
Black Guillemot	BLGU
Black Kite	BKKI
Black Noddy	ANMI
Black Oystercatcher	BLOY
Black Phoebe	BLPH
Black Rail	BLRA
Black Rosy-Finch	BRFI
Black Scoter	BLSC
Black Skimmer	BLSK
Black Storm-Petrel	BSPE
Black Swift	BLSW
Black Tern	BLTE
Black Turnstone	BLTU
Black Vulture	BLVU
Black-And-White Warbler	BAWW
Black-Backed Woodpecker	BTWO
Black-Bellied Plover	BBPL
Black-Bellied Storm-Petrel	BBPE
Black-Billed Cuckoo	BBCU
Black-Billed Magpie	BBMP
Blackbirds	IC$$
Black-Browed Albatross	BBAB
Blackburnian Warbler	BLWA
Black-Capped Chickadee	BCCH
Black-Capped Gnatcatcher	BCGN
Black-Capped Petrel	BCPE
Black-Capped Vireo	BCVI
Black-Chinned Hummingbird	BCHM
Black-Chinned Sparrow	BCSP
Black-Crested Titmouse	BCTM
Black-Crown Night Heron	BCNH
Black-Faced Grassquit	BFGR
Black-Footed Albatross	BFAL
Black-Headed Grosbeak	BHGR
Black-Headed Gull	BHGU
Black-Headed Nightingale-Thrush	BHNT
Black-Legged Kittiwake	BLKI
Black-Naped Tern	BNTE
Black-Necked Stilt	BNST
Blackpoll Warbler	BPWA
Black-Tailed Gnatcatcher	BTGN
Black-Tailed Godwit	LILI
Black-Tailed Gull	BTGU
Black-Throat Blue Warbler	BTBW
Black-Throat Gray Warbler	BGWA
Black-Throat Green Warbler	BTGW
Black-Throated Sparrow	BTSP
Black-Vented Oriole	BVOR
Black-Vented Shearwater	PUOP
Black-Whiskered Vireo	BWVI
Black-Winged Petrel	BWPE
Black-Winged Stilt	HIHI
Blk-Bellied Whistl Duck	BBWD
Blue Bunting	CPRL

Blue Grosbeak	BLGR
Blue Jay	BLJA
Blue Mockingbird	BLMO
Blue Rock Thrush	MOSO
Blue-Footed Booby	BLBO
Blue-Gray Gnatcatcher	BGGN
Blue-Gray Noddy	BGNO
Blue-Headed Vireo	SOVI
Bluethroat	BLUE
Blue-Throated Hummingbird	BUHU
Blue-Winged Teal	BWTE
Blue-Winged Warbler	BWWA
Boat-Tailed Grackle	BTGR
Bobolink	BOBO
Bohemian Waxwing	BOWA
Bonaparte's Gull	BOGU
Bonin Petrel	BOPE
Boobies & Gannets	SL$$
Boreal Chickadee	BOCH
Botteri's Sparrow	BOSP
Brambling	BRAM
Brandt's Cormorant	BRCO
Brant	BRAN
Brewer's Blackbird	BRBL
Brewer's Sparrow	BRSP
Bridled Quail-Dove	BRQD
Bridled Tern	BRTE
Bridled Titmouse	BRTI
Bristle-Thighed Curlew	BTCU
Broad-Billed Hummingbird	BBHU
Broad-Billed Sandpiper	BDSA
Broad-Tailed Hummingbird	BTHU
Broad-Winged Hawk	BWHA
Bronzed Cowbird	BZCO
Brown Booby	BRBO
Brown Creeper	BRCR
Brown Jay	CYMO
Brown Noddy	NOTE
Brown Pelican	BRPE
Brown Pelican	PEOC
Brown Shrike	LANC
Brown Thrasher	BRTH
Brown-Capped Rosy-Finch	BCRF
Brown-Chested Martin	BCMA
Brown-Crested Flycatcher	WCFL
Brown-Headed Cowbird	BHCO
Brown-Headed Nuthatch	BHNU
Buff-Banded Rail	BBRA
Buff-Bellied Hummingbird	BFHU
Buff-Breasted Flycatcher	EMFU
Buff-Breasted Sandpiper	BBSA
Buff-Collared Nightjar	CRID
Bufflehead	BUFF
Buller's Shearwater	NZSH
Bullock's Oriole	BORI
Bulwer's Petrel	BULP
Bumblebee Hummingbird	HEHU
Burrowing Owl	BUOW
Burrowing Owl	SPEC
Bushtit	BUSH
Cactus Wren	CTWR
Cahow	PTCA
California Condor	CACO
California Gnatcatcher	PCAF
California Gull	CAGU
California Thrasher	CATH
California Towhee	PICR
Calliope Hummingbird	CAHU
Canada Goose	CAGO
Canada Warbler	CAWA
Canvasback	CANV
Canyon Towhee	BRTO
Canyon Wren	CNWR

Cape May Warbler	CMWA
Cape Verde Shearwater	CVSH
Caracaras, Falcons	FL$$
Caribbean Coot	CBCO
Caribbean Elaenia	CAEL
Caribbean Martin	CAMA
Carolina Chickadee	CACH
Carolina Wren	CAWR
Caspian Tern	CATE
Cassin's Auklet	CAAU
Cassin's Finch	CAFI
Cassin's Kingbird	CAKI
Cassin's Sparrow	CASP
Cassin's Vireo	VICA
Cattle Egret	CAEG
Cave Swallow	CASW
Cedar Waxwing	CEWA
Cerulean Warbler	CRWA
Chestnut-Backed Chickadee	CBCH
Chestnut-Cheeked Starling	VBST
Chestnut-Collared Longspur	CCLO
Chestnut-Sided Warbler	CSWA
Chihuahuan Raven	WNRA
Chimney Swift	CHSW
Chinese Egret	EGEU
Chinese Goshawk	ACCS
Chinese Pond-Heron	CPHE
Chipping Sparrow	CHSP
Christmas Shearwater	CISH
Chuck-Will's Widow	CHWW
Cinnamon Hummingbird	AMRU
Cinnamon Teal	CITE
Citrine Wagtail	CIWA
Clapper Rail	CLRA
Clark's Grebe	AECL
Clark's Nutcracker	CLNU
Clay-Colored Robin	TUGR
Clay-Colored Sparrow	CCSP
Cliff Swallow	CLSW
Colima Warbler	CLWA
Collared Forest Falcon	MISE
Collared Kingfisher	HACH
Collared Plover	CPLO
Common Black Hawk	BLHA
Common Chaffinch	FRIC
Common Crane	CRAN
Common Cuckoo	COCU
Common Eider	COEI
Common Goldeneye	COGO
Common Grackle	COGR
Common Greenshank	GREE
Common Ground-Dove	GRDO
Common House-Martin	DEUR
Common Kestrel	EUKE
Common Loon	COLO
Common Merganser	COME
Common Moorhen	COGA
Common Murre	COMU
Common Nighthawk	CONI
Common Pauraque	PAUR
Common Pochard	COPO
Common Poorwill	POWI
Common Raven	CORA
Common Redpoll	REDP
Common Ringed Plover	RIPL
Common Rosefinch	CAER
Common Sandpiper	COSA
Common Snipe	COSN
Common Swift	COSW
Common Tern	COTE
Common Yellowthroat	YELL
Connecticut Warbler	COWA
Cook's Petrel	COPE

Cooper's Hawk	COHA
Cordilleran Flycatcher	CFLY
Cormorants	PH$$
Corn Crake	COCR
Cory's Shearwater	FFSH
Costa's Hummingbird	COHU
Couch's Kingbird	TYCO
Crane-Hawk	GERC
Cranes	GR$$
Craveri's Murrelet	CRMU
Crescent-Chested Warbler	CCWA
Crested Auklet	CRAU
Crested Caracara	CCHW
Crested Honeycreeper	PADO
Crimson-Collared Grosbeak	RHCE
Crimson-Crowned Fruit-Dove	CCFD
Crissal Thrasher	TOCR
Cuban Martin	CUMA
Cuban Pewee	CUPE
Cuckoos, Anis, Roadrunners	CU$$
Curlew Sandpiper	CUSA
Curve-Billed Thrasher	CBTH
Dark-Eyed Junco	SCJU
Dickcissel	DICK
Diurnal Birds Of Prey	FA$$
Double-Crested Cormorant	DCCO
Dovekie	DOVE
Downy Woodpecker	DOWO
Ducks	ANA$
Ducks,Geese,Swans	AN$$
Dunlin	DUNL
Dusky Flycatcher	DUFL
Dusky Thrush	TUNA
Dusky Warbler	PHYF
Dusky-Capped Flycatcher	OLFL
Eared Grebe	EAGR
Eared Quetzel	EUNE
Eastern Bluebird	EABL
Eastern Kingbird	EAKI
Eastern Meadowlark	EAME
Eastern Phoebe	EAPH
Eastern Screech Owl	SCOW
Eastern Towhee	RSTO
Eastern Wood Pewee	EAPE
Eastern Yellow Wagtail	EYWA
Egrets, Herons	AR$$
Egrets, Ibises, Herons, Bitterns	CI$$
Elegant Tern	ELTE
Elegant Trogon	TOEL
Elf Owl	ELOW
Elfin-Woods Warbler	EWWA
Emperor Goose	EMGO
Eskimo Curlew	ESCU
Eurasian Bullfinch	EUBU
Eurasian Coot	EUCO
Eurasian Curlew	EUCU
Eurasian Dotterel	DOTT
Eurasian Hobby	FASU
Eurasian Hoopoe	UPEP
Eurasian Oystercatcher	HAOS
Eurasian Siskin	CSPN
Eurasian Wigeon	EUWI
Eurasian Woodcock	EUWO
Eurasian Wryneck	WRYN
European Golden-Plover	PLUA
Evening Grosbeak	EVGR
Eyebrowed Thrush	EBTH
Falcated Duck	FATE
Fan-Tailed Warbler	FTWA
Far Eastern Curlew	AUCU
Ferruginous Hawk	FEHA
Ferruginous Pygmy Owl	FEOW
Field Sparrow	FISP

Fieldfare	TUPI
Fish Crow	FICR
Five-Striped Sparrow	FSSP
Flame-Colored Tanager	FCTA
Flammulated Owl	FLOW
Flesh-Footed Shearwater	COSH
Florida Scrub Jay	SCJA
Fork-Tailed Flycatcher	FTFL
Fork-Tailed Storm-Petrel	FTSP
Fork-Tailed Swift	WRSW
Forster's Tern	FOTE
Fox Sparrow	FOSP
Franklin's Gull	FRGU
Friendly Ground-Dove	FRGD
Frigatebirds	FR$$
Fulmars, Petrels, Shearwaters	PR$$
Fulvous Whistling Duck	FWDU
Gadwall	GADW
Gallinules, Rails, Coots	RA$$
Garganey	GATE
Geese	ANS$
Gila Woodpecker	GIWO
Gilded Flicker	GIFL
Glaucous Gull	GLGU
Glaucous-Winged Gull	GWGU
Glossy Ibis	GLIB
Golden-Cheeked Warbler	GCWA
Golden-Crowned Kinglet	GCKI
Golden-Crowned Sparrow	GCSP
Golden-Crowned Warbler	BACU
Golden-Fronted Woodpecker	GFWO
Golden-Winged Warbler	GWWA
Gould's Petrel	GPET
Grace's Warbler	GRWA
Grasshopper Sparrow	GRSP
Gray Bunting	GBUN
Gray Catbird	GRCA
Gray Flycatcher	GRFL
Gray Hawk	GRHA
Gray Heron	ARDC
Gray Jay	GRJA
Gray Kingbird	GRKI
Gray Nightjar	JUNJ
Gray Silky-Flycatcher	GRSF
Gray Vireo	GRVI
Gray Wagtail	GYWA
Gray-Backed Tern	GYTE
Gray-Breasted Martin	GBMA
Gray-Cheeked Thrush	GCTH
Gray-Crowned Rosy-Finch	GRRF
Gray-Crowned Yellowthroat	GRCH
Gray-Headed Chickadee	CHCH
Gray-Hooded Gull	GHGU
Gray-Streaked Flycatcher	CGSF
Gray-Tailed Tattler	POTA
Great Black-Backed Gull	GBBG
Great Blue Heron	GBHE
Great Cormorant	GRCO
Great Crested Flycatcher	GCFL
Great Crested Tern	STEB
Great Egret	CAAL
Great Frigatebird	GRFR
Great Gray Owl	GGOW
Great Horned Owl	GHOW
Great Kiskadee	KIFL
Great Knot	GRKN
Great Skua	NOSK
Great Spotted Woodpecker	DMAJ
Greater Akialoa	GRAK
Greater Antillean Grackle	GAGR
Greater Antillean Oriole	BCOR
Greater Flamingo	AMFL
Greater Pewee	CSFL

Greater Roadrunner	ROAD
Greater Sand-Plover	GSPL
Greater Scaup	GRSC
Greater Shearwater	GRSH
Greater Yellowlegs	GRYE
Great-Tailed Grackle	GTGR
Great-Winged Petrel	PMAC
Grebes	PO$$
Green Heron	GHER
Green Jay	GEJA
Green Kingfisher	GEKI
Green Mango	PRMA
Green Sandpiper	TROC
Green Violet-Ear	VEHU
Green-Breasted Mango	ANPR
Greenish Elaenia	MYVI
Green-Tailed Towhee	GTTO
Green-Throated Carib	GTCA
Green-Winged Teal	GRTE
Groove-Billed Ani	GBAN
Grosbeak, Bunting, Cardinals	CAR$
Grtr White-Fronted Goose	WFGO
Guam Rail	GURA
Guam Rail	RAOW
Gull-Billed Tern	GBTE
Gulls	LAR$
Gyrfalcon	FARU
Gyrfalcon	GYRF
Hairy Woodpecker	HAWO
Hammond's Flycatcher	HAFL
Harlequin Duck	HADU
Harris's Hawk	HAHA
Harris's Sparrow	HASP
Hawaii Amakihi	HAWA
Hawaii Creeper	LOMM
Hawaiian (Nene) Goose	HAGO
Hawaiian Crow	HACR
Hawaiian Duck	ANWY
Hawaiian Hawk	HWHA
Hawfinch	HAWF
Heermann's Gull	HMGU
Henslow's Sparrow	HESP
Hepatic Tanager	HETA
Herald Petrel	STPE
Hermit Thrush	HETH
Hermit Warbler	HEWA
Herring Gull	HEGU
Hispaniolan Pewee	HPEW
Hoary Redpoll	HORE
Hodgson's Hawk-Cuckoo	HACU
Hooded Merganser	HOME
Hooded Oriole	HOOR
Hooded Warbler	HOWA
Hook-Billed Kite	CUNC
Horned Grebe	HOGR
Horned Lark	HOLA
Horned Puffin	HOPU
House Finch	HOFI
House Wren	HOWR
Hudsonian Godwit	HUGO
Hummingbirds	TO$$
Hutton's Vireo	HUVI
Iceland Gull	ICGU
Iiwi	IIWI
Inca Dove	INDO
Indigo Bunting	INBU
Intermediate Egret	PLEG
Island Scrub-Jay	ISSJ
Ivory Gull	IVGU
Ivory-Billed Woodpecker	IBWO
Jabiru	JABI
Jack Snipe	EUJA
Japanese Night-Heron	JNHE

Japanese Sparrowhawk	ACCG
Japanese Sparrowhawk	AGUL
Jouanin's Petrel	JOPE
Juan Fernandez Petrel	JFPE
Juncos, Buntings, Towhees, Sparrows	EM$$
Juniper Titmouse	JUTM
Kamao	MYMY
Kauai Amakihi	KAAM
Kelp Gull	LADO
Kentucky Warbler	KEWA
Kermadec Petrel	KEPE
Key West Quail-Dove	KWQD
Killdeer	KILL
King Eider	KIEI
King Rail	KIRA
Kingfishers	AD$$
Kirtland's Warbler	KIWA
Kittlitz's Murrelet	KIMU
La Sagra's Flycatcher	LSFL
Ladder-Backed Woodpecker	LBWO
Lanceolated Warbler	LOLA
Lapland Longspur	LALO
Large-Billed Tern	LBTE
Lark Bunting	LKBU
Lark Sparrow	LASP
Laughing Gull	LAAT
Lawrence's Goldfinch	LAGO
Laysan Albatross	LAAL
Laysan Duck	ANLA
Laysan Finch	TELC
Lazuli Bunting	LABU
Le Conte's Sparrow	LCSP
Le Conte's Thrasher	LCTH
Leach's Storm-Petrel	LSPE
Least Auklet	LEAU
Least Bittern	LEBI
Least Flycatcher	LEFL
Least Grebe	LEGR
Least Sandpiper	LESA
Least Storm-Petrel	LTPE
Least Tern	LEAT
Least Tern	STEA
Lesser Antillean Pewee	LAPE
Lesser Blck-Backed Gull	LBBG
Lesser Frigatebird	LEFR
Lesser Goldfinch	LEGO
Lesser Nighthawk	LENI
Lesser Sand-Plover	MGPL
Lesser Scaup	LESC
Lesser White-Front Goose	LWFG
Lesser Whitethroat	SYCU
Lesser Yellowlegs	LEYE
Lewis's Woodpecker	LEWO
Light-Mantled Albatross	LMAA
Limpkin	LIMP
Lincoln's Sparrow	LISP
Little Blue Heron	LBHE
Little Bunting	LBUN
Little Curlew	LECU
Little Egret	EGGA
Little Gull	LIGU
Little Pied Cormorant	PMLA
Little Ringed Plover	LRPL
Little Shearwater	LISH
Little Stint	CAMI
Little Tern	CYTE
Loggerhead Kingbird	LOFL
Loggerhead Shrike	LOSH
Long-Billed Curlew	LBCU
Long-Billed Dowitcher	LBTO
Long-Billed Murrelet	LBMU
Long-Billed Thrasher	LBTH
Long-Eared Owl	LEOW

Long-Tailed Duck	OLDS
Long-Tailed Jaeger	LTJA
Long-Toed Stint	LTST
Loons	GA$$
Louisiana Waterthrush	LOWA
Lucifer Hummingbird	LUHU
Lucy's Warbler	LUWA
Macgillivray's Warbler	MGWA
Magnificent Frigatebird	MAFR
Magnificent Hummingbird	RIHU
Magnolia Warbler	MAWA
Magpies, Jays, Ravens, Crows	CV$$
Malayan Night-Heron	NYME
Mallard	MALL
Mangrove Cuckoo	MACU
Mangrove Swallow	MSWA
Manx Shearwater	MASH
Many-Colored Fruit-Dove	MCFD
Marbled Godwit	MAGO
Marbled Murrelet	MAMU
Mariana Crow	CORK
Mariana Fruit-Dove	MAFD
Mariana Swiftlet	MASW
Marsh Sandpiper	TSYA
Marsh Wren	LBMW
Martins & Swallows	HI$$
Masked Booby	BFBO
Masked Duck	MADU
Masked Tityra	TISE
Matsudaira's Storm-Petrel	MSPE
Maui Alauahio	MAUA
Maui Parrotbill	PSXA
Mccown's Longspur	MCLO
Mckay's Bunting	MCBU
Mergansers, Seaducks	MER$
Merlin	MERL
Mew Gull	MEGU
Mexican Chickadee	MECH
Mexican Jay	MEJA
Micronesian Kingfisher	HACI
Middendorff's Grasshoppr-Warbler	GHWA
Millerbird	MILL
Mississippi Kite	MIKI
Molokai Creeper	LOMF
Mottled Duck	MODU
Mottled Owl	CIVI
Mottled Petrel	SCPE
Mountain Bluebird	MOBL
Mountain Chickadee	MOCH
Mountain Plover	MOPL
Mourning Dove	MODO
Mourning Warbler	MOWA
Murphy's Petrel	MUPE
Muscovy Duck	CMOS
N. Beardless Tyrannulet	BEFL
N. Rough-Winged Swallow	SSER
Narcissus Flycatcher	NAFL
Nashville Warbler	NAWA
Nelsons Sharp-Tail Sparrow	NSSP
Neotropic Cormorant	OLCO
Nightingale Reed Warbler	ACLU
Nightingale Reed Warbler	ALUS
Nightjars, Nighthawks	CP$$
Nihoa Finch	TELU
Nordmann's Greenshank	TRGU
Northern Cardinal	CARD
Northern Flicker	COFL
Northern Fulmar	NOFU
Northern Gannet	GANN
Northern Goshawk	GOSH
Northern Harrier	NOHA
Northern Hawk-Owl	HAOW
Northern Jacana	JACA

Northern Lapwing	LAPW
Northern Mockingbird	MOCK
Northern Parula	NOPA
Northern Pintail	NOPI
Northern Pygmy Owl	PYOW
Northern Saw-Whet Owl	SWOW
Northern Shoveler	NOSH
Northern Shrike	NRSH
Northern Waterthrush	NOWA
Northern Wheatear	WHEA
Northwestern Crow	NOCR
Nukupu'U	HELU
Nuthatches	SI$$
Nuttall's Woodpecker	NUWO
Nutting's Flycatcher	NUFL
Oahu Amakihi	OAAM
Oahu Creeper	LMMC
Oak Titmouse	PLTI
O'H	PSPS
Old World Warblers	SY$$
Olive Sparrow	OLSP
Olive Warbler	OLWA
Olive-Backed Pipit	ITPI
Olive-Sided Flycatcher	OSFL
Omao	HATH
Orange-Billed Nightingale-Thrush	CAUA
Orange-Crowned Warbler	OCWA
Orchard Oriole	OROR
Oriental Cuckoo	ORCU
Oriental Greenfinch	CASI
Oriental Scops Owl	OTSU
Oriental Turtle-Dove	SORI
Osprey	OSPR
Ovenbird	OVEN
Owls	ST$$
P. Rican Screech Owl	BLOW
Pacific Black Duck	ANSU
Pacific Golden-Plover	PLUF
Pacific Imperial-Pigeon	PIPG
Pacific Loon	GAPA
Pacific Reef-Egret	REHE
Pacific-Slope Flycatcher	WEFL
Paint-Billed Crake	PBCR
Painted Bunting	PABU
Painted Redstart	PARE
Palila	PSBA
Pallas's Bunting	EMPA
Palm Warbler	PAWA
Parakeet Auklet	PAAU
Parasitic Jaeger	PAJA
Passerine Birds	PA$$
Pearly-Eyed Thrasher	PETH
Pechora Pipit	PEPI
Pectoral Sandpiper	PESA
Pelagic Cormorant	PECO
Peregrine Falcon	FPEG
Peregrine Falcon	PEFA
Phainopepla	PHAI
Phalaropes	PHA$
Phalaropes, Sandpipers	SO$$
Philadelphia Vireo	PHVI
Phoenix Petrel	PPTL
Pied-Billed Grebe	PBGR
Pigeon Guillemot	PIGU
Pigeons & Doves	CO$$
Pileated Woodpecker	PIWO
Pine Bunting	EMLE
Pine Grosbeak	PIGR
Pine Siskin	PISI
Pine Warbler	PIWA
Pink-Footed Shearwater	PFSH
Pin-Tailed Snipe	PISN
Pinyon Jay	PINJ

Piping Plover	CMLO
Piping Plover	PIPL
Piratic Flycatcher	PFLY
Plain Pigeon	PRPP
Plain-Capped Starthroat	HECO
Plovers	CHA$
Plumbeous Vireo	PLUV
Pochards & Allies	AYT$
Polynesian Storm-Petrel	NFUL
Pomarine Jaeger	POJA
Po'Ouli	MEPH
Prairie Falcon	PRFA
Prairie Warbler	PRWA
Prothonotary Warbler	POWA
Puerto Rican Bullfinch	PRBU
Puerto Rican Emerald	PREM
Puerto Rican Flycatcher	MYAT
Puerto Rican Lizard-Cuckoo	LICU
Puerto Rican Nightjar	PRWW
Puerto Rican Spindalis	PRIS
Puerto Rican Tanager	PRTA
Puerto Rican Vireo	PRVI
Puerto Rican Woodpecker	PRWO
Purple Finch	PUFI
Purple Gallinule	PUGA
Purple Martin	PUMA
Purple Sandpiper	PUSA
Purple Swamphen	PPPP
Purple-Throated Carib	EUJU
Pygmy Nuthatch	PYNU
Pyrrhuloxia	PYRR
Rails, Gallinules, Coots, Cranes	GF$$
Razorbill	RAZO
Red Crossbill	RECR
Red Knot	REKN
Red Phalarope	REPH
Red-Bellied Woodpecker	RBWO
Red-Billed Pigeon	RBPI
Red-Billed Tropicbird	RBTR
Red-Breasted Merganser	RBME
Red-Breasted Nuthatch	RBNU
Red-Breasted Sapsucker	SPRU
Red-Cockaded Woodpecker	RCWO
Reddish Egret	REEG
Red-Eyed Vireo	REVI
Red-Faced Cormorant	RFCO
Red-Faced Warbler	RFWA
Red-Flanked Bluetail	TACY
Red-Footed Booby	RFBO
Red-Footed Falcon	FAVE
Redhead	REDH
Red-Headed Woodpecker	RHWO
Red-Legged Kittiwake	KLKI
Red-Legged Thrush	RLTH
Red-Naped Sapsucker	SPNU
Red-Necked Grebe	RNGR
Red-Necked Phalarope	NOPH
Red-Necked Stint	RNSA
Red-Shouldered Hawk	RSHA
Red-Tailed Hawk	RTHA
Red-Tailed Tropicbird	RTTR
Red-Throated Loon	RTLO
Red-Throated Pipit	RTPI
Red-Winged Blackbird	RWBL
Reed Bunting	EMSC
Rhinoceros Auklet	RHAU
Ring-Billed Gull	RBGU
Ringed Kingfisher	RIKI
Ringed Storm-Petrel	RISP
Ring-Necked Duck	RNDU
Roadside Hawk	BUMA
Rock Sandpiper	ROSA
Rock Wren	ROWR

Roseate Spoonbill	ROSP
Roseate Tern	RSTE
Rose-Breasted Grosbeak	RBGR
Rose-Throated Becard	PAAG
Ross's Goose	ROGO
Ross's Gull	ROGU
Rough-Legged Hawk	RLHA
Royal Tern	ROTE
Ruby-Crowned Kinglet	RCKI
Ruby-Throated Hummingbird	RTHU
Ruddy Duck	RUDU
Ruddy Ground-Dove	COTA
Ruddy Quail-Dove	RQDO
Ruddy Turnstone	RUTU
Ruff	RUFF
Rufous Hummingbird	RUHU
Rufous-Backed Robin	RBRO
Rufous-Capped Warbler	BARU
Rufous-Crowned Sparrow	RCSP
Rufous-Winged Sparrow	RWSP
Rustic Bunting	RUBU
Rusty Blackbird	RUBL
Sabine's Gull	SAGU
Sage Sparrow	SGSP
Sage Thrasher	SATH
Sanderling	SAND
Sandhill Crane	SACR
Sandpipers	SCO$
Sandwich Tern	SATE
Savannah Sparrow	SASP
Say's Phoebe	SAPH
Scaly-Naped Pigeon	SNPI
Scarlet Ibis	SCIB
Scarlet Tanager	SCTA
Schrenck's Bittern	SLBI
Scissor-Tailed Flycatcher	STFL
Scoter	MEL?
Scott's Oriole	SCOR
Seaside Sparrow	SESP
Sedge Wren	SBMW
Semipalmated Plover	SEPL
Semipalmated Sandpiper	SESA
Sharp-Shinned Hawk	SSHA
Sharp-Tailed Sandpiper	SHSA
Shiny Cowbird	GLCO
Shorebirds	CD$$
Short-Billed Dowitcher	SBDO
Short-Eared Owl	SEOW
Short-Tailed Albatross	DIAL
Short-Tailed Albatross	STAL
Short-Tailed Hawk	STHA
Short-Tailed Shearwater	STSH
Short-Tailed Swift	STSW
Shy Albatross	WCAL
Siberian Accentor	PRMO
Siberian Blue Robin	LUCY
Siberian Rubythroat	SIRU
Siskins, Redpolls, Finches,Crossbills	FI$$
Skuas & Jaegers	STR$
Skuas, Jaegers, Gulls, Terns	LA$$
Sky Lark	SKYL
Slate-Throated Redstart	STRE
Slaty-Backed Gull	SBGU
Sltmrsh Sharp-Tail Sparrow	STSP
Small Kauai Thrush	SKTH
Smew	SMEW
Smith's Longspur	SMLO
Smooth-Billed Ani	SBAN
Snail Kite	ROSO
Snow Bunting	SNBU
Snow Goose	ANCL
Snow Goose	LSGO
Snowy Egret	SNEG

Snowy Owl	NYSC
Snowy Plover	SNPL
Social Flycatcher	MYSI
Solitary Sandpiper	SOSA
Song Sparrow	SOSP
Sooty Shearwater	SOSH
Sooty Tern	SOTE
Sora	SORA
South Polar Skua	SOSK
Southern Caracara	PPLA
Southern Martin	SOMA
Spectacled Eider	SPEI
Spoon-Billed Sandpiper	SBSA
Spoonbills, Ibises	TK$$
Spot-Billed Duck	APOE
Spotless Crake	PTAB
Spotted Owl	SPOW
Spotted Rail	SRAI
Spotted Redshank	SPRE
Spotted Sandpiper	SPSA
Spotted Towhee	SPTO
Sprague's Pipit	SPPI
Stejneger's Petrel	STJP
Steller's Eider	PSLI
Steller's Eider	STEI
Steller's Jay	STJA
Steller's Sea Eagle	SSEA
Stilt Sandpiper	STSA
Stonechat	SAXT
Storm-Petrels	HY$$
Streak-Backed Oriole	SHOR
Streaked Shearwater	SHES
Stygian Owl	ASIS
Sulphur-Bellied Flycatcher	SBFL
Summer Tanager	SUTA
Surf Scoter	SUSC
Surface Feeding Ducks	ANT$
Surfbird	SURF
Swainson's Hawk	SWHA
Swainson's Thrush	SWTH
Swainson's Warbler	SWWA
Swallow-Tailed Kite	STKI
Swamp Sparrow	SWSP
Swans	CYG$
Swifts	AP$$
Swinhoe's Snipe	SWSN
Tahiti Petrel	TAHP
Taiga Bean-Goose	BEGO
Tamaulipas Crow	MECR
Tanagers	THR$
Tawny-Shoulder Blackbird	TSBL
Temminck's Stint	TEST
Tengmalm's Owl	BOOW
Tennessee Warbler	TEWA
Terek Sandpiper	XECI
Terns & Noodies	STE$
Thayer's Gull	THGU
Thick-Billed Kingbird	TBKI
Thick-Billed Murre	TBMU
Thick-Billed Vireo	VICR
Thrashers, Mockingbirds	MI$$
Thrushes	TUR$
Titmice, Chickadees	PE$$
Townsend's Shearwater	PUAU
Townsend's Solitaire	TOSO
Townsend's Warbler	TOWA
Tree Pipit	ATRV
Tree Swallow	TRSW
Tricolored Blackbird	TRBL
Tricolored Heron	LOHE
Tristram's Storm-Petrel	TRST
Tropical Kingbird	TRKI
Tropical Parula	TRPA

Tropicbirds	PW$$
Trumpeter Swan	TMSW
Tubenoses	PF$$
Tufted Duck	TUDU
Tufted Flycatcher	TFLY
Tufted Puffin	TUPU
Tufted Titmouse	BCTI
Tundra Bean-Goose	TBGO
Tundra Swan	WHSW
Turkey Vulture	TUVU
Tyrant Flycatchers	TD$$
Upland Sandpiper	UPSA
Varied Bunting	VABU
Varied Thrush	VATH
Varied Thrush	ZONA
Variegated Flycatcher	VAFL
Vaux's Swift	VASW
Veery	VEER
Verdin	VERD
Vermilion Flycatcher	VEFL
Vesper Sparrow	VESP
Violet-Crowned Hummingbird	AVIO
Violet-Green Swallow	VGSW
Vireos	VI$$
Virginia Rail	VIRA
Virginia's Warbler	VIWA
Vultures	CT$$
W Indian Whistling Duck	WIWD
Wagtails & Pipits	MO$$
Wandering Albatross	WAAL
Wandering Tattler	WATA
Warbling Vireo	WAVI
Wedge-Rumped Storm-Petrel	OCTE
Wedge-Tailed Shearwater	WTSH
Western Bluebird	WEBL
Western Grebe	WEGR
Western Gull	WEGU
Western Kingbird	WEKI
Western Meadowlark	WEME
Western Reef-Heron	WERH
Western Sandpiper	WESA
Western Screech Owl	OTKE
Western Scrub-Jay	APHC
Western Spindalis	SHTA
Western Tanager	WETA
Western Wood Pewee	WEPE
Whimbrel	WHIM
Whip-Poor-Will	WPWI
Whiskered Auklet	WHAU
Whiskered Screech Owl	WHOW
Whiskered Tern	CHHY
Whistling Ducks	DEN$
White Ibis	WHIB
White Tern	WHTE
White Wagtail	WHWA
White-Bellied Storm-Petrel	WBSP
White-Breasted Nuthatch	WBNU
White-Cheeked Pintail	BAPI
White-Cheeked Starling	ASST
White-Collared Seedeater	WCSE
White-Collared Swift	STZO
White-Crowned Pigeon	WCPI
White-Crowned Sparrow	WCSP
White-Eared Hummingbird	WEHU
White-Eyed Vireo	WEVI
White-Faced Ibis	WFIB
White-Faced Storm-Petrel	PEMA
White-Headed Woodpecker	WHWO
White-Necked Crow	WNCR
White-Necked Petrel	WNPE
White-Rumped Sandpiper	WRSA
White-Rumped Swiftlet	WSWI
White-Tailed Hawk	WTHA

White-Tailed Kite	WTKI
White-Tailed Sea Eagle	HAAL
White-Tailed Tropicbird	WTTR
White-Throated Ground-Dove	WTGD
White-Throated Needletail	NTSW
White-Throated Robin	WTRO
White-Throated Sparrow	WTSP
White-Throated Swift	WTSW
White-Tipped Dove	WFDO
White-Winged Crossbill	WWCR
White-Winged Dove	WWDO
White-Winged Scoter	WWSC
White-Winged Tern	WWST
Whooper Swan	WPSW
Whooping Crane	WHCR
Willet	WILL
Williamson's Sapsucker	WISA
Willow Flycatcher	WIFL
Willow Warbler	PHTR
Wilson's Phalarope	WIPH
Wilson's Plover	WIPL
Wilson's Snipe	WISN
Wilson's Storm-Petrel	WSPE
Wilson's Warbler	WIWA
Winter Wren	WIWR
Wood Duck	WODU
Wood Sandpiper	WOSA
Wood Stork	MYAM
Wood Stork	WOIB
Wood Thrush	WOTH
Wood Warbler	WOWA
Wood Warblers	PU$$
Woodpeckers	PC$$
Worm-Eating Warbler	WEWA
Worthen's Sparrow	WOSP
Wrens	TW$$
Xantus's Hummingbird	HYXA
Xantus's Murrelet	XAMU
Yellow Bittern	CHBI
Yellow Grosbeak	PHCH
Yellow Rail	YERA
Yellow Warbler	YEWA
Yellow-Bellied Flycatcher	YBFL
Yellow-Bellied Sapsucker	YBSA
Yellow-Billed Cuckoo	YBCU
Yellow-Billed Loon	YBLO
Yellow-Billed Magpie	YBMA
Yellow-Breasted Bunting	EMAU
Yellow-Breasted Chat	YBCH
Yellow-Breasted Crake	YBRA
Yellow-Crowned Night-Heron	YCNH
Yellow-Eyed Junco	YEJU
Yellow-Faced Grassquit	YFGR
Yellow-Footed Gull	LALI
Yellow-Green Vireo	YGVI
Yellow-Headed Blackbird	YHBL
Yellow-Legged Gull	LCAC
Yellow-Nosed Albatross	YNAL
Yellow-Rumped Warbler	YRWA
Yellow-Shouldered Blackbird	YSBL
Yellow-Throated Bunting	EMEL
Yellow-Throated Vireo	YTVI
Yellow-Throated Warbler	YTWA
Yucatan Vireo	YUVI
Zenaida Dove	ZEDO
Zone-Tailed Hawk	ZTHA

Disposition	Age	Sex	Injured animal outcome?	Necropsy	State	Estimated weather conditions at time of mortality/injury	Level of Certainty
BLM investigations	Adult	Female	Died	N	AL	Clear	Observed or Confirmed (100%)
Buried onsite	After Hatching Year	Male	Euthanized	Y	AK	Fog	Valid (>90%)
CDFW lab San Bernadino	After Second Year	Unknown	Other		AZ	Raining	Probable (>50%)
CDFW Law Enforcement	Hatching Year		Rehab Center		AR	Snowing	Possible (<50%, >0)
CFWO lab	Juvenille		Released		CA	Unknown	Not Applicable (0% or Unknown)
Freezer on site	Sub-Adult		Veternarian		CO	Wind	
Incinerated	Unknown		Zoo		CT		
Left in place					DE		
Nest relocated					DC		
Other					FL		
SDMNH					GA		
Sent to National Eagle Repository					HI		
Transferred to other permittee (enter permit #)					ID		
Used in Research Trials (searcher efficiency and carcass removal)					IL		
USFWS Law Enforcement					IN		
					IA		
					KS		
					KY		
					LA		
					ME		
					MD		
					MA		
					MI		
					MN		
					MS		
					MO		
					MT		
					NE		
					NV		
					NH		
					NJ		
					NM		
					NY		
					NC		
					ND		
					OH		
					OK		
					OR		
					PA		
					RI		
					SC		
					SD		
					TN		
					TX		
					UT		
					VT		
					VA		
					WA		
					WV		
					WI		
					WY		

From: Fraser, Jody
To: Carol Watson; Chris Huntley
Subject: Fwd: Monthly SPUT report for Desert Sunlight, permit numbers MB20979B-1 and MB20960B-3
Date: Monday, July 14, 2014 1:43:28 PM
Attachments: Avian_Bat_Mortality_20140707b.pdf
R8_SPUT_mortality reporting_macro.7.7.2014.xlsx

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fyi

---------- Forwarded message ----------
From: **crissy slaughter** <criffy@hotmail.com>
Date: Tue, Jul 8, 2014 at 11:14 AM
Subject: Monthly SPUT report for Desert Sunlight, permit numbers MB20979B-1 and MB20960B-3
To: "jody_fraser@fws.gov" <jody_fraser@fws.gov>
Cc: Kathy Simon <kathy@ironwoodconsultinginc.com>, Brooks Corvus <brooks@corvusecological.com>, Brian Sandstrom <bjerome30@hotmail.com>, Therese Carpenter <therese.carpenter@firstsolar.com>, Amanda Beck <abeck@firstsolar.com>, "tamara.haynes@firstsolar.com" <tamara.haynes@firstsolar.com>, "armand.gonzales@wildlife.ca.gov" <armand.gonzales@wildlife.ca.gov>, "eduardo_nieves@fws.gov" <eduardo_nieves@fws.gov>, Ashley H <ashley@cvstrat.com>, "heather_beeler@fws.gov" <heather_beeler@fws.gov>, Thomas Dietsch <thomas_dietsch@fws.gov>, "erin_dean@fws.gov" <erin_dean@fws.gov>, "fmcmenimen@blm.gov" <fmcmenimen@blm.gov>, "cperry@blm.gov" <cperry@blm.gov>, "pksharpgarcia@gmail.com" <pksharpgarcia@gmail.com>

Hello All,

Attached is the monthly SPUT table and updated avian mortality figure for Desert Sunlight, permit numbers MB20979B-1 and MB20960B-3.

Thank you,
Crissy Slaughter

--
Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
U.S. Fish and Wildlife Service
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
760.322.4648 fax
jody_fraser@fws.gov

From: Fraser, Jody
To: Chris Gregory
Subject: Fwd: Desert Sunlight BBCS
Date: Monday, July 14, 2014 2:00:15 PM
Attachments: 20140708_Desert Sunlight Fatality Monitoring Plan CLEAN 20140611_TVD_JSF.docx

---

---------- Forwarded message ----------
From: **Fraser, Jody** <jody_fraser@fws.gov>
Date: Tue, Jul 8, 2014 at 1:56 PM
Subject: Re: Desert Sunlight BBCS
To: Thomas Dietsch <thomas_dietsch@fws.gov>

Hi Tom,
Hope you're having fun! I've attached my review of your review. There are some outstanding questions from our original review that I left in there; some of which I conveyed to you yesterday in the email below. One other thing, I'm curious if we should offer a method that will get to our question of day vs. night impacts per your comment below? Let me know what you think and I'll forward to Amedee?
Thanks,
Jody
Carcasses from species that are nonresident and are night-migrants will be considered night-time fatalities; and those that are nonresident and day-migrants will be considered day-time fatalities[FWS MB-TD1] .

[FWS MB-TD1]This approach is not adequate to determine when mortalities are actually occurring as is requested per the monitoring objectives.

On Mon, Jul 7, 2014 at 4:38 PM, Fraser, Jody <jody_fraser@fws.gov> wrote:

> Thanks for the heads up, Tom. Here are my questions of the day -- you know, to contemplate in your spare time at NCTC (i.e., while you're not in the bar -- well, or even if you are in the bar):
>
> 1) Does the line-distance sampling method make sense here?
>
> 2) Does the response to this comment make sense?
>
> Our original comment: The field study cited here, which is used to justify 35m and 70m search widths, is problematic. According to Table 1 (page 7) of that reference:
>
> Pheasant: no birds left at 61-70m, unequal # of birds 51-60m (3-5x amount of other distances)
>
> Pigeon: no birds left at 41-70m, unequal # of birds 21-30m (2-4x amount of other distances)
>
> Quail: no birds left at 41-60m, unequal # of birds 61-70m (2-3x amount of other distances)
>
> Starling: no birds left at 31-40m, unequal # of birds 61-70m (1/3-1/2x amount of other

distances)

Sparrow: no birds left at 31-40 & 51-70m, unequal # of birds 21-30m (2-5x amount of other distances)

We should discuss and examine this reference carefully. All birds/carcasses were seen less frequently as a function of distance away from the observer (sparrows were only seen 40% of time within 10m). The transect widths need to be reduced greatly and all birds/sizes need to be searched for equally. The proposed DS protocol includes a 20% area search for large birds, 10% area for bats and small birds.

PAR response: We disagree that the field study data indicate problems. The table shows sample sizes ranging from 23 to 35 in five categories of birds and overall detection probabilities greater than 30% in all cases. The greater concentration of birds at greater distances is appropriate because it concentrates effort in the more-difficult-to-estimate areas. Also, because the intent is to fit a distance-detection function, it is not meaningful to consider N within each distance band; the continuous function is fit to overall N for the class of birds (eg pheasant) for which detection is being measured. Further, Carcasses are expected to be seen less frequently as a function of distance and the trial is intended to provide data that allows us to quantify the detection function.

I just realized it's 8 back there, so I'll send this now. I'm sure I'll have more.

Have fun!!

On Sat, Jul 5, 2014 at 3:26 PM, Dietsch, Thomas <thomas_dietsch@fws.gov> wrote:

> Hi Jody,
>
> On my walk this afternoon, it occurred to me that I hadn't really responded to the 20% coverage in my comments. Please add something to the effect that the Service has appointed a product review team to address this question. Until the team provides their analysis, we recommend starting at a higher percentage of at least 30%, which could be modified later, as needed.
>
> Have a good week!
>
> Cheers, Tom
>
> --
> **********
> Thomas Dietsch, PhD
> Migratory Bird Biologist
> US Fish and Wildlife Service, Region 8
> Carlsbad Fish and Wildlife Office
> 2177 Salk Ave, Suite 250

> Carlsbad, CA 92008
> (760) 431-9440 Ext. 214
> **********

--
Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
U.S. Fish and Wildlife Service
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
760.322.4648 fax
jody_fraser@fws.gov

From: Thomas Dietsch
To: Jody Fraser
Subject: 20140708_Desert Sunlight Fatality Monitoring Plan CLEAN 20140611_TVD_JSF_2014_07_15.docx
Date: Tuesday, July 15, 2014 6:38:08 PM
Attachments: 20140708_Desert Sunlight Fatality Monitoring Plan CLEAN 20140611_TVD_JSF_2014_07_15.docx

---

Hi Jody,

I've gone through the plan and made a few changes. Give me a call tomorrow for general comments.

Hasta manana!

Tom

From: Fraser, Jody
To: Chris Gregory; Tera Baird; Pete Sorensen; Joel Pagel
Subject: Fwd: DSL Carcass Persistence Trial Results
Date: Tuesday, July 22, 2014 8:17:40 AM
Attachments: DS_Carcass Persistence Trials - Round 1 Results.pdf

---

fyi

---------- Forwarded message ----------
From: **brian sandstrom** <bjerome30@hotmail.com>
Date: Mon, Jul 21, 2014 at 5:49 PM
Subject: DSL Carcass Persistence Trial Results
To: "eduardo_nieves@fws.gov" <eduardo_nieves@fws.gov>, "jody_fraser@fws.gov" <jody_fraser@fws.gov>, "cperry@blm.gov" <cperry@blm.gov>, "fmcmenimen@blm.gov" <fmcmenimen@blm.gov>, "thomas_dietsch@fws.gov" <thomas_dietsch@fws.gov>
Cc: brooks hart <brooks@corvusecological.com>, crissy slaughter <criffy@hotmail.com>, kathy simon <kathy@ironwoodconsultinginc.com>, therese carpenter <therese.carpenter@firstsolar.com>, "pksharpgarcia@gmail.com" <pksharpgarcia@gmail.com>, "dave.sterner@firstsolar.com" <dave.sterner@firstsolar.com>

Hello everyone,

Attached is a report of the results from the first Carcass Persistence Trials at Desert Sunlight Solar Farm completed in the Spring, May 7 - June 22 by Corvus Ecological Consulting.

If you have any questions please contact me.

Thanks,

Brian Sandstrom
949-423-8770
bjerome30@hotmail.com

--
Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
U.S. Fish and Wildlife Service
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
760.322.4648 fax
jody_fraser@fws.gov

From:	brian sandstrom
To:	eduardo_nieves@fws.gov; jody_fraser@fws.gov; cperry@blm.gov; fmcmenimen@blm.gov; thomas_dietsch@fws.gov
Cc:	brooks hart; crissy slaughter; kathy simon; therese carpenter; pksharpgarcia@gmail.com; admin@corvusecological.com; dave.sterner@firstsolar.com
Subject:	DSL Avian Incident 7/25
Date:	Friday, July 25, 2014 1:51:31 PM
Attachments:	HUMM_072514_1.JPG HUMM_072514_9.JPG

Hello everyone,

This morning at Desert Sunlight Solar Farm an intact carcass of a female Selaphorus hummingbird, either an Allen's or Rufous, was found in Block 8, array 7, row 30. The bird is stored in the biology freezer.

If you have any questions please contact me.

Thanks,

Brian Sandstrom
949-423-8770
bjerome30@hotmail.com

From: Dietsch, Thomas
To: Chris Gregory; Chris Nicolai; Manuela Huso
Subject: Fwd: DSL Carcass Persistence Trial Results
Date: Friday, July 25, 2014 5:29:03 PM
Attachments: DS_Carcass Persistence Trials - Round 1 Results.pdf

---

Hi all,

Here is the report on carcass persistence trials at Desert Sunlight. They are just starting these trials, so there will be more data reported for each season.

Cheers, Tom

---------- Forwarded message ----------
From: **brian sandstrom** <bjerome30@hotmail.com>
Date: Mon, Jul 21, 2014 at 5:49 PM
Subject: DSL Carcass Persistence Trial Results
To: "eduardo_nieves@fws.gov" <eduardo_nieves@fws.gov>, "jody_fraser@fws.gov" <jody_fraser@fws.gov>, "cperry@blm.gov" <cperry@blm.gov>, "fmcmenimen@blm.gov" <fmcmenimen@blm.gov>, "thomas_dietsch@fws.gov" <thomas_dietsch@fws.gov>
Cc: brooks hart <brooks@corvusecological.com>, crissy slaughter <criffy@hotmail.com>, kathy simon <kathy@ironwoodconsultinginc.com>, therese carpenter <therese.carpenter@firstsolar.com>, "pksharpgarcia@gmail.com" <pksharpgarcia@gmail.com>, "dave.sterner@firstsolar.com" <dave.sterner@firstsolar.com>

Hello everyone,

Attached is a report of the results from the first Carcass Persistence Trials at Desert Sunlight Solar Farm completed in the Spring, May 7 - June 22 by Corvus Ecological Consulting.

If you have any questions please contact me.

Thanks,

Brian Sandstrom
949-423-8770
bjerome30@hotmail.com

--
****

Thomas Dietsch, PhD
Migratory Bird Biologist
US Fish and Wildlife Service, Region 8
Carlsbad Fish and Wildlife Office

2177 Salk Ave, Suite 250
Carlsbad, CA 92008
(760) 431-9440 Ext. 214
****

From:	brian sandstrom
To:	eduardo_nieves@fws.gov; jody_fraser@fws.gov; cperry@blm.gov; fmcmenimen@blm.gov; thomas_dietsch@fws.gov
Cc:	brooks hart; crissy slaughter; kathy simon; therese carpenter; pksharpgarcia@gmail.com; admin@corvusecological.com; dave.sterner@firstsolar.com
Subject:	DSL Avian Incident 7/28
Date:	Monday, July 28, 2014 1:06:58 PM
Attachments:	LENI_072814_2.JPG LENI_072814_6.JPG

Hello everyone,

This morning at Desert Sunlight Solar Farm the carcass of a Lesser Nighthawk was found in an open staging area between block 1 and the substation on site. The bird was hit in the morning on the highway and fell from the truck in the staging area. It was collected and stored in the biology freezer

If you have any questions please contact me.

Thanks,

Brian Sandstrom
949-423-8770
bjerome30@hotmail.com

From:	crissy slaughter
To:	jody_fraser@fws.gov
Cc:	Kathy Simon; Brooks Corvus; Brian Sandstrom; Amanda Beck; tamara.haynes@firstsolar.com; armand.gonzales@wildlife.ca.gov; eduardo_nieves@fws.gov; Ashley H; heather_beeler@fws.gov; Thomas_Dietsch; Erin Lockward; fmcmenimen@blm.gov; cperry@blm.gov; pksharpgarcia@gmail.com
Subject:	Monthly SPUT report for Desert Sunlight, permit numbers MB20979B-1 and MB20960B-3
Date:	Monday, August 04, 2014 2:46:26 PM
Attachments:	R8_SPUT_mortality reporting_allyears_4Aug2014.xlsx Avian_Bat_Mortality_20140804.pdf

Hello All,

Attached is the monthly SPUT table and updated avian mortality figure for Desert Sunlight, permit numbers MB20979B-1 and MB20960B-3.

Thank you,
Crissy Slaughter

Additional Documentation Attachment to Comment 2-F1
Attachment I-9



Fraser, Jody <jody_fraser@fws.gov>

Update on YCR and solar

12 messages

Fraser, Jody <jody_fraser@fws.gov> Tue, Aug 5, 2014 at 1:09 PM
To: "Anderson, Tom" <tom_w_anderson@fws.gov>, Christian Schoneman <christian_schoneman@fws.gov>, Nate Caswell <nate_caswell@fws.gov>, Terence Murphy <tmurphy@usbr.gov>, Carolyn Ronning <cronning@usbr.gov>, Lesley Fitzpatrick <lesley_fitzpatrick@fws.gov>, Brenda Zaun <brenda_zaun@fws.gov>, Scott Sewell <scott.sewell@wildlife.ca.gov>, "Konno, Eddy@Wildlife" <Eddy.Konno@wildlife.ca.gov>, Rick Francis <richard.francis@wildlife.ca.gov>, Karen Riesz <karen.riesz@wildlife.ca.gov>, Magdalena Rodriguez <Magdalena.Rodriguez@wildlife.ca.gov>
Cc: Pete Sorensen <Pete_Sorensen@fws.gov>, Tera Baird <Tera_Baird@fws.gov>, Felicia Sirchia <Felicia_Sirchia@fws.gov>, Jenness McBride <Jenness_McBride@fws.gov>, Carol Roberts <carol_a_roberts@fws.gov>, James Thiede <jthiede@blm.gov>, Susan Cooper <susan_e_cooper@fws.gov>, Jessica Rempel <jessica_rempel@fws.gov>, Ray Bransfield <ray_bransfield@fws.gov>

Hi everyone,
First of all, we want to thank all of you for putting in the time and energy to attend conference calls; pull together costs and descriptions of marsh creation, enhancement, and restoration work; and to talk in general about potential impacts to Yuma clapper rail from utility-scale solar projects and how to offset those impacts on your lands. Unfortunately, despite all of our efforts, our leadership in Region 8 disagrees with our assessment that take of YCR from solar projects is reasonably certain to occur (even though we have two dead bodies in 2 years) and does not support our proposal to offset the impacts of the taking off-site. So, the focus will be on-site minimization measures and monitoring to determine if take does occur, without the benefit of formal consultation or a consensus on what might constitute adequate mortality monitoring to learn more about the issue.

We (field office staff working on this) view this as a failure on the part of our agency to conserve trust resources and are concerned that this is precedent setting for all other solar projects within the range of the species. BUT, if the BLM and our leadership agree that take may occur across all projects, but cannot be attributed to any single project, we may still have an opportunity to flesh out and implement our programmatic strategy. I don't follow this logic, but am willing to run with it in hopes that we can get some off-site habitat compensation in place at some point down the road. So, I intend to clean up the draft conservation measure with all the numbers and options so we're ready to go -- if and when another rail dies or we decide to move forward with the programmatic. We'll be sure to pass it by you when the time comes.

In the meantime, we will also continue to seek partnerships and funding to learn more about YCR demographics, dispersal behaviors, and population viability. The more data we have, the better equipped we are to make an argument one way or the other in the best interest of the species.

Again, thank you. If you have any questions or anymore information to add, please just let us know.
Jody

--
Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
U.S. Fish and Wildlife Service
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
760.322.4648 fax
jody_fraser@fws.gov

Riesz, Karen@Wildlife <Karen.Riesz@wildlife.ca.gov> Tue, Aug 5, 2014 at 1:25 PM
To: "Fraser, Jody" <jody_fraser@fws.gov>

I'm so sorry to hear that, Jody. I don't consider any of our work to be a loss, though. I think this issue has brought our agencies closer together in partnership. Also, like you stated, by considering various options we're already ahead in any decision-making that may be needed in the future.

~Karen

Karen A. Riesz

Environmental Scientist

Region 6 Inlands Deserts

California Depart. of Fish and Wildlife

78078 Country Club Drive, Suite 109

Bermuda Dunes, CA 92203

t: (760) 200-9371

f: (760) 200-9358

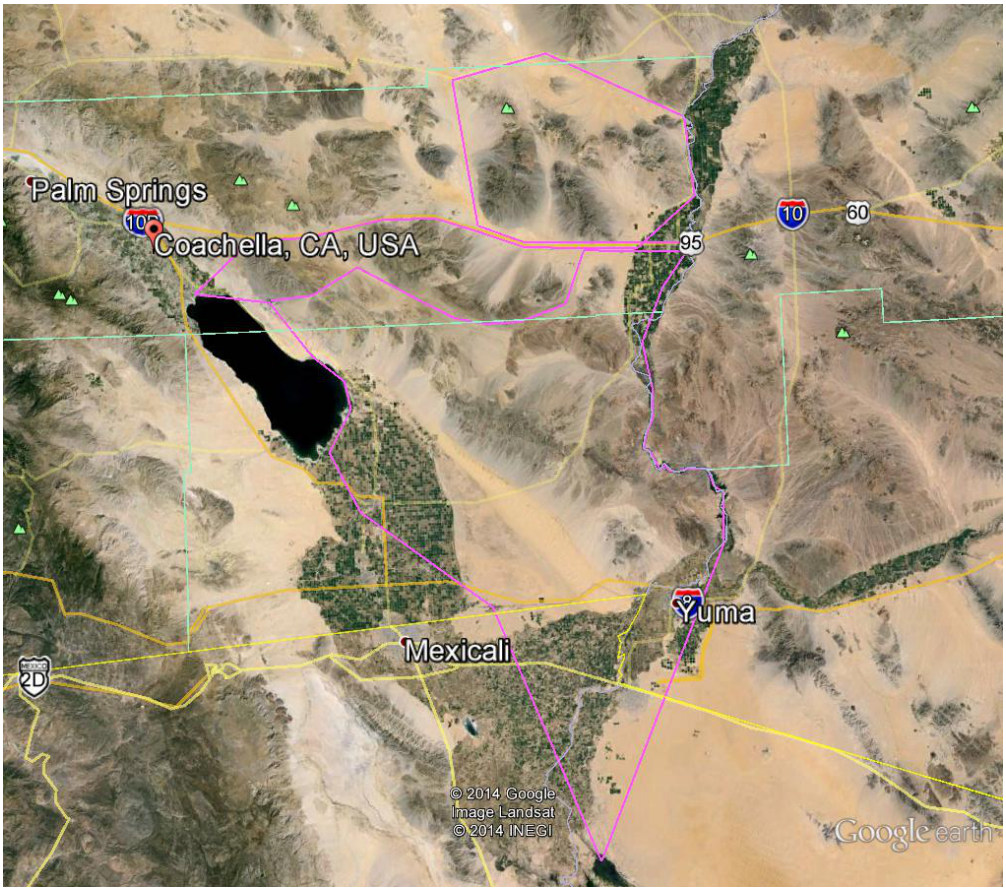
Karen.Riesz@wildlife.ca.gov

From: Fraser, Jody [mailto:jody_fraser@fws.gov]
Sent: Tuesday, August 05, 2014 1:10 PM
To: Anderson, Tom; Christian Schoneman; Nate Caswell; Terence Murphy; Carolyn Ronning; Lesley Fitzpatrick; Brenda Zaun; Sewell, Scott@Wildlife; Konno, Eddy@Wildlife; Francis, Richard@Wildlife; Riesz, Karen@Wildlife; Rodriguez, Magdalena@Wildlife
Cc: Pete Sorensen; Tera Baird; Felicia Sirchia; Jenness McBride; Carol Roberts; James Thiede; Susan Cooper; Jessica Rempel; Ray Bransfield
Subject: Update on YCR and solar

[Quoted text hidden]

Roberts, Carol <carol_a_roberts@fws.gov> Tue, Aug 5, 2014 at 2:34 PM
To: "Fraser, Jody" <jody_fraser@fws.gov>, Pete Sorensen <pete_sorensen@fws.gov>, Tera Baird <tera_baird@fws.gov>

Very sad, very sad indeed. If bodies won't convince them, clearly there is nothing that will. I took the liberty of tracing routes that would be more likely to be used by Yuma Ridgway's rails, given their use of the Colorado River and Salton Sea basin. IMHO, projects along these areas may have the same effect as the two that already resulted in take. The path through the Imperial Valley is just one of many possibilities, whereas those through the desert seem like limited options.



- Carol

+

Carol A Roberts, Division Chief
Environmental Contaminants/Federal Projects
Carlsbad Fish and Wildlife Office
2177 Salk Avenue, Suite 250
Carlsbad, CA 92008

(760) 431-9440, ext. 271/ fax (760) 431-5901
24-hr spill phone number is 760-607-9768

carol_a_roberts@fws.gov

"The significant problems we have cannot be solved with the same level of thinking with which we created them." -Albert Einstein

[Quoted text hidden]

Zaun, Brenda <brenda_zaun@fws.gov> Tue, Aug 5, 2014 at 2:44 PM
To: "Fraser, Jody" <jody_fraser@fws.gov>

Jody, that is very disappointing, and must be especially frustrating to you after all of the work you (and others) have put in. I'm sorry to hear that, but I think you're moving forward in the right (only) direction you can so we'll have good data in the future and, hopefully, get some funding to research the information we don't have.

Take care,
Brenda

Brenda Zaun
Zone Biologist (I&M) / Invasive Species Strike Team Coordinator (AZ)
SW Arizona National Wildlife Refuge Complex
9300 E. 28th Street
Yuma, Arizona 85365
(office) 928/345-4911
(fax) 928/783-8611

On Tue, Aug 5, 2014 at 1:09 PM, Fraser, Jody <jody_fraser@fws.gov> wrote:
[Quoted text hidden]

Fitzpatrick, Lesley <lesley_fitzpatrick@fws.gov> Wed, Aug 6, 2014 at 8:33 AM
To: "Fraser, Jody" <jody_fraser@fws.gov>
Cc: "Anderson, Tom" <tom_w_anderson@fws.gov>, Christian Schoneman <christian_schoneman@fws.gov>, Nate Caswell <nate_caswell@fws.gov>, Terence Murphy <tmurphy@usbr.gov>, Carolyn Ronning <cronning@usbr.gov>, Brenda Zaun <brenda_zaun@fws.gov>, Scott Sewell <scott.sewell@wildlife.ca.gov>, "Konno, Eddy@Wildlife" <Eddy.Konno@wildlife.ca.gov>, Rick Francis <richard.francis@wildlife.ca.gov>, Karen Riesz <karen.riesz@wildlife.ca.gov>, Magdalena Rodriguez <Magdalena.Rodriguez@wildlife.ca.gov>, Pete Sorensen <Pete_Sorensen@fws.gov>, Tera Baird <Tera_Baird@fws.gov>, Felicia Sirchia <Felicia_Sirchia@fws.gov>, Jenness McBride <Jenness_McBride@fws.gov>, Carol Roberts <carol_a_roberts@fws.gov>, James Thiede <jthiede@blm.gov>, Susan Cooper <susan_e_cooper@fws.gov>, Jessica Rempel <jessica_rempel@fws.gov>, Ray Bransfield <ray_bransfield@fws.gov>

Jody: you gave it your best shot, that is all anyone can ask. I will continue to include the mortality risk in the 5-year review and the recovery plan, so it won't vanish from sight.

Lesley

On Tue, Aug 5, 2014 at 1:09 PM, Fraser, Jody <jody_fraser@fws.gov> wrote:
[Quoted text hidden]

Fraser, Jody <jody_fraser@fws.gov> Wed, Aug 6, 2014 at 10:03 AM
To: "Riesz, Karen@Wildlife" <Karen.Riesz@wildlife.ca.gov>

Thanks, Karen. We're certainly still working on solar projects, particularly in Imperial, so there will be other project-specific opportunities -- we may just have to approach it from a general marsh bird perspective.

We look forward to working more closely with you guys as well.
Take care,
Jody
[Quoted text hidden]

Fraser, Jody <jody_fraser@fws.gov> Wed, Aug 6, 2014 at 10:07 AM
To: "Zaun, Brenda" <brenda_zaun@fws.gov>

Thanks, Brenda. We'll keep doing what we can.
Looking forward to working with you again soon. Maybe next year we can help out on the marsh bird surveys ;)

Jody
[Quoted text hidden]

McBride, Jenness <jenness_mcbride@fws.gov> Wed, Aug 6, 2014 at 10:18 AM
To: Jody Fraser <jody_fraser@fws.gov>, Pete Sorensen <pete_sorensen@fws.gov>, Ken Corey <ken_corey@fws.gov>

How is this going to affect DRECP? BLM already objected to our inclusion of basic biological information on YCR population decline and dispersal in the desert. Dudek has calculated operational impacts to YCR (for all RE technologies combined), something like 60 birds plan-wide through 2040. I don't think BLM has noticed that yet....

---------- Forwarded message ----------
From: **Fraser, Jody** <jody_fraser@fws.gov>
Date: Tue, Aug 5, 2014 at 1:09 PM
Subject: Update on YCR and solar
[Quoted text hidden]

Zaun, Brenda <brenda_zaun@fws.gov> Wed, Aug 6, 2014 at 10:19 AM
To: "Fraser, Jody" <jody_fraser@fws.gov>

Absolutely! You need to come out here for marshbird surveys :-)

Brenda

Brenda Zaun
Zone Biologist (I&M) / Invasive Species Strike Team Coordinator (AZ)
SW Arizona National Wildlife Refuge Complex
9300 E. 28th Street
Yuma, Arizona 85365
(office) 928/345-4911
(fax) 928/783-8611

[Quoted text hidden]

Sorensen, Pete <pete_sorensen@fws.gov> Wed, Aug 6, 2014 at 12:17 PM
To: "McBride, Jenness" <jenness_mcbride@fws.gov>
Cc: Jody Fraser <jody_fraser@fws.gov>, Ken Corey <ken_corey@fws.gov>

i cant believe all the hocus pocus #s being thrown around--available evidence easily could be interpreted to support a much higher estimate, but others, like Ren and BLM, have their head buried in the sand

[Quoted text hidden]

Riesz, Karen@Wildlife <Karen.Riesz@wildlife.ca.gov> Thu, Aug 7, 2014 at 8:12 AM
To: "Fraser, Jody" <jody_fraser@fws.gov>

Let me know if I can help in any way.

~Karen

Karen A. Riesz

Environmental Scientist

Region 6 Inlands Deserts

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Karen.Riesz@wildlife.ca.gov

From: Fraser, Jody [mailto:jody_fraser@fws.gov]
Sent: Wednesday, August 06, 2014 10:04 AM
To: Riesz, Karen@Wildlife
Subject: Re: Update on YCR and solar

[Quoted text hidden]

Rodriguez, Magdalena@Wildlife <Magdalena.Rodriguez@wildlife.ca.gov> Mon, Aug 11, 2014 at 1:44 PM
To: "Fraser, Jody" <jody_fraser@fws.gov>

Well that's a bummer. Sorry to hear that all your effort was For Not.

Magdalena

From: Fraser, Jody [mailto:jody_fraser@fws.gov]
Sent: Tuesday, August 05, 2014 1:10 PM
To: Anderson, Tom; Christian Schoneman; Nate Caswell; Terence Murphy; Carolyn Ronning; Lesley Fitzpatrick; Brenda Zaun; Sewell, Scott@Wildlife; Konno, Eddy@Wildlife; Francis, Richard@Wildlife; Riesz, Karen@Wildlife; Rodriguez, Magdalena@Wildlife
Cc: Pete Sorensen; Tera Baird; Felicia Sirchia; Jenness McBride; Carol Roberts; James Thiede; Susan Cooper; Jessica Rempel; Ray Bransfield

Subject: Update on YCR and solar

Hi everyone,

[Quoted text hidden]

From: Thomas Dietsch
To: Amedee Brickey
Subject: Bird Mortality Photos
Date: Wednesday, August 13, 2014 4:28:47 PM
Attachments: COLO_041814_1.JPG
20130508_094904.jpg
Desert sunlight mortality.jpg
ISECS - WEGR Mortality 06-20-13 .pdf

Hi Amedee,

Here are a few bird mortality photos I have in my archive. I also have picture of various passerines, though nothing as connected to the solar as these. There are a number underneath powerlines, if that might be helpful. I think this is a different Clapper Rail than the one you have. I also added a loon picture just because they are such stunning birds, even in death, and there are two pictures of Western Grebes with associated smears on the panels. The second with the bird still lying on the panel is within the ISECS mortality report and would need to be extracted. I couldn't find any pictures of the Peregrine. You might check with CEC. Let me know if you come up with anything.

Thanks, Tom

****

Thomas Dietsch, PhD.
Migratory Bird Biologist
US Fish and Wildlife Service, Region 8
Carlsbad Fish and Wildlife Office
2177 Salk Avenue, Suite 250
Carlsbad, CA 92008
(760) 431-9440 Ext. 214

****

From:	Fraser, Jody
To:	Amedee Brickey
Cc:	Thomas Dietsch; Pete Sorensen
Subject:	Fwd: Desert Sunlight mortality monitoring
Date:	Monday, August 18, 2014 10:09:53 AM
Attachments:	20140716_Desert Sunlight Fatality Monitoring Plan CLEAN 20140611_FWS comments.docx

Hi Amedee,
Just trying to figure out where we are on this. After we sent these comments up to you, I think you'd mentioned holding off on responding until after a meeting with industry. But I think that happened some time ago and I think we should get this moving again. I suspect they're almost operational out there.
Thanks,
Jody

---------- Forwarded message ----------
From: **Fraser, Jody** <jody_fraser@fws.gov>
Date: Wed, Jul 16, 2014 at 5:24 PM
Subject: Desert Sunlight mortality monitoring
To: Amedee Brickey <amedee_brickey@fws.gov>
Cc: Thomas Dietsch <thomas_dietsch@fws.gov>, Pete Sorensen <Pete_Sorensen@fws.gov>, Tera Baird <Tera_Baird@fws.gov>

Hi Amedee,
Tom and I sifted through what WEST sent and attached are our comments. Bottom line -- they're still proposing 20% every 14 or 25 days depending on the season. We still find this unacceptable as it does not yet incorporate the carcass persistence trials that are ongoing at the site.

Please give it a look -- we left some of the comments in that they either didn't address; addressed and we don't agree; or remain outstanding pending additional discussions. Once you've had a chance to review, I'd like to be the one to send it back to WEST so we can try to maintain some semblance of field level lead. Does that seem fair? Even though we all know Amanda will be calling you :)

Sorry it took awhile to get to this, but other issues have been bearing down on us.
Talk soon,
Jody

--
Jody Fraser, Biologist
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760.322.4648 fax
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--
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760.322.2070 ph x207
760.322.4648 fax
jody_fraser@fws.gov

From: Heather Beeler
To: Thomas Dietsch
Subject: FW: Monthly SPUT report for Desert Sunlight, permit numbers MB20979B-1 and MB20960B-3
Date: Monday, August 18, 2014 3:18:53 PM
Attachments: R8_SPUT_mortality reporting_allyears_4Aug2014.xlsx
Avian_Bat_Mortality_20140804.pdf

---

fyi

****

Heather Beeler
Eagle Permit Coordinator
USFWS Pacific Southwest Region
2800 Cottage Way W-2606
Sacramento, CA 95825
(916) 414-6651
(916) 414-6486 (fax)
****

From: crissy slaughter [mailto:criffy@hotmail.com]
Sent: Monday, August 04, 2014 2:46 PM
To: jody_fraser@fws.gov
Cc: Kathy Simon; Brooks Corvus; Brian Sandstrom; Amanda Beck; tamara.haynes@firstsolar.com; armand.gonzales@wildlife.ca.gov; eduardo_nieves@fws.gov; Ashley H; heather_beeler@fws.gov; Thomas Dietsch; Erin Lockward; fmcmenimen@blm.gov; cperry@blm.gov; pksharpgarcia@gmail.com
Subject: Monthly SPUT report for Desert Sunlight, permit numbers MB20979B-1 and MB20960B-3

Hello All,

Attached is the monthly SPUT table and updated avian mortality figure for Desert Sunlight, permit numbers MB20979B-1 and MB20960B-3.

Thank you,
Crissy Slaughter

From: Fesnock, Amy
To: Jody Fraser
Subject: Fwd: Desert Sunlight Fatality Monitoring revisions
Date: Wednesday, August 20, 2014 4:56:35 PM
Attachments: 20140716_Desert Sunlight Fatality Monitoring Plan CLEAN 20140611_FWS comments.docx

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Hey Jody-
Hope all is well... Who in BLM is working on this with you? Kim Marsden? Larry LaPre? Mark Massar? Or could it be no one?

I am very concerned that Sunlight is not giving a good faith effort in their monitoring plan, and I really want to make sure that BLM is doing are part to ensure we get good data by which to make more informed decisions and the ability to actually implement adaptive management. It seems to me that route this plan is going is to mot have enough data as to make it inconclusive enough to make any recommended changes. Such kind of subversion cannot be tolerated.

Let me know if I need to engage, will you?

thanks!
A

---------- Forwarded message ----------
From: **Brickey, Amedee** <amedee_brickey@fws.gov>
Date: Wed, Aug 20, 2014 at 4:48 PM
Subject: Fwd: Desert Sunlight Fatality Monitoring revisions
To: Amy Fesnock <afesnock@blm.gov>

FYI

Amedee Brickey
Deputy Chief, Migratory Birds
Pacific Southwest Region
2800 Cottage Way W-2606
Sacramento, CA 95825
Phone: (916) 414-6480

" I want to leave a committed life behind" - MLK

---------- Forwarded message ----------
From: **Fraser, Jody** <jody_fraser@fws.gov>
Date: Tue, Aug 19, 2014 at 3:24 PM
Subject: Re: Desert Sunlight Fatality Monitoring revisions
To: Paul Rabie <prabie@west-inc.com>, Therese Carpenter <Therese.Carpenter@firstsolar.com>
Cc: "Brickey, Amedee" <amedee_brickey@fws.gov>, "Perkins, Winifred" <Winifred.Perkins@nexteraenergy.com>, "Field, Jennifer"

<JENNIFER.FIELD@nexteraenergy.com>, "Nagy, Laura" <Laura.Nagy@tetratech.com>, Wally Erickson <werickson@west-inc.com>, Thomas Dietsch <thomas_dietsch@fws.gov>, Pete Sorensen <Pete_Sorensen@fws.gov>

All,
Our sincere apologies for the delay in responding to your submittal of the revised mortality monitoring plan for the Desert Sunlight project. As you know, we have been working internally and with the solar industry to clarify monitoring objectives and methods. The team drafting the comprehensive mortality monitoring protocol has begun work on the product, but it is not expected to be available for a few more months. That being said, we would like to work with you go begin monitoring at the Desert Sunlight site as soon as possible given the project is largely operational, correct? The crux of the most recent plan submitted appears to be the percent of the site covered, the frequency based on carcass persistence, and the day vs. night timing of mortalities. Please give our comments a look and let's have a call at your earliest convenience.
Thanks,
Jody

On Wed, Jun 11, 2014 at 5:07 PM, Paul Rabie <prabie@west-inc.com> wrote:

> All,
>
> Please find a revised copy of the fatality monitoring plan for the Desert Sunlight Solar Farm attached, in both redline and clean versions. We have responded to USFWS comments from February either with edits or within the comments themselves (redline version). In addition, we have incorporated more recent guidance that has been transmitted by the Service.
>
> We would like to emphasize that the goal of this document is to get an interim monitoring program in place, and so it is strictly a monitoring protocol. As such, it lacks some features that one might expect in a BBCS, most notably, an adaptive management section.
>
> Thank you for your input and guidance on previous versions of the plan.
>
> Regards,
>
> **Paul Rabie, PhD.**
>
> **Biometrician**
>
> Environmental & Statistical Consultants
> 415 W 17th, Ste. 200
> Cheyenne, WY 82001
> (307) 634-1756
> Direct - (307) 771-2910
> Cell - (612) 860-0415
> www.west-inc.com

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760.322.4648 fax
jody_fraser@fws.gov

--
****
Amy L. Fesnock
CA BLM Wildlife and T&E Lead
2800 Cottage Way, W-1928
Sacramento, CA 95825

afesnock@blm.gov
916-978-4646

From:	Lehong Chow
To:	eduardo_nieves@fws.gov; jody_fraser@fws.gov; cperry@blm.gov; fmcmenimen@blm.gov; thomas_dietsch@fws.gov
Cc:	brooks@corvusecological.com; criffy@hotmail.com; kathy@ironwoodconsultinginc.com; therese.carpenter@firstsolar.com; pksharpgarcia@gmail.com; admin@corvusecological.com; bjerome30@hotmail.com
Subject:	DSL avian incident BRCO 8/21/14
Date:	Thursday, August 21, 2014 3:42:21 PM
Attachments:	BHCO_20140821_1.jpg BHCO_20140821_2.jpg BHCO_20140821_3.jpg BHCO_20140821_5.jpg

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Hello,

An adult male brown-headed cowbird carcass was found within bird netting of stored unused posts near block 1 array 8 just north of the substation. The nearest project component is the fenced storage area with additional unused equipment. The solar arrays are approximately 70m from the location of the carcass. Photos are attached.

If you have further inquiries about this mortality, please feel free to contact me. (949)423-8770

Thanks,
Lehong

Lehong Chow
Biologist
Ironwood Consulting, Inc
Subcontractor

P: (909)798-0330 ext. 5
C: (626)375-1064
E: lchow@ironwoodbio.com

From:	crissy slaughter
To:	jody_fraser@fws.gov
Cc:	Kathy Simon; Brooks Corvus; Brian Sandstrom; tamara.haynes@firstsolar.com; armand.gonzales@wildlife.ca.gov; eduardo_nieves@fws.gov; Ashley H; heather_beeler@fws.gov; Thomas Dietsch; Erin Lockward; fmcmenimen@blm.gov; cperry@blm.gov; pksharpgarcia@gmail.com; davesterner@firstsolar.com; Therese_Carpenter; erin_dean@fws.gov
Subject:	Monthly SPUT report for Desert Sunlight, permit numbers MB20979B-1 and MB20960B-3
Date:	Tuesday, September 02, 2014 12:15:17 PM
Attachments:	R8_SPUT_mortality reporting_DS_2Sept14_macro.xlsx Avian_Bat_Mortality_20140901.pdf

Hello All,

Attached is the monthly SPUT table and updated avian mortality figure for Desert Sunlight, permit numbers MB20979B-1 and MB20960B-3.

Thank you,
Crissy Slaughter

From: Fraser, Jody
To: Amedee Brickey; Thomas Dietsch; Pete Sorensen
Subject: Fwd: Desert Sunlight Fatality Monitoring revisions
Date: Tuesday, September 09, 2014 9:49:09 AM
Attachments: 20140716_Desert Sunlight Fatality Monitoring Plan CLEAN 20140611_FWS comments.docx

---

Hey Amedee and Tom,
Any ideas why there's been radio silence on FS's end on this? It's been 3-weeks and nuthin... Have they been talking to you Amedee? Thoughts on next moves?
Jody

---------- Forwarded message ----------
From: **Fraser, Jody** <jody_fraser@fws.gov>
Date: Tue, Aug 19, 2014 at 3:24 PM
Subject: Re: Desert Sunlight Fatality Monitoring revisions
To: Paul Rabie <prabie@west-inc.com>, Therese Carpenter <Therese.Carpenter@firstsolar.com>
Cc: "Brickey, Amedee" <amedee_brickey@fws.gov>, "Perkins, Winifred" <Winifred.Perkins@nexteraenergy.com>, "Field, Jennifer" <JENNIFER.FIELD@nexteraenergy.com>, "Nagy, Laura" <Laura.Nagy@tetratech.com>, Wally Erickson <werickson@west-inc.com>, Thomas Dietsch <thomas_dietsch@fws.gov>, Pete Sorensen <Pete_Sorensen@fws.gov>

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Jody

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Thank you for your input and guidance on previous versions of the plan.

Regards,

Paul Rabie, PhD.

Biometrician

Environmental & Statistical Consultants
415 W 17th, Ste. 200
Cheyenne, WY 82001
(307) 634-1756
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www.west-inc.com

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--
Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
U.S. Fish and Wildlife Service
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
760.322.4648 fax
jody_fraser@fws.gov

--
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jody_fraser@fws.gov

From: Gregory, Chris
To: Manuela Huso; Chris Nicolai; Thomas Dietsch
Subject: Fwd: Notes from meeting
Date: Tuesday, September 16, 2014 1:47:47 PM
Attachments: Desert Sunlight BioBlitz Lessons Learned Pagel 2013.pdf

---

BioBlitz discussed from today's call.

From: Pagel, Joel
To: Thomas Dietsch
Subject: photos
Date: Friday, September 19, 2014 1:18:01 PM
Attachments: bioblitz 2013 desert sunlight 026.JPG
bioblitz 2013 desert sunlight 002.JPG
bioblitz 2013 desert sunlight 008.JPG
bioblitz 2013 desert sunlight 015.JPG
bioblitz 2013 desert sunlight 028.JPG

From: Marsden, Kim
To: Thomas Dietsch
Subject: Fwd: Quartzite 2014 Avian Work Plan Line Transect Modification Request
Date: Wednesday, September 24, 2014 12:27:15 PM
Attachments: QZ 2014 Line Transect Modifications_Memo.docx

---

fyi
---------- Forwarded message ----------
From: **Tonya Moore** <tonya@ironwoodbio.com>
Date: Wed, Sep 24, 2014 at 9:26 AM
Subject: Quartzite 2014 Avian Work Plan Line Transect Modification Request
To: "Marsden, Kim" <kmarsden@blm.gov>, Roy Skinner <Roy.Skinner@firstsolar.com>, "Rodriguez, Magdalena@Wildlife" <Magdalena.Rodriguez@wildlife.ca.gov>, "Fraser, Jody" <jody_fraser@fws.gov>

Good morning everyone,

For the 2014 avian surveys, Ironwood is recommending modifying the avian transects from the straight lines to more of a triangle method to ensure the surveyors could observe more area. We kept the original locations of the transects on site to ensure that we could compare results with older data. Thus this change did not affect the effort or costs but does give more thorough coverage of the site.

I have attached a memo sent to me, per my request, explaining the new transect information with a map depicting this change. If you believe this method should not be pursued please let us know soon so that we can return to the original methodology.

The avian surveys have been occurring every month as outlined within the avian work plan and we are gearing up to ensure that another round of golden eagle surveys will be started this winter season.

Kim, I was not sure how you wanted this “new” transect information filed for BLM purposes. Should we attach an update to the exiting work plan or write the memo as an amendment and attach to original? Please instruct me as to how you would like to see the information if acceptable.

If you have misplaced the original work plans (dated 042814) please inform me and I will send you a link to the information.

Let me know if anything else is needed.

Have a positively great fall day!

Tonya Moore

Ironwood Consulting, Inc

(760) 646-6477

tonya@ironwoodbio.com

"Love, laughter and sunshine!"

--

Kim Marsden
Natural Resource Specialist
Bureau of Land Management
California Desert District
Renewable Energy Coordinating Office
22835 Calle San Juan de los Lagos
Moreno Valley, CA 92553
951-697-5223

> ***In spring at the end of the day you should smell like dirt~ Margaret Atwood***

From: Fraser, Jody
To: Thomas Dietsch; Joel Pagel; Tera Baird
Subject: Fwd: Quartzite 2014 Avian Work Plan Line Transect Modification Request
Date: Thursday, September 25, 2014 8:14:51 AM
Attachments: QZ 2014 Line Transect Modifications_Memo.docx

Any thoughts are more than welcome -- encouraged, in fact ;)

---------- Forwarded message ----------
From: **Tonya Moore** <tonya@ironwoodbio.com>
Date: Wed, Sep 24, 2014 at 9:26 AM
Subject: Quartzite 2014 Avian Work Plan Line Transect Modification Request
To: "Marsden, Kim" <kmarsden@blm.gov>, Roy Skinner <Roy.Skinner@firstsolar.com>, "Rodriguez, Magdalena@Wildlife" <Magdalena.Rodriguez@wildlife.ca.gov>, "Fraser, Jody" <jody_fraser@fws.gov>

Good morning everyone,

For the 2014 avian surveys, Ironwood is recommending modifying the avian transects from the straight lines to more of a triangle method to ensure the surveyors could observe more area. We kept the original locations of the transects on site to ensure that we could compare results with older data. Thus this change did not affect the effort or costs but does give more thorough coverage of the site.

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The avian surveys have been occurring every month as outlined within the avian work plan and we are gearing up to ensure that another round of golden eagle surveys will be started this winter season.

Kim, I was not sure how you wanted this “new” transect information filed for BLM purposes. Should we attach an update to the exiting work plan or write the memo as an amendment and attach to original? Please instruct me as to how you would like to see the information if acceptable.

If you have misplaced the original work plans (dated 042814) please inform me and I will send you a link to the information.

Let me know if anything else is needed.

Have a positively great fall day!

Tonya Moore

Ironwood Consulting, Inc

(760) 646-6477

tonya@ironwoodbio.com

"Love, laughter and sunshine!"

--
Jody Fraser, Biologist
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jody_fraser@fws.gov

From: Thomas Dietsch
To: Joel Pagel
Cc: Jody Fraser
Subject: QZ 2014 Line Transect Modifications_Memo.docx
Date: Tuesday, September 30, 2014 1:03:19 PM
Attachments: QZ 2014 Line Transect Modifications_Memo.docx

Hi Jeep,

I gave their modification request another read, This time I read the text rather than just looking at the pictures! I think they do a good job addressing the questions that we discussed and actually increase the total area covered. The end points for each leg of the triangle are separated by 250 m. There is still some potential for overlap for birds >100m, which I can ask how they will address.

Let me know if you have any thoughts. Otherwise, I'll reply with an affirmative response with a question or two. I'll also ask for a summary of previous surveys.

Thanks, Tom

From: Thomas Dietsch
To: Amy_Fesnock@blm.gov
Subject: Desert Sunlight SPUT report and Solar Avian Interactions presentation
Date: Tuesday, September 30, 2014 2:59:31 PM
Attachments: Dietsch_Solar Avian Interactions_AOU_2014_09_24.pdf
Avian_Bat_Mortality_20140901.pdf

Hi Amy,

I've attached the Desert Sunlight SPUT report and the presentation that I gave at the American Ornithological Union meeting last week. Keep in mind that most of the data in the presentation and all of the data in the SPUT report are incidental reports. One of the slides gives a summary of the caveats that I associate with this data. The data for PV projects comes from 3 different projects. Though the majority of the data come from Desert Sunlight, the waterbird mortalities are consistent across the other projects. Please let me know if you have any questions about either the report or the presentation.

I had a call with Jody Fraser and Pete Sorenson this morning and we discussed the Desert Sunlight BBCS. As you probably know, we provided comments back to the project proponent on the latest version of the BBCS last month, but haven't heard anything from them since. Everyone is available if you would like to schedule a meeting to discuss our comments and recommendations for the BBCS.

Please let us know if there is anything that we can do to help.

Thanks, Tom

****

Thomas Dietsch, PhD.
Migratory Bird Biologist
US Fish and Wildlife Service, Region 8
Carlsbad Fish and Wildlife Office
2177 Salk Avenue, Suite 250
Carlsbad, CA 92008
(760) 431-9440 Ext. 214

****

From: Fraser, Jody
To: Amy Fesnock
Subject: Fwd: Desert Sunlight Fatality Monitoring revisions
Date: Wednesday, October 01, 2014 1:59:26 PM
Attachments: 20140716_Desert Sunlight Fatality Monitoring Plan CLEAN 20140611_FWS comments.docx

---

Here you go...

---------- Forwarded message ----------
From: **Fraser, Jody** <jody_fraser@fws.gov>
Date: Tue, Aug 19, 2014 at 3:24 PM
Subject: Re: Desert Sunlight Fatality Monitoring revisions
To: Paul Rabie <prabie@west-inc.com>, Therese Carpenter <Therese.Carpenter@firstsolar.com>
Cc: "Brickey, Amedee" <amedee_brickey@fws.gov>, "Perkins, Winifred" <Winifred.Perkins@nexteraenergy.com>, "Field, Jennifer" <JENNIFER.FIELD@nexteraenergy.com>, "Nagy, Laura" <Laura.Nagy@tetratech.com>, Wally Erickson <werickson@west-inc.com>, Thomas Dietsch <thomas_dietsch@fws.gov>, Pete Sorensen <Pete_Sorensen@fws.gov>

All,
Our sincere apologies for the delay in responding to your submittal of the revised mortality monitoring plan for the Desert Sunlight project. As you know, we have been working internally and with the solar industry to clarify monitoring objectives and methods. The team drafting the comprehensive mortality monitoring protocol has begun work on the product, but it is not expected to be available for a few more months. That being said, we would like to work with you go begin monitoring at the Desert Sunlight site as soon as possible given the project is largely operational, correct? The crux of the most recent plan submitted appears to be the percent of the site covered, the frequency based on carcass persistence, and the day vs. night timing of mortalities. Please give our comments a look and let's have a call at your earliest convenience.
Thanks,
Jody

On Wed, Jun 11, 2014 at 5:07 PM, Paul Rabie <prabie@west-inc.com> wrote:

> All,
>
> Please find a revised copy of the fatality monitoring plan for the Desert Sunlight Solar Farm attached, in both redline and clean versions. We have responded to USFWS comments from February either with edits or within the comments themselves (redline version). In addition, we have incorporated more recent guidance that has been transmitted by the Service.
>
> We would like to emphasize that the goal of this document is to get an interim monitoring program in place, and so it is strictly a monitoring protocol. As such, it lacks some features that one might expect in a BBCS, most notably, an adaptive management section.
>
> Thank you for your input and guidance on previous versions of the plan.
>
> Regards,

Paul Rabie, PhD.

Biometrician

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--
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jody_fraser@fws.gov

From:	Baird, Tera
To:	Pete Sorensen
Cc:	Thomas Dietsch; Jody Fraser
Subject:	Fwd: Genesis Solar, LLC Monthly Avian Mortality and Injury Report for September 2014 - SPUT Permit #MB16465B-2
Date:	Friday, October 03, 2014 12:29:51 PM
Attachments:	image003.png GSEP_R8_SPUT_mortality reporting _through September 31 2014 rev.xlsx 20140929_ISEGS_R8_SPUT_mortality reporting.xlsx 20140902_attach_R8_SPUT_mortality reporting_DS.xlsx

---

Genesis, ISEGS, Desert Sunlight SPUT .

Campo Verde just received a SPUT and we don't have an updated spreadsheet.
ISEC - South sends monthly reports (no "approved" BBCS or SPUT to handle carcasses) The monthly reports are on the K:drive.

Would you like a link to the ISEC- South reports via google drive?

Tera Keeler Baird
Biologist
777 East Tahquitz Canyon Way, Suite 208
Palm Springs, California 92262
(760) 322-2070 extension 217

---------- Forwarded message ----------
From: **Baird, Tera** <tera_baird@fws.gov>
Date: Wed, Oct 1, 2014 at 8:52 AM
Subject: Fwd: Genesis Solar, LLC Monthly Avian Mortality and Injury Report for September 2014 - SPUT Permit #MB16465B-2
To: Thomas Dietsch <thomas_dietsch@fws.gov>, Jody Fraser <jody_fraser@fws.gov>

Tera Keeler Baird
Biologist
777 East Tahquitz Canyon Way, Suite 208
Palm Springs, California 92262
(760) 322-2070 extension 217

---------- Forwarded message ----------
From: **Mosley, Charlyn** <Charlyn.Mosley@nexteraenergy.com>
Date: Tue, Sep 30, 2014 at 2:40 PM
Subject: Genesis Solar, LLC Monthly Avian Mortality and Injury Report for September 2014 - SPUT Permit #MB16465B-2
To: "erin_dean@fws.gov" <erin_dean@fws.gov>, "heather_beeler@fws.gov" <heather_beeler@fws.gov>, "Tera_Baird@fws.gov" <Tera_Baird@fws.gov>,

"Armand.Gonzales@wildlife.ca.gov" <Armand.Gonzales@wildlife.ca.gov>
Cc: "Mazur, Susan" <Susan.Mazur@fpl.com>, "Stokes, Idayna"
<Idayna.Stokes@nexteraenergy.com>, "Goguts, Luke" <Luke.Goguts@nexteraenergy.com>

In accordance with Condition H of Permit #MB164658-2, this email will serve as notification that there were 2 mortalities observed in the month of September at the Genesis Solar, LLC facility. Please do not hesitate to contact me with any questions you may have.

Thank you,

Charlyn Mosley

Sr PGD Environmental Specialist

Email: charlyn.mosley@nexteraenergy.com

office phone: 760-921-1401

Cell phone: 760-831-2651

FAX: 760-921-1168



From: Fraser, Jody
To: Amy Fesnock; Kim Marsden; Magdalena Rodriguez; Pete Sorensen; Joel Pagel
Subject: Fwd: Desert Sunlight PCM plan
Date: Monday, October 06, 2014 7:18:38 AM
Attachments: Desert Sunlight PCM memo 20141003.docx
Desert Sunlight Fatality Monitoring Plan_WEST 20141003 CLEAN.docx
Desert Sunlight Fatality Monitoring Plan_WEST 20141003.DOCX

FYI

---------- Forwarded message ----------
From: **Paul Rabie** <prabie@west-inc.com>
Date: Sun, Oct 5, 2014 at 7:47 PM
Subject: Desert Sunlight PCM plan
To: "Fraser, Jody" <jody_fraser@fws.gov>, "Brickey, Amedee" <amedee_brickey@fws.gov>, Eric Davis <eric_davis@fws.gov>, Tera Baird <Tera_Baird@fws.gov>, Thomas Dietsch <thomas_dietsch@fws.gov>, Pete Sorensen <Pete_Sorensen@fws.gov>
Cc: Therese Carpenter <Therese.Carpenter@firstsolar.com>, Beth Deane <Beth.Deane@firstsolar.com>, "Perkins, Winifred" <Winifred.Perkins@nexteraenergy.com>, "Field, Jennifer" <JENNIFER.FIELD@nexteraenergy.com>, Wally Erickson <werickson@west-inc.com>, Ken Levenstein <klevenstein@west-inc.com>, Dave Sterner <Dave.Sterner@firstsolar.com>, Laura Abram <laura.abram@firstsolar.com>, John Sakers <John.Sakers@firstsolar.com>, David Lazerwitz <dlazerwitz@fbm.com>

Please find attached a revision of the Desert Sunlight PCM plan (both redline and clean copies), and a brief memo regarding same.

Paul Rabie, PhD.
ESA Certified Ecologist

Biometrician

Environmental & Statistical Consultants
415 W 17th, Ste. 200
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U.S. Fish and Wildlife Service
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262

760.322.2070 ph x207
760.322.4648 fax
jody_fraser@fws.gov

From: Fraser, Jody
To: Pete Sorensen
Subject: Fwd: Monthly SPUT report for Desert Sunlight, permit numbers MB20979B-1 and MB20960B-3
Date: Monday, October 06, 2014 7:20:32 AM
Attachments: DS_3Oct14_R8_SPUT_mortality reporting_correct.xlsx
Avian_Bat_Mortality_20141003.pdf

Up-to-date SPUT rpt for Sunlight...

---------- Forwarded message ----------
From: **crissy slaughter** <criffy@hotmail.com>
Date: Fri, Oct 3, 2014 at 4:48 PM
Subject: Monthly SPUT report for Desert Sunlight, permit numbers MB20979B-1 and MB20960B-3
To: "jody_fraser@fws.gov" <jody_fraser@fws.gov>
Cc: Kathy Simon <kathy@ironwoodconsultinginc.com>, Brooks Corvus <brooks@corvusecological.com>, Brian Sandstrom <bjerome30@hotmail.com>, "tamara.haynes@firstsolar.com" <tamara.haynes@firstsolar.com>, "armand.gonzales@wildlife.ca.gov" <armand.gonzales@wildlife.ca.gov>, "eduardo_nieves@fws.gov" <eduardo_nieves@fws.gov>, Ashley H <ashley@cvstrat.com>, "heather_beeler@fws.gov" <heather_beeler@fws.gov>, Thomas Dietsch <thomas_dietsch@fws.gov>, Erin Lockward <admin@corvusecological.com>, "fmcmenimen@blm.gov" <fmcmenimen@blm.gov>, "cperry@blm.gov" <cperry@blm.gov>, "pksharpgarcia@gmail.com" <pksharpgarcia@gmail.com>, "dave.sterner@firstsolar.com" <davesterner@firstsolar.com>, Therese Carpenter <therese.carpenter@firstsolar.com>, "erin_dean@fws.gov" <erin_dean@fws.gov>, "ryan.magill2@nexteraenergy.com" <ryan.magill2@nexteraenergy.com>, "myra.gardiner@nexteraenergy.com" <myra.gardiner@nexteraenergy.com>, "john.sakers@firstsolar.com" <john.sakers@firstsolar.com>

Hello All,

Attached is the monthly SPUT table and updated avian mortality figure for Desert Sunlight, permit numbers MB20979B-1 and MB20960B-3.

Thank you,

Crissy Slaughter

Ironwood Consulting, Inc.

--
Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
U.S. Fish and Wildlife Service
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
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760.322.4648 fax
jody_fraser@fws.gov

From: Fraser, Jody
To: Amy Fesnock; Pete Sorensen; Tera Baird
Subject: Fwd: DSL Avian Incidents 10/8
Date: Thursday, October 09, 2014 9:30:19 AM
Attachments: AMCO_100814_1.JPG
RUDU_100814_1.JPG
AUWA_100814_2.JPG
AMCO_100814_8.JPG
WISN_100814_2.JPG
WISN_100814_3.JPG

More gen-tie mortalities...

---------- Forwarded message ----------
From: **brian sandstrom** <bjerome30@hotmail.com>
Date: Wed, Oct 8, 2014 at 8:45 PM
Subject: DSL Avian Incidents 10/8
To: "eduardo_nieves@fws.gov" <eduardo_nieves@fws.gov>, "jody_fraser@fws.gov" <jody_fraser@fws.gov>, "cperry@blm.gov" <cperry@blm.gov>, "fmcmenimen@blm.gov" <fmcmenimen@blm.gov>, "thomas_dietsch@fws.gov" <thomas_dietsch@fws.gov>
Cc: brooks hart <brooks@corvusecological.com>, crissy slaughter <criffy@hotmail.com>, kathy simon <kathy@ironwoodconsultinginc.com>, therese carpenter <therese.carpenter@firstsolar.com>, "pksharpgarcia@gmail.com" <pksharpgarcia@gmail.com>, "admin@corvusecological.com" <admin@corvusecological.com>, "dave.sterner@firstsolar.com" <dave.sterner@firstsolar.com>

Hello everyone,

The carcasses of an American Coot, Ruddy Duck and an Audobon's Warbler were found today along the Desert Sunlight Gen-tie that runs parallel to Kaiser Road. The quarterly gen-tie invasive weed survey was being conducted and the carcasses were found incidentally in the survey area. All carcasses were fresh and intact. They were all collected and stored in the bio freezer.

The wings of a Wilson's Snipe were found on the Desert Sunlight Solar Farm site. Both wings were hanging from the site's perimeter fence north of block 14, array 18. White wash was observed below the wings. The wings were collected and stored in the bio freezer.

If you have any questions please contact me.

Thanks,

Brian Sandstrom
949-423-8770
bjerome30@hotmail.com

--
Jody Fraser, Biologist
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Palm Springs, CA 92262
760.322.2070 ph x207
760.322.4648 fax
jody_fraser@fws.gov

From: Fraser, Jody
To: Pete Sorensen; Tera Baird
Subject: Fwd: DSL Avian Incidents 10/9
Date: Friday, October 10, 2014 8:51:37 AM
Attachments: EAGR_100914_1.JPG
EAGR_100914_9.JPG
AMCO_100914_1.JPG
AMCO_100914_2.JPG
AMCO_100914_3.JPG

Poor little guy(s).

---------- Forwarded message ----------
From: **brian sandstrom** <bjerome30@hotmail.com>
Date: Thu, Oct 9, 2014 at 10:47 PM
Subject: DSL Avian Incidents 10/9
To: "eduardo_nieves@fws.gov" <eduardo_nieves@fws.gov>, "jody_fraser@fws.gov" <jody_fraser@fws.gov>, "cperry@blm.gov" <cperry@blm.gov>, "fmcmenimen@blm.gov" <fmcmenimen@blm.gov>, "thomas_dietsch@fws.gov" <thomas_dietsch@fws.gov>
Cc: brooks hart <brooks@corvusecological.com>, crissy slaughter <criffy@hotmail.com>, kathy simon <kathy@ironwoodconsultinginc.com>, therese carpenter <therese.carpenter@firstsolar.com>, "pksharpgarcia@gmail.com" <pksharpgarcia@gmail.com>, "admin@corvusecological.com" <admin@corvusecological.com>, "dave.sterner@firstsolar.com" <dave.sterner@firstsolar.com>

Hello everyone,

The carcass of an Eared Grebe was found between the security fences at the south pond. The carcass was collected and stored in the bio freezer. Also found at the south pond was an American Coot that was alive but exhausted on the outside of the pond security fence. The AMCO didn't have any obvious trauma and when it was placed in a bucket with water it floated normally and drank water. It was taken to Lake Tamarisk to be released but when set in the water it was obvious it had internal issues. The bird was disoriented and swam against the shore. Its strength slowly left and twenty minutes after being released it had died. The carcass was collected and stored in the bio freezer.

If you have any questions please contact me.

Thanks,

Brian Sandstrom
949-423-8770
bjerome30@hotmail.com

--
Jody Fraser, Biologist

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jody_fraser@fws.gov

From:	Fraser, Jody
To:	amedee_brickey@fws.gov; afesnock@blm.gov; kmarsden@blm.gov; andrea.martine@energy.ca.gov; thomas_dietsch@fws.gov; tera_baird@fws.gov; pete_sorensen@fws.gov; carol.watson@energy.ca.gov; magdalena.rodriguez@wildlife.ca.gov; joel_pagel@fws.gov; jody_fraser@fws.gov
Subject:	Re: [Update] Interagency discussion - Sunlight and Genesis
Date:	Tuesday, October 14, 2014 8:24:38 AM
Attachments:	20140819_Desert Sunlight Fatality Monitoring Plan_revised June_July_FWS comments.docx

Sorry...doesn't look like that attachment took. Here it is.

On Tue, Oct 14, 2014 at 8:23 AM, jody_fraser@fws.gov <jody_fraser@fws.gov> wrote:

> Hi all,
> Just a reminder we're talking this morning about mortality monitoring on solar. I've attached our comments on the Sunlight plan. Sorry I didn't send this sooner.
> Talk to you in a bit.
> Jody
>
> **Interagency discussion - Sunlight and Genesis**
>
> Looking for consensus among agencies on mortality monitoring methods in the interim as FWS "product team" develops a standardized protocol.
>
> When Tue Oct 14, 2014 10am – 11:30am Pacific Time
>
> Where 866.763.2732; 8565940# (map)
>
> Who
> - Jody Fraser - creator
> - Pete Sorensen
> - Amedee Brickey
> - andrea.martine@energy.ca.gov
> - Thomas Dietsch
> - magdalena.rodriguez@wildlife.ca.gov
> - carol.watson@energy.ca.gov
> - Kim Marsden
> - Amy Fesnock
> - Joel Pagel
> - Tera Baird

--
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760.322.4648 fax
jody_fraser@fws.gov

From: Fraser, Jody
To: amedee_brickey@fws.gov; afesnock@blm.gov; kmarsden@blm.gov; andrea.martine@energy.ca.gov; thomas_dietsch@fws.gov; tera_baird@fws.gov; pete_sorensen@fws.gov; carol.watson@energy.ca.gov; magdalena.rodriguez@wildlife.ca.gov; joel_pagel@fws.gov; jody_fraser@fws.gov
Subject: Re: [Update] Interagency discussion - Sunlight and Genesis
Date: Tuesday, October 14, 2014 8:55:37 AM
Attachments: 20141005_attach_Desert Sunlight Fatality Monitoring Plan_WEST 20141003.DOCX

And here's what WEST sent back to us last week. It addresses our comments. FYI.

On Tue, Oct 14, 2014 at 8:24 AM, Fraser, Jody <jody_fraser@fws.gov> wrote:

> Sorry...doesn't look like that attachment took. Here it is.
>
> On Tue, Oct 14, 2014 at 8:23 AM, jody_fraser@fws.gov <jody_fraser@fws.gov> wrote:
>
> > Hi all,
> > Just a reminder we're talking this morning about mortality monitoring on solar. I've attached our comments on the Sunlight plan. Sorry I didn't send this sooner.
> > Talk to you in a bit.
> > Jody
>
> **Interagency discussion - Sunlight and Genesis**
>
> Looking for consensus among agencies on mortality monitoring methods in the interim as FWS "product team" develops a standardized protocol.
>
> When Tue Oct 14, 2014 10am – 11:30am Pacific Time
>
> Where 866.763.2732; 8565940# (map)
>
> Who
> - Jody Fraser - creator
> - Pete Sorensen
> - Amedee Brickey
> - andrea.martine@energy.ca.gov
> - Thomas Dietsch
> - magdalena.rodriguez@wildlife.ca.gov
> - carol.watson@energy.ca.gov
> - Kim Marsden
> - Amy Fesnock
> - Joel Pagel
> - Tera Baird

--
Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
U.S. Fish and Wildlife Service
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207

760.322.4648 fax
jody_fraser@fws.gov

--
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From: Fraser, Jody
To: amedee_brickey@fws.gov; afesnock@blm.gov; kmarsden@blm.gov; andrea.martine@energy.ca.gov; thomas_dietsch@fws.gov; tera_baird@fws.gov; pete_sorensen@fws.gov; carol.watson@energy.ca.gov; magdalena.rodriguez@wildlife.ca.gov; joel_pagel@fws.gov; jody_fraser@fws.gov
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Date: Tuesday, October 14, 2014 8:55:37 AM
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> - Joel Pagel
> - Tera Baird

--
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> 760.322.4648 fax
> jody_fraser@fws.gov

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760.322.4648 fax
jody_fraser@fws.gov

From:	Kalish, John
To:	ken_corey@FWS.gov; john_kalish@blm.gov; Marshall, Paul@Energy; Lesh, Geoff@Energy; Fooks, Brett@Energy; Ali, Anwar@Energy; Watson, Carol@Energy; German, Charles; Townsend-Hough, Ellie@Energy; Conway, Mike@Energy; Marxen, Chris@Energy; Knight, Eric@Energy; Wylie, Doug@Waterboards; Vaccaro, Kourtney@Energy; Johnson, Roger@Energy; Pete Sorensen; Tera Baird; Thomas Dietsch; Rodriguez, Magdalena@Wildlife; Jody Fraser; kmarsden@blm.gov
Subject:	Fwd: Genesis photos #2
Date:	Friday, October 17, 2014 2:03:34 PM
Attachments:	20141016_153434.jpg 20141016_153441.jpg 20141016_153604.jpg

---------- Forwarded message ----------
From: **Perry, Cedric** <cperry@blm.gov>
Date: Fri, Oct 17, 2014 at 1:41 PM
Subject: Genesis photos #2
To: John Kalish <jkalish@blm.gov>

Cedric C. Perry

Project Manager

Bureau of Land Management (BLM)

22835 Calle San Juan De Los Lagos

Moreno Valley, Ca. 92553

Office # 951-697-5388

Cell Ph # 951-208-5794

--
John R. Kalish, Field Manager
Bureau of Land Management
Palm Springs-South Coast Field Office
1201 Bird Center Dr
Palm Springs, CA 92262
760-833-7100

From: Marsden, Kim
To: Jody Fraser; Thomas Dietsch
Subject: Fwd: Quartzite 2014 Avian Work Plan Line Transect Modification Request
Date: Thursday, October 30, 2014 10:16:49 AM
Attachments: QZ 2014 Line Transect Modifications_Memo.docx

We need to approve or deny the change in methodology for avian transects.
---------- Forwarded message ----------
From: **Tonya Moore** <tonya@ironwoodbio.com>
Date: Wed, Sep 24, 2014 at 9:26 AM
Subject: Quartzite 2014 Avian Work Plan Line Transect Modification Request
To: "Marsden, Kim" <kmarsden@blm.gov>, Roy Skinner <Roy.Skinner@firstsolar.com>, "Rodriguez, Magdalena@Wildlife" <Magdalena.Rodriguez@wildlife.ca.gov>, "Fraser, Jody" <jody_fraser@fws.gov>

Good morning everyone,

For the 2014 avian surveys, Ironwood is recommending modifying the avian transects from the straight lines to more of a triangle method to ensure the surveyors could observe more area. We kept the original locations of the transects on site to ensure that we could compare results with older data. Thus this change did not affect the effort or costs but does give more thorough coverage of the site.

I have attached a memo sent to me, per my request, explaining the new transect information with a map depicting this change. If you believe this method should not be pursued please let us know soon so that we can return to the original methodology.

The avian surveys have been occurring every month as outlined within the avian work plan and we are gearing up to ensure that another round of golden eagle surveys will be started this winter season.

Kim, I was not sure how you wanted this “new” transect information filed for BLM purposes. Should we attach an update to the exiting work plan or write the memo as an amendment and attach to original? Please instruct me as to how you would like to see the information if acceptable.

If you have misplaced the original work plans (dated 042814) please inform me and I will send you a link to the information.

Let me know if anything else is needed.

Have a positively great fall day!

Tonya Moore

Ironwood Consulting, Inc

(760) 646-6477

tonya@ironwoodbio.com

"Love, laughter and sunshine!"

--

Kim Marsden
Natural Resource Specialist
Bureau of Land Management
California Desert District
Renewable Energy Coordinating Office
22835 Calle San Juan de los Lagos
Moreno Valley, CA 92553
951-697-5223

> ***In spring at the end of the day you should smell like dirt~ Margaret Atwood***

From:	Thomas B. Smith
To:	Thomas Dietsch
Cc:	kristen.ruegg@gmail.com; "Fuller, Trevon"; Ryan Harrigan
Subject:	Followup materials
Date:	Monday, November 03, 2014 9:58:12 AM
Attachments:	mec12977.pdf mec12393.pdf Target taxa.docx

Hi Tom,

It was good to talk. Below are some useful links. The first is the webinar Kristen gave for the FWS. Attached is the list of target taxa we have identified so far and a couple of papers of interest including the recent WIWA paper. Additional papers can be found on the CTR web site: http://www.environment.ucla.edu/ctr/research/neotropical-migrants.html.

1. Link to the webinar (with Kristen presenting the research): http://training.fws.gov/topic/online-training/webinars/osa.html.

2. Link to download recent Powerpoint presentation: http://nctc.adobeconnect.com/Ruegg

3. Link to Science Magazine article covering the WIWA paper: http://news.sciencemag.org/biology/2014/08/hidden-bird-migrations-revealed-dna

I look forward to getting a list of target water birds from you! I'm excited to be moving forward!

All the best,

Tom

From:	crissy slaughter
To:	jody_fraser@fws.gov
Cc:	Kathy Simon; Brooks Corvus; Brian Sandstrom; tamara.haynes@firstsolar.com; armand.gonzales@wildlife.ca.gov; eduardo_nieves@fws.gov; Ashley H; heather_beeler@fws.gov; Thomas Dietsch; Erin Lockward; fmcmenimen@blm.gov; cperry@blm.gov; pksharpgarcia@gmail.com; davesterner@firstsolar.com; Therese_Carpenter; erin_dean@fws.gov; ryan.magill2@nexteraenergy.com; myra.gardiner@nexteraenergy.com; john.sakers@firstsolar.com; adam.dobrzanski@nexteraenergy.com
Subject:	Monthly SPUT report for Desert Sunlight, permit numbers MB20979B-1 and MB20960B-3
Date:	Tuesday, November 04, 2014 8:58:19 AM
Attachments:	DS_03Nov14_R8_SPUT_mortality reporting.xlsx Avian_Bat_Mortality_20141103.pdf

Hello All,

Attached is the monthly SPUT table and updated avian mortality figure for Desert Sunlight, permit numbers MB20979B-1 and MB20960B-3.

Thank you,

Crissy Slaughter
Ironwood Consulting, Inc.

From: Davis, Eric
To: Thomas Dietsch; Amedee Brickey
Subject: Fwd: BBCS/Bird and Bat Fatality Monitoring Plan for the Desert Sunlight Solar Farm
Date: Wednesday, November 05, 2014 11:54:28 AM
Attachments: DRAFT_DSL_BBCS_4Nov2014.docx

We need to review this ASAP so we can finalize the BBCS by Thanksgiving. Can you do it by next Fri so we can discuss on Mon 17 Nov? Amedee, could you check in with Amy to make sure that plan would meet her timelines?

Eric Davis
Assistant Regional Director, Region 8
Migratory Birds and State Programs
916-978-6189

Let us celebrate the 50th anniversary of the Wilderness Act of 1964.
Let us learn from the 100th anniversary of the death of the last passenger pigeon in 1914.

---------- Forwarded message ----------
From: **Wally Erickson** <werickson@west-inc.com>
Date: Tue, Nov 4, 2014 at 1:59 PM
Subject: BBCS/Bird and Bat Fatality Monitoring Plan for the Desert Sunlight Solar Farm
To: "Fesnock, Amy" <afesnock@blm.gov>
Cc: "Fraser, Jody" <jody_fraser@fws.gov>, "Brickey, Amedee" <amedee_brickey@fws.gov>, Eric Davis <eric_davis@fws.gov>, Tera Baird <Tera_Baird@fws.gov>, Thomas Dietsch <thomas_dietsch@fws.gov>, Pete Sorensen <Pete_Sorensen@fws.gov>, "Cc: Therese Carpenter" <Therese.Carpenter@firstsolar.com>, Beth Deane <Beth.Deane@firstsolar.com>, "Perkins, Winifred" <Winifred.Perkins@nexteraenergy.com>, "Field, Jennifer" <JENNIFER.FIELD@nexteraenergy.com>, Ken Levenstein <klevenstein@west-inc.com>, Dave Sterner <Dave.Sterner@firstsolar.com>, Laura Abram <laura.abram@firstsolar.com>, John Sakers <John.Sakers@firstsolar.com>, David Lazerwitz <dlazerwitz@fbm.com>, Michael Sintetos <msintetos@blm.gov>, Thomas Pogacnik <tpogacni@blm.gov>, Kim Marsden <kmarsden@blm.gov>, Frank Mcmenimen <fmcmenimen@blm.gov>, "Weiner, Peter H." <peterweiner@paulhastings.com>

From: The Desert Sunlight Project

To: Amy Fesnock, BLM

Regarding: BBCS/Bird and Bat Fatality Monitoring Plan for the Desert Sunlight Solar Farm, Riverside County,California

In follow-up to our meeting on October 15th and related correspondence with both BLM and USFWS, attached is the revised Bird and Bat Conservation Strategy for the Desert Sunlight Project. Because the Project is finishing up construction and will commence commercial operations in a couple of months, we have updated the BBCS accordingly to focus on post-construction avian and bat fatality monitoring.

As we discussed at our last meeting, and in further discussions internally, we have incorporated the following parameters for the monitoring plan:

Parameter	Current Plan
Solar Field- % coverage for monitoring	25%
Solar Field- frequency of searches	Every 7 days during migration and every 21 days during non-migration
Fenceline- % coverage for monitoring	100% (same frequency as solar field)
GenTie- % coverage for monitoring	50% (same frequency as solar field)
Duration of monitoring	minimum of 2 years
Bias trials – array, fenceline and gentie	Yes searcher efficiency and Yes carcass removal trials

Please let the Desert Sunlight team know any comments or questions that you have so that we may get the plan finalized as soon as possible. As always, we appreciate your assistance in continuing to move this process forward.

Regards

Wallace Erickson (on behalf of the Desert Sunlight Project)

Cell - (307) 630-7830
www.west-inc.com

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Please consider the environment before printing.

From: Fraser, Jody
To: Thomas Dietsch
Date: Wednesday, November 12, 2014 11:08:34 AM
Attachments: 20140819_Desert Sunlight Fatality Monitoring Plan_revised June_July_FWS comments.docx

---

Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
jody_fraser@fws.gov

From: Fraser, Jody
To: Pete Sorensen
Subject: Fwd:
Date: Wednesday, November 12, 2014 12:35:44 PM
Attachments: 20140819_Desert Sunlight Fatality Monitoring Plan_revised June_July_FWS comments.docx
20141112_DRAFT_DSL_BBCS_4Nov2014_JSF comments.docx

Here are our comments on the previous version of the mortality monitoring plan and the most recent BBCS. We have a call at 2 with Amy.

---------- Forwarded message ----------
From: **Fraser, Jody** <jody_fraser@fws.gov>
Date: Wed, Nov 12, 2014 at 12:28 PM
Subject: Fwd:
To: Thomas Dietsch <thomas_dietsch@fws.gov>

Ok, here are my quick and dirty on the most recent iteration.

---------- Forwarded message ----------
From: **Fraser, Jody** <jody_fraser@fws.gov>
Date: Wed, Nov 12, 2014 at 11:08 AM
Subject:
To: Thomas Dietsch <thomas_dietsch@fws.gov>

Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
jody_fraser@fws.gov

From: Fraser, Jody
To: Thomas Dietsch
Subject: a few more edits...
Date: Wednesday, November 12, 2014 3:20:46 PM
Attachments: 20141112_DRAFT_DSL_BBCS_4Nov2014_JSF comments.docx
20141112_Desert Sunlight BBCS inter-agency call notes_JFraser.docx

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I made some changes based on our call. And I've attached my notes from the call.

From: Pagel, Joel
To: Jody Fraser; Pete Sorensen; Thomas Dietsch
Subject: bioblitz 2013
Date: Wednesday, November 12, 2014 5:32:18 PM
Attachments: Desert Sunlight BioBlitz Lessons Learned Pagel 2013.pdf

---

I don't know if you want to share this with Amy, or not. It may help her understand the task of monitoring; especially if she looks at the lesson's learned.

jeep

From:	Wally Erickson
To:	eric.veerkamp@energy.ca.gov; Fesnock, Amy
Cc:	Amedee Brickey; Jody Fraser; Thomas Dietsch; Tera Baird; eric.davis@fws.gov; Pete Sorensen; Magdalena Rodriguez; carol.watson@energy.ca.gov; Ali, Anwar@Energy; eric.knight@energy.ca.gov; jkalish@blm.gov; kim_marsden@blm.gov; Thomas Pogacnik; Winifred Perkins; Romero, Lauren; Idayna.stokes@nee.com; Jennifer Field; Ashley Pinnock; Kenneth Stein; Luke Goguts; Tracey Johnson; Paul Rabie
Subject:	RE: revised BBCS/Bird and Bat Fatality Monitoring Plan for the Genesis Solar Project, Riverside County,California
Date:	Thursday, November 13, 2014 4:50:56 PM
Attachments:	Genesis_BBCS_13Nov2014_clean.pdf Genesis BBCS Comment Response Matrix_Nov13.docx

13 November 2014

From: The Genesis Solar Project

To: Eric Veerkamp (CEC) and Amy Fesnock (BLM)

Cc: Amedee Brickey (USFWS), Jody Fraser (USFWS), Tera Baird (USFWS), Thomas Dietsch (USFWS), Pete Sorenson (USFWS), Eric Davis (USFWS), Magdalena Rodriguez (CDFW), Eric Knight (CEC), Carol Watson (CEC), Anwar Ali (CEC), Kim Mardsen (BLM), John Kalish (BLM), Thomas Thomas Pogacnik (BLM), Luke Goguts (NEER), Winifred Perkins (NEER), Kenny Stein (NEER), Ashley Pinnock (NEER), Jennifer Field (NEER), Lauren Romero (NEER), Idayna Stokes (NEER),Tracey Johnson (WEST), Paul Rabie (WEST)

In follow-up to our meeting on October 24th and related correspondence, attached is the revised Bird and Bat Conservation Strategy for the Genesis Project that is consistent with the recently submitted revised BBCS for Desert Sunlight. Because the Project is operational, we have updated the BBCS accordingly to focus on post-construction avian and bat fatality monitoring. We have included a comment and response document in a separate file that identifies the original REAT agency comments and includes responses to those comments. Given the large number of comments, and the change in format for the new BBCS, we provided reference to the sections in the March 2014 version of the BBCS as well as a reference in our response to the new section in this version of the BBCS where the comment was addressed. The comments related to pre-construction or construction activities were moved to the end of the Response document and most of these were not specifically addressed unless they indirectly or directly were related to the post-construction activities. There may be a few of these that still need to be addressed but we wanted to focus on the outstanding monitoring issues immediately.

As we discussed at our last meeting and in further discussions internally, we have incorporated the following parameters for the monitoring plan:

Parameter	Current Plan
Solar Field- % coverage for monitoring	25%
Solar Field- frequency of searches	Every 7 days during migration and every 21 days during non-migration
Fenceline- % coverage for monitoring	100% (same frequency as solar field)
GenTie- % coverage for monitoring	50% (same frequency as solar field)
Evaporation Pond monitoring	100% (same frequency as solar field)
Power Block Monitoring	100% of perimeter (same frequency as solar field)
Duration of monitoring	minimum of 2 years
Bias trials – array, fenceline, evaporation pond and gentie	Yes searcher efficiency and Yes carcass removal trials

Please let the Genesis team know of any comments or questions that you have so that we may get the plan finalized as soon as possible. As always, we appreciate your assistance in continuing to move this process forward.

The attached BBCS is currently in pdf format given the size of the original WORD file and I wasn't sure if any of you had a size limit on emailed documents. The Word version can be made available.

Regards

Wallace Erickson (on behalf of the Genesis Solar Project)

COO and Sr. Statistician

Environmental & Statistical Consultants

office: (307) 634-1756
Direct - (307) 632-2940
Cell - (307) 630-7830

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 Please consider the environment before printing.

From: Thomas Dietsch
To: Jody Fraser; Joel Pagel
Cc: Pete Sorensen
Subject: Draft_DSL_BBCS_2014_11_04 Merged Document_2014_11_13.docx
Date: Thursday, November 13, 2014 5:24:15 PM
Attachments: Draft_DSL_BBCS_2014_11_04 Merged Document_2014_11_13.docx

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Hi all,

Unfortunately, I wasn't able to make much progress today, but here is the merged version that includes my edits/comments and Jody's most recent version. Jeep said he would take a stab at it on Friday. Jeep if you can send your latest version after tomorrow, I'll pick up again on Monday. I suggest we check in on Monday to see where we are and come up with a plan to finish things up.

Thanks, Tom

From:	Pagel, Joel
To:	Pete Sorensen; Jody Fraser
Subject:	Fwd: DSSF Avian Incidents 4/28
Date:	Friday, November 14, 2014 12:30:14 PM
Attachments:	TOWA_042714_1.jpg WWDO_041426_2.jpg UNBI_042814_1.JPG

---

this is a great reminder about how quick those carcasses disappear.

jeep
---------- Forwarded message ----------
From: **Sorensen, Pete** <pete_sorensen@fws.gov>
Date: Fri, Nov 14, 2014 at 11:42 AM
Subject: Fwd: DSSF Avian Incidents 4/28
To: Joel Pagel <joel_pagel@fws.gov>

---------- Forwarded message ----------
From: **Fraser, Jody** <jody_fraser@fws.gov>
Date: Tue, Apr 29, 2014 at 8:19 AM
Subject: Fwd: DSSF Avian Incidents 4/28
To: Pete Sorensen <Pete_Sorensen@fws.gov>, Ken Corey <Ken_Corey@fws.gov>, Tera Baird <Tera_Baird@fws.gov>, Joel Pagel <joel_pagel@fws.gov>

Scavengers...

---------- Forwarded message ----------
From: **brian sandstrom** <bjerome30@hotmail.com>
Date: Tue, Apr 29, 2014 at 7:05 AM
Subject: DSSF Avian Incidents 4/28
To: "eduardo_nieves@fws.gov" <eduardo_nieves@fws.gov>, "jody_fraser@fws.gov" <jody_fraser@fws.gov>, mark massar <mmassar@blm.gov>, "cperry@blm.gov" <cperry@blm.gov>, "fmcmenimen@blm.gov" <fmcmenimen@blm.gov>, "thomas_dietsch@fws.gov" <thomas_dietsch@fws.gov>
Cc: brooks hart <brooks@corvusecological.com>, crissy slaughter <criffy@hotmail.com>, kathy simon <kathy@ironwoodconsultinginc.com>, therese carpenter <therese.carpenter@firstsolar.com>, "pksharpgarcia@gmail.com" <pksharpgarcia@gmail.com>, "admin@corvusecological.com" <admin@corvusecological.com>

Hello everyone,

There were two avian mortalities documented over the weekend and one yesterday:

- 26 April 2014 - The carcass of a White-winged dove was found on Center line drive underneath transmission lines. The bird was located at 0500 and when it was check at 0730, unknown scavengers had removed the carcass.

- 27 April 2014 - The carcass of a Townsend's Warbler was found on West Side Drive underneath transmission lines. The bird was located at 0930. It was left in place and when it was checked at 0800 the following day, unknown scavengers had removed the carcass.

- 28 April 2014 - The wing of an unidentified duck was located in Block 7, Array 7, Row 55 within solar array framework. It was collected and stored in the freezer in the bio office.

If you have any questions please contact me.

Thanks,

Brian Sandstrom
949-423-8770
bjerome30@hotmail.com

--
Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
U.S. Fish and Wildlife Service
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
760.322.4648 fax
jody_fraser@fws.gov

From: Sorensen, Pete
To: Joel Pagel; Jody Fraser; Thomas Dietsch
Subject: Fwd: DSSF Avian Incidents 4/28
Date: Friday, November 14, 2014 12:55:18 PM
Attachments: TOWA_042714_1.jpg
WWDO_041426_2.jpg
UNBI_042814_1.JPG

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just winging it, but the unknown duck looks like a gadwall to me. Tom, if Marie is still doing her wingbees, maybe you should ask her just for fun
---------- Forwarded message ----------
From: **Pagel, Joel** <joel_pagel@fws.gov>
Date: Fri, Nov 14, 2014 at 12:29 PM
Subject: Fwd: DSSF Avian Incidents 4/28
To: Pete Sorensen <pete_sorensen@fws.gov>, Jody Fraser <jody_fraser@fws.gov>

this is a great reminder about how quick those carcasses disappear.

jeep
---------- Forwarded message ----------
From: **Sorensen, Pete** <pete_sorensen@fws.gov>
Date: Fri, Nov 14, 2014 at 11:42 AM
Subject: Fwd: DSSF Avian Incidents 4/28
To: Joel Pagel <joel_pagel@fws.gov>

---------- Forwarded message ----------
From: **Fraser, Jody** <jody_fraser@fws.gov>
Date: Tue, Apr 29, 2014 at 8:19 AM
Subject: Fwd: DSSF Avian Incidents 4/28
To: Pete Sorensen <Pete_Sorensen@fws.gov>, Ken Corey <Ken_Corey@fws.gov>, Tera Baird <Tera_Baird@fws.gov>, Joel Pagel <joel_pagel@fws.gov>

Scavengers...

---------- Forwarded message ----------
From: **brian sandstrom** <bjerome30@hotmail.com>
Date: Tue, Apr 29, 2014 at 7:05 AM
Subject: DSSF Avian Incidents 4/28
To: "eduardo_nieves@fws.gov" <eduardo_nieves@fws.gov>, "jody_fraser@fws.gov" <jody_fraser@fws.gov>, mark massar <mmassar@blm.gov>, "cperry@blm.gov" <cperry@blm.gov>, "fmcmenimen@blm.gov" <fmcmenimen@blm.gov>, "thomas_dietsch@fws.gov" <thomas_dietsch@fws.gov>
Cc: brooks hart <brooks@corvusecological.com>, crissy slaughter <criffy@hotmail.com>, kathy simon <kathy@ironwoodconsultinginc.com>, therese carpenter <therese.carpenter@firstsolar.com>, "pksharpgarcia@gmail.com" <pksharpgarcia@gmail.com>, "admin@corvusecological.com" <admin@corvusecological.com>

Hello everyone,

There were two avian mortalities documented over the weekend and one yesterday:

- 26 April 2014 - The carcass of a White-winged dove was found on Center line drive underneath transmission lines. The bird was located at 0500 and when it was check at 0730, unknown scavengers had removed the carcass.

- 27 April 2014 - The carcass of a Townsend's Warbler was found on West Side Drive underneath transmission lines. The bird was located at 0930. It was left in place and when it was checked at 0800 the following day, unknown scavengers had removed the carcass.

- 28 April 2014 - The wing of an unidentified duck was located in Block 7, Array 7, Row 55 within solar array framework. It was collected and stored in the freezer in the bio office.

If you have any questions please contact me.

Thanks,

Brian Sandstrom
949-423-8770
bjerome30@hotmail.com

--
Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
U.S. Fish and Wildlife Service
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
760.322.4648 fax
jody_fraser@fws.gov

From: Dietsch, Thomas
To: Chris Nicolai
Subject: Fwd: DSSF Avian Incidents 4/28
Date: Saturday, November 15, 2014 3:01:59 PM
Attachments: Wing.JPG

Hi Chris,

Any thoughts on the ID of this bird? Looks like a duck wing but I'm not sure beyond that. This was found last spring at Desert Sunlight, a PV field.

Thanks, Tom

---------- Forwarded message ----------
From: **brian sandstrom** <bjerome30@hotmail.com>
Date: Tue, Apr 29, 2014 at 6:02 PM
Subject: DSSF Avian Incidents 4/28
To: Thomas Dietsch <thomas_dietsch@fws.gov>

Tom,

The TOWA was left overnight because it was found sunday morning by Operations and Management (O&M). Sunday's there are only a couple O&M workers doing maintenance in random shelters on site. These are the only personnel on site. They do not have the protocols for carcass collection or a freezer to store the bird. I had them take photos and give me the exact location and I checked it first thing Monday morning. It was less than 24 hours and the bird had been removed.

The White-winged dove was found by a security guard at 0500. By 0700 the carcass had been removed by scavengers and again I had nothing to collect.

I've attached a photo of the UNBI wing. I have some ideas what it is but without knowing for sure I didn't want to document wrong. I've also passed images on to folks who will be letting me know what it is and the data will be updated once it is identified correctly. Let me know if your people identify it. I'm curious.

Thanks for your interest and question. Feel free to contact me anytime.

Brian

From: thomas_dietsch@fws.gov
Date: Tue, 29 Apr 2014 16:37:10 -0700
Subject: RE: DSSF Avian Incidents 4/28
To: bjerome30@hotmail.com

Hi Brian,

Thank you for the report. Can you tell me why you left the carcasses overnight? Also, can you send me a spread wing view picture of the unidentified duck wing (top and bottom)? I know some waterfowl biologists that can identify the species by wing.

Thanks, Tom

From: brian sandstrom [mailto:bjerome30@hotmail.com]
Sent: Tuesday, April 29, 2014 7:05 AM
To: eduardo_nieves@fws.gov; jody_fraser@fws.gov; mark massar; cperry@blm.gov; fmcmenimen@blm.gov; thomas_dietsch@fws.gov
Cc: brooks hart; crissy slaughter; kathy simon; therese carpenter; pksharpgarcia@gmail.com; admin@corvusecological.com
Subject: DSSF Avian Incidents 4/28

Hello everyone,

There were two avian mortalities documented over the weekend and one yesterday:

- 26 April 2014 - The carcass of a White-winged dove was found on Center line drive underneath transmission lines. The bird was located at 0500 and when it was check at 0730, unknown scavengers had removed the carcass.

- 27 April 2014 - The carcass of a Townsend's Warbler was found on West Side Drive underneath transmission lines. The bird was located at 0930. It was left in place and when it was checked at 0800 the following day, unknown scavengers had removed the carcass.

- 28 April 2014 - The wing of an unidentified duck was located in Block 7, Array 7, Row 55 within solar array framework. It was collected and stored in the freezer in the bio office.

If you have any questions please contact me.

Thanks,

Brian Sandstrom

949-423-8770

bjerome30@hotmail.com

--
****
Thomas Dietsch, PhD
Migratory Bird Biologist
US Fish and Wildlife Service, Region 8
Carlsbad Fish and Wildlife Office
6010 Hidden Valley Road, Suite 101
Carlsbad, CA 92011
(760) 431-9440 Ext. 214
****

From: Pagel, Joel
To: Thomas Dietsch; Jody Fraser; Pete Sorensen
Subject: Desert Sunlight
Date: Monday, November 17, 2014 11:46:06 AM
Attachments: Draft_DSL_BBCS_2014_11_04 Merged Document_2014_11_13.docx

---

Here are my comments. Some are just for you both, and some are in general comments that we may wish to include. We may wish to have an internal discussion asap.

The more carefully I read this bbcs, the more it clearly shows a bias for the company to NOT find birds and develop realistic estimators. We need to be careful here, as this plan WILL become the precedent and it is really hard to change precedent as we are seeing with Ivanpah. I would rather hold off and get a better plan, than let some of this mush go through and be implemented.

jeep
Joel E. Pagel, Ph.D.

From:	Thomas Dietsch
To:	Jody Fraser
Cc:	Pete Sorensen
Subject:	Draft_DSL_BBCS_2014_11_04 Revised Document_2014_11_18.docx
Date:	Tuesday, November 18, 2014 6:26:06 PM
Attachments:	Draft_DSL_BBCS_2014_11_04 Revised Document_2014_11_18.docx

Hi Jody,

Here's the revised BBCS for Desert Sunlight. I've added or left in comments for us to discuss before we finalize the document.

Let's check in tomorrow AM or whenever you are in the office.

Thanks, Tom

From:	Wally Erickson
To:	Fraser, Jody
Cc:	Veerkamp, Eric@Energy; Fesnock, Amy; Amedee Brickey; Thomas Dietsch; Eric Davis; Pete Sorensen; Magdalena Rodriguez; Carol Watson; Ali, Anwar@Energy; Eric Knight; John Kalish; Kim Marsden; Thomas Pogacnik; Winifred Perkins; Romero, Lauren; Idayna.stokes@nee.com; Jennifer Field; Ashley Pinnock; Kenneth Stein; Luke Goguts; Tracey Johnson; Paul Rabie
Subject:	Re: revised BBCS/Bird and Bat Fatality Monitoring Plan for the Genesis Solar Project, Riverside County,California
Date:	Wednesday, November 19, 2014 11:46:52 AM
Attachments:	Genesis_BBCS_13Nov2014_clean.docx

Jody

Attached is the word version of the Genesis BBCS per your request. It is a 6 mb file, so let me know when you receive it.

Regards,

Wallace Erickson

COO and Sr. Statistician

Environmental & Statistical Consultants
415 W 17th, Ste. 200
Cheyenne, WY 82001
(307) 634-1756
Direct - (307) 632-2940
Cell - (307) 630-7830
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Please consider the environment before printing.

On Wed, Nov 19, 2014 at 10:49 AM, Fraser, Jody <jody_fraser@fws.gov> wrote:

> Wally,
> Can you please send the Word version of the document?
> Thanks,
> Jody
>
> Jody Fraser, Biologist
> Palm Springs Fish and Wildlife Office
> 777 E. Tahquitz Canyon Way, Suite 208
> Palm Springs, CA 92262
> 760.322.2070 ph x207
> jody_fraser@fws.gov

On Thu, Nov 13, 2014 at 4:50 PM, Wally Erickson <werickson@west-inc.com> wrote:

13 November 2014

From: The Genesis Solar Project

To: Eric Veerkamp (CEC) and Amy Fesnock (BLM)

Cc: Amedee Brickey (USFWS), Jody Fraser (USFWS), Tera Baird (USFWS), Thomas Dietsch (USFWS), Pete Sorenson (USFWS), Eric Davis (USFWS), Magdalena Rodriguez (CDFW), Eric Knight (CEC), Carol Watson (CEC), Anwar Ali (CEC), Kim Mardsen (BLM), John Kalish (BLM), Thomas Thomas Pogacnik (BLM), Luke Goguts (NEER), Winifred Perkins (NEER), Kenny Stein (NEER), Ashley Pinnock (NEER), Jennifer Field (NEER), Lauren Romero (NEER), Idayna Stokes (NEER),Tracey Johnson (WEST), Paul Rabie (WEST)

In follow-up to our meeting on October 24th and related correspondence, attached is the revised Bird and Bat Conservation Strategy for the Genesis Project that is consistent with the recently submitted revised BBCS for Desert Sunlight. Because the Project is operational, we have updated the BBCS accordingly to focus on post-construction avian and bat fatality monitoring. We have included a comment and response document in a separate file that identifies the original REAT agency comments and includes responses to those comments. Given the large number of comments, and the change in format for the new BBCS, we provided reference to the sections in the March 2014 version of the BBCS as well as a reference in our response to the new section in this version of the BBCS where the comment was addressed. The comments related to pre-construction or construction activities were moved to the end of the Response document and most of these were not specifically addressed unless they indirectly or directly were related to the post-construction activities. There may be a few of these that still need to be addressed but we wanted to focus on the outstanding monitoring issues immediately.

As we discussed at our last meeting and in further discussions internally, we have incorporated the following parameters for the monitoring plan:

Parameter	Current Plan
Solar Field- % coverage for monitoring	25%
Solar Field- frequency of searches	Every 7 days during migration and every 21 days during non-migration
Fenceline- % coverage for monitoring	100% (same frequency as solar field)
GenTie- % coverage for monitoring	50% (same frequency as solar field)

Evaporation Pond monitoring	100% (same frequency as solar field)
Power Block Monitoring	100% of perimeter (same frequency as solar field)
Duration of monitoring	minimum of 2 years
Bias trials – array, fenceline, evaporation pond and gentie	Yes searcher efficiency and Yes carcass removal trials

Please let the Genesis team know of any comments or questions that you have so that we may get the plan finalized as soon as possible. As always, we appreciate your assistance in continuing to move this process forward.

The attached BBCS is currently in pdf format given the size of the original WORD file and I wasn't sure if any of you had a size limit on emailed documents. The Word version can be made available.

Regards

Wallace Erickson (on behalf of the Genesis Solar Project)

COO and Sr. Statistician

Environmental & Statistical Consultants

office: (307) 634-1756
Direct - (307) 632-2940
Cell - (307) 630-7830

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Please consider the environment before printing.

From: Fraser, Jody
To: Thomas Dietsch
Cc: Joel Pagel; Pete Sorensen
Subject: Re: desert sunlight bbcs
Date: Wednesday, November 19, 2014 1:05:19 PM
Attachments: 20141118_Draft_DSL_BBCS_4Nov2014_FWS comments integrated.docx

---

Jeep,
We'll give you a call.
Jody

Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
jody_fraser@fws.gov

On Wed, Nov 19, 2014 at 11:25 AM, Thomas Dietsch <thomas_dietsch@fws.gov> wrote:

> Just to be clear, Tom P is pressuring Amy who is pressuring Jody. Eric is pressuring me to meet Amy's timeline. And right on cue, Amy is now pressing on Genesis!
>
> **From:** Pagel, Joel [mailto:joel_pagel@fws.gov]
> **Sent:** Wednesday, November 19, 2014 9:45 AM
> **To:** Jody Fraser; Pete Sorensen; Thomas Dietsch
> **Subject:** desert sunlight bbcs
>
> before tom sends in the redline version of desert sunlight, are we all going to go over it together? at least talk through some of the aspects of the plan on the phone?
>
> Tom told me last eve. that Amy was pressuring him to get it asap. While I think we need to help her as much as possible, we need to be clear and comfortable on this one, as it will serve as the precedent for DS, Genesis, Blythe, McCoy, quartzite, and the facilities in imp. county..
>
> thanks,
>
> jeep

From: Fraser, Jody
To: Thomas Dietsch
Subject: One more time...
Date: Wednesday, November 19, 2014 3:50:51 PM
Attachments: 20141119_Draft_DSL_BBCS_4Nov2014_FWS comments integrated.docx

---

Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
jody_fraser@fws.gov

From: brian sandstrom
To: thomas_dietsch@fws.gov
Subject: FW: Monthly SPUT report for Desert Sunlight, permit numbers MB20979B-1 and MB20960B-3
Date: Wednesday, November 19, 2014 6:18:55 PM
Attachments: DS_03Nov14_R8_SPUT_mortality reporting.xlsx
Avian_Bat_Mortality_20141103.pdf

Tom,

The October SPUT was sent but here it is again. Easy enough. We can produce any type of report you might want at the push of a button. Let me know if you need any other information.

Brian

From: criffy@hotmail.com
To: jody_fraser@fws.gov
CC: kathy@ironwoodconsultinginc.com; brooks@corvusecological.com; bjerome30@hotmail.com; tamara.haynes@firstsolar.com; armand.gonzales@wildlife.ca.gov; eduardo_nieves@fws.gov; ashley@cvstrat.com; heather_beeler@fws.gov; thomas_dietsch@fws.gov; admin@corvusecological.com; fmcmenimen@blm.gov; cperry@blm.gov; pksharpgarcia@gmail.com; dave.sterner@firstsolar.com; therese.carpenter@firstsolar.com; erin_dean@fws.gov; ryan.magill2@nexteraenergy.com; myra.gardiner@nexteraenergy.com; john.sakers@firstsolar.com; adam.dobrzanski@nexteraenergy.com
Subject: Monthly SPUT report for Desert Sunlight, permit numbers MB20979B-1 and MB20960B-3
Date: Tue, 4 Nov 2014 16:57:52 +0000

Hello All,

Attached is the monthly SPUT table and updated avian mortality figure for Desert Sunlight, permit numbers MB20979B-1 and MB20960B-3.

Thank you,

Crissy Slaughter
Ironwood Consulting, Inc.

From: Pagel, Joel
To: Jody Fraser; Thomas Dietsch; Pete Sorensen; Linda Allison
Subject: Fwd: field obsv.
Date: Thursday, November 20, 2014 2:28:51 PM
Attachments: M1_APWRA_monitoring_protocol_7_11_07.pdf

---

per our conversation...

jeep
---------- Forwarded message ----------
From: **puma** <puma@dcn.org>
Date: Thu, Nov 20, 2014 at 2:20 PM
Subject: Re: field obsv.
To: "Pagel, Joel" <joel_pagel@fws.gov>

I attached M1 from the Altamont Pass, which should include a dead bird definition.

Cheers

Shawn

On 20.11.2014 13:23, Pagel, Joel wrote:
> per our discussion

From: Thomas Dietsch
To: Jody Fraser; Joel Pagel
Subject: 20141120_Draft_DSL_BBCS_4Nov2014_FWS comments integrated.docx
Date: Thursday, November 20, 2014 2:39:33 PM
Attachments: 20141120_Draft_DSL_BBCS_4Nov2014_FWS comments integrated.docx

---

I made a few changes to the searcher efficiency and added a comment, but am still processing what we heard, so go ahead. I'll take a look at the detection function section.

From: Allison, Linda
To: Fraser, Jody
Subject: Re: Hi!
Date: Thursday, November 20, 2014 2:57:09 PM
Attachments: 20141104_attach_DRAFT_DSL_BBCS_4Nov2014_lja.docx

---

I had handwritten comments that I've now added to the proposal you sent me (attached).

This proposal said pretty much nothing. Distance sampling is not for the faint-hearted, I should know. So I think they should have explained why they think they will have enough data to do this correctly, and how they modified their study design to account for differences between their distance protocols and the strip-transect protocols used in the simulations.

Linda

~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Linda Allison
Desert Tortoise Monitoring Coordinator
U.S. Fish and Wildlife Service
Desert Tortoise Recovery Office
1340 Financial Blvd, #234
Reno, NV 89502
775-861-6324
Linda_Allison@fws.gov

http://www.fws.gov/nevada/desert_tortoise/dtro/dtro_monitor.html

On Thu, Nov 20, 2014 at 2:19 PM, Fraser, Jody <jody_fraser@fws.gov> wrote:

> Haha! I prolly failed because I talk too much!
>
> Linda, thank you so much for participating in the call. We're very worried about these monitoring protocols being precedent setting. Unfortunately, we're not getting any back up by our management to push for anything better :(
>
> Maybe you and Shawn should get together and write a protocol for solar projects :)
>
> Jody Fraser, Biologist
> Palm Springs Fish and Wildlife Office
> 777 E. Tahquitz Canyon Way, Suite 208
> Palm Springs, CA 92262
> 760.322.2070 ph x207
> jody_fraser@fws.gov
>
> On Thu, Nov 20, 2014 at 2:14 PM, Allison, Linda <linda_allison@fws.gov> wrote:
>
> > Trials - Until we were off the phone, I forgot you were one of the test subjects!
> >
> > ~~~~~~~~~~~~~~~~~~~~~~~~~~~~
> >
> > Linda Allison
> > Desert Tortoise Monitoring Coordinator
> > U.S. Fish and Wildlife Service
~~~~~~~~~~~~~~~~~~~~~~~~~~~~

From: Fraser, Jody
To: Thomas Dietsch; Joel Pagel
Subject: Fwd: Hi!
Date: Thursday, November 20, 2014 2:58:31 PM
Attachments: 20141104_attach_DRAFT_DSL_BBCS_4Nov2014_lja.docx

---

Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
jody_fraser@fws.gov

---------- Forwarded message ----------
From: **Allison, Linda** <linda_allison@fws.gov>
Date: Thu, Nov 20, 2014 at 2:57 PM
Subject: Re: Hi!
To: "Fraser, Jody" <jody_fraser@fws.gov>

I had handwritten comments that I've now added to the proposal you sent me (attached).

This proposal said pretty much nothing. Distance sampling is not for the faint-hearted, I should know. So I think they should have explained why they think they will have enough data to do this correctly, and how they modified their study design to account for differences between their distance protocols and the strip-transect protocols used in the simulations.

Linda

~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Linda Allison
Desert Tortoise Monitoring Coordinator
U.S. Fish and Wildlife Service
Desert Tortoise Recovery Office
1340 Financial Blvd, #234
Reno, NV 89502
775-861-6324
Linda_Allison@fws.gov
~~~~~~~~~~~~~~~~~~~~~~~~~~~~

From: Thomas Dietsch
To: Jody Fraser
Subject: FW: my review... (in bold)
Date: Thursday, November 20, 2014 5:36:39 PM
Attachments: 20141120_Draft_DSL_BBCS_4Nov2014_FWS comments integrated additional from jeep.docx

---

Hi Jody,

Will this work for those two bolded sentences?

Effective search area includes the area from the perimeter to that distance from the end of the panel row where the fraction of birds detected for each target size class is above a set fraction (threshold) as determined through robust searcher efficiency trials. The BLM and Wildlife agencies prefer that the threshold detection rate be set to at least 0.6 - 0.8; however analysis of raw data and detectability curves by the agencies will ultimately determine the threshold detection rate will be used to evaluate effective search area.

From: Pagel, Joel [mailto:joel_pagel@fws.gov]
Sent: Thursday, November 20, 2014 4:59 PM
To: Thomas Dietsch; Jody Fraser; Pete Sorensen
Subject: my review... (in bold)

(i.e., 95- **+**100 degrees F) warrant driving in **open covered (buggies), and/or** air-conditioned vehicles. (pp 12)

sampling will encompass approximately **at least** 25% of the completed solar arrays as summarized in Table 1 unless or until data support changes in this sampling design. (pp 16)

Consequently, the effective area monitored is expected to be **substantially** less than 25%. Therefore, this will be corrected based on results of the distance sampling and detection function analysis (pp 17) (changed significantly to substantially)

Distance sampling **and resulting data** will be used to calculate detectability curves to **determine** the effective search area for these different panel configurations. **Effective search area characterizes the distance in from the end of the panel row where at least xx% of birds of the target size class are detected via robust trials. The BLM and Wildlife agencies would prefer a detection rate of at least 0.6 - 0.8; however analysis of raw data by the agencies will ultimately determine the target detection rate considered to be acceptable**. Due to potential differences in visibility based on the direction that the observer is moving (N or S) in relation to the South facing angle of the fixed panels (pp 17)

placement of searcher-efficiency trial specimens will be distributed throughout the year (appropriately organized to provide season-specific estimates with adequate samples per season/**per person** to provide a robust estimate of searcher efficiency), with few specimens placed at any one time. Carcasses will be placed carefully to minimize disturbance of substrates that may bias carcass detection. (pp 29)

Persons with scientific expertise may be invited by TAC members if deemed appropriate. In addition, representatives from the Project and the consultants involved in the conduct of

the studies **may be** invited attend and participate in meetings. (pp 38)

finally, I still strongly recommend that they search only north to south, versus having the ability to search north to south and south to north. Maybe this needs to go in the letter...

From: Fraser, Jody
To: Thomas Dietsch; Joel Pagel; Pete Sorensen
Subject: DRAFT email to BLM, Amedee, and Eric on Sunlight
Date: Thursday, November 20, 2014 6:40:39 PM
Attachments: 20141120_Draft_DSL_BBCS_4Nov2014_FWS comments integrated.docx

---

OK, here's the draft transmittal email and our "final" comments in track changes. I think I should attach a TAILS number to it since we've spent so much frickin' time on this...we should get credit for it!

This needs to go out asap on Friday, so don't dilly-dally.

Thanks, Tom and Jeep, for your deep commitment to these issues and helping me get through this. Your help is invaluable.

Amy,
Thank you for your patience as we worked through this plan (again). While you continue to reassure us that we will have opportunities in the future to perfect the methodology and extend the monitoring period, I'm sure you can understand our trepidation based on our experiences on ISEGS, Genesis, and the Imperial County projects.

Per your recommendation, we have made changes to the text (in track-changes) within the constraints (25% of the solar field, 100% of the fence line, and 50% of the gen-tie) established during various meetings with NE. The biggest issues for us are as follows:

- While we recognize that 2 years is the minimum time required for monitoring and the BLM has discretion to require additional years based on the incoming data, we remain concerned about this considering the project will be on the landscape for a minimum of 30 years. The species identified and the mortalities per species is likely to differ considerably between years and there is no way this variability will be captured in such a short time period.

- We are concerned that distance sampling has never been used for this application (mortality monitoring on wind and solar); the justification for using this methodology is not well supported in the document, i.e., the simulation they provide has not been peer-reviewed, nor was the citation included in the References section. We should have the ability to modify the methodology after the first year.

- We are concerned about the monitoring intervals (7 and 21 days), which are not supported by the Corvus carcass surveys performed on-site and much of the available literature. We strongly believe that the intervals coupled with the distance sampling method as proposed will result in significant undersampling, which cannot be corrected for using statistics.

- The References section does not reflect what was cited in the document; therefore, we were unable to understand some of the assumptions set forth in the plan.

- We are concerned about using observers who do not have academic ornithological and field ecology/biology background. We added language that requires an Authorized Avian Biologist to be on-site during monitoring to provide oversight.

- If there needs to be a TAC, it should be open to public participation so that the process is transparent.

- We know you are working on an IM that requires third-party monitoring that eliminates confidentiality agreements; facilitates open communication to wildlife agencies from all project-related staff; requires submission of all raw data and methods; and makes all data available for peer review and assessment. We support this wholeheartedly and would like to offer any assistance with/review of the draft document.

Please feel free to contact us with any questions you may have on our comments. And please do cc us on your transmittal to Wally, First Solar, and NextEra.
Thanks,
Jody

Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
jody_fraser@fws.gov

From: Fraser, Jody
To: Linda Allison; Chris Gregory
Subject: Fwd: Sunlight mortality monitoring
Date: Friday, November 21, 2014 12:46:54 PM
Attachments: HTH_Desert Sunlight Dectectability Study Report_Nov2013.pdf
20141121_Draft_DSL_BBCS_4Nov2014_FWS comments integrated.docx

---

FYI -- Linda, thanks again for all of your input!

---------- Forwarded message ----------
From: **Fraser, Jody** <jody_fraser@fws.gov>
Date: Fri, Nov 21, 2014 at 12:31 PM
Subject: Sunlight mortality monitoring
To: Amy Fesnock <afesnock@blm.gov>, Amedee Brickey <amedee_brickey@fws.gov>, Eric Davis <eric_davis@fws.gov>
Cc: Pete Sorensen <Pete_Sorensen@fws.gov>, Ken Corey <Ken_Corey@fws.gov>, Thomas Dietsch <thomas_dietsch@fws.gov>, Joel Pagel <joel_pagel@fws.gov>

Amy,

Thank you for your patience as we have worked through this plan (again). As discussed, this document does not contain the necessary components of a BBCS and serves primarily as s a monitoring plan; additional work will need to be done to complete the BBCS. While you continue to reassure us that we will have opportunities in the future to refine the methodology and extend the monitoring period, I'm sure you can understand our trepidation based on our experiences on ISEGS, Genesis, and the Imperial County projects in that making changes once the monitoring has commenced has been very difficult.

Per your recommendation, we have made changes to the text (in track-changes) within the constraints (2-yr monitoring period, 25% of the solar field, 100% of the fence line, and 50% of the gen-tie) established during various meetings with NE. While we still assert that 25% coverage of the solar field is insufficient, especially as proposed (i.e., using distance sampling), the biggest issues for us in this current iteration of the monitoring document are as follows. Hopefully, these points are considered as we move forward with this and other projects:

- While we recognize that 2 years is the minimum time required for monitoring and the BLM has discretion to require additional years based on the incoming data, we remain concerned about this considering the project will be on the landscape for a minimum of 30 years. The species identified and the mortalities per species are likely to differ considerably between years and there is no way this variability will be captured in such a short time period. We recommend that periodic monitoring of the facility (panel area, gen-tie, and fence line) is performed at various increments for the life of the project, especially as other projects go online in the desert; this will allow us to better understand and evaluate cumulative impacts and the contribution of this facility to overall avian impacts.

- We are concerned that distance sampling has never been used for this application (mortality monitoring on wind and solar); the justification for using this methodology is not well supported in the document or by the detectability study that HT Harvey ran on the Desert

Sunlight site (attached). Furthermore, many citations were not included in the References section, making evaluation difficult. The proposed plan is a hybrid of distance sampling and wind energy mortality monitoring methods that are based on different and not necessarily compatible assumptions. Nonetheless, we have made our changes in consultation with known distance sampling and mortality monitoring experts and would encourage that independent experts be included in discussions before any further revisions are made to the methodology. After some evaluation period, we should have the ability to modify the methodology, if necessary.

- We remain concerned about the monitoring intervals (7 and 21 days), which are not supported by the Corvus carcass surveys performed on-site, HTH's detectability study, and much of the available literature. We believe that these intervals coupled with the distance sampling method as proposed will result in significant under-sampling, which cannot be corrected for using statistics. Additionally, as proposed, surveys are unlikely to capture rare mortality events of uncommon and/or listed species, such as Yuma Ridgway's (clapper) rail.

- The References section does not reflect what was cited in the document; therefore, we were unable to understand some of the assumptions set forth in the plan.

- We remain concerned about using surveyors who do not have academic ornithological and field ecology/biology background. While training will be conducted, locating carcasses can be quite difficult, especially using distance sampling. Therefore, we added language that requires an Authorized Avian Biologist to be on-site during monitoring to provide oversight.

- If there needs to be a TAC, it should be open to public participation so that the process is transparent. We recommend seeking input from academic and NGO partners, as well as other consultants who have the appropriate expertise.

- We know you are working on an IM that requires third-party monitoring that eliminates confidentiality agreements; facilitates open communication to wildlife agencies from all project-related staff; requires submission of all raw data and methods; and makes all data available for peer review and assessment. We support this wholeheartedly and would like to offer any assistance with/review of the draft document.

We know time is short, but we would like to have a conversation should you have any questions or concerns about our comments. And please do cc us on your transmittal to WEST, First Solar, and NextEra.
Thanks,
Jody

Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
jody_fraser@fws.gov

From: Fraser, Jody
To: Eduardo Nieves; Erin Dean
Subject: Fwd: Sunlight mortality monitoring
Date: Friday, November 21, 2014 1:13:18 PM
Attachments: HTH_Desert Sunlight Dectectability Study Report_Nov2013.pdf
20141121_Draft_DSL_BBCS_4Nov2014_FWS comments integrated.docx

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FYI. Our most recent round of comments on First Solar/NextEra's mortality monitoring plan for Desert Sunlight. As I told Ed yesterday, we've been going back and forth with this applicant on this project, Genesis, Blythe, and McCoy for some time. And unfortunately, we are being constrained by agreements the BLM has made with the applicant on duration, coverage of the site, etc. Pretty frustrating.
Let me know if you have any questions,
Jody

---------- Forwarded message ----------
From: **Fraser, Jody** <jody_fraser@fws.gov>
Date: Fri, Nov 21, 2014 at 12:31 PM
Subject: Sunlight mortality monitoring
To: Amy Fesnock <afesnock@blm.gov>, Amedee Brickey <amedee_brickey@fws.gov>, Eric Davis <eric_davis@fws.gov>
Cc: Pete Sorensen <Pete_Sorensen@fws.gov>, Ken Corey <Ken_Corey@fws.gov>, Thomas Dietsch <thomas_dietsch@fws.gov>, Joel Pagel <joel_pagel@fws.gov>

Amy,

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Bird and Bat Conservation Strategy
Desert Sunlight Solar Farm Project -
Riverside County, California

DRAFT

Prepared for:

Desert Sunlight 250, LLC and

Desert Sunlight 300, LLC

700 Universe Blvd., Juno Beach, Florida 33408

Prepared by:

Western EcoSystems Technology, Inc.

415 West 17th Street, Suite 200
Cheyenne, Wyoming 82001

November 4, 2014

LIST OF ACRONYMS

BBCM	Bird and Bat Conservation Measure
BBCS	Bird and Bat Conservation Strategy
BGEPA	Bald and Golden Eagle Protection Act
BLM	Bureau of Land Management
BMP	Best Management Practice
CDFW	California Department of Fish and Wildlife
CVSR	California Valley Solar Ranch
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
IBA	Important Bird Area
MBTA	Migratory Bird Treaty Act
MW	Megawatt
NEPA	National Environmental Policy Act
O&M	Operations and Maintenance
PV	Photovoltaic
ROD	Record of Decision
ROW	right-of-way
USFWS	United States Fish and Wildlife Service
BCI	Bat Conservation International
GBBO	Great Basin Bird Observatory
FEIS	Final Environmental Impact Statement
SEZ	Solar Energy Zone
Dry Lake SEZ	Dry Lake Solar Energy Zone
APLIC	Avian and Power Line Interaction Committee
US	United States
Project	Desert Sunlight Solar Farm Project
ha	Hectare
ESA	Endangered Species Act
AC	alternating current
PEIS	Programmatic Environmental Impact Statement
WEAP	Worker Environmental Awareness Program
SWCA	SWCA Environmental Consultants
HEA	Habitat Equivalency Analysis
m	Meter
ft	Foot
km	Kilometer
Bat Lead	Lead Bat Biologist
Solar PEIS	*Programmatic Environmental Impact Statement (PEIS) for Solar Energy Development in Six Southwestern States*
USEPA	US Environmental Protection Agency
SE	standard error
DOE	Department of Energy
SWPPP	Stormwater Pollution Prevention Plan
ESA-E	listed as endangered under the federal Endangered Species Act
BLM-S	listed as a sensitive species by Bureau of Land Management
USFWS-BCC	US Fish and Wildlife Service Bird of Conservation Concern
EIR	environmental impact report
kV	Kilovolt

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Appendix A. Incidental Bird and Bat mortalities and injuries previously reported during construction of Desert Sunlight Solar Farm Project as of October 31, 2014~~Most Frequently Reported and Size Categories of Bird Species on e-Bird (eBird 2014) in Riverside County, California~~

Appendix B: Desert Sunlight Wildlife Incident Reporting System (WIRS)

1.0 INTRODUCTION

Desert Sunlight 250, LLC and Desert Sunlight 300, LLC (collectively, Desert Sunlight), has constructed and will operate the Desert Sunlight Solar Farm Project (Project), which consists of two main components: 1) a 550-megawatt (MW) photovoltaic (PV) generating facility; and 2) a 220-kilovolt (kV) generation interconnection (Gen-tie) line. The Project comprises approximately 1,700 hectares (ha; 4,200 acres) of land administered by the Bureau of Land Management (BLM) six miles north of Desert Center in Riverside County, California (Figure 1).

Information on pre-construction site conditions, avian and bat species present at the Project, risk assessment, and conservation measures implemented during pre-construction and construction phases are found in the Project's ~~approved~~ proposed "Avian and Bat Protection Plan, Desert Sunlight Solar Farm Project, BLM Case File Number CACA-48649, Riverside County, California" (Ironwood Consulting 2011). The Avian and Bat Protection Plan (ABPP) was included as part of Appendix H in the Desert Sunlight Solar Farm Project, California Desert Conservation Area Plan Amendment and Final Environmental Impact Statement (USDI BLM 2011) and the Project received a Record of Decision from the Secretary of the Department of the Interior on August 09, 2011. Avian and Bat Protection Plans have since been renamed, and are presently known as Bird and Bat Conservation Strategies (BBCS~~s~~). This BBCS replaces the ABPP and was developed in coordination with BLM to provide a written record of the Project's post-construction efforts to monitor potential project impacts to birds and bats and to document conservation measures that have been or will be taken to avoid, minimize, and/or mitigate for potential impacts. After introductory material on project description, the BBCS purpose, and regulatory framework, this BBCS addresses post-construction monitoring and adaptive management.



Figure 1. Location of the Desert Sunlight Solar Farm Project, Riverside County, California.

1.1 Purpose

This document represents one chapter of the proposed BBCS for Desert Sunlight. The primary purpose of this ~~BBCS~~ Avian Fatality Monitoring Plan is to describe post-construction monitoring protocols ~~and adaptive management intended to avoid, minimize, and/or mitigate potential impacts to~~to identify the extent of mortality and injury to bird and bat species. Information from this plan will augment the ~~in this~~ BBCS, which is intended to guide the implementation of avoidance, minimization, and mitigation measures identified in the Project's approval documentation, and includes the following objectives:

- Identify construction and operational activities that may increase potential adverse effects to avian and bat species on and adjacent to Project components;
- Specify steps that will be taken to avoid, minimize, and mitigate any potential adverse effects on these species; articulate monitoring methods to determine effectiveness; and identify contingency measures;
- provide details for an Avian Fatality Monitoring ~~Study~~ Plan to be conducted post-construction, including applicable approved protocols that would be used for any surveys and/or monitoring conducted; and
- ~~detail long-term monitoring and reporting goals for the Project.~~

Comment [USFWS 1]: These should be in the BBCS, but are considerably lacking and should be re-constructed, and better described in the BBCS.

Comment [FWS2]: Extraneous info that is stated in other docs.

~~1.2 Regulatory Setting~~

~~Several federal and state laws and regulations, including National Environmental Policy Act (NEPA), the Endangered Species Act (ESA), the Migratory Bird Treaty Act (MBTA), the Bald and Golden Eagle Protection Act (BGEPA), and California Endangered Species Act, provide the foundation for the development of this BBCS.~~

~~*1.2.1 National Environmental Policy Act*~~

~~Under NEPA (42 United States Code [USC] §§ 4321-4370h), federal agencies are required to prepare an environmental impact statement (EIS) for any major federal action significantly affecting the quality of the human environment. An EIS must include an examination of the environmental impacts of a proposed project, a reasonable range of alternatives for a project, and other related matters. The environmental impacts of the Project have been addressed in the Final EIS and ROD (BLM 2011a,b). This BBCS implements Mitigation Measure (MM) WIL-5 in the Project's ROD.~~

~~*1.2.2 Endangered Species Act*~~

~~Certain species at risk of extinction, including many birds and bats, are protected under the federal ESA. The ESA defines and lists species as "endangered" and "threatened" and provides regulatory protection for the listed species. The ESA provides a program for conservation and recovery of threatened and endangered species. Section 7(a)(2) of the ESA directs all federal agencies to insure that any action they authorize, fund, or carry out does not jeopardize the~~

~~continued existence of an endangered or threatened species or destroy or adversely modify designated or proposed critical habitat (collectively, referred to as protected resources).~~

~~*1.2.3 Migratory Bird Treaty Act*~~

~~The MBTA (16 USC §§ 703, *et seq.*), makes it unlawful to "pursue, hunt, take, capture or kill; attempt to take capture or kill; possess; offer to or sell, barter, purchase, or deliver; or cause to be shipped, exported, imported, transported, or received any native migratory bird, part, nest, egg, or product." The MBTA, enforced by USFWS, protects all MBTA-listed migratory birds within the United States. In the continental U.S., native non-covered species generally belong to the Order Galliformes. Common non-native species not protected by the MBTA include rock pigeon (*Columba livia*), Eurasian collared-doves (*Streptopelia decaocto*), European starling (*Sturnus vulgaris*), and house sparrow (*Passer domesticus*; USFWS 2005). Although permits may be obtained to collect MBTA-listed birds for scientific purposes or to destroy depredating migratory birds, the MBTA does not provide any permit mechanism authorizing the incidental take of migratory birds in connection with otherwise lawful activities. Nevertheless, federal agencies such as the BLM have been directed to evaluate the effects of its actions on migratory birds, with an emphasis on species of concern (per Executive Order 13186).~~

~~*1.2.4 Bald and Golden Eagle Protection Act*~~

~~The BGEPA (16 USC §§ 668-668d) prohibits the take, defined as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb," of any bald eagle (*Haliaeetus leucocephalus*) or golden eagle (*Aquila chrysaetos*). Through recent regulation (50 Code of Federal Regulations [CFR] § 22.26; USFWS 2009), the USFWS can authorize take of bald and golden eagles when the take is associated with, but not the purpose of, an otherwise lawful activity and cannot practicably be avoided. The USFWS has issued Eagle Conservation Plan Guidance (USFWS 2013a) for land-based wind energy projects to help project proponents avoid unanticipated take of bald and golden eagles and comply with the BGEPA. Although the guidelines were developed for land-based wind energy projects, certain components of eagle surveys and monitoring are applicable to other renewable energy projects, including PV solar plants, and have been incorporated into this BBCS as appropriate.~~

~~*1.2.5 California Department of Fish and Game Codes*~~

~~CDFG Code Sections 2050-2085 – These codes encompass the applicable declarations and definitions of the California Endangered Species Act (CESA).~~

~~CDFG Code Sections 3503 and 3503.5 – These codes state that it is unlawful to take, possess, or needlessly destroy the nest or eggs of any bird (including birds of prey) or take, possess, or destroy birds of prey, except as otherwise provided by this code or any regulation made pursuant thereto.~~

~~CDFG Code Sections 3511, 4700, 5050, and 5515 – These state laws classify and prohibit the take of "fully protected" bird, mammal, amphibian/reptile, and fish species in California.~~

~~CDFG Code Section 3513 – This code prohibits any take or possession of birds that are designated by the MBTA as migratory non-game birds except as allowed by federal rules and regulations promulgated pursuant to the MBTA.~~

~~CDFG Code Section 4150 – This code defines all mammals that naturally occur in California as non-game mammals with exceptions for those defined as game mammals, fully protected mammals, or fur-bearing mammals. Non-game mammals or parts thereof may not be taken or possessed except as otherwise provided by this code or any regulation made pursuant thereto.~~

~~1.3 Corporate Policy and Coordination~~

~~Desert Sunlight maintains a commitment to work cooperatively to minimize adverse impacts to protected bird and bat species. Through the planning and construction stages of the Project, Desert Sunlight and its contractors and consultants worked in coordination with federal and state agency personnel regarding necessary wildlife surveys, siting considerations, mitigation measures and adaptive management to ensure that potential issues that could affect bird and bat species were identified as early as possible in the planning process and addressed through appropriate design, mitigation and adaptive management measures. Desert Sunlight will continue to work with the agencies to implement conservation measures intended to avoid, minimize, and/or mitigate potential impacts to bird and bat species, including those measures identified in this BBCS.~~

2.0 PROJECT DESCRIPTION

The Project is a PV solar power plant being developed on approximately 1,700 ha (4,200 acres) of public land administered by the BLM in Riverside County, California, approximately 9.7 km (~~six~~ 6 miles) north of the rural community of Desert Center (Figure 1). Project construction is anticipated to be concluded on or about January 2015. The Project consists of two main components: 1) a 550 MW PV generating facility (Solar Farm) of solar equipment; and 2) a 220 kV Gen-tie Line. More specifically, the Solar Farm consists of 466 individual PV arrays, with each array occupying 2.4 to 2.8 ha (6 to 7 acres) and consisting of rows of PV panels supported on steel posts, a power conversion station, and a transformer. High-capacity 34-kV collection lines will transfer power output from the PV arrays to the onsite substation via overhead lines. The total acreage of the Project (including the Gen-tie Line) is 4,085 acres (1,653 ha). A chain-link fence topped with barbed wire encloses the entire Solar Farm, including support facilities (encompassing approximately 3,697 acres [1,496 ha]). The solar arrays cover 2,984 acres (1,208 ha).

In addition to the PV generating facility, other primary Project features include an operations and maintenance (O&M) building, visitor center, parking areas, access roads, fiber-optic lines, water wells, wastewater treatment facilities, an onsite electrical substation, and the 220 kV Gen-tie Line connecting the Project to the power grid.

Project features -- including solar panels, overhead electrical feeder and distribution lines, the Gen-tie Line, temporary retention basins, and the perimeter security fence -- pose potential

mortality and injury risks to birds and bats. This BBCS focuses on permanent Project infrastructure elements including the solar panel arrays, perimeter fence and the Gen-tie Line. To minimize the threat of electrocution and collision, the Project's electrical distribution infrastructure is being built to avian-safe standards following Avian Power Line Interaction Committee (APLIC) guidelines (APLIC 2005, 2006, 2012). Should birds or bats collide with the on-site distribution powerlines, injuries and fatalities will be documented during sampling of the solar arrays, as well as incidentally by Project staff during other activities.

3.0 SITE CHARACTERIZATION

The Project site is located in a relatively flat, previously undeveloped area of Chuckwalla Valley in eastern Riverside County. It is approximately 9.6 km (5.9 mi) north of Interstate 10 and the rural community of Desert Center, between the cities of Coachella to the west and Blythe to the east. Joshua Tree National Park wraps around the Project site to the west, north, and east; at its closest point, the Project is approximately 2.2 km (1.4 miles) southwest of the park boundary. Lake Tamarisk, a small golf-resort community, is approximately 6.4 km (four miles) to the south. The inactive Kaiser Eagle Mountain Mine is approximately 1.6 km (one mile) to the west.

The Project site is in the Colorado Desert Bioregion, which is the western extension of the Sonoran Desert of southern Arizona and northwestern Mexico. The Mojave Desert, which includes portions of Joshua Tree National Park, lies immediately north of the Project area. Chuckwalla Valley encompasses a series of alluvial fans that gently slope toward the southwest and southeast.

The 2011 FEIS prepared for the Project (BLM 2011a) describes the biological setting of the Project area. The FEIS included the results of biological surveys conducted in areas of potential impact associated with the Solar Farm, Gen-tie Line, Red Bluff Substation, and possible alternative sites (all collectively referred to as the Biological Study Area [BSA]). Before construction began on the Project, vegetation in the BSA consisted of Sonoran creosote (*Larrea tridentata*) bush scrub and desert dry wash woodland communities. To prepare for installation of the solar arrays, the Solar Farm site was disked and rolled, such that the Project landscape is now relatively flat and uniform, with vegetation re-establishing on the site. Stabilized sand sheets and pockets of sand dune deposits are located to the east of the Project area, but the Solar Farm site lacks wind-blown sand formations. Disturbed and developed areas that are either barren or dominated by ruderal vegetation occur primarily along roadsides. Agricultural areas, mostly fallow jojoba (*Simmondsia chinensis*) farms, are located southeast of the Project site.

Two temporary 0.4-ha (1-acre) ponds provided water during construction of the Project. One of the ponds was removed, and the second pond will be removed by the end of 2014. Several retention basins, which may hold water for some time after a storm event, are located within the Project's perimeter security fence, along the western upstream boundary and on the southeastern downstream boundary. An open portion of the Colorado River Aqueduct runs around the north end of Chuckwalla Valley, from about 6 to 10 km (4 to 6 miles) north of the

Project site. An aquaculture facility, covering approximately 24 ha (60 acres), lies about 3 km (2 miles) south of the Project site and contains perennially open water. The community of Lake Tamarisk includes homes, a golf course, and a small lake complex. The habitat structure and available water in this community routinely attract resident and migratory birds. All of these water features (when watered, in the case of the retention basins) ~~have the potential to~~can attract water-associated birds and shorebirds, either during migration stopover periods or in the course of local and intraregional movements.

As of Oct 31, 2014, 198 avian and bat injuries or mortalities have been documented on-site during incidental construction monitoring of the Project (Appendix A, First Solar 2014). Avian mortalities are being reported by construction workers and other staff incidental to their work activities. Consequently, the incidental nature of the data needs to be considered when evaluating the information reported to date. Incidentally collected data do not provide enough information to accurately quantify the scope of actual avian mortalities on a project site. However, these data can provide important information such as the composition of species which may be at risk in the future. In addition, the data provide insights into project features and types of injuries that may be associated with mortalities (U.S. Fish and Wildlife Service 2014). The majority of mortalities documented on the Project site are water-associated taxa (SPUT data).

Comment [FWS3]: Nov. 4, 2014 SPUT rept.



Figure 2. Desert Sunlight Solar Farm vicinity map.

4.0 POST-CONSTRUCTION MONITORING PLAN

This section outlines a standardized approach to document known and projected bird and bat fatalities and injuries, and to estimate seasonal and annual post-construction fatality rates associated with Project features. The Plan includes an approach to determine whether there are spatial patterns of fatality rates within the solar field (i.e.~~g.~~., different fatality rates near panels on the edge of the solar arrays vs. the interior area of the arrays). The Plan is consistent with the Bird Monitoring and Avoidance Plan outlined in the Project's FEIS (BLM 2011a), and builds on standards and guidelines developed for the electric-utility and renewable-energy industries to quantify the risk of fatality and injury for birds and bats that may result from interactions with energy-related infrastructure (e.g., Anderson et al. 1999; APLIC 2005, 2006, 2012; California Energy Commission [CEC] and CDFG 2007; USFWS 2010, 2012). In particular, the Plan outlines a statistically sound spatial and temporal sampling plan, including protocols for independently estimating and correcting for quarterly searcher-efficiency and seasonal (i.e., at least quarterly) scavenger (avian and mammalian) removal rates. It describes specific data to be collected during scheduled carcass searches, protocols for handling any dead or injured birds and bats that are found, and procedures for reporting incidents to relevant government agencies. The study design is compatible with the BLM (2011b) Record of Decision requirement (MM-WIL-05) that, after the study is ~~deemed~~ complete, Desert Sunlight will ultimately submit a description of the study design and monitoring results to peer-reviewed scientific journals.

4.1 Goals and Objectives

Primary goals of the post-construction fatality monitoring program are:

1. Estimate overall annual avian fatality rate and species composition associated with ~~unique aspects~~the primary features of the Project~~'s solar facilities~~infrastructure. This estimate should include mortality associated with solar arrays, overhead lines including the Gen-tie Line, perimeter fence and other features of the Project that are may result in injury and fatality.
2. Determine which species, subspecies, and regional populations are at risk from ~~primary~~ project ~~features~~infrastructure and whether there are spatial and temporal patterns of fatality rates within the solar field (e.g., different fatality rates near panels on the edge of the solar arrays vs. the interior area of the arrays) and other project infrastructure.

~~2.~~3. Measuring effects of the Project in the context of other solar facilities. Comparable methods (e.g., line-distance sampling) and a comprehensive species list should be used at each of the project sites and positive and negative data should be reported for each (i.e., for each species, the surveyors state that no sign was found, sign was found that was inconclusive of fatality, or actual fatality estimates). Using similar methodologies, a comprehensive species list, and consistent data collection are steps that would make results useful for comparison across sites.

These goals need to be structured in a way that provides information on seasonal differences in fatality rates, and information about which taxonomic groups are most vulnerable. ~~and may~~SAdditional surveys and data analysis may be required and/or modified in the future by the BLM as data become available.~~.~~ Fatality estimates need to be adjusted to address carcass persistence and searcher efficiency as they change through seasons. Additionally, carcass persistence ~~surveys~~ trials will inform search intervals, which may be modified by the BLM based on trial results.

~~-~~Consistent with the above goals, the specific objectives of this Plan are as follows:

1. Conduct fatality searches for a minimum of 2~~two~~ years according to a spatial and temporal sampling plan that provides representative and statistically sound coverage of the solar arrays, consistent with monitoring required of other industries. The need for additional m~~M~~onitoring beyond the second year will depend on an evaluation of the survey results from the first 2 years to determine if the goals of the monitoring program have been met ~~depend on and be limited to issues identified during the first two years of monitoring, if any, and be narrowly focused to correspond to any such issues~~ (see section 5.0, Adaptive Management). The need to extend the monitoring period will be determined by the BLM and FWS. Standardized monitoring, as approved by the BLM and FWS, ~~is anticipated to~~will commence within 30 days of after the commercial operation delivery (COD) date (anticipated January 2015). Standardized monitoring on public lands may be altered ~~by the BLM~~ if new concepts~~,~~ and methods are developed and adopted by the BLM and the ~~w~~Wildlife agencies.
2. Conduct statistically sound, seasonal assessments to quantify and evaluate searcher efficiency of each searcher, and support calculations of adjusted fatality rates that account for variation in searcher efficiency related to seasons, different searchers, habitat visibility ~~classes~~ (to the degree applicable), and carcass ~~type~~species/size classes.
3. Conduct statistically sound, seasonal assessments ~~(i.e., at least quarterly during the first year of monitoring)~~ to quantify and evaluate carcass removal rates (i.e., carcass removal, destruction including dismemberment, or burial in sand due to scavengers, decay, or other abiotic [e.g., wind] or human [e.g., vehicle activity] factors) and support calculation of adjusted fatality rates that account for variation in carcass removal rates by season and carcass type/size classes. Seasonal assessments will ~~be~~ be used to determine appropriate search intervals during each season.

4. Use current, scientifically validated and accepted methods for calculating fatality rates adjusted for searcher-efficiency, carcass removal rates, and spatial and temporal sampling intensity. At present, the best methods are distance sampling combined with searcher efficiency and carcass removal bias adjustments and a fatality estimator such as the Shoenfeld (2004) or Huso (2012) estimators, but it should be noted that fatality estimation is an area of active research and 'best methods' are changing rapidly. Therefore, as data are collected, adaptive management of the study design and monitoring protocol may be necessary, and will be done as directed by the BLM in consultation with the ~~w~~Wildlife agencies.
5. Evaluate all applicable data using Dalthorp et al 2014 regarding evidence of absence estimator to adjust survey parameters as needed.
6. Summarize the species composition of fatalities according to taxonomic family, ~~,~~ and ecological guild (e.g., raptors, water-associated birds, passerines, etc.) to determine species or groups at risk.
~~5.~~ To the extent possible, summarize the composition of fatalities according to their likely propensity to collide with project components during the day vs. during the night based on known migratory patterns for the particular species.
7. Evaluate potential causes and correlates by collecting data collected beyond that which is required under the SPUT. Data to be collected include the weight of whole birds recovered, known published migration periods, summaries of preceding weather conditions which would have made migration likely (i.e., low pressure systems moving cross continent to the north of the project area, followed by periods of high pressure systems).
~~6.~~8. Data summaries, ~~and~~ accompanying raw data, and any GIS shapefiles will be ~~reported~~submitted to the BLM and Wildlife agencies with each seasonal report.

4.2 Monitoring Methods

A monitoring program will be implemented for at least ~~two~~ 2 years post-construction as specified below. This monitoring period may be extended by the BLM based on data analysis, quality of raw and analyzed data, and assessment of field effort to collect that data. ~~The~~Survey results and analysis ~~ongoing monitoring~~ will inform adaptive management decisions regarding any additional appropriate and practicable BBCMs to avoid, minimize, and/or mitigate for observed impacts.

4.2.1 Post-Construction Monitoring of Solar Arrays

The fundamental characteristics of a sampling program designed to produce valid estimates of fatality rates for a solar farm (including the number of arrays to be searched, the search interval, the seasonal extent of coverage, and the number of years of sampling) are determined based on several factors. These factors include the questions of interest~~,~~; the species of interest (e.g., resident, migratory, and/or wintering species) in the Project area~~,~~; desired precision~~,~~; best estimates of carcass-removal rates~~,~~; searcher efficiency~~,~~; expected encounter rates (in addition to searcher efficiency), which affect whether distance curves can be built at all (minimum 60-80

required); the Project size and layout~~,~~; and other relevant environmental (i.e., seasonal patterns), landscape~~,~~; and habitat characteristics.

The following hierarchical terminology is useful for describing the spatial and temporal sampling design used to monitor solar arrays:

1) **Panel Cartridge:** An engineered assembly of solar panels installed as a single unit (approximately 2.5 x 2.9 meters [m; 8.2 x 9.5 feet (ft)]).
2) **Row:** A collection of panel cartridges arrayed side-by-side on a common, linear support structure (variable lengths ranging from approximately 71 to 142 m [232 to 464 ft]).
3) **Section or Subarray:** A collection of usually 20 commonly energized rows that represent one quarter of a typical array; dimensions (on the order of 71 x 84 m [232 x 274 ft]) are mostly uniform within blocks, but vary slightly among blocks; in most cases, structurally continuous rows span sections of two adjacent arrays.
4) **Array:** A collection of four sections connected to a common power converter station (PCS) and transformer, encompassing 2.4–2.8 ha (5.9-6.9 ac), depending on subsection dimensions and spacing between subsections (i.e., 466 total units in the Solar Farm).
5) **Block:** Collections of commonly energized arrays (20 blocks, each composed of 11–32 arrays).

4.2.2 Survey Strategy

Sampling strategies used in carcass searches have typically involved transect sampling, whereby searchers walk or drive along pre-defined transects and search for carcasses in a swath where width depends on visibility, target taxa, and other factors. The layout of PV facilities presents problems for a transect-sampling approach because rows of panels are close together (i.e., less than ~~five~~ 5 m [16 ft] at the Project). Because the panels are mounted off-horizontal, a searcher walking or driving a transect between two rows can only effectively search one side of the transect (a 2.5-m [8.2-ft] swath), and the other side is obscured by the edge of a PV cartridge. However, walking perpendicular to panel rows along the edges of the rows allows observers to see a greater distance of the ground beneath the panels. ~~Because the transect width is only 2.5 m, transects would need to be four to 12 times as long as if the width could be 10 – 30 m to maintain the same search area.~~ Surveyors will walk the lines unless temperatures (i.e., 95-100+ degrees F) warrant driving in open, covered (buggies) and/or air-conditioned vehicles. Should driving surveys be used, searcher efficiency trials will be conducted prior to implementation; results will be submitted and evaluated by the BLM and FWS within 2-weeks of completion of the trials to determine if conducting surveys using vehicles is acceptable. Other accommodations may be required to enable completion of surveys during high temperatures, such as shifting surveys to dawn and dusk.

~~-~~The layout of PV facilities is ~~are~~ well-suited to a distance-sampling approach. Distance sampling involves ~~searchers walking or driving~~searching a transect line and~~, but it departs from transect survey methodology in its assumptions about carcass detection along the transect. Distance sampling starts from the~~ ~~assume~~ption that searcher efficiency decreases (possibly

dramatically) as a function of distance from the observer, and is ideally suited to situations in which animals (or carcasses) are sparsely distributed across a landscape (Buckland et al. 1993). However, Freilich et al. (2005) found that this holds only if the survey effort results in enough sightings, i.e., if surveys were only sufficient to detect 24 desert tortoises, the distance estimates were not informative. The assumption herein is that ~~T~~the landscape at the Project is flat and relatively clear of vegetation, which ~~lends additional~~should support ~~to~~ a distance sampling design.

Comment [FWS4]: Freilich, J. E., R. J. Camp, J. J. Duda, and A. E. Karl. 2005. Problems with sampling desert tortoises: a simulation analysis based on field data. Journal of Wildlife Management 69:45-56.

Distance sampling adjusts carcass counts for variable searcher efficiency by accounting for the *effective* area searched along a transect. Effective area is the actual area multiplied by the probability of detection at that distance. As a highly simplified example, if a searcher walks a 10-m long transect line and detects 90% of all carcasses within 10-m of the line, and 60% of carcasses that are 10 to 20 m (33 to 66 ft) from the line, then the effective area between zero and 10 m would be $10\,m \times 10\,m \times 0.9 = 90\,m^2$ and the effective area searched between 10 and 20 m would be $10\,m \times 10\,m \times 0.6 = 60\,m^2$. For the total 10 by 20-m area, the adjustment factor would be $\frac{90\,m^2 + 60\,m^2}{100\,m^2 + 100\,m^2} = 0.75$. In practice, searcher efficiency is modeled as a continuous function of distance, and the detection function is estimated from the carcass data (as opposed to a bias trial). The searcher efficiency bias trials can be used to augment carcass data for the detection function. If the detection function calculated from the bias trials differs from the detection function calculated from the carcass data, this suggests non-random distribution of carcasses within the arrays, and simultaneously provides an adjustment factor to account for non-random distribution of carcasses. Preliminary data from the California Valley Solar Ranch (CVSR) suggests that non-random carcass distribution may not be a problem at PV solar facilities (H.T. Harvey and Associates 2014). One advantage to a data-driven detection function is that it is not necessary to specify a transect width: the detection function includes information about the distance at which searcher efficiency drops to zero. The detection function should be used to determine the effective search area for the study.

4.2.3 Spatial Sampling Design

~~Recent statistical power and precision analyses conducted for another solar project being built roughly 193 km (120 miles) north of the Project site provides some guidance for developing a spatial sampling regime (TerraStat Consulting Group 2013). These simulations were based on projected sampling across an entire 392 MW solar thermal facility, so the results may not accurately reflect the expectation at facilities of different sizes or where sampling is constrained to smaller portions of a large facility; nevertheless, the general guidance they provide is useful. The simulation analyses were parameterized based on several wind-energy studies conducted in the Mojave Desert, and incorporated one of several well-studied mathematical approaches for estimating fatality rates adjusted for proportion of area sampled, search interval, searcher efficiency, and carcass persistence (Shoenfeld 2004). The power analyses assessed the effect of varying the proportion of area sampled from 1% to 30%, using search intervals of 7, 21, and 25 days, and simulating four hypothetical mortality rates (0.5, 1.0, 5.0, and 10 fatalities/MW/year), assuming exponentially distributed carcass removal rates with means of 7.4 or 21.8 days and searcher efficiencies of 0.55 and 0.69 for small and large birds, respectively.~~

Comment [FWS5]: Extraneous information that did not influence any decisions about the methodology.

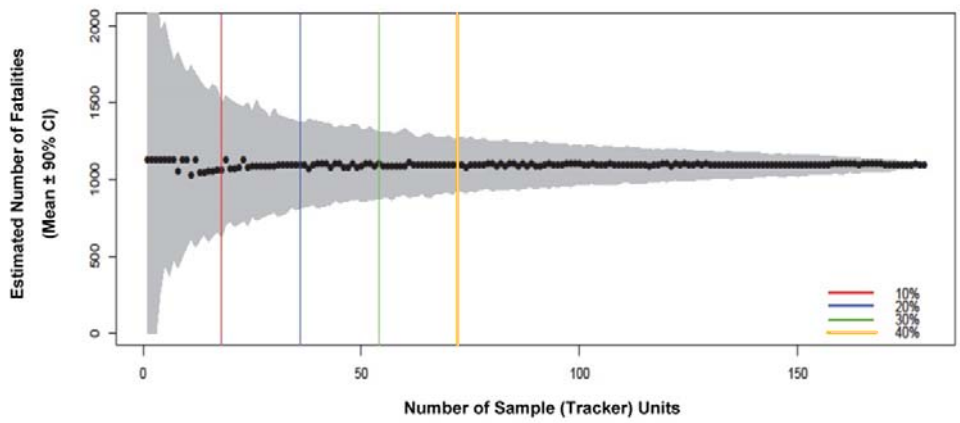
The simulation results indicated that the 90% confidence interval for the facility-wide fatality estimate narrowed as the survey area increased, as the search interval decreased, and as the simulated mortality rate increased. The coefficient of variation (CV: $100\% \times \frac{standard\ deviation}{mean}$) provides a way to evaluate the relative amount of imprecision in an estimate. The CV is useful because it doesn't depend on the size of the estimate and so can be compared between large and small estimates. Larger values of CV are associated with estimates that are less precise: a CV of 100% indicates an estimate with a standard deviation that is equal to the mean. At all of the simulated mortality rates, and based on a 21-day search interval, the CV for the fatality estimates approached an asymptote once the proportion of area searched reached about 20%. In addition, at the 20% sample level, the CV for the fatality estimates was less than 25% for mortality rates that exceeded 1.0 fatality/MW/year. This level of precision generally is considered adequate for answering the primary questions of interest in such fatality studies (Strickland et al. 2011), and is consistent with guidance from the USFWS Land-Based Wind Energy Guidelines (2012), which states that "the carcass searching protocol should be adequate to answer applicable Tier 4 questions at an appropriate level of precision to make *general* conclusions about the project, *and is not intended to provide highly precise measurements of fatalities*" (p. 45; emphasis added). At the lowest simulated mortality rate, with a 21-day search interval, the coefficient of variation was above 50% at 20% of area sampled, which would be considered a marginal precision level for answering the questions of interest. From a practical standpoint, the importance of precision is diminished if impacts are low. For example, if the take estimate is 0.1 bird per year with 200% CV, this suggests a 90% confidence interval of about (0, 0.4), or a range of less than half a bird per year. On the other hand, if the take estimate is 100 birds per year and the CV is 20%, the 90% confidence interval is (61, 139), or a range of 78 birds per year.

At the lower simulated mortality rates, increasing the proportion of area sampled from 20% to 30% had less impact on the precision compared to decreasing the search interval from 21 days to 7 days. For the two highest simulated mortality rates, however, varying the search interval had less effect on the precision of the adjusted fatality estimates, whether based on 20% or 30% of area sampled, with the CVs remaining between about 8% – 19%. At the 1.0 fatality/MW/year mortality rate with 20% of the area sampled, the CV increased from about 25% with a 7-day search interval to about 40% with a 21-day search interval. At the 0.5 fatalities/MW/year mortality rate with 20% of the area sampled, the relevant change in the CV was from 37% to 57%.

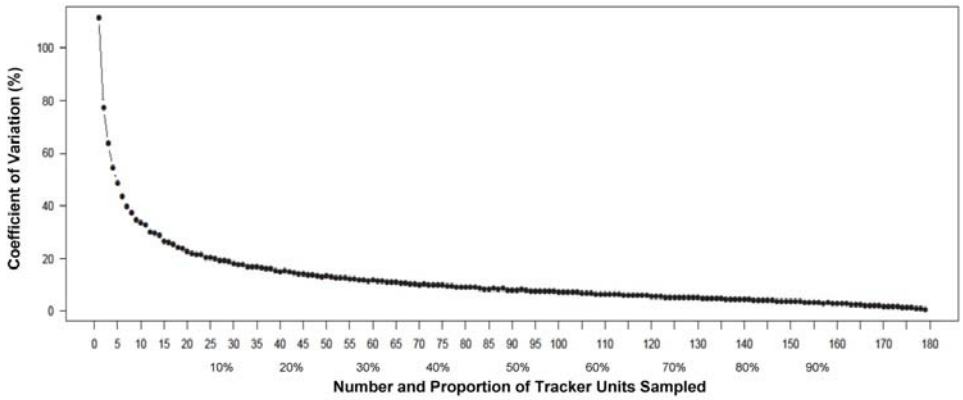
Analysis of data from the CVSR in San Luis Obispo County, California (H.T. Harvey and Associates 2014) corroborates the simulation results. The CVSR is a recently completed 250-MW facility comprising nine discrete photovoltaic solar arrays, which collectively cover approximately 642 ha (1,586 acres) of primarily degraded annual grassland. Beginning in fall 2012, 100% of two arrays were surveyed weekly for bird and bat fatalities using 50-foot transects for large birds and 20-foot transects for bats and small birds. A total of 175 avian fatalities was found during standardized surveys in the two arrays over 10 months. The Huso (2010) estimator was used to estimate the number of fatalities based on documented fatalities adjusted for searcher efficiency and carcass persistence.

~~Two methods were used to evaluate the potential effects of reduced search area on fatality estimates at CVSR. Spatial clustering of fatalities was evaluated using Global Moran's I index, which indicates whether objects are clumped, uniform, or random in their spatial distribution (ESRI ArcInfo 10.0, geographic statistical toolbox). Spatial clumping of fatalities within the individual arrays would introduce additional uncertainty into the fatality estimates if sampling covered considerably less than 100% of the survey area. The second method involved resampling the observed fatality data to generate distributions of fatality estimates that would have resulted from searching less than 100% of the study area. Sample sizes varied from one sample unit up to the total number of sample units in the study area (180). (At CVSR, a sample unit was one "tracker unit," a group of 18 rows of solar panels covering approximately 0.34 ha (0.85 acres); sample units at CVSR were about a quarter the size of the proposed sample units at Desert Sunlight.) For each sample size, 2,000 simulated datasets were generated from the original data. Then, for each simulated dataset, the total number of fatalities for the study area was calculated by scaling the sample count according to the proportion of area represented in the sample. This procedure resulted in a distribution of possible fatality estimates for each level of area sampled. Based on these distributions, means, 90% confidence intervals (CI), and CVs were calculated for each sample size to evaluate the effect of sampling variation on the magnitude and precision of the fatality estimates.~~

~~The geospatial analysis indicated that the distribution of fatalities in the two, 100% searched arrays did not differ significantly from a random distribution (H.T. Harvey and Associates 2014). Results of the resampling analysis indicated that the mean fatality estimates and the 90% CIs for those estimates stabilized at about 20% of area sampled (Figure 3). Examined in a different way, the results indicated that the CVs of the sample distributions declined with increasing sample size and that, again beyond about 20% of area sampled, further increases in area sampled resulted in only small increases in precision (Figure 4). Moreover, at the 20% sample level, the CV for the fatality estimates was well below 20%, which is a level of precision that is considered adequate for answering the primary questions of interest in such fatality studies (Strickland et al. 2011, USFWS 2012). With regard to applying these results to other sites, it is important to note that the results may be sensitive to: 1) the relative proportions of large and small birds represented in the fatality sample, which were combined for this analysis; 2) the number and distribution of fatalities across the site; and 3) the influence of variation in searcher efficiency and carcass persistence.~~



~~**Figure 3. Resampling results from the California Valley Solar Ranch illustrating how the accuracy and precision of fatality estimates and varies with proportion of area sampled.**~~



~~**Figure 4. Resampling results from the California Valley Solar Ranch illustrating how the coefficient of variation for fatality estimates varies with proportion of area sampled.**~~

Based on ~~the simulation analyses, data from CVSR,~~ consultation with ~~relevant~~ permitting and Wildlife agencies~~, and consideration of the characteristics of this particular Project~~, sampling will encompass approximately a minimum of 25% of the completed solar arrays as summarized in ~~(~~Table 1 unless or until data support changes in this sampling design.~~)~~.

Table 1. Solar array sampling area characteristics.

Total area	1,208 ha
Proportion sampled	25%
Sampling unit	~2.6-ha spatial equivalent of 1 array

Number of sampling units (whole facility)	466
Migration season search interval (~~March~~ February 15 thru May 31, ~~September~~ August 1 thru ~~October~~November 15)	7 days unless adjusted by BLM and ~~w~~Wildlife agencies based on results carcass persistence trials.
Non-migration season search interval (June 1 thru ~~August~~July 31, November 16 through Feb 14)	21 days unless adjusted by BLM and ~~w~~Wildlife agencies based on results of carcass persistence trials.
Anticipated surveys per year	30
Duration of sampling	2 years with potential modifications after 1 year or when required by the BLM and ~~w~~Wildlife agencies

Because both the layout of the solar arrays and the landscape of the Solar Farm (i.e., mostly flat and free of vegetation) are largely uniform, a relatively simple random sampling design is likely to be adequate for sampling the arrays. However, in the absence of data, a spatially balanced sampling design will be used. Because spatially balanced designs ensure that sample effort is distributed over the whole study area, they help to ensure that spatially organized trends in mortality–should they exist-- can be extracted from the data. The drivers of spatial variation in avian activity ~~are not important to~~may be important to the statistical sampling design if avian use patterns affect the distribution of mortalities on the project site. ~~but a~~As an example, ~~two~~ factors that may affect avian use patterns ~~are~~include: 1) habitat variation around the Project site; ~~or~~ 2) the possibility that distinct movement corridors variably concentrate birds over certain areas of the Project site (e.g., migrating or commuting water-associated birds); or 3) use of distribution lines (and other transmission line infrastructure) as roosting sites. Distribution lines within the solar field may also pose a collision risk to birds ~~within the solar field~~. To achieve spatially balanced sampling, the site will be divided into 10 approximately equal-sized sampling areas and sampling will be stratified among those areas. Sampling will also be stratified proportionally among areas with distribution lines and those without.

The sampling units for the surveys consist of areas equivalent in size to a single array, but because of the concatenation of panel rows across arrays, they may include conjoined sections from multiple individual arrays (Figure 5). Within sampling areas, individual sampling units will be randomly selected to compose a 25% sample (± 1–2%). However, because of the configuration of the Project, the proposed survey technique is not likely to capture 100% of the sampling areas due to low detectability within the panel field because monitors are searching from the ends of rows rather than walking down each row or every other row (i.e., as was done at CVSR). Consequently, the effective area monitored is expected to be significantly less than 25%. Therefore, this will be corrected based on results of the distance sampling and detection function analysis.

Observers will survey sampling units ~~by driving or walking along~~ from the outer edges of collections of continuous solar panel rows and scanning between each row for fatalities, with each side-specific survey covering half the width of the sampling unit (Figures 5 and 6). Surveys will occur along roadways that run approximately north–south (consistent with the “Bio Blitz” report; USFWS 2013) through the middle of most arrays and along the outer edges of some arrays. Most sampling units consist of combined array sections from four adjacent arrays. In

most cases, the four sections run together both north to south and east to west, forming a continuous block composed of 40 continuous panel rows that are approximately 140 m- (460-ft) long. In these cases, two north-south routes will comprise the sampling-unit survey, with each route involving scanning across a maximum of 70 m (230 ft; Figure 5). Other sampling units have an additional roadway and powerline corridor running through the middle, such that the sampling unit consists of two subsections, each composed of 40 panel rows that are approximately 70 m long. In these cases, four north-south routes will comprise the sampling unit survey, with each route involving a maximum scanning distance of 35 m (115 ft) covering half the width of a subsection (Figure 5). For a few other sampling units with different layouts along the perimeter of the Solar Farm, ~~a hybrid survey scenario will apply~~the analysis will need to take into account the potentially different row lengths. Distance sampling and resulting data will be used to calculate detectability curves to calculate the effective search area for these different panel configurations. The effective search area includes the area from the perimeter to that distance from the end of the panel row where the fraction of birds detected for each target size class is above a set fraction (threshold) as determined through robust searcher efficiency trials. The BLM and Wildlife agencies prefer that the threshold detection rate be set to at least 0.6 - 0.8; however, analysis of raw data and detectability curves by the agencies will ultimately determine the threshold detection rate that will be used to evaluate effective search area. Also, ~~D~~due to potential differences in visibility based on the direction that the observer is moving (N or S) in relation to the south-facing angle of the fixed panels, detectability needs to be calculated for the each direction that the observers moved during transects.

~~-~~Given the results of the initial detectability field trial, the expectation is that effective sampling for ~~medium and~~ larger birds (1000+ grams) ~~(Appendix A)~~ will extend the full width of all sampling units, whether composed of 140-m or 70-m long panel rows. For smaller and medium sized birds (0-100 grams and 101-999 grams) and bats, however, effective sampling is expected to be constrained to less than the maximum viewing distance. Density estimation using distance sampling techniques is easier, and can be accomplished with greater precision if the data are truncated at a distance beyond which the probability of detection is low (Buckland et al. 1993). Accordingly, data will be truncated and the density of carcasses in the effective search area will be used to calculate the density of carcasses in the whole solar facility.

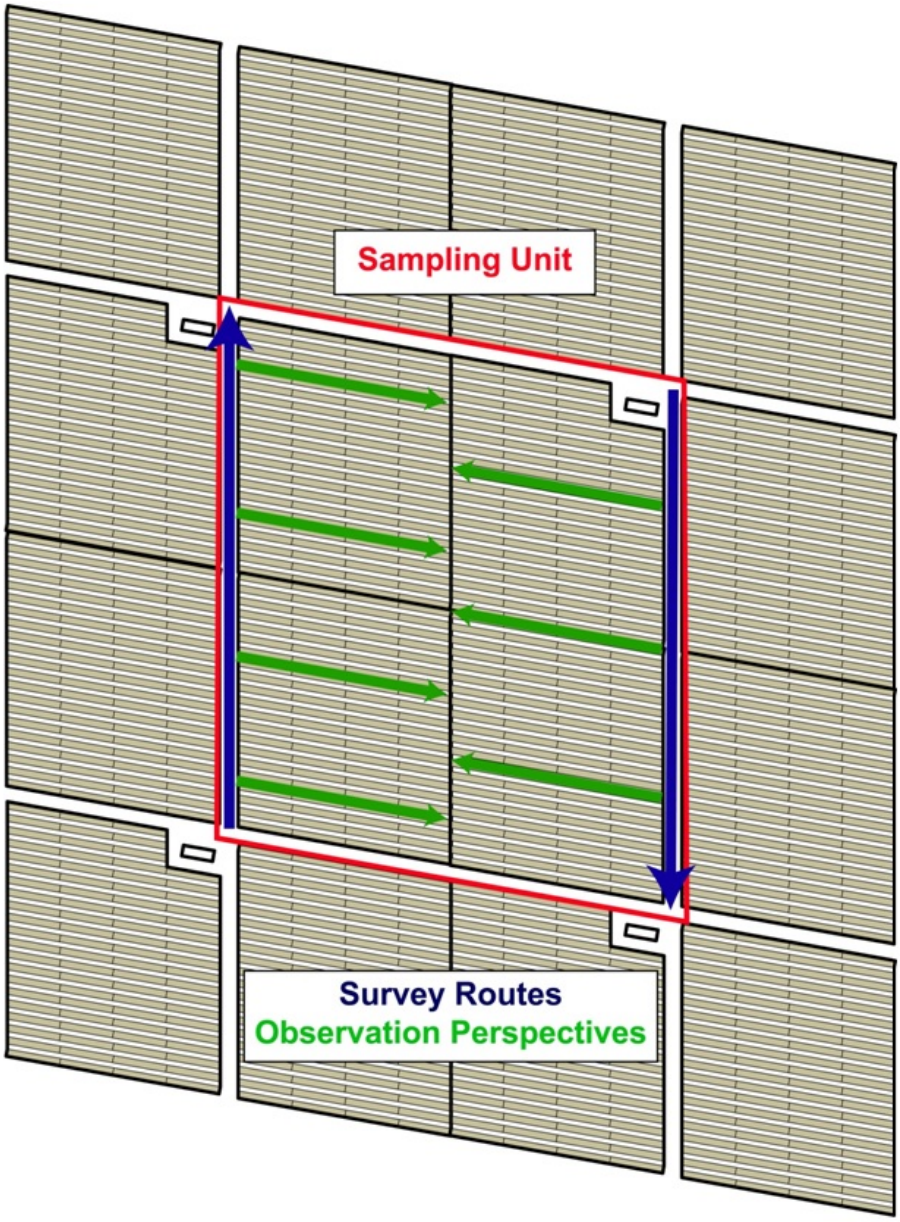


Figure 5. Illustration of a typical sampling unit and perimeter survey with travel routes and search areas ('observation perspectives').

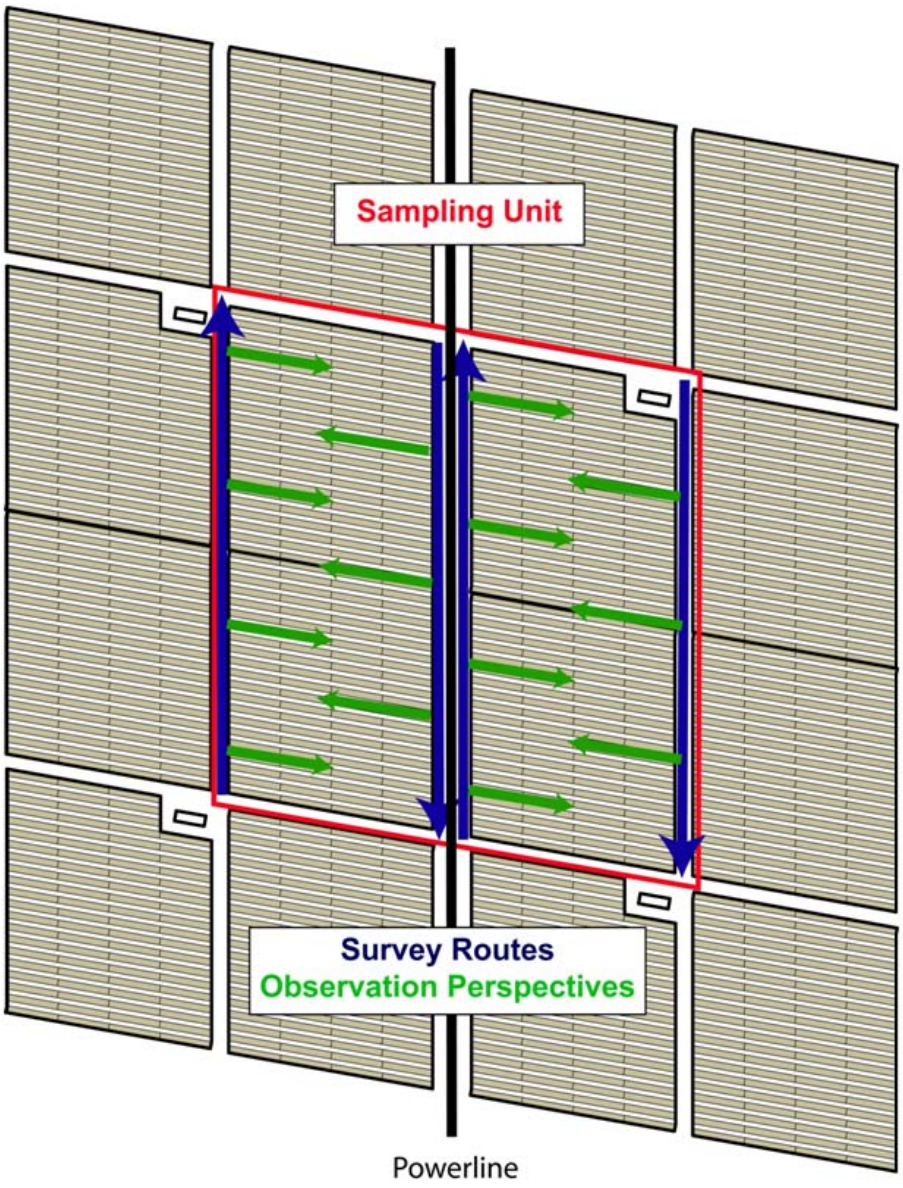


Figure 6. Illustration of a sampling unit survey including a distribution powerline with travel routes and search areas ('observation perspectives').

The perimeter-only survey design reflects two concerns: 1) minimizing movement between rows of solar panels. Because the area between electrified panel rows is an area of elevated risk, best practices dictate that personnel do not enter elevated risk zones unnecessarily; and 2) achieving an effective balance between logistic efficiency and sampling rigor given the constraints of transect spacing due to the width of panel rows. In support of the latter objective, a field trial was conducted to evaluate the ability of observers to detect carcasses of different types and sizes based on perimeter-only surveys that did not require walking between the rows of panels (H.T. Harvey and Associates 2013c). The field-trial surveys involved walking along the north-south edges of array sections perpendicular to the rows of panels and using naked-eye and binocular-aided scanning to search for placed carcasses of five non-native bird species, ranging in size from small house sparrows (*Passer domesticus*) to large ring-necked pheasants (*Phasianus colchicus*).

The field trial confirmed that, given the relatively flat, sandy, and uncluttered substrate that characterizes most of this solar facility, relatively large carcasses, such as rock pigeons (*Columba livia*) and pheasants, can be reliably detected using perimeter-only surveys, even when the continuous span of the solar-panel rows is 140 m, which applies across most of the facility. For smaller carcasses up to the size of small quail (*Coturnix japonica* in this case), however, detection probabilities will be much more strongly a function of distance. Distance sampling is well-equipped to estimate population sizes, even when the detection function indicates a rapid decay in detectability with distance (Buckland et al. 1993).

Not being able to detect most small to many medium-sized carcasses over a substantial portion of the solar facility would comprise a problematic bias if the probability of carcass occurrence was non-random within arrays (i.e., within sample units). In other words, the bias would create a problem for achieving representative sampling if the probability of mortality due to panel collisions varied in some predictable fashion relative to the distance from array edges, or if there was a tendency for fatalities to be clustered in the interior of the panel areas. Whether or not such conditions may apply to this facility is currently unknown; however, initial post-construction monitoring at another large photovoltaic solar facility in central California has not demonstrated any particular spatial bias in the distribution of fatalities documented there (H.T. Harvey and Associates 2014).

On this basis, fatality sampling will proceed using distance-sampling survey techniques and analytical methods, which include estimating and accounting for distance-related variation in the probability of detection based on the carcass data and bias trial data. In addition, searcher-efficiency trials that are tailored to include evaluating the influence of distance on the probability of detection will be conducted to assess and adjust for the possibility of a spatial bias in the distribution of fatalities. This can be accomplished by comparing the detection function derived from independent searcher-efficiency trials with the detection function derived from the actual fatality data (as it is calculated based on standard distance-sampling techniques). If the two independently derived functions suggest divergent relationships between distance and the probability of detection, the pattern of divergence between them can be used to adjust results of the distance-sampling-based fatality estimate. Depending on the detectability curve results,

methods for follow-up studies may be needed to corrected for this potential source of bias as determined by BLM and the ~~w~~Wildlife agencies.

4.2.4 Temporal Sampling Design

The appropriate frequency of fatality surveys depends on the species of interest and average carcass persistence times (Smallwood 2007, Strickland et al. 2011, USFWS 2012). Large raptors tend to persist and remain detectable for extended periods (weeks to months) due to low scavenging rates and relatively slow decay rates. If only large species were of interest, extended search intervals of 30–45 days might be appropriate; however, smaller birds and bats typically disappear at much faster rates, so shorter search intervals are required to ensure effective documentation of fatality rates among these species.

~~Publically accessible data from three wind-energy studies in the nearby Mojave Desert region of California and western Arizona provide additional, relevant insight (Chatfield et al. 2009, 2010; Thompson and Bay 2012). These studies recorded average persistence times of 17.5–46.8 days for large birds (average 29.0 days, median 22.6 days) and from 5.6–17.4 days (average 9.9 days, median 6.5 days) for small birds.~~ If the ~~average~~ median carcass-persistence time for small and medium birds and bats on the Project site ~~ranks~~ is low ~~toward the low end of values from these studies, which is typical for a broad range of other studies,~~ a 7-day search interval may be required to effectively document fatality rates for small birds and bats. If, however, median small-bird and bat carcass-persistence rates are ~~closer to or exceed the average value from these studies~~greater than 7 days, then a longer search interval may be more appropriate. The initial indications of rapid scavenging by ravens at the Project site suggested that a shorter search interval may be needed to provide precise fatality estimates for small bird and bat carcasses., ~~but L~~later data from Corvus (2014) suggests that ~~in spite of~~there is a period of rapid initial removal, particularly for small and medium carcasses with 50% of carcasses in these size classes removed in 8 and 5 days, respectively. Overall, mean carcass persistence in May and June was greater than 10 days for any size of carcass, and greater than 24 days for large carcasses.

Based on these considerations and preliminary data, and based on the simulation analyses discussed previously, the search interval for fatality monitoring will be variable depending on season (Table 2). Searches will be conducted every 7 days during spring and fall migration (~~March~~ February 15 – May 31, and ~~September~~ August 1 – ~~October 31~~November 15), and every 21 days during summer and winter (June 1 to ~~August~~ July 31, and November 16 to February ~~28/29~~14). After the first 6 months of fatality monitoring and concurrent carcass-removal trials (see below) have been conducted, the search interval may be adjusted based on estimates of carcass persistence. Using this seasonal approach will introduce a bias toward those species that migrate during the windows with more frequent monitoring. Migration is staggered and not all species migrate at the same time. Consequently, species that migrate outside of these designated periods may be underrepresented in the samples. In addition, Fall migration is typically longer than Spring ~~M~~migration with individuals at different life history stages migrating at different times. The data should be evaluated for potential bias resulting from differing migratory periods among species.

Adjusting fatality counts for carcass removal works best when the search interval remains constant through time (Huso 2010); however, within survey periods, season-specific estimates of carcass persistence can be calculated and incorporated in the overall estimation process when variable search intervals are used in different seasons (Shoenfeld 2004; Huso 2010, 2012; and other estimators all have facility to accommodate season-specific estimates). In addition, survey schedules will ensure that fatality surveys are evenly spaced in time to maximize detection of potential, unusual fatality events (Strickland et al. 2011). ~~For these reasons, a standard schedule for completing the surveys will be developed and followed, such that some surveys occur on each day of the standard work week and all sampling units are surveyed on a regular schedule, as dictated by the season.~~

4.2.5 Survey and Data Collection Protocols

Fatality surveys will be conducted ~~on foot or by vehicle,~~ with the observers striving for a consistent pace/speed and approach, and a uniform search effort throughout the search. Searchers will use binoculars at their discretion to survey for carcasses between each row of panels. ~~Surveyors will never be far from a vehicle and will be encouraged to take breaks. Additionally, t~~The Project has rigorous safety protocols in place that address heat and other safety issues. When a potential carcass is detected, the observer will immediately proceed down the row to confirm the detection and, if valid, fully document and bag it according to standard protocols (see below). Depending on the size and nature of the carcass, the observer will either immediately collect the carcass (smaller, easily collected and transported packages) or flag it for pick-up once the sampling-unit survey is completed (larger, messier, or otherwise complicated collections) or to identify it to species. All carcasses will be stored in freezers on-site until the BLM and FWS determine the ultimate disposition.

All bird and bat injuries and fatalities discovered during, or incidental to, the standard carcass surveys will be documented according to the requirements and standards reflected in the USFWS Avian Injury and Mortality Reporting Form. The form is a reporting requirement of the USFWS Special Utility (SPUT) Permit issued to the Project to authorize the handling of dead or injured birds. In addition, finds will be classified as a fatality according to standards commonly applied in California (Altamont Pass Monitoring Team 2007, CEC and CDFG 2007), which dictate that when only feathers are found, to be classified as a fatality, each find must include a feather spot of at least five tail feathers or two primaries within 5 m (16.4 ft) or less of each other, or a total of 10 feathers. Searchers will make their best attempt to classify feather spots by size according to the sizes or identifying features of the feathers. A separate fatality estimate will be made for feather spots for which size classification is impossible. Digital photographs will be taken to document all incidents, and when possible, plausible cause of death will be indicated on data sheets based on evidence (such as blood or fecal smears on solar panels, burns that may indicate electrocution~~,~~ or blunt trauma that may indicate collisions). All carcasses will be examined and where possible cause of death will be recorded (e.g. burns may indicate electrocution, and blunt trauma may indicate collisions). The Authorized Avian Biologist will make any decisions on questionable finds.

All fatalities will be assigned to a size class, a taxonomic family, and an ecological guild according to ~~Appendix A~~weight categories (e.g., 0-100 grams; 101-999 grams; and 1000+ grams). ~~Carcasses from species that are nonresident and are night-migrants will be considered night-time fatalities; and those that are nonresident and day-migrants will be considered day-time fatalities. Residents and species known to migrate both at night and during the day will be classified as uncertain with respect to likely time of death.~~ Species will also be classified as resident, overwintering, or whether they are diurnal or nocturnal migrants (or both). It is necessary to know size classes to appropriately correct for searcher efficiency and scavenging, and information about taxonomic family, ecological guild, and time of day when active are relevant to the specific USFWS and project goals of the monitoring plan.

To ensure accurate ~~delineation~~ documentation of the fatality locations, the observer will record the array number, Global Positioning System (GPS) coordinates in latitude/longitude ~~at the site of the fatality~~of the carcass location~~,~~ using a handheld device accurate to ± 3 to 4 m (9.8 to 13.1 ft), and a measurement of the distance from the fatality location to the end of the panel row from which the carcass was detected. When an observer proceeds down panel rows to confirm and document detected fatalities, they may detect other fatalities that they did not observe based on the perimeter-only survey. Because it is not known how the initial detection of a carcass in a row may affect subsequent detections in the same row, all fatalities located during surveys should be included in the analysis. ~~Including such detections in the fatality estimate will confound estimation of fatality density based on application of standard distance-sampling analytical methodology. Therefore, all such supplementary detections will be classified as "incidental" finds (discussed further below) and will be excluded from calculation of adjusted fatality estimates.~~

Data records for each survey will also include: 1) full first and last names of all relevant surveyors in case of future questions; 2) start and stop times for each individual sampling-unit survey; 3) a description of the weather conditions during each search; 4) a standardized description of the current habitat and visibility classes represented within each sampling unit; and 5) a description of any search-area access issues, if relevant. Data collected will also include all appropriate fields contained in the SPUT permit.

All personnel involved in implementing this Plan will be ~~covered~~ included as sub-permittees under the Project's USFWS SPUT Permit, issued either to the Project or a consultant authorized by the Project. If the CDFW does not consider coverage under the USFWS SPUT permit sufficient, all personnel implementing this plan will also be covered under any applicable CDFW Scientific Collecting Permit if provided and issued either to the Project or its consultant. Ideally, the relevant state and federal permits will allow fatalities discovered during the study to be removed from the field, stored on-site in a freezer, and used in searcher-efficiency and carcass-removal bias trials. Necessary exceptions will apply to all special-status species (see below). Otherwise, surveyors will place all discovered carcasses or body parts that are not of a special-status species and are not part of an ongoing bias trial in zip-locked plastic bags, clearly label each bag with the incident number, and deliver the bags for storage in the designated freezer at the Project facility.

4.2.6 Fence Line Monitoring

The perimeter fence is subject to inspections approximately once every 7 days during spring and fall migration, and approximately once every 21 days during winter and summer periods with intervals adjusted as necessary based on the carcass persistence trials to be consistent with search intervals at other project features. A searcher will drive the entire inner perimeter of the fence, scanning for fatalities within an approximate 6-m strip transect centered on the fence. Travel speed will be no greater than 5 miles per hour (8 kilometers per hour) while searching to ensure quality detection, and safety. Personnel conducting fence checks will document bird and bat injuries and fatalities discovered along the inner fence line. Injuries and fatalities along the fence line will be documented in the same manner as used for those discovered during the array carcass surveys, and will be reported to the USFWS and CDFW as part of the same overall reporting process. Searcher efficiency trials will be conducted along the inside of the fence in a similar fashion to the trials at the solar arrays. Carcass removal trials conducted at solar arrays will include areas near the inside of the fence as well.

4.2.7 Power Line Monitoring

Power lines are built to APLIC (2005, 2006, 2012) guidelines; ~~as such fatality due to power lines is considered to have been minimized~~however, there is still a collision risk for many bird species. ~~However~~Consequently, a 50% sample of the Gen-tie Line will be monitored every ~~seven~~ 7 days during spring and fall migration and approximately every 21 days during summer and winter with intervals adjusted as necessary based on the carcass persistence trials to be consistent with search intervals at other project features. Searchers will drive or walk 50% of the Gen-tie Line during each visit, scanning for birds within 15 m from the line. Injuries and fatalities along the Gen-tie Line will be documented in the same manner as used for those discovered during the array carcass surveys, and will be reported to the USFWS and CDFW as part of the same overall reporting process.

Some overhead electrical feeder and distribution power lines are co-located within the solar arrays and these co-located power lines may be searched as part of the regular monitoring schedule at arrays. Fatalities that are determined to have been caused by the power lines (as determined by the nature of injuries) will be reported as such to the USFWS and CDFW as part of the same overall reporting process and included in fatality estimates~~, but excluded from adjusted fatality estimates attributed to PV arrays~~. In addition, portions of the Gen-tie Line are co-located with third-party structures and facilities, including other transmission infrastructure and roadways and, therefore, the source of a particular fatality may not be attributable to the Project's facilities.

4.2.8 Clearance Surveys

Depending on when fatality surveys commence, a one-time clearance survey will be conducted beginning approximately 21 days before the first round of official surveys begins in all areas planned for survey (fence line~~fenceline~~, gen-tie sample areas and solar arrays). The purpose of this survey will be to clear the survey area of any accumulated carcasses that may be present. The sequence of clearance surveys will mirror the schedule for the first official survey to ensure

that the interval between the clearance survey and the first standard survey is the same for all sampling units. This is necessary to ensure that carcasses detected during the first round of surveys represent only fatalities that occurred during a preceding interval equivalent to the search interval that will apply afterward. Carcasses that are missed during the clearance survey will cause an upward (conservative) bias in the fatality estimate. Additionally, some estimators (such as the Huso estimator described above) become biased if carcasses that are not detected during a trial are still available during subsequent trials. ~~This 'bleed-through' effect can be ameliorated by including only fresh carcasses in the fatality estimate, where 'fresh' means a carcass that has arrived since the previous search. Carcasses that cannot reliably be aged (probably most carcasses) will be assumed to be fresh; this will cause an upward (conservative) bias in the fatality estimate.~~

Comment [FWS MB-TD6]: The carcass aging process is not well defined and may vary seasonally. Appropriate caveats can be included in the reporting, but all carcasses found during surveys should be used.

4.3 Bird Rescue

Surveyors will record any injured or rescued birds or bats located during surveys. Birds will be assessed by a qualified biologist to determine if it is appropriate to transport the individual to the nearest permitted rehabilitation facility for proper care, or to release them. Injured raptors will be handled only by experienced personnel and will be taken only to rehabilitation facilities that are permitted to handle raptors; this provision is particularly important for eagles. From the Project site, the closest rehabilitation facilities capable of handling all avian species are:

- Coachella Valley Wild Bird Center, 46500 Van Buren, Indio, California, 92201; Phone: 760-347-2647; Contact: Linda York, Executive Director; Hours of Operation: 9:00am-12:00pm, 7 days a week. http://coachellavalleywildbirdcenter.org/
- The Living Desert Zoo & Gardens, 47900 Portola Avenue, Palm Desert, California, 92260; Phone: 760-346-5694 x8 x1; Contact: Sheila Lindquist, North American Manager; Hours of operation: 8:00am-1:30pm (June-September), 9:00am-5:00pm (October-May), 7 days a week (closed Christmas Day). http://www.livingdesert.org/animals/wildlife-rehabilitation/
- Hope Wildlife Rescue, 18950 Consul Avenue, Corona, CA 92881; Phone: 951-279-3232; Contact: Bill Anderson or Cyndi Floreno; **must call first (this is a CA-licensed rehabilitator working out of a personal residence)**.
- All God's Creatures Wildlife Rescue & Rehabilitation, Chino Hills, CA; Phone: 909-393-1590; Contact: Lori Bayour; http://www.allgodscreatures.net/index.html; no address available, contact by phone.
- International Bird Rescue, Los Angeles Center, San Pedro, CA, 90731; Phone: 310-514-2573; Hours: 8:00 am - 5:00 pm.
- A list of wildlife rehabilitators maintained by California Department of Fish and Wildlife: http://www.dfg.ca.gov/wildlife/WIL/rehab/facilities.html
- The California Council for Wildlife Rehabilitators: http://www.ccwr.org/resources/rehabilitation-facilities-region-6.html

If stranded, but apparently uninjured, water-associated birds are discovered at any time during surveys, the surveyor will take immediate steps to notify an on-call biologist, and assist with efforts to secure the bird and have it transferred as expediently as possible to Lake Tamarisk for release into the water ~~there~~. Injured water-associated birds may be taken to International Bird Rescue, which specializes in the care and rehabilitation of water-associated birds. If a mass event involving many such birds is observed, the surveyor will immediately notify on-call biologist or other biological personnel working on the site about the details and request their assistance identifying injured versus non-injured birds and transporting injured birds to the nearest rehabilitation facility. International Bird Rescue can also assist with mass stranding events. Rehabilitation facilities should be compensated for the costs associated with each bird put under their care.

If a surveyor discovers a dead individual of a species that is fully protected by the state or federally or state-listed as threatened or endangered, and for which handling is not specifically authorized under the applicable salvage permits, he/she will collect data and photos as for any other fatality, but then flag the carcass to mark its location and leave it in place. If it is a federally listed species under the Endangered Species Act, the surveyor will ~~within 24 hours call~~immediately call a USFWS Office of Law Enforcement special agent to determine the appropriate follow-up action.

4.4 Searcher Efficiency Trials

Estimating searcher-efficiency (distance-related detection functions) is a standard component of the distance-sampling approach. Moreover, because estimating detection functions is applied to all survey data and can be organized to variably adjust in relation to covariates of interest (e.g., season, habitat, and carcass size classes), application of this approach will account for typical factors of interest for fatality studies (CEC and CDFG 2007, Huso 2010, Korner-Nievergelt et al. 2011, USFWS 2012, Smallwood 2013). In this case, independent searcher-efficiency trials per biologist, per season, will be conducted to help assess and adjust for potential spatial bias in the distribution of fatalities among arrays. Separate trials will be conducted to assess detection probability associated with fence and gen-tie line searches.

~~The desert landscape in which this Project is located generally changes little with the seasons, save for brief periods following winter and spring rains when floods may occur and blooming plants may flourish. Therefore, the need to repeat searcher efficiency trials to evaluate the effects of seasonal habitat change will be limited. A recent meta-analysis involving data from more than 70 wind energy projects suggested that including habitat visibility class as a predictive variable generally eliminated any otherwise apparent seasonal effects on searcher efficiency (Smallwood 2013). Nevertheless,~~ ~~the~~ Ssupplementary searcher efficiency trials for this Project will be repeated ~~quarterly~~ seasonally (winter, spring, summer, and fall) and trials will be organized so that all search personnel participate in bias trials. Placement of trial specimens will be timed to limit the number of trial carcasses placed on the landscape at any one time (minimizing the chance of artificially attracting scavengers or, conversely, scavenger swamping; Smallwood 2007). This approach will also ensure that any new surveyors that join the crew participate in searcher efficiency trials. The trials will also be managed to ensure effective

quantification of searcher efficiency in relation to predefined habitat visibility classes (low, medium, and high, if relevant), size classes of birds (small and large), and detection distance.

The bias-trial sample sizes required to produce precise, adjusted fatality estimates are not well established, in part because needs may vary substantially depending on actual project-specific searcher efficiency, carcass removal, and fatality rates. To ensure reasonable mathematical integrity and statistical power, the software package developed by Huso et al. (2012) for estimating wind-energy-related fatalities requires a minimum of 10 bias-trial samples for each covariate-group analyzed. If there was no substantive variation in habitat/substrate cover within the Solar Farm, this requirement would translate a minimum need to place at least 10 small and 10 large birds as test specimens during each seasonal period. However, using searcher-efficiency trials to help evaluate the efficacy of perimeter-only surveys and the distance-sampling approach used in this investigation will require larger sample sizes to produce a sampling design that effectively accounts for distance as a key covariate of interest. In addition, if growth of new ruderal vegetation, or substrate heterogeneity caused by flood events, is sufficient to create a new visibility class under the arrays, the specimen numbers would need to increase to effectively account for this factor. It will also be necessary to ensure that the estimates of searcher efficiency encompass variation among multiple surveyors. ~~The influence of individual surveyors will not be accounted for in a formal, statistical sense by including "surveyor" as a covariate in the estimation model; however, all surveyors will be tested similarly.~~ Each surveyor will be exposed to multiple test specimens of each size class, and at similar repeated levels if testing in different habitat visibility classes is required. A minimum of 20 carcass samples per size class is anticipated within the fence line~~, solar array,~~ and gen-tie sampling areas per season. Within solar arrays, a sufficient number of carcasses shall be placed across the potential range of distances being searched to allow calculation of a robust searcher efficiency detection function for each observer across the entire distance.

Comment [FWS MB-TD7]: Do searcher efficiency trials need to be conducted in an arena with adequate trial samples at each distance? Even if done in survey plots there needs to be adequate trial samples at each distance.

Comment [USFWS 8]: How will these few samples 'test' the observers?

Jody, did we settle on a number for searcher efficiency trials?

Besides representing birds of different sizes, another important factor to consider in searcher-efficiency and carcass-removal trials is the bird species to use as trial specimens. Ideally, all carcasses used for both searcher-efficiency and carcass-removal trials should reflect the range of species likely to be encountered as fatalities in the Project area (CEC and CDFG 2007). Because obtaining sufficient samples of "natural" carcasses often is difficult, researchers frequently resort to using readily available, non-native surrogate species in bias trails; however, this practice may result in biased results when compared to studies that use only "natural" specimens (Smallwood 2007). For all bias trials, this program will maximize use of representative native or naturalized species authorized by permits, either found during the study or gathered elsewhere, as needed, and from diverse sources where possible, but all trial carcasses will be obtained and deployed in a manner that are consistent with applicable regulatory requirements.

Another factor that influences carcass detectability is how fresh and intact the carcass is (Smallwood 2007, 2013). If multiple pieces of a depredated or scavenged carcass are scattered over a modest area, in some cases the fatality may be more easily detected; however, detectability generally decreases when only remnants of a carcass are present, or when the

carcass is aged and degraded. Nevertheless, in contrast to wind-energy projects, there is little expectation that this Project will cause injuries and fatalities that result in dismembered carcasses, so this factor is not expected to influence searcher-efficiency or carcass-removal rates (Smallwood 2013). Therefore, bias trials conducted in this study will involve primarily intact carcasses. The searcher-efficiency trial specimens may range from freshly thawed to partially decayed (i.e., selected, subject to availability, to mimic the range of carcass decay that typically accrues over 7-day periods).

A field supervisor or other technician not involved in the standard surveys will place the trial specimens and will recover any specimens missed by the surveyors. All trial specimens will be placed according to a sampling plan that randomly allocates carcasses of different sizes among survey plots and survey days within the assessment areas, but is stratified to ensure equitable representation of different surveyors, fence line vs. solar arrays vs. gen-tie and seasons. To minimize the possibility of unnecessarily attracting scavengers or, conversely, contributing to scavenger swamping, which could affect ongoing carcass-removal trials (Smallwood 2007, Smallwood et al. 2010), placement of searcher-efficiency trial specimens will ~~occur sporadically~~be distributed throughout the ~~first~~ year (appropriately organized to provide season-specific estimates with adequate samples per surveyor/per season to provide a robust estimate of searcher efficiency~~, if required~~), with few specimens placed at any one time. Carcasses will be placed carefully to minimize disturbance of substrates that may bias carcass detection.

All trial specimens will be inconspicuously marked with a piece of black electrical tape wrapped around one leg, in a manner that allows the surveyor to readily distinguish trial specimens from new fatalities, but without rendering the specimen unnaturally conspicuous (Smallwood 2007, USFWS 2012). To ensure a degree of "natural" placement, carcasses need to be represented by placing between rows of panels, under panels, near i-beams supporting the panels, or in the open. Therefore, carcasses will be tossed towards the designated, randomly chosen placement spot from a distance of ~~one~~ 3 to ~~two~~ 6 m. Documentation of each location will include GPS coordinates, notes about the substrate and carcass placement, and a digital photo of the placement location.

Surveyors will have only one opportunity to discover placed specimens. Any missed specimens will be recovered as quickly as possible after surveys have been completed in a given area, and after the surveyor(s) have become aware of the trial through discovery of one or more specimens. Some researchers have argued for leaving missed specimens in place to enable possible discovery in a subsequent survey and thereby mimic the natural situation in which "bleed-through" is possible (e.g., Smallwood 2013, Warren-Hicks et al. 2013; discussed further below). Although this approach may have merit in some situations, its potential value for this Project is offset by the need to avoid attracting ravens, which represent a threat to desert tortoises living in the area (Ironwood Consulting 2010b).

4.5 Carcass Persistence Trials

The degree to which carcasses persist on the landscape depends on a variety of factors reflecting seasonal variation in landscape/climatic conditions and the scavenger community.

The composition and activity patterns of the scavenger community often vary seasonally as birds migrate, new juvenile birds and mammals join the local population, and mammalian scavengers variably hibernate or estivate. Seasonally variable climatic conditions also may contribute to variation in carcass decay and removal rates due to variation in temperatures, solar insolation, wind patterns, and the frequency of flooding events. Therefore, to ensure accurate treatment of this bias factor, carcass-persistence rates will be assessed on a quarterly or at least semi-annual basis during the first year that fatality surveys are conducted (CEC and CDFG 2007, USFWS 2012, Smallwood 2013), and during the second year as needed. It is also imperative that carcass-persistence trials effectively account for the influence of carcass type/size, given that persistence times may vary widely depending on the species and size class involved (Smallwood 2013).

To quantify carcass persistence, a minimum of ~~10 small and 10 large birds~~20 small, 20 medium, and 10 large carcasses for each survey area (i.e., a total of 50 carcasses within each area for a total of 150 carcasses for each persistence trial) ~~-~~will be randomly placed and monitored within the solar arrays, along the fence line, and along 50% of the Gen-tie Line each season. A minimum of ½ of the carcasses will be monitored, using motion-triggered, digital trail cameras (e.g., see Smallwood et al. 2010) while the remaining will be visited on foot, for 30 days or until the carcass has deteriorated to a point where it would no longer qualify as a documentable fatality. For carcasses not set up with cameras, the carcass will be visited once a day for the first 4 days, and then every 3 to 5 days until 30 days is reached. Fake cameras or cameras without bias trial carcasses will also be placed to avoid training ravens to recognize cameras as "feeding stations". Periodic ground-based checking of carcasses also will occur to guard against misleading indicators of carcass removal, such as wind blowing the carcass out of the camera's field of view. To minimize potential bias caused by scavenger swamping (Smallwood 2007, Smallwood et al. 2010), carcass-persistence specimens will be distributed across the entire Solar Farm, not just in areas subject to standard surveys, and new specimens will be placed every two to three weeks in small numbers.

Trial specimens will include only intact, fresh (i.e., estimated to be no more than one or two days old and not noticeably desiccated) bird carcasses that are either discovered during the study or are acquired from other sources after having been frozen immediately following death. If permits allow, specimens used will be strictly limited to species known to occur in the area or that are substantially similar to such species. Surrogates, such as game birds and domestic waterfowl, will not be used unless required by permit restrictions, because scavenging rates for surrogates may be artificially high (Smallwood 2007, 2013).

To reduce possible biases related to leaving scent traces or visual cues that may unnecessarily alert potential scavengers, all carcasses used in carcass-persistence trials will be handled with latex gloves, and handling time will be minimized. All trial specimens will be inconspicuously marked with a small piece of green electrical tape wrapped around a leg to distinguish them from both unmarked fatalities and searcher-efficiency trial specimens.

Upon conclusion of the relevant monitoring period, each trial specimen will be classified into one of the following categories:

Intact: Whole and unscavenged other than by insects

Scavenged/depredated: Carcass present but incomplete, dismembered, or flesh removed

Feather spot: Carcass scavenged and removed, but sufficient feathers remain to qualify as a fatality, as defined above

Removed: Not enough remains to be considered a fatality during standard surveys, as defined above

4.6 Estimating Adjusted Fatality Rates

The sampling design will enable calculation of fatality estimates adjusted for searcher-efficiency, carcass-removal rates, and proportion of area sampled. The adjustment for searcher efficiency will occur by virtue of applying standard methods for analyzing detection data collected using distance-sampling methods, with the data partitioned by season and standardized carcass size classes. The probability of detecting rare events, such as a Yuma Ridgeway's (~~Yuma~~ formerly Clapper) Rail mortality should be calculated using the Evidence of Absence approach (Dalthorp et al 2014.

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The fatality estimates will be adjusted for variation in carcass persistence, by applying seasonal and carcass-size-specific correction factors to the fatality estimates that have been adjusted for distance-related variation in the probability of detection.

The analytical approach used to calculate adjusted fatality estimates will be similar to that applied in cases where the fatality estimates are derived from strip transects. ~~It is instructive to briefly review the history of methodologies applied in the context of renewable-energy studies, primarily at wind energy facilities, relevant insights about important factors to consider, and example formulations that will be applicable. It is also important to recognize that developing methods for conducting fatality surveys and associated bias trials, and for deriving accurate, adjusted, facility-wide fatality estimates is an actively evolving science. Accordingly, the analytical methods ultimately applied in this investigation may evolve over time to ensure application of the most current, rigorous and scientifically sound methods.~~

Comment [FWS9]: Extraneous information for methodology document – More appropriately placed in the subsequent reports.

~~The recent history of estimating bird and bat fatalities at renewable-energy facilities involves use of primarily four estimators (Korner-Nievergelt et al. 2011, Smallwood 2013, Warren-Hicks et al. 2013). Erickson et al. (2000) and Johnson et al. (2000, 2003) first developed and used a "naïve" estimator, representing a straightforward adjustment of the raw fatality count for the probability of carcass persistence and probability of detection. Shoenfeld (2004) modified the "naïve" estimator by assuming a Poisson process for the occurrence of bird deaths and scavenger removal, with that modification applied by Kerns and Kerlinger (2004) and Erickson et al. (2004). The modified estimator proved to be biased low, however, after which Smallwood (2007) developed an estimator that incorporated an adjustment for periodic repetition of search events.~~

~~Yet in practice, periods between searches often are inconsistent, which violates a primary assumption of Smallwood's estimator. Huso (2010) then conducted simulations and conceptualized the logic behind development of a new estimator, based on Thompson (1992). Huso's estimator is more flexible than the Shoenfeld and Smallwood estimators because it allows for unequal probability sampling, accounting for potential differences in searchability among plots and variation in detectability due to carcass size or type of habitat. It also incorporates an "effective search interval," based on the mean carcass persistence time, which is defined as the length of time during which the probability of a carcass persisting is more than 1%. Based on simulations, Huso (2010) found that her estimator was consistently less biased than the Shoenfeld and Smallwood estimators. In addition, although the Shoenfeld estimator could perform similarly under certain conditions (e.g., when search intervals are relatively long [14–28 days] and mean carcass persistence time is relatively short [less than 16 days]), Arnett et al. (2009) found that it greatly underestimated fatality when search efficiency was low (e.g., 13% for some bats).~~

~~A potential problem with both the Huso and Shoenfeld estimators is that their formulations assume that a given carcass is available to be discovered by a surveyor only once (Huso 2010), or that it is detectable with the same probability until it is removed (Shoenfeld 2004). In other words, the estimators make unrealistic assumptions about the probability that a carcass can be discovered in a subsequent survey if it was missed during the first survey conducted after deposition on the landscape. The idea that a given carcass may persist through more than one survey period is called "bleed through" (Smallwood 2013, Warren-Hicks et al. 2013).~~

~~More recently, Korner-Nievergelt et al. (2011) developed a new estimator, based on an explicit process model built from the conceptual model originally developed by Baerwald and Barclay (2009), which allowed for detection of carcasses during repeated searches, and accommodated decreasing searcher efficiency in repeated searches due to factors such as carcass decay. Based on simulations, they found that the Shoenfeld (2004) estimator generally underestimated fatalities unless carcass persistence time was long. They found that the naïve (Johnson et al. 2003) and Huso (2010) estimators overestimated fatalities when searcher efficiency was constant (and low for the Huso estimator), the search interval was short (1-, 7-, and 14-day intervals were analyzed), and average persistence time was long (30 days), but both estimators performed well when searcher efficiency decreased over time. The Korner-Nievergelt estimator appeared unbiased under all simulated scenarios where searcher efficiency and the probability of carcass removal remained constant over time, but it underestimated fatalities when searcher efficiency decreased over time. The Huso estimator proved robust when searcher efficiency and the probability of carcass removal decreased over time, whereas the Korner-Nievergelt estimator appeared robust to decreasing removal probability, but underestimated fatalities when searcher efficiency decreased over time and the search interval was short. All of the compared estimators were similarly biased low when the probability of carcass removal was high and increased through time. In the end, Korner-Nievergelt et al. (2011) concluded that no single estimator consistently outperformed the others and was likely to work optimally in all study situations. For this reason, the estimator (or estimators) selected will depend on the conditions~~

~~measured at the site and monitoring needs, including comparisons with previous studies and inclusion in meta-analyses.~~

~~Analogs of both the Huso and Korner-Nievergelt estimators should perform well for the Project. Korner-Nievergelt et al. (2011) touted stated that their new estimator as is adaptable to different situations, because it was is based on an explicit process model; however, the Huso (2010) estimator and related software (Huso et al. 2012; developed for wind-energy assessments but easily adaptable to solar-energy investigations) incorporates additional parameterization to model the influence on searcher efficiency and carcass removal of covariates, such as season, carcass type/size, and habitat visibility classes.~~

For illustrative purposes, we summarize here the basic formulation of the Huso estimator, the first part of which pertains to fatality estimation for different strata, or groups. Essentially, the smallest group for which fatalities are estimated can be considered a stratum, with stratum *k* representing, for example, a set of similarly sized birds within a defined habitat visibility class. Note that strata should be defined to ensure minimum variance in detection probabilities within individual strata, whereas probabilities may vary considerably among strata (e.g., for small versus large birds, or in habitats of low versus high visibility). Depending on the circumstances, there can be strata based on species groups, size classes, seasons, habitats, and/or infrastructure types (also could conceivably model distance categories as another covariate).

For a particular stratum *k* for a given survey plot and search interval, fatality can be estimated as:

$$\hat{F}_k = \frac{c_k}{g_k},$$

where c_k is the number of observed carcasses and g_k is the probability of detecting a carcass. The detection probability *g* typically is the product of three variables: the probability of a carcass persisting (*r*), the probability of a carcass being observed given that it persists (*p*), and the effective proportion of the interval sampled (*v*):

$$\hat{g} = \hat{p} * \hat{r} * \hat{v}.$$

The probability of a carcass being observed given that it persists (i.e., searcher efficiency) is estimated as:

$$\hat{p} = \frac{number\_observed}{number\_available},$$

with data for calculating this metric derived from searcher-efficiency trials where known numbers of carcasses are distributed over the search area and carcass detection rates are quantified.

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The probability of a carcass persisting is estimated as:

$$\hat{r} = \frac{\bar{t}(1-e^{-I/\bar{t}})}{I},$$

where $\bar{t}$ is the estimated mean carcass persistence time and *I* is estimated as:

$$I = \min(I_a, \tilde{I}),$$

where I_a is the minimum actual time between searches and $\tilde{I}$ is the effective search interval, defined as:

$$\tilde{I} = -\log(0.01) \cdot \bar{t}.$$

The effective proportion of the interval sampled is estimated as:

$$\hat{v} = \min(1, \tilde{I} / I_a).$$

For this investigation, the formulation for calculating $\hat{F}_j$ would differ from that outlined above, in that "c_k" would represent the estimated number of fatalities already adjusted for searcher efficiency, based on application of distance-sampling methodology, and then g_k would represent the product of only the estimated carcass persistence (*r*) and the effective proportion of the interval sampled (*v*). With this modification, the rest of the formulation would be similar.

For a given plot in search interval *j*, the adjusted total number of fatalities is calculated as:

$$\hat{F}_j = \sum_{k=1}^{K} \hat{F}_{jk},$$

where $\hat{F}_{jk}$ is the estimated number of fatalities within stratum *k* of search interval *j*.

Finally, the estimate of Project-wide total fatalities during a given search interval is estimated as:

$$\hat{F} = \frac{1}{a} \times \left(\sum_{i=1}^{n} \frac{1}{\pi_i} \sum_{j=1}^{J} \hat{F}_{ij} \right),$$

where $\hat{F}_{ij}$ is the number of fatalities on plot *i* in search interval *j*, *a* is the proportion of area that was searched and π_i represents a modified weight associated with an unequal probability

sample (Huso 2010), and is the product of the probability of selecting plot *i* and the proportion of fatalities contained in plot *i*. The total number of search intervals is *J*, assuming that there is the same number of search intervals for each plot. In practice, one need not assume that *J* is constant, but presenting it this way simplifies the notation.

Adjusted fatality estimates for the Solar Farm will be expressed per unit area (e.g., acres ~~or~~ and arrays) per year.

4.7 Incidental Mortality Documentation

Once post-construction fatality monitoring begins, all subsequent bird and bat injuries and fatalities detected incidental to the standardized, post-construction monitoring program will be classified as "incidental finds," documented using similar procedures as are used for specimens discovered during the standardized surveys, and integrated with records from the standardized surveys for summary reporting and evaluation purposes. Incidental finds that occur outside of standard search areas will not be included in calculations of adjusted post-construction fatality estimates, but will be summarized within seasonal and annual reports (discussed below).

~~To ensure compatibility with the standardized fatality monitoring program, it will be essential that dead birds found in the standard search areas by other personnel be left in place, undisturbed, and not reported to the standard fatality surveyors at least until after the next scheduled search. Allowing incidentally detected carcasses to remain in place for one or more scheduled searches is consistent with the assumptions of distance sampling and the fatality estimators; failing to do so will degrade the precision of the estimates. For this reason, the locations of i~~Incidental finds located in standardized search areas will be ~~documented using location descriptions, specimen descriptions, and digital photographs, and will only be~~ reported directly to ~~the personnel responsible for overseeing the fatality monitoring program~~Authorized Biologist~~, without informing any of the standard fatality surveyors~~. These incidental finds will be documented using the same procedures as those discovered during standardized surveys. Data from incidental finds within standardized search areas will be included in analyses to estimate mortality within the solar arrays. Appropriate caveats can be included within the seasonal and annual reports to document the potential magnitude of any biases created by recovering these carcasses. ~~Incidental finds discovered in standard search areas can then serve to supplement the searcher efficiency trial specimens, and can be recovered later, as appropriate, by the monitoring team. Incidental finds within standard search areas that are discovered by searchers will be reported as normal. A summary of those that are not discovered by searchers will be reported, including whether they were recovered, and species identification. Incidental finds discovered outside the standard search areas can either be used as carcass removal trial specimens, if discovered fresh and permits allow, or recovered in short order by the fatality monitoring team per the usual practices for documenting and handling fatalities, outlined elsewhere in this Plan.~~

Comment [FWS10]: This is contrary to the raven mgmt. plan which requires that all carcasses be removed upon discovery to avoid conflicts with desert tortoises in adjacent habitats.

5.0 MINIMUM CREDENTIALS OF MONITORING PERSONNEL AND TRAINING

The mortality monitoring program will be overseen by an Authorized Avian Biologist approved by BLM and Wildlife agencies that has demonstrated the ability to accurately identify the species of birds and bats potentially impacted by the project. The Authorized Avian Biologist must be on-site during all monitoring periods to aid other staff in identifying effected species and cause of death.

Monitoring personnel may include solar facility staff. Monitors will be trained in distance-sampling search methodology, correct identification and documentation of carcasses, implementation of carcass removal trials and notification of a rehabilitation center in the event of injured birds or bats. Only staff/technicians that are listed under the SPUT permit will be allowed to handle carcasses. Accurate identification of rare, special status species will be emphasized during training. All surveyors will have photo cards to classify specimens and will take photographs of all finds. All data collection will be standardized and the Authorized Avian Biologist will decide which to report as survey observations; however, all observations that were not conclusive will be reported.

The curriculum and training materials for training of personnel in monitoring methods will be approved by BLM and the ~~W~~wildlife agencies ~~occur over a 2-day period~~ and will be conducted by ~~a qualified biologist~~The Authorized Avian Biologist prior to initiation of the study. Training materials may be augmented by wildlife agency input. Components of the training program will include:

- A classroom-based portion with lecture and handout materials, and photographic or specimen-based (if available) species identification;
- A field-based portion that allows trainees the opportunity to practice and receive feedback on conducting carcass searches and trials, identification of species, completing data forms, and following protocols for assessing and assisting injured birds and bats.
- Assessment of learning outcomes for each participant.
- A training log to be updated with each trainee's name and contact information upon successful completion of the course.

The ~~biologist~~ Authorized Avian Biologist that will conduct the training will, minimally, have a master's degree in biological sciences, zoology, botany, ecology, or a related field, and at least one year of field experience with avian or bat research or monitoring in the region. ~~A qualified~~The Authorized Avian ~~b~~Biologist will be on-site ~~call~~ to assist with species identification (e.g., via review of photographs ~~or onsite assistance if necessary~~) and other aspects of reporting. All reference material should be maintained and provided to the agencies in the event that there are questions about species identification.

6.0 REPORTING

6.1 USFWS Bird Fatality/Injury Reporting Program

The Project will report all documented bird injuries and fatalities to the USFWS using the required Avian Injury and Mortality Reporting Form that is a reporting requirement of the USFWS SPUT Permit issued to the Project to authorize the handling of dead or injured birds. SPUT reporting will be submitted monthly or in accordance with the terms of the permit. Similar reporting to the CDFW will be accomplished as a condition of any relevant Scientific Collecting Permit that the CDFW may issue to authorize the handling of dead or injured birds under state law.

6.2 Incidental Bird Injury/Fatality Reporting

All injury and fatality incidents discovered outside of the standardized~~standard~~ carcass surveys will be documented in the same manner as used for those discovered during the carcass surveys, and will be reported to the USFWS and CDFW as part of the ~~same overall reporting~~SPUT process. Special status or listed species will also be handled in a way that is consistent with project-specific SPUT permit conditions.

~~To ensure compatibility with the standardized fatality monitoring program, it will be essential that dead birds incidentally found by other personnel be left in place, undisturbed, and not reported to the standard fatality surveyors at least until after the next scheduled search. Allowing incidentally detected carcasses to remain in place for one or more scheduled searches is consistent with the assumptions of distance sampling and the fatality estimators; failing to do so will degrade the precision of the estimates. For this reason, the locations of incidental finds in standardized search areas will be documented using location descriptions, specimen descriptions, and digital photographs, and will only be reported directly to the personnel responsible for overseeing the fatality monitoring program, without informing any of the standard fatality surveyors. Incidental finds discovered in standard search areas can then serve to supplement the searcher-efficiency trial specimens, and can be recovered later, as appropriate, by the monitoring team. Incidental finds within standard search areas that are discovered by searchers will be reported as normal. A summary of those that are not discovered by searchers will be reported, including whether they were recovered, and species identification. Incidental finds discovered outside the standard search areas can either be used as carcass-removal trial specimens, if discovered fresh and permits allow, or recovered in short order by the fatality monitoring team per the usual practices for documenting and handling fatalities, outlined elsewhere in this Plan.~~ Additional details on reporting are found in the Desert Sunlight Wildlife Incident Reporting System (Appendix B).

6.3 Summary Reports

~~Quarterly~~ ~~monthly~~Seasonal electronic summaries of all biological monitoring activities will be submitted to BLM, USFWS, and CDFW throughout the ~~initial 2-year~~ monitoring period.~~.~~ After the fourth quarter of each year of monitoring, a biologist representing the Project will assist the

Project in preparing and submitting to the CDFW, BLM, and USFWS an annual report that summarizes dates, durations, and results of all fatality monitoring conducted to date.

~~A second comprehensive report will be prepared after the second full year of monitoring and submitted to the agencies.~~ To address the specific objectives of the monitoring plan, summary reports will include overall fatality estimates with confidence intervals, and fatality estimates by season. In addition, to the extent possible, fatality rates will be estimated and reported for likely diurnal, and likely nocturnal species, and for ecological guilds of interest (e.g., raptors, water-associated birds, passerines). Summary reports will also include spatial analyses of the data that address whether fatalities are randomly distributed throughout the facility. All raw field notes, field data, photographs, and GIS data will be submitted to the agencies.

7.0 TECHNICAL ADVISORY ~~GROUP~~ COMMITTEE AND ADAPTIVE MANAGEMENT

A Technical Advisory ~~Group~~ Committee (TAC~~G~~) will monitor Project activities, including fatality data, to provide recommendations to the BLM on the need for any adaptive management, including the adoption of avoidance and minimization measures ~~based on reported data~~and methods for assessing their effectiveness. The TAC~~G~~ will consist of ~~a single~~ resource specialists and project biologists from the BLM, USFWS, and CDFW. Persons with scientific expertise may be invited by TAC members if deemed appropriate. In addition, representatives from the Project and the consultants involved in the conduct of the studies will attend and participate in meetings. The TAC~~G~~ will provide advice and recommendations to the BLM Authorized Officer on developing and implementing effective measures to monitor, avoid, minimize, and mitigate impacts to wildlife species and their habitats related to operations. The BLM Authorized Officer will evaluate any recommendations of the TAC~~G~~, including discussions with Desert Sunlight concerning new measures or measures that are not completely detailed in this BBCS and requisite effectiveness monitoring, and make a decision on what measure(s) and monitoring to require for implementation.

A TAC~~G~~ Lead from the Project will be designated for the group whose duties will include disseminating Project data, including data on fatality events, setting up and moderating meetings, reviewing of fatality data, and documenting adaptive management recommendations for the Project. Because the Project occurs on BLM land and BLM is the federal decision-maker, BLM will provide a designated TAC~~G~~ Lead for the Project. It is the TAC~~G~~ Lead's responsibility to coordinate meetings and involve all team members.

The guiding principles, duties, and responsibilities of the TAC~~G~~ include the following.

- The TAC is only an advisory committee.
- Make recommendations based on best available science and existing approvals and permits to address specific issues resulting from the Project.

- Recommendations will generally be made by consensus. Where consensus cannot be reached, multiple recommendations will be put forth to the BLM, FWS, and CDFW management for a final ~~management~~ decision.
- ~~The TACG is only an advisory committee, and final management decisions will be made by the BLM Authorized Officer.~~
- Provide sufficient flexibility to adapt as more is learned about the Project as well as strategies to reduce avian impacts if warranted.
- Review results of fatality monitoring.
- In accordance with Mitigation Measure (MM) WIL-5 of the Project's Record of Decision (ROD), if BLM, FWS, and CDFW determine~~s~~, based on post-construction monitoring, that bird mortality caused by solar facilities is substantial and is having potentially adverse impacts on special-status bird populations, the TA~~G~~C may recommend adaptive management strategies such as installing additional bird flight diverters, alterations to project components that have been identified as key mortality features, or implementing other appropriate actions to address the relevant findings based on the data.
- Review annual report on status of compliance with mitigation measures and permit conditions and provide recommendations to the BLM Authorized Officer and Wildlife agencies, as necessary.
- Evaluate effectiveness of implemented adaptive management strategies and provide the BLM Authorized Officer and Wildlife agencies with recommendations based on findings.
- The TACG~~G~~ will terminate when the BLM Authorized Officer and Wildlife agencies determine~~s~~ that it is no longer a necessary pathway in reducing avian and bat impacts.

The TACG~~G~~ shall hold the first meeting ~~approximately six 6~~3 ~~months after~~prior to commencement of post-construction monitoring commences to review any final details of the monitoring plan. Subsequent meetings will be held ~~once a year~~following each monitoring season~~,~~ ~~typically~~ and after the end of ~~the~~ each annual monitoring cycle.

After the initial ~~6~~3-month period, ~~and after the first year of monitoring,~~ the TACG~~G~~ will review the findings for each monitoring season to determine if adjustments to the monitoring frequency are warranted based on carcass persistence trial and other study results. Desert Sunlight and the agencies will also meet at the end of the second year of monitoring to determine if continued/focused monitoring is warranted. Continued/focused monitoring may be warranted if data indicate that bird mortality caused by solar facilities is substantial and is having potential adverse impacts on special-status bird populations or there are other special circumstances. Such monitoring will be designed to address specific concerns that are identified after review of the data.

8.0 REFERENCES

Comment [FWS11]: These references do not match those that are included in the text. Please revise.

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Appendix A. Incidental Bird and Bat mortalities and injuries previously reported during construction of Desert Sunlight Solar Farm Project as of October 31, 2014 (First Solar 2014).

Bird Species Common Name (AOU English Name)	Count
Western Grebe	25
Eared Grebe	16
American Coot	10
American Avocet	7
Unidentified Bird	7
Loggerhead Shrike	6
Mourning Dove	6
Common Loon	5
Sora	5
Wilson's Warbler	5
Brown Pelican	4
Common Raven	4
Double-crested Cormorant	4
Great-tailed Grackle	4
Ruddy Duck	4
Ash-throated Flycatcher	3
Brown-headed Cowbird	3
Common Poorwill	3
Horned Lark	3
Sagebrush Sparrow	3
Townsend's Warbler	3
Western Tanager	3
White-crowned Sparrow	3
Yellow-headed Blackbird	3
Black-headed Grosbeak	2
Brewer's Blackbird	2
Common Yellowthroat	2
Costa's Hummingbird	2
House Finch	2
Lesser Nighthawk	2
Pied-billed Grebe	2
Say's Phoebe	2
Unidentified Sparrow	2
Virginia Rail	2
Yellow-rumped Warbler	2
American Kestrel	1
American White Pelican	1

Barn Owl	1
Black-crowned Night-Heron	1
Black-tailed Gnatcatcher	1
Blue-winged Teal	1
Burrowing Owl	1
Clapper Rail	1
Common Merganser	1
Great Egret	1
Lesser Scaup	1
Long-eared Owl	1
Mallard	1
Northern Mockingbird	1
Prairie Falcon	1
Red-breasted Merganser	1
Redhead	1
Red-necked Phalarope	1
Red-winged Blackbird	1
Savannah Sparrow	1
Surf Scoter	1
Tree Swallow	1
Unidentified Blackbird	1
Unidentified Duck	1
Unidentified Empidonax Flycatcher	1
Unidentified Hummingbird	1
Unidentified Jaeger	1
Verdin	1
Western Meadowlark	1
White-faced Ibis	1
White-winged Dove	1
Wilson's Snipe	1
Yellow Warbler	1
Bird Total	194
Bat Species	
California Myotis	1
Pallid Bat	1
Townsend's Big -eared Bat	1
Western Mastiff Bat	1
Bat Total	4
Grand Total	198

~~**Appendix A. Most Frequently Reported and Size Categories of Bird Species on e-Bird (eBird 2014) in Riverside County, California**~~

Appendix A. Most frequently reported bird species on e-Bird (eBird 2014) in Riverside County, California. Species are listed in decreasing order of frequency. Guild and size indicate classifications of these birds for reporting purposes. Birds 12 inches or greater in length are classified as a large bird, and 9 inches or less are classified as a small bird. Wingspan is used to determine classification of birds that are between nine and twelve inches in length, with a threshold of 18 inches.

Species	Guild	Size
house finch	Passerines	Small
common raven	Large Corvids	Large
black phoebe	Passerines	Small
mourning dove	Doves/Pigeons	Large
white-crowned sparrow	Passerines	Small
yellow-rumped warbler	Passerines	Small
red-tailed hawk	Diurnal Raptors	Large
American coot	Rails/Coots	Large
northern mockingbird	Passerines	Small
American kestrel	Diurnal Raptors	Large
Say's phoebe	Passerines	Small
mallard	Waterfowl	Large
European starling	Passerines	Small
great egret	Water-associated birds	Large
lesser goldfinch	Passerines	Small
killdeer	Shorebirds	Large
great-tailed grackle	Passerines	Large
red-winged blackbird	Passerines	Small
song sparrow	Passerines	Small
American crow	Large Corvids	Large
turkey vulture	Vultures	Large
California towhee	Passerines	Small
great blue heron	Water-associated birds	Large
verdin	Passerines	Small
Eurasian collared-dove	Doves/Pigeons	Large
northern flicker	Woodpeckers	Large
Bewick's wren	Passerines	Small
snowy egret	Water-associated birds	Large
common yellowthroat	Passerines	Small
Nuttall's woodpecker	Woodpeckers	Small
house sparrow	Passerines	Small
black-necked stilt	Shorebirds	Large
ruddy duck	Waterfowl	Large
double-crested cormorant	Water-associated birds	Large
bushtit	Passerines	Small
loggerhead shrike	Passerines	Small
Costa's hummingbird	Swifts/Hummingbirds	Small
ruby-crowned kinglet	Passerines	Small
western scrub-jay	Passerines	Small
eared grebe	Loons/Grebes	Large
rock pigeon	Doves/Pigeons	Large
ring-billed gull	Gulls/Terns	Large
western bluebird	Passerines	Small
western kingbird	Passerines	Small
western meadowlark	Passerines	Small

Appendix A. Most frequently reported bird species on e-Bird (eBird 2014) in Riverside County, California. Species are listed in decreasing order of frequency. Guild and size indicate classifications of these birds for reporting purposes. Birds 12 inches or greater in length are classified as a large bird, and 9 inches or less are classified as a small bird. Wingspan is used to determine classification of birds that are between nine and twelve inches in length, with a threshold of 18 inches.

Species	Guild	Size
pied-billed grebe	Loons/Grebes	Large
spotted towhee	Passerines	Small
northern shoveler	Waterfowl	Large
Cooper's hawk	Diurnal Raptors	Large
orange-crowned warbler	Passerines	Small
American white pelican	Water-associated birds	Large
phainopepla	Passerines	Small
California gull	Gulls/Terns	Large
red-shouldered hawk	Diurnal Raptors	Large
Gambel's quail	Upland Game Birds	Large
dark-eyed junco	Passerines	Small
Brewer's blackbird	Passerines	Small
northern harrier	Diurnal Raptors	Large
Cassin's kingbird	Passerines	Small
western grebe	Loons/Grebes	Large
house wren	Passerines	Small
northern rough-winged swallow	Passerines	Small
white-faced ibis	Water-associated birds	Large
black-crowned night-heron	Water-associated birds	Large
Savannah sparrow	Passerines	Small
American pipit	Passerines	Small
cliff swallow	Passerines	Small
greater roadrunner	Cuckoos	Large
tree swallow	Passerines	Small
American robin	Passerines	Small
barn swallow	Passerines	Small
greater yellowlegs	Shorebirds	Large
American avocet	Shorebirds	Large
ring-necked duck	Waterfowl	Large
least sandpiper	Shorebirds	Small
California thrasher	Passerines	Small
gadwall	Waterfowl	Large
American wigeon	Waterfowl	Large
acorn woodpecker	Woodpeckers	Small
yellow warbler	Passerines	Small
brown-headed cowbird	Passerines	Small
osprey	Diurnal Raptors	Large
Abert's towhee	Passerines	Small
Wilson's warbler	Passerines	Small
cactus wren	Passerines	Small
California quail	Upland Game Birds	Large
white-winged dove	Doves/Pigeons	Small
wrentit	Passerines	Small
marsh wren	Passerines	Small
white-throated swift	Swifts/Hummingbirds	Small
bufflehead	Waterfowl	Large

Appendix A. Most frequently reported bird species on e-Bird (eBird 2014) in Riverside County, California. Species are listed in decreasing order of frequency. Guild and size indicate classifications of these birds for reporting purposes. Birds 12 inches or greater in length are classified as a large bird, and 9 inches or less are classified as a small bird. Wingspan is used to determine classification of birds that are between nine and twelve inches in length, with a threshold of 18 inches.

Species	Guild	Size
ash-throated flycatcher	Passerines	Small
green-winged teal	Waterfowl	Large
Lincoln's sparrow	Passerines	Small
black-tailed gnatcatcher	Passerines	Small
oak titmouse	Passerines	Small
cinnamon teal	Waterfowl	Large
Caspian tern	Gulls/Terns	Large
Bullock's oriole	Passerines	Small
northern pintail	Waterfowl	Large
rock wren	Passerines	Small
long-billed dowitcher	Shorebirds	Small
mountain chickadee	Passerines	Small
hooded oriole	Passerines	Small
black-headed grosbeak	Passerines	Small
black-chinned hummingbird	Swifts/Hummingbirds	Small
Common Gallinule	Rails/Coots	Large
blue-gray gnatcatcher	Passerines	Small
green heron	Water-associated birds	Large
horned lark	Passerines	Small
white-tailed kite	Diurnal Raptors	Large
black-throated sparrow	Passerines	Small
Herring gull	Gulls/Terns	Large
Canada goose	Waterfowl	Large
American goldfinch	Passerines	Small
belted kingfisher	Kingfishers	Large
Bonaparte's gull	Gulls/Terns	Large
western tanager	Passerines	Small
white-breasted nuthatch	Passerines	Small
spotted sandpiper	Shorebirds	Small
yellow-headed blackbird	Passerines	Small
brown pelican	Water-associated birds	Large
ladder-backed woodpecker	Woodpeckers	Small
western sandpiper	Shorebirds	Small
band-tailed pigeon	Doves/Pigeons	Large
chipping sparrow	Passerines	Small
great horned owl	Owls	Large
cedar waxwing	Passerines	Small
lark sparrow	Passerines	Small
vermilion flycatcher	Passerines	Small
lesser scaup	Waterfowl	Large
blue grosbeak	Passerines	Small
hermit thrush	Passerines	Small
redhead	Waterfowl	Large
cattle egret	Water-associated birds	Large
peregrine falcon	Diurnal Raptors	Large
sora	Rails/Coots	Small

Appendix A. Most frequently reported bird species on e-Bird (eBird 2014) in Riverside County, California. Species are listed in decreasing order of frequency. Guild and size indicate classifications of these birds for reporting purposes. Birds 12 inches or greater in length are classified as a large bird, and 9 inches or less are classified as a small bird. Wingspan is used to determine classification of birds that are between nine and twelve inches in length, with a threshold of 18 inches.

Species	Guild	Size
black-bellied plover	Shorebirds	Large
Steller's jay	Passerines	Small
violet-green swallow	Passerines	Small
western wood-pewee	Passerines	Small
prairie falcon	Diurnal Raptors	Large
mountain bluebird	Passerines	Small
sharp-shinned hawk	Diurnal Raptors	Large
long-billed curlew	Shorebirds	Large
Clark's grebe	Loons/Grebes	Large
black-throated gray warbler	Passerines	Small
warbling vireo	Passerines	Small
Virginia rail	Rails/Coots	Small
canvasback	Waterfowl	Large
Brewer's sparrow	Passerines	Small

Appendix B: Desert Sunlight Wildlife Incident Reporting System (WIRS)

DESERT SUNLIGHT
WILDLIFE INCIDENT REPORTING SYSTEM (WIRS)

BACKGROUND AND INTRODUCTION

Desert Sunlight will voluntarily implement a wildlife incident response and reporting system. Desert Sunlight will record and report all dead and injured wildlife including but not limited to birds found incidentally in the project areas over the entire life of the project as part of the project operations and monitoring efforts. The purpose of this Wildlife Incident Reporting System (WIRS) is to standardize the actions taken by site personnel in response to wildlife incidents found within project boundaries. The WIRS provides direction for site personnel who may encounter a wildlife incident in an effort to fulfill obligations in reporting wildlife incidents. Wildlife fatalities or injuries found by project personnel or others will be reported and processed following the protocols described in this document.

DESERT SUNLIGHT WIRS POLICY

This WIRS will be active for the life of the solar projects. All employees, contractors and subcontractors of Desert Sunlight have a responsibility to comply with all environmental laws and regulations. Most birds are protected by the federal MBTA, and eagles are further protected by the BGEPA. In addition, the state of California has an Endangered Species Act (CESA). Under the federal statutes, it is illegal to harm, harass, kill, or collect birds that may be found in the solar facility. A summary of these statutes is presented below. It is recognized that other wildlife including bats are generally not protected by federal or state law unless listed as a threatened or endangered species. However, it is the policy of FS to treat all wildlife incidents the same as avian incidents and include them in the WIRS.

It is illegal to collect an injured or dead bird without appropriate federal and state permits. **THE TOUCHING, POSSESSION, TRANSFER, OR TAMPERING WITH ANY WILDLIFE SPECIES (ALIVE OR DEAD) BY DESERT SUNLIGHT EMPLOYEES OR SUBCONTRACTORS IS STRICTLY PROHIBITED UNLESS CONSISTENT WITH PERMITS.** The WIRS is designed to provide a means of recording and collecting data about wildlife species found in the solar facilities to increase the understanding of solar and wildlife interactions. Desert Sunlight maintains an ongoing commitment to investigate wildlife incidents involving company facilities and to work cooperatively with federal and state agencies in an effort to minimize the potential for future bird and wildlife fatalities. The objective of this policy is to insure that the best available information about wildlife incidents found in Desert Sunlight facilities is recorded and the proper authorities are notified. It is the responsibility of Desert Sunlight employees, contractors and subcontractors to report all wildlife incidents as outlined in this WIRS.

APPLICABLE LAWS AND REGULATIONS

Migratory Bird Treaty Act

The Migratory Bird Treaty Act of 1918 (MBTA) (16 USC 703-712) is the cornerstone of migratory bird conservation and protection in the United States. The MBTA implements four treaties that provide for international protection of migratory birds. It is a strict liability statute wherein proof of intent is not an element of a "taking" violation. Wording is clear that most actions resulting in a taking or possession (permanent or temporary) of a protected species can be a violation, regardless of intent.

Specifically, the MBTA states: “Unless and except as permitted by regulations...it shall be unlawful at any time, by any means or in any manner, to pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess…any migratory bird, any part, nest, or egg of any such bird…(The Act) prohibits the taking, killing possession, transportation, and importation of migratory birds, their eggs, parts, and nests, expect when specifically authorized by the Department of the Interior." The word "take" is defined as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap capture, or collect."

The MBTA protects 836 species of migratory birds (listed in 50 CFR 10.13), including waterfowl, shorebirds, seabirds, wading birds, raptors, and passerines. Generally, the MBTA protects all birds in the U.S. except upland gamebirds (e.g., pheasant, quail, etc), rock doves (pigeons), European starlings, and English house sparrows. Nearly all birds found at Desert Sunlight are protected under the MBTA.

Bald and Golden Eagle Protection Act

In June 1940, Congress signed into law the Bald and Golden Eagle Protection Act (BGEPA) (16 USC 668-688d) which affords additional protection to the bald and golden eagle. Specifically, the BGEPA states: “Whoever, with the United States or any place subject to the jurisdiction thereof, without being permitted to do so as provided…shall knowingly or with wanton disregard for the consequences of his act take, possess, transport…at any time or in any manner, any bald or golden eagle, alive or dead, or any part, nest or egg thereof shall be fined…that the commission of each taking or other act prohibited by this section, with respect to a bald or golden eagle, shall constitute a separate violation of this section." Penalties for violations of the BGEPA are up to $250,000 and/or 2 years imprisonment for a felony (violations are defined as a felony), with fines doubled for organizations. FS

Endangered Species Act

In 1973, the Endangered Species Act (ESA) (16 USC 1513-1543) was passed to protect endangered and threatened species and to provide a means to conserve their ecosystems. Under the ESA, Federal agencies are directed to utilize their authorities to conserve listed species, as well as "Candidate" species that may be listed in the near future, and make sure that federal agencies' actions do not jeopardize the

continued existence of these species. As with the MBTA and the BGEPA, the ESA as amended prohibits the taking of species listed under the act as threatened or endangered.

BLM Sensitive Species

BLM Sensitive Species are species designated by the State Director and includes only those species that are not already federal listed proposed, or candidate species, or State listed because of potential endangerment. BLM's policy is to "ensure that actions authorized, funded, or carried out do not contribute to the need to list any of these species as threatened or endangered."

California Fish and Game Code

Sections 3511, 4700, 5050, and 5515 of the California Fish and Game Code outline protection for fully protected species of mammals, birds, reptiles, amphibians, and fish. Species that are fully protected by these sections may not be taken or possessed at any time. CDFW cannot issue permits or licenses that authorize the "take" of any fully protected species, except under certain circumstances such as scientific research and live capture and relocation of such species pursuant to a permit for the protection of livestock. Furthermore, is the responsibility of the CDFW to maintain viable populations of all native species. To that end, the CDFW has designated certain vertebrate species as Species of Special Concern because declining population levels, limited ranges, and/or continuing threats have made them vulnerable to extinction**.**

DESERT SUNLIGHT WILDLIFE INCIDENT REPORTING

The following procedures are to be followed when Desert Sunlight personnel or subcontractors discover a wildlife fatality or injury while on site. These procedures are intended to be in place for the life of the project and are independent of the post-construction monitoring studies. Prior to the initiation of operations, on-site training will be provided to Desert Sunlight personnel and subcontractors regarding the implementation of this WIRS.

When To Use The WIRS - What Constitutes A Reportable Incident?

For the purposes of this reporting system, *incident* is a general term that refers to any wildlife species, or evidence thereof, that is found dead or injured within the wind project. Note that an incident may include an injured animal and does not necessarily refer only to a carcass or fatality.

An intact carcass, carcass parts, bones, scattered feathers, or an injured wildlife species all represent reportable incidents. Desert Sunlight personnel and subcontractors shall report all such discoveries even if you are uncertain if the carcass or parts are associated with the facility.

> A ***fatality*** is any find where death occurred, such as a carcass, carcass parts, bones, or feather spot (10 or more feathers).
>
> An ***injury*** or injured animal is any wildlife species with an apparent injury, or that exhibits signs of distress to the point where it cannot move under normal means or does not display normal escape or defense behavior.

Prior to assuming a wildlife species is injured, it should be observed to determine if it cannot or does not display normal behaviors. For example, raptors will occasionally walk on the ground, especially if they have captured a prey item. Raptors also "mantle" or hold their wings out and down to cover a prey item. These types of behaviors may make the wings appear broken or the animal injured. Identification of specific behaviors typical to the life cycles and distress behaviors of wildlife will be part of the Desert Sunlight wildlife training program. Always exercise caution before approaching an injured wildlife species. **Under no circumstances are site personnel that are not included in the SPUT permit allowed to handle carcasses or injured animals.**

Note: *Any incident involving a federally or state listed threatened or endangered species, bald eagle, or golden eagle must be reported to USFWS and/or California Department of Fish and Wildlife (CDFW) within 24 hours of identification. See project personnel listing for contact information.*

MATERIALS NEEDED TO REPORT AN INCIDENT

1. A copy of this WIRS

2. A Wildlife Incident Report Form (see Attachment 1)
3. Project Personnel Listing and Contact Information
4. Pencil, Pen
5. Camera
6. Flagging

DESERT SUNLIGHT WILDLIFE INCIDENT REPORTING PROCEDURES

The following procedures apply if the incident involves a **Wildlife Fatality** or **Injured Wildlife Species**:

- **Leave the subject animal in place**. A flag may be used to mark its location for easy finding while the data sheet is being completed. It is recommended that any flagging be marked with the date, time, and initials of the recorder. **DO NOT HANDLE THE CARCASS.**

- **Report** the find to the Site Operations Manager immediately.

- The Site Operations Manager shall complete the following steps:

    - **Photograph** the incident as it was found in the field. Take at least two pictures: a close up shot of the animal as it lays in the field and a broader view of the animal (marked by a flag) with the road, turbines, or other local features in the view. For the close up picture, place an object (e.g., radio, pencil, coin, etc.) next to the carcass for a scale of size.

    - **Prepare a Wildlife Incident Report Form.** The form and associated instructions are presented below.

    - **Report** the find to Desert Sunlight's Environmental Department.

The following procedures apply if the incident involves an **Injured Wildlife Species**:

- **Move** to a distance far enough away that it is not visibly disturbed or uneasy due to your presence. **DO NOT ATTEMPT TO CAPTURE OR HANDLE AN INJURED ANIMAL.**

- **Report** the find immediately to the Operations Site Manager

- The Site Operations Manager shall complete the following steps:

    - **Report** the find to the Environmental Affairs Lead immediately.

    - **Contact** a local rehabilitation center (*see contact list below*) for further instructions on handling and transport/pickup of the injured animal.

    - **Prepare a Wildlife Incident Report Form.** The form and instructions for filling out the form are provided below.

*** Any incident involving a federally or state listed threatened or endangered species or a bald or golden eagle must be reported to the USFWS and/or CDFW within 24 hours of identification. These**

incidents will be reported to the agency verbally by the Operations Manager or Desert Sunlight's Environmental Department.

DESERT SUNLIGHT
WILDLIFE INCIDENT REPORTING FORM

INCIDENT DETAILS
Project Location/Name:

Name of Observer/s:_____ Date: _____ Time: _____

Type of Incident: ☐ Injury ☐ Fatality

Carcass Condition: ☐ Intact Carcass ☐ Partial Carcass ☐ Feathers Only

Age of Remains (days): ☐ 1-2 (fluid filled eyes) ☐ 2-4 (maggots) ☐ 5+ (dried bones/feathers)

Photos Taken: ☐ Yes ☐ No (Take photos of - Birds: beak, legs, feathers, body. Wildlife: face and ears, tail and feet, body)

Who was notified of incident? (see contact list below)_____

Comments on Carcass Condition or Behavior of Injured Animal:_____

_____

LOCATION
Where Found: ☐ On Access Road ☐ Solar Array ☐ Under Power Line ☐ Substation

GPS Coordinates: UTM N:_____ UTM E:_____ DATUM:_____

Comments on Location:_____

_____

IDENTIFICATION
☐ Bird ☐ Bat ☐ Mammal ☐ Other:_____

Species (to best of ability):_____

Description of Color/Markings:_____

Does Animal Resemble a Species of Concern discussed at Training? ☐ Yes ☐ No

Identification Remarks:_____

_____

(Describe details of - Birds: beak size, color, and shape; leg size, color, and shape; feather color; body size. Bats: color of fur and wings; muzzle long or short, tail attached or extending; ear color and shape); Other Wildlife: color of fur, any markings, and body size.

_____

ENVIRONMENTAL CONDITIONS
Weather (Check all that apply): ☐ Clear ☐ Cloudy ☐ Rain ☐ Dust Storm

Approximate Temperature (F°):_____

Wind: ☐ Calm ☐ Breezy/Gusty ☐ Strong Winds

Habitat where found: ☐ Gravel (access road/turbine pad) ☐ Bare Ground ☐ Wash ☐ Desert scrub

OTHER NOTES/COMMENTS:_____

_____

CONTACT LIST (Immediately notify one of these individuals of incident)

1. Operations Manager:
2. Environmental Affairs Lead:

From: Fraser, Jody
To: Thomas Dietsch
Subject: Genesis
Date: Wednesday, December 03, 2014 4:04:55 PM
Attachments: 20141203_Genesis_BBCS_13Nov2014_clean_jsf.docx

Geez, editing sections 1-3 was a cake walk. Thanks for doing the heavy-lifting on this...

Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
jody_fraser@fws.gov

From:	Fraser, Jody
To:	Brickey, Amedee
Cc:	Rodriguez, Magdalena@Wildlife; Thomas Dietsch (thomas_dietsch@fws.gov); Amy Fesnock (afesnock@blm.gov); Pete Sorensen (pete_sorensen@fws.gov); Ali, Anwar@Energy; Watson, Carol@Energy; Martine, Andrea@Energy; Veerkamp, Eric@Energy
Subject:	Re: Feather spot definition
Date:	Thursday, December 04, 2014 2:15:24 PM
Attachments:	20141104_attach_map_Avian_Bat_Mortality.pdf

Sunlight mortalities...

Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
jody_fraser@fws.gov

On Thu, Dec 4, 2014 at 2:03 PM, Brickey, Amedee <amedee_brickey@fws.gov> wrote:

> Thanks Mags... An addition piece of information is that on ISEGS their persistence trails were for Medium birds, Small birds, and Feather spots, instead of large, medium, and small sized birds.
>
> Since they have not had any "large birds" so far. This method has worked out fine. Any large birds will be lumped into the Medium bird category for carcass persistence assumptions...so, it is a more conservative approach.

Amedee Brickey
Deputy Chief, Migratory Birds
Pacific Southwest Region
2800 Cottage Way W-2606
Sacramento, CA 95825
Phone: (916) 414-6480

" I want to leave a committed life behind" - MLK

On Thu, Dec 4, 2014 at 1:48 PM, Rodriguez, Magdalena@Wildlife <Magdalena.Rodriguez@wildlife.ca.gov> wrote:

> All,
>
> This is the feather spot definition from the most recent Ivanpah summer quarterly report.
>
> "Feather spots consisted of groups of feathers composed of at least two or more primary

> flight feathers, five or more tail feathers, or 10 or more feathers of any type concentrated together in
> an area 1 m^2 or smaller; feathers with significant skin or flesh, or any bone, attached were considered detections but were not necessarily considered feather spots."

From:	crissy slaughter
To:	jody_fraser@fws.gov
Cc:	Kathy Simon; Brooks Corvus; Brian Sandstrom; tamara.haynes@firstsolar.com; armand.gonzales@wildlife.ca.gov; eduardo_nieves@fws.gov; Ashley H; heather_beeler@fws.gov; Thomas Dietsch; fmcmenimen@blm.gov; cperry@blm.gov; pksharpgarcia@gmail.com; dave.sterner@firstsolar.com; Therese Carpenter; myra.gardiner@nexteraenergy.com; john.sakers@firstsolar.com; Dobrzanski, Adam; charlyn.mosley@nexteraenergy.com; idayna.stokes@nexteraenergy.com; erin_dean@fws.gov
Subject:	Monthly SPUT report for Desert Sunlight, permit numbers MB20979B-2 and MB20960B-4
Date:	Thursday, December 04, 2014 2:39:17 PM
Attachments:	DS_03Dec14_R8_SPUT_mortality reporting.xlsx Avian_Bat_Mortality_20141203.pdf

Hello All,

Attached is the monthly SPUT table and updated avian mortality figure for Desert Sunlight, permit numbers MB20979B-2 and MB20960B-4.

Thank you,

Crissy Slaughter
Ironwood Consulting, Inc.

From: Thomas Dietsch
To: Jody Fraser
Subject: Genesis_BBCS_13Nov2014_usfws comments 2014_12_05.docx
Date: Friday, December 05, 2014 1:58:01 PM
Attachments: Genesis_BBCS_13Nov2014_usfws comments 2014_12_05.docx

---

Hi Jody,

Here's our changes and comments. .

Thanks, Tom

From: Thomas Dietsch
To: Jody Fraser
Cc: Pete Sorensen
Subject: Genesis_BBCS_13Nov2014_usfws comments 2014_12_05.docx
Date: Friday, December 05, 2014 2:42:43 PM
Attachments: Genesis_BBCS_13Nov2014_usfws comments 2014_12_05.docx

---

Hi Jody,

Here's the final version! Have a good weekend!

Thanks, Tom

From:	Fraser, Jody
To:	Veerkamp, Eric@Energy; Eric Knight; Carol Watson; Andrea Martine; Anwar Ali
Cc:	Magdalena Rodriguez; Amy Fesnock; Thomas Dietsch; Pete Sorensen; Amedee Brickey
Subject:	FWS comments on Genesis plan
Date:	Monday, December 08, 2014 11:27:43 AM
Attachments:	20141205_Genesis_BBCS_13Nov2014_usfws comments.docx HTH_Desert Sunlight Dectectability Study Report_Nov2013.pdf

Hi Eric et al.,
Attached are the FWS comments on the Genesis mortality monitoring plan. Much of it is the same as for Desert Sunlight because, by and large, WEST cut and pasted the plan. As such, this transmittal email very much resembles that which we sent to BLM with our comments on the DS plan.

First, the title of the document as a BBCS is inappropriate, as this document does not contain the necessary components of a BBCS and serves primarily as s a monitoring plan; additional work will need to be done to complete the BBCS.

Per the BLM's recommendations for the Genesis and Desert Sunlight plans, we have made changes to the text (in track-changes) within the constraints (2-yr monitoring period, 25% of the solar field, 100% of the fence line, and 50% of the gen-tie) established during various meetings between the BLM and NE. The biggest issues for us in this current iteration of the monitoring document are listed below. Some of these points were brought up by the BLM in its most recent meeting with NE on the Sunlight project and are expected to be carried forward and addressed for this, the McCoy, and Blythe project plans.

- We still assert that 25% coverage of the solar field is insufficient, especially as proposed (i.e., using distance sampling). BLM discussed this with WEST. Because the agencies do not believe that surveyors will be effective at detecting carcasses at the distances WEST had proposed under the Sunlight plan, WEST will develop a method for estimating the effective survey area. For Genesis, they do propose narrower transects; however, searcher efficiency trials are still necessary and should be done seasonally and/or whenever there is a change in staff conducting the monitoring.

- While we recognize that 2 years is the minimum time required for monitoring and the CEC/BLM have discretion to require additional years based on the incoming data, we remain concerned about this considering the project will be on the landscape for a minimum of 30 years. The species identified and the mortalities per species are likely to differ considerably between years and there is no way this variability will be captured in such a short time period. We recommend that periodic monitoring of the facility (panel area, gen-tie, and fence line) is performed at various increments for the life of the project, especially as other projects go online in the desert; this will allow us to better understand and evaluate cumulative impacts and the contribution of this facility to overall avian impacts.

- We are concerned that distance sampling has never been used for this application (mortality monitoring on wind and solar); the justification for using this methodology is not well supported in the document or by the detectability study that HT Harvey ran on the Desert Sunlight site (attached). The proposed plan is a hybrid of distance sampling and wind energy mortality monitoring methods that are based on different and not necessarily compatible assumptions. We have made our changes in consultation with known distance sampling and mortality monitoring experts and would encourage that independent experts be included in

discussions before any further revisions are made to the methodology. After some evaluation period, we should have the ability to modify the methodology, if necessary.

- We remain concerned about the monitoring intervals (7 and 21 days), which are not supported by the Corvus carcass surveys performed on the Desert Sunlight site, HTH's detectability study, and much of the available literature. We believe that these intervals coupled with the distance sampling method as proposed will result in significant under-sampling, which cannot be corrected for using statistics. Additionally, as proposed, surveys are unlikely to capture rare mortality events of uncommon and/or listed species, such as Yuma Ridgway's (clapper) rail.

- We remain concerned about using surveyors who do not have academic ornithological and field ecology/biology background. While training will be conducted, locating carcasses can be quite difficult, especially using distance sampling. Therefore, we added language that requires an Authorized Avian Biologist to be on-site during monitoring to provide oversight. The most recent SPUT report submitted by NE showed that for the month of October 2014, virtually none of the birds were identified; this supports the need for an on-site authorized biologist who is responsible for identification, proper data collection, including taking photographs, and determining cause of death, etc. BLM did express this concern in its transmittal email to WEST, First Solar, and NE on the Sunlight plan. However, we should reiterate this concern for this and other projects.

- If there needs to be a TAC, it should be open to public participation so that the process is transparent. We recommend seeking input from academic and NGO partners, as well as other consultants who have the appropriate expertise.

- BLM is currently working on a policy that requires third-party monitoring that eliminates confidentiality agreements; facilitates open communication to wildlife agencies from all project-related staff; requires submission of all raw data and methods; and makes all data available for peer review and assessment. We support this wholeheartedly and encourage CEC to support and implement this requirement for projects under its jurisdiction.

If you have any questions or concerns about our comments, please contact us. And please cc us on your transmittal to WEST and NextEra.
Thanks,

Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
jody_fraser@fws.gov

From:	Fesnock, Amy
To:	Veerkamp, Eric@Energy
Cc:	Fraser, Jody; Knight, Eric@Energy; Watson, Carol@Energy; Martine, Andrea@Energy; Ali, Anwar@Energy; Rodriguez, Magdalena@Wildlife; Thomas Dietsch; Pete Sorensen; Amedee Brickey
Subject:	Re: FWS comments on Genesis plan
Date:	Tuesday, December 09, 2014 10:46:02 AM
Attachments:	20141205_Genesis_BBCS_9dec2014_usfws and BLM comments.docx

I went ahead and added BLM comments to the FWS document.

Sorry I missed my Friday deadline.

Cheers!
A

On Mon, Dec 8, 2014 at 12:15 PM, Veerkamp, Eric@Energy <Eric.Veerkamp@energy.ca.gov> wrote:

> Jody,
>
> Thank you for your work on this. When the consolidated comments are forwarded to NEER for their consideration, I think it would be helpful for them to have the introductory/summary statements you have provided in your email. Is it your intent that these statements are for NEER consumption or solely for the agencies? It is still my desire and intention to forward all comments on to NEER by Thursday if at all possible.
>
> I do have two fairly simplistic observations that I would like to share; first, I think it was agreed, and with fair justification, that we would not use the term "TAC", but rather "TAG", second, Genesis was referred to by the acronym "GSEG" in either the revised plan or the comments, I want it to be clear to reduce any possible confusion that the project is "GSEP".
>
> Thanks.
>
> Eric W. Veerkamp, AICP
>
> Compliance Project Manager
>
> California Energy Commission
>
> 1516 9th Street, MS 2000
>
> Sacramento, CA 95814
>
> 916-654-4611
>
> Eric.Veerkamp@energy.ca.gov

From: Fraser, Jody [mailto:jody_fraser@fws.gov]
Sent: Monday, December 08, 2014 11:28 AM
To: Veerkamp, Eric@Energy; Knight, Eric@Energy; Watson, Carol@Energy; Martine, Andrea@Energy; Ali, Anwar@Energy
Cc: Rodriguez, Magdalena@Wildlife; Amy Fesnock; Thomas Dietsch; Pete Sorensen; Amedee Brickey
Subject: FWS comments on Genesis plan

Hi Eric et al.,

Attached are the FWS comments on the Genesis mortality monitoring plan. Much of it is the same as for Desert Sunlight because, by and large, WEST cut and pasted the plan. As such, this transmittal email very much resembles that which we sent to BLM with our comments on the DS plan.

First, the title of the document as a BBCS is inappropriate, as this document does not contain the necessary components of a BBCS and serves primarily as s a monitoring plan; additional work will need to be done to complete the BBCS.

Per the BLM's recommendations for the Genesis and Desert Sunlight plans, we have made changes to the text (in track-changes) within the constraints (2-yr monitoring period, 25% of the solar field, 100% of the fence line, and 50% of the gen-tie) established during various meetings between the BLM and NE. The biggest issues for us in this current iteration of the monitoring document are listed below. Some of these points were brought up by the BLM in its most recent meeting with NE on the Sunlight project and are expected to be carried forward and addressed for this, the McCoy, and Blythe project plans.

- We still assert that 25% coverage of the solar field is insufficient, especially as proposed (i.e., using distance sampling). BLM discussed this with WEST. Because the agencies do not believe that surveyors will be effective at detecting carcasses at the distances WEST had proposed under the Sunlight plan, WEST will develop a method for estimating the effective survey area. For Genesis, they do propose narrower transects; however, searcher efficiency trials are still necessary and should be done seasonally and/or whenever there is a change in staff conducting the monitoring.

- While we recognize that 2 years is the minimum time required for monitoring and the CEC/BLM have discretion to require additional years based on the incoming data, we

remain concerned about this considering the project will be on the landscape for a minimum of 30 years. The species identified and the mortalities per species are likely to differ considerably between years and there is no way this variability will be captured in such a short time period. We recommend that periodic monitoring of the facility (panel area, gen-tie, and fence line) is performed at various increments for the life of the project, especially as other projects go online in the desert; this will allow us to better understand and evaluate cumulative impacts and the contribution of this facility to overall avian impacts.

- We are concerned that distance sampling has never been used for this application (mortality monitoring on wind and solar); the justification for using this methodology is not well supported in the document or by the detectability study that HT Harvey ran on the Desert Sunlight site (attached). The proposed plan is a hybrid of distance sampling and wind energy mortality monitoring methods that are based on different and not necessarily compatible assumptions. We have made our changes in consultation with known distance sampling and mortality monitoring experts and would encourage that independent experts be included in discussions before any further revisions are made to the methodology. After some evaluation period, we should have the ability to modify the methodology, if necessary.

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If you have any questions or concerns about our comments, please contact us. And please cc us on your transmittal to WEST and NextEra.

Thanks,

Jody Fraser, Biologist

Palm Springs Fish and Wildlife Office

777 E. Tahquitz Canyon Way, Suite 208

Palm Springs, CA 92262

760.322.2070 ph x207

jody_fraser@fws.gov

--
****
Amy L. Fesnock
CA BLM Wildlife and Listed Species Lead
2800 Cottage Way, W-1928
Sacramento, CA 95825

afesnock@blm.gov
916-978-4646

From: Fraser, Jody
To: Joel Pagel
Subject: Fwd: FWS comments on Genesis plan
Date: Friday, December 12, 2014 8:46:28 AM
Attachments: 20141205_Genesis_BBCS_13Nov2014_usfws comments.docx
HTH_Desert Sunlight Dectectability Study Report_Nov2013.pdf

Per your request. Virtually the same as Desert Sunlight, but with CEC involved, the process is a bit different. Eric V. asked for the Tues meeting to reconcile some differences in agency comments. CEC, instead of BLM will transmit our comments.

---------- Forwarded message ----------
From: **Fraser, Jody** <jody_fraser@fws.gov>
Date: Mon, Dec 8, 2014 at 11:27 AM
Subject: FWS comments on Genesis plan
To: "Veerkamp, Eric@Energy" <Eric.Veerkamp@energy.ca.gov>, Eric Knight <eric.knight@energy.ca.gov>, Carol Watson <carol.watson@energy.ca.gov>, Andrea Martine <andrea.martine@energy.ca.gov>, Anwar Ali <anwar.ali@energy.ca.gov>
Cc: Magdalena Rodriguez <Magdalena.Rodriguez@wildlife.ca.gov>, Amy Fesnock <afesnock@blm.gov>, Thomas Dietsch <thomas_dietsch@fws.gov>, Pete Sorensen <Pete_Sorensen@fws.gov>, Amedee Brickey <amedee_brickey@fws.gov>

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If you have any questions or concerns about our comments, please contact us. And please cc us on your transmittal to WEST and NextEra.
Thanks,

Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
jody_fraser@fws.gov

From: Charbonneau, Adrienne
To: Fraser, Jody
Subject: RE: McCoy SPUT permit application
Date: Monday, December 15, 2014 12:35:40 PM
Attachments: BSPP Raven Monitoring Plan_091514.pdf
Common Raven Management-Control Plan Final May 2014.pdf

Jody, here you go! Let me know if you need anything else.-Adrienne

From: Fraser, Jody [mailto:jody_fraser@fws.gov]
Sent: Monday, December 15, 2014 3:18 PM
To: Charbonneau, Adrienne
Cc: Field, Jennifer; Schneck, Greg; Stein, Kenneth; Heather Beeler; Magdalena Rodriguez; Kim Marsden; Thomas Dietsch
Subject: Re: McCoy SPUT permit application

This is an EXTERNAL email. Exercise caution. DO NOT open attachments or click links from unknown senders or unexpected email.

Hi Adrienne,
Thanks for the prompt response. I do not have final versions of either plan, so if you could send them to me, that would be great. They may be buried in Tera's email, but I don't have access to that right now.
Much appreciated,
Jody

Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
jody_fraser@fws.gov

On Mon, Dec 15, 2014 at 12:07 PM, Charbonneau, Adrienne <Adrienne.Charbonneau@nexteraenergy.com> wrote:

Jody, both the McCoy and Blythe Raven Management Plans have been approved by all agencies. The May version for McCoy is the final version. If you would like copies of either of these I would be happy to send over. Thank you,

Adrienne Charbonneau
Environmental Specialist
Environmental Services
Office: 561-691-7510
Mobile: 850-445-7015
Fax: 561-691-7070

From: Fraser, Jody [mailto:jody_fraser@fws.gov]
Sent: Monday, December 15, 2014 2:39 PM
To: Field, Jennifer; Schneck, Greg; Stein, Kenneth; Charbonneau, Adrienne
Cc: Heather Beeler; Magdalena Rodriguez; Kim Marsden; Thomas Dietsch
Subject: Re: McCoy SPUT permit application

This is an EXTERNAL email. Exercise caution. DO NOT open attachments or click links from unknown senders or unexpected email.

Hi all,
I know FWS is working on issuance of the construction SPUT for this project, and will soon be processing one for Blythe as well; however, having recently taken these projects over from Tera, I'm not sure of the status of the raven mgmt plans for either of these projects, which serve as the foundation for the construction monitoring component under the SPUTs. Can someone please let me know the status? The most recent version I have for McCoy is from May...
Thanks,
Jody

Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
jody_fraser@fws.gov

On Wed, Nov 26, 2014 at 10:35 AM, Heather Beeler <heather_beeler@fws.gov> wrote:
Jennifer & Greg,
As requested by the Service's Palm Springs Fish and Wildlife Office, I am processing your SPUT permit application to authorize salvage of dead birds during construction for compliance with your Raven Management Plan. Although your application provides a written description of the project's location and a map, I need something more concise for the permit. Can you provide me with either a physical address for the project's location or GPS coordinates if there is not an actual address?

For clarification please correct or provide all the following to me in your response:

Records Location: 135 North Commercial Street, Blythe, CA 92225
Carcasses Collection Location:
Carcasses Stored: (freezer's physical location)

Thanks for your help,
Heather

****

Heather Beeler
Eagle Permit Coordinator
USFWS Pacific Southwest Region
2800 Cottage Way W-2606
Sacramento, CA 95825

(916) 414-6651
(916) 414-6486 (fax)
****

Pacific Southwest Region Eagle Permits webpage:
http://www.fws.gov/Cno/conservation/MigratoryBirds/EaglePermits.html

California and Nevada Golden Eagle Working Group webpage:
http://www.dfg.ca.gov/wildlife/nongame/GEWG/

From:	Knight, Eric@Energy
To:	Perkins, Winifred; werickson@west-inc.com
Cc:	Fraser, Jody; Pete Sorensen; Amedee Brickey; Martine, Andrea@Energy; Thomas Dietsch; Knight, Eric@Energy; Rodriguez, Magdalena@Wildlife; Watson, Carol@Energy; Amy Fesnock; Ali, Anwar@Energy; Johnson, Roger@Energy; Kalish, John; Field, Jennifer; Tera Baird; eric.davis@fws.gov; Kenny Stein; Goguts, Luke; kim_marsden@blm.gov; tpogacni@blm.gov; lauren.romero@nexteraenergy.com; prabie@west_inc.com; tjohnson@west_inc.com; Pinnock, Ashley; idayna.stokes@nee.com; Veerkamp, Eric@Energy
Subject:	Genesis BBCS; revised consolidated comments as of 12/19
Date:	Friday, December 19, 2014 4:35:32 PM
Attachments:	Genesis BBCS consolidated comments_12-16-14.docx

Transmitted by Eric Knight on behalf of Eric Veerkamp, CEC CPM for GSEP.

Eric Knight, Manager
Environmental Office
California Energy Commission
916.653.1850
Eric.Knight@energy.ca.gov
www.energy.ca.gov

>>.
Hello all,
For your review, please find attached consolidated agency comments on the most recent submittal of the BBCS for Genesis (GSEP), received on November 13, 2014. In large part, these comments are reflective of comments provided on the Desert Sunlight project with other items specific to Genesis. Comments have been made in the body of the document at the location of the language or instance.

I hope that by having this in your hands prior to the week of the Christmas holiday, that it is better for your review team, as I know various individuals are already beginning to take time off.

Thank you everybody for your hard work on this effort. Please let me know if you have any questions or concerns. I will be in office most of the days around Christmas and New Year's.

Eric W. Veerkamp, AICP
Compliance Project Manager
California Energy Commission
1516 9th Street, MS 2000
Sacramento, CA 95814
916-654-4611
Eric.Veerkamp@energy.ca.gov

From: Veerkamp, Eric@Energy
Sent: Monday, December 15, 2014 5:04 PM
To: 'Fraser, Jody'; 'Pete Sorensen'; 'Amedee Brickey'; Martine, Andrea@Energy; 'Thomas Dietsch'; Knight, Eric@Energy; Rodriguez, Magdalena@Wildlife; Watson, Carol@Energy; 'Amy Fesnock'; Ali, Anwar@Energy; Johnson, Roger@Energy

Subject: Genesis BBCS; consolidated comments for review prior to our discussion on Tuesday, 12/16

Hello all,
Please find attached a consolidated set of agency comments on the most recent submittal of the BBCS for Genesis (GSEP). As we were reviewing the document here at the Energy Commission, some inconsistencies were noted between different reviewers (based on what was discussed during our last call on 12/4). It is of course important to speak with one voice to NextEra Energy, so I am hoping we can iron out a few last items before sending it on to NextEra, I think we are pretty close. I would like to send the comments by 12/19 before people start leaving for the Christmas holiday.

Thanks everybody.

Eric W. Veerkamp, AICP
Compliance Project Manager
California Energy Commission
1516 9th Street, MS 2000
Sacramento, CA 95814
916-654-4611
Eric.Veerkamp@energy.ca.gov



From:	Sorensen, Pete
To:	Joel Pagel
Cc:	Jody Fraser
Subject:	Fwd: Genesis BBCS; revised consolidated comments as of 12/19
Date:	Friday, December 19, 2014 4:39:18 PM
Attachments:	Genesis BBCS consolidated comments_12-16-14.docx

---------- Forwarded message ----------
From: **Knight, Eric@Energy** <Eric.Knight@energy.ca.gov>
Date: Fri, Dec 19, 2014 at 4:35 PM
Subject: Genesis BBCS; revised consolidated comments as of 12/19
To: "Perkins, Winifred" <Winifred.Perkins@nexteraenergy.com>, "werickson@west-inc.com" <werickson@west-inc.com>
Cc: "Fraser, Jody" <jody_fraser@fws.gov>, Pete Sorensen <Pete_Sorensen@fws.gov>, Amedee Brickey <amedee_brickey@fws.gov>, "Martine, Andrea@Energy" <Andrea.Martine@energy.ca.gov>, Thomas Dietsch <thomas_dietsch@fws.gov>, "Knight, Eric@Energy" <Eric.Knight@energy.ca.gov>, "Rodriguez, Magdalena@Wildlife" <Magdalena.Rodriguez@wildlife.ca.gov>, "Watson, Carol@Energy" <Carol.Watson@energy.ca.gov>, Amy Fesnock <afesnock@blm.gov>, "Ali, Anwar@Energy" <anwar.ali@energy.ca.gov>, "Johnson, Roger@Energy" <Roger.Johnson@energy.ca.gov>, "Kalish, John" <jkalish@blm.gov>, "Field, Jennifer" <JENNIFER.FIELD@nexteraenergy.com>, Tera Baird <Tera_Baird@fws.gov>, "eric.davis@fws.gov" <eric.davis@fws.gov>, Kenny Stein <kenneth.stein@nexteraenergy.com>, "Goguts, Luke" <Luke.Goguts@nexteraenergy.com>, "kim_marsden@blm.gov" <kim_marsden@blm.gov>, "tpogacni@blm.gov" <tpogacni@blm.gov>, "lauren.romero@nexteraenergy.com" <lauren.romero@nexteraenergy.com>, "prabie@west_inc.com" <prabie@west_inc.com>, "tjohnson@west_inc.com" <tjohnson@west_inc.com>, "Pinnock, Ashley" <Ashley.Pinnock@nexteraenergy.com>, "idayna.stokes@nee.com" <idayna.stokes@nee.com>, "Veerkamp, Eric@Energy" <Eric.Veerkamp@energy.ca.gov>

Transmitted by Eric Knight on behalf of Eric Veerkamp, CEC CPM for GSEP.

Eric Knight, Manager

Environmental Office

California Energy Commission

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>>>

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Eric W. Veerkamp, AICP

Compliance Project Manager

California Energy Commission

1516 9th Street, MS 2000

Sacramento, CA 95814

916-654-4611

Eric.Veerkamp@energy.ca.gov



AVIAN INJURY AND M

Data Sheet Instruc

***Please contact**

[INSERT APPROPRIATE R8 CONTACT INFORMATION] with any questions, problems, or suggestions for improvements to this form.

ABOUT THIS SPREADSHEET:

-Priority fields are indicated by an astericks and columns are shaded in grey. **At the very least, please try to populate all these fields, and any other applicable fields where possible, if that information is available.**

-**Drop down boxes are provided with several of the fields for your convenience, and to support greater consistency of data for these fields.**

-Please try to use one of the options provided within the drop down boxes for these fields. However, if you can not find the appropriate match in the drop down, you may enter your own text in the field as well.

-**If the option you select is "other" or contains the word "other" or you have additional details about your choice:** please try to provide additional details with your selection (again, all data entry cells in this spreadsheet will allow the entry of free text).

-**If you have been permitted to relocate a nest**, you may also report that relocation in this spreadsheet. This activity can be reported by use of the following fields: "Species Common Name", "Condition of Bird/Carcass (or if Active Nest Relocation, please indicate that here)", "Number of individuals found or number of nests relocated (if active nest relocation) " and "Disposition" (select the "Nest relocated" option).

IORTALITY REPORT FORM

tions and Information

Instructions for Eagle Injuries/Mortalities

IF YOU DISCOVER AN EAGLE:

If the eagle is dead, please complete the following steps:

1. Call your USFWS Office of Law Enforcement (OLE) point-of-contact Resident Agent in Charge (RAC) identified in your Special Purpsoe Utility (SPUT) permit conditions for instructions and approval before collecting or moving the carcass or its parts. You must contact OLE as soon as possible, but no later than 24 hours after discovery, to report the mortality.
2. Fill out as many of the fields in this sheet as possible regarding the incident, and send the report to your Regional USFWS Migratory Bird Permit Office as soon as possible.

If the eagle is alive, please complete the following steps:

1. Do not handle the eagle. Call your local migratory bird rehabilitation facility or a licensed veterinarian immediately for assistance.

2. Call your Regional USFWS OLE RAC identitied in your SPUT permit as soon as possible, but no later than 24 hours after discovery, to report the injury.

3. Fill out as many of the fields in this sheet as possible regarding the incident, and send the report to your Regional USFWS Migratory Bird Permit Office as soon as possible.

CORE IN
*Report Year (yyyy):
*Project Proponent:
*Project Name:
*Project Type:
*USFWS Salvage Permit # (If Applicable):
*USFWS Eagle Permit # (If Applicable):

NFORMATION
2014
Post-construction monitoring
Sunrise Powerlink
Transmission Line
MB13710B-1

From:	Pagel, Joel
To:	Pete Sorensen; Jody Fraser; Magdalena Rodriguez; Thomas Dietsch
Subject:	comments on Genesis BBCS Dec. 2014 agency consolodated draft review comments
Date:	Monday, December 29, 2014 3:30:13 PM
Attachments:	Genesis BBCS consolidated comments_12-16-14 pagel review.docx

I have about 33 or 34 comments; all in track changes and highlighted in yellow for you all to consider including with our final review. I have included Magdalena so that she has the benefit of additional input as she prepares her review.

thanks,

jeep
Joel E. Pagel, Ph.d.

From: Brickey, Amedee
To: Thomas Dietsch
Subject: Fwd: Revised Desert Sunlight BBCS
Date: Monday, January 05, 2015 9:43:58 AM
Attachments: Draft_DSL_BBCS_updated_Dec24_clean.docx
Draft_DSL_BBCS_updated_Dec24_finalredline.docx

FYI, in case you have not already gotten this from Jody.

Amedee Brickey
Deputy Chief, Migratory Birds
Pacific Southwest Region
2800 Cottage Way W-2606
Sacramento, CA 95825
Phone: (916) 414-6480

" I want to leave a committed life behind" - MLK

---------- Forwarded message ----------
From: **Fesnock, Amy** <afesnock@blm.gov>
Date: Wed, Dec 31, 2014 at 2:01 PM
Subject: Fwd: Revised Desert Sunlight BBCS
To: Jody Fraser <Jody_Fraser@fws.gov>, "Brickey, Amedee" <Amedee_Brickey@fws.gov>, Eric Davis <eric_davis@fws.gov>

I wanted to let you know that BLM has accepted the attached BBCS for Desert Sunlight as final.

We cognize that it does not provide every element that the Service staff had identified, but the Bureau does think it will meet the requirements of the ROWG and provides sufficient flexibility to modify as it is implemented.

Thank you for all your assistance in getting this done. Hope you have a happy new year.
A

---------- Forwarded message ----------
From: **Wally Erickson** <werickson@west-inc.com>
Date: Wed, Dec 24, 2014 at 10:16 AM
Subject: Revised Desert Sunlight BBCS
To: "Fesnock, Amy" <afesnock@blm.gov>, Thomas Pogacnik <tpogacni@blm.gov>
Cc: David Lazerwitz <dlazerwitz@fbm.com>, Kenneth Stein <Kenneth.Stein@nexteraenergy.com>, Winifred Perkins <winifred.perkins@nexteraenergy.com>, John Sakers <John.Sakers@firstsolar.com>, Roy Skinner <roy.skinner@firstsolar.com>, James Woodruff <james.woodruff@firstsolar.com>, Tracey Johnson <tjohnson@west-inc.com>

Amy

Please find attached the revised Desert Sunlight BBCS. We have include a redline/comment Word version and a "cleaned up" Word version with comments and redlines removed. The Redline version includes the USFWS comments and edits they made on the October 28th version, as well as our edits and comments/responses to those suggestions. We accepted many of their suggested edits, and provided responses when we felt like the suggested changes needed some additional edits, or where we might have respectfully disagreed with the edits or changes.

We want to thank you a bunch for moving this forward and working so hard near the holidays to get this plan in the shape it is in. We have adjusted the plan based on our agreed upon monitoring parameters that we had discussed extensively over the past week. If there is anything you would like to discuss in more detail, or need additional clarification, please feel free to give me a call. I will be available on my cell phone pretty much anytime between now and the end of the year with the exception of Christmas day to resolve any outstanding issues over the phone.

We are hoping that this plan in acceptable and we can move forward with implementation of this plan in January. We look forward to working with the BLM and the Wildlife agencies on this important monitoring project.

Have a great Holiday Season and thanks again.

Regards

Wallace Erickson

COO and Sr. Statistician

Environmental & Statistical Consultants
415 W 17th, Ste. 200
Cheyenne, WY 82001
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Direct - (307) 632-2940
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Please consider the environment before printing.

--
****
Amy L. Fesnock
CA BLM Wildlife and Listed Species Lead
2800 Cottage Way, W-1928
Sacramento, CA 95825

afesnock@blm.gov
916-978-4646

From:	Fraser, Jody
To:	Pete Sorensen; Thomas Dietsch; Joel Pagel
Cc:	Magdalena Rodriguez; Kim Marsden; Carol Watson; Andrea Martine
Subject:	Fwd: Revised Desert Sunlight BBCS
Date:	Monday, January 05, 2015 10:16:01 AM
Attachments:	Draft_DSL_BBCS_updated_Dec24_clean.docx Draft_DSL_BBCS_updated_Dec24_finalredline.docx

FYI...This will establish what gets finalized for Genesis.

Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
jody_fraser@fws.gov

---------- Forwarded message ----------
From: **Fesnock, Amy** <afesnock@blm.gov>
Date: Wed, Dec 31, 2014 at 2:01 PM
Subject: Fwd: Revised Desert Sunlight BBCS
To: Jody Fraser <Jody_Fraser@fws.gov>, "Brickey, Amedee" <Amedee_Brickey@fws.gov>, Eric Davis <eric_davis@fws.gov>

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From: **Wally Erickson** <werickson@west-inc.com>
Date: Wed, Dec 24, 2014 at 10:16 AM
Subject: Revised Desert Sunlight BBCS
To: "Fesnock, Amy" <afesnock@blm.gov>, Thomas Pogacnik <tpogacni@blm.gov>
Cc: David Lazerwitz <dlazerwitz@fbm.com>, Kenneth Stein <Kenneth.Stein@nexteraenergy.com>, Winifred Perkins <winifred.perkins@nexteraenergy.com>, John Sakers <John.Sakers@firstsolar.com>, Roy Skinner <roy.skinner@firstsolar.com>, James Woodruff <james.woodruff@firstsolar.com>, Tracey Johnson <tjohnson@west-inc.com>

Amy

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Have a great Holiday Season and thanks again.

Regards

Wallace Erickson

COO and Sr. Statistician

Environmental & Statistical Consultants
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Cheyenne, WY 82001
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Please consider the environment before printing.

--

****

Amy L. Fesnock
CA BLM Wildlife and Listed Species Lead
2800 Cottage Way, W-1928
Sacramento, CA 95825

afesnock@blm.gov
916-978-4646

From: Fraser, Jody
To: Thomas Dietsch; Joel Pagel; Magdalena Rodriguez
Subject: Fwd: Revised Desert Sunlight BBCS
Date: Monday, January 12, 2015 9:05:08 AM
Attachments: Draft_DSL_BBCS_updated_Dec24_clean.docx
Draft_DSL_BBCS_updated_Dec24_finalredline.docx

FYI

Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
jody_fraser@fws.gov

---------- Forwarded message ----------
From: **Green, Frankie** <frankie_green@fws.gov>
Date: Thu, Jan 8, 2015 at 1:34 PM
Subject: Fwd: Revised Desert Sunlight BBCS
To: Rachel London <rachel_london@fws.gov>, Diane Elam <diane_elam@fws.gov>, Jana Affonso <jana_affonso@fws.gov>, Eric Davis <eric_davis@fws.gov>, Amedee Brickey <amedee_brickey@fws.gov>, Jody Fraser <jody_fraser@fws.gov>, Pete Sorensen <pete_sorensen@fws.gov>
Cc: Larry Bright <larry_bright@fws.gov>

FYI - my apologies to those of you who have already seen this - but wanted to make sure it got to anyone who probably should see it.

Enjoy!

---------- Forwarded message ----------
From: **Ray Brady** <rbrady@blm.gov>
Date: Thu, Jan 8, 2015 at 2:07 PM
Subject: Fwd: Revised Desert Sunlight BBCS
To: Larry Bright <larry_bright@fws.gov>, Frankie_Green@fws.gov

FYI

Sent from my iPhone

Begin forwarded message:

> **From:** "Fesnock, Amy" <afesnock@blm.gov>
> **Date:** January 8, 2015 at 1:14:55 PM EST
> **To:** Ray Brady <rbrady@blm.gov>, Brian Novosak <bnovosak@blm.gov>, Sandra Brewer <sbrewer@blm.gov>, Kimberly Dow <kddow@blm.gov>,

Timothy Hughes <thughes@blm.gov>, Elroy Masters <emasters@blm.gov>, Richard Bouts <rbouts@blm.gov>, Jayme Lopez <j06lopez@blm.gov>
Cc: Thomas Pogacnik <tpogacni@blm.gov>, Michael Sintetos <msintetos@blm.gov>, Jeremiah Karuzas <jkaruzas@blm.gov>
Subject: Fwd: Revised Desert Sunlight BBCS

Hi Ray-
Here is the Avian Mortality Plan/BBCS that CA BLM accepted for the Desert Sunlight Solar Project.

While it is final, I do consider it to be a work in progress. The FWS staff still have some concerns, but agreed it was better to start collecting data. A critical component of this plan is that the results will be reviewed quarterly and if the approach needs to be modified it will.

Concerns have been raised that the mortality monitoring for the fence will just be conducted from inside the fence. This will be evaluated and may need to be altered to include monitoring from both side of the fence.

Concerns have been raised as to how the distance sampling will work, this will be evaluated and may require "tweaking".

Concerns have been raised as to how many carcasses are part of the searcher efficiency trials, the carcass removal trails, and whether sampling 25-30% of the solar field and the rest of the facilities is sufficient. We spent a lot of time hashing out the numbers because CA BLM was concerned that the correction values would be too large and our ability to really detect the effects (and determine whether adaptive management would be needed) might get lost in wide confidence intervals. If the confidence intervals are too wide -- more surveys will be added and mitigation will be assessed using the "high end" of the confidence interval. There was much discussion on how much monitoring with a high degree of precision was very costly. CA BLM agreed, but wanted to make it clear that if we accepted a monitoring protocol that might lead to wide confidence intervals, the grant holder could then not come back and argue that mitigation wasn't needed because of the uncertainty of the effects.

Just wanted to make sure you were aware of the major caveats of this plan -- and places where it might have potential weaknesses and how we are looking at addressing those weaknesses should they be real.

I know you asked Tom about sharing this with BLM AZ and BLM NV -- I have included the bio leads for these states... but am uncertain which other folks might also be interested in this. Please feel free to share. If you have any questions, I'd be happy to discuss.

Cheers!
A

---------- Forwarded message ----------
From: **Wally Erickson** <werickson@west-inc.com>
Date: Wed, Dec 24, 2014 at 10:16 AM
Subject: Revised Desert Sunlight BBCS
To: "Fesnock, Amy" <afesnock@blm.gov>, Thomas Pogacnik <tpogacni@blm.gov>
Cc: David Lazerwitz <dlazerwitz@fbm.com>, Kenneth Stein <Kenneth.Stein@nexteraenergy.com>, Winifred Perkins <winifred.perkins@nexteraenergy.com>, John Sakers <John.Sakers@firstsolar.com>, Roy Skinner <roy.skinner@firstsolar.com>, James Woodruff <james.woodruff@firstsolar.com>, Tracey Johnson <tjohnson@west-inc.com>

Amy

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We are hoping that this plan in acceptable and we can move forward with implementation of this plan in January. We look forward to working with the BLM and the Wildlife agencies on this important monitoring project.

Have a great Holiday Season and thanks again.

Regards

Wallace Erickson

COO and Sr. Statistician

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Please consider the environment before printing.

--
****

Amy L. Fesnock
CA BLM Wildlife and Listed Species Lead
2800 Cottage Way, W-1928
Sacramento, CA 95825

afesnock@blm.gov
916-978-4646

--

Frankie Green
National Hydropower Coordinator
U.S. Fish and Wildlife Service
Mailstop: ES
5275 Leesburg Pike
Falls Church, VA 22041-3803
phone: 703-358-1884
fax: 703-358-1800

From:	crissy slaughter
To:	jody_fraser@fws.gov
Cc:	Kathy Simon; Brooks Corvus; Brian Sandstrom; tamara.haynes@firstsolar.com; armand.gonzales@wildlife.ca.gov; eduardo_nieves@fws.gov; Ashley H; heather_beeler@fws.gov; Thomas Dietsch; fmcmenimen@blm.gov; cperry@blm.gov; pksharpgarcia@gmail.com; dave.sterner@firstsolar.com; Therese Carpenter; myra.gardiner@nexteraenergy.com; john.sakers@firstsolar.com; Dobrzanski, Adam; charlyn.mosley@nexteraenergy.com; idayna.stokes@nexteraenergy.com; erin_dean@fws.gov
Subject:	Monthly SPUT report for Desert Sunlight, permit numbers MB20979B-2 and MB20960B-4
Date:	Monday, January 12, 2015 11:40:05 AM
Attachments:	Avian_Bat_Mortality_20150105.pdf DS_12Jan15_R8_SPUT_mortality reporting.xlsx

Hello All,

Attached is the monthly SPUT table and updated avian mortality figure for Desert Sunlight, permit numbers MB20979B-2 and MB20960B-4.

Thank you,

Crissy Slaughter
Ironwood Consulting, Inc.

From:	Watson, Carol@Energy
To:	Jody Fraser; Pagel, Joel; Thomas Dietsch; Sorensen, Pete; Rodriguez, Magdalena@Wildlife; Martine, Andrea@Energy
Subject:	FW: Updated Genesis BBCS - revision 3
Date:	Wednesday, January 28, 2015 1:53:40 PM
Attachments:	Genesis BBCS consolidated comments rev3.docx

We will be discussing this most recent iteration of the Genesis BBCS on Feb 6th (onsite meeting); and it is the intent of all parties to finalize this document if at all possible. I would appreciate any feedback you may have prior to the meeting, to ensure that the needs of all the responsible wildlife agencies are met by this document. I can set up a conf call if we think it necessary/ have time.

Best,
Carol

From: Wally Erickson [mailto:werickson@west-inc.com]
Sent: Wednesday, January 28, 2015 1:22 PM
To: Veerkamp, Eric@Energy; Fesnock, Amy
Cc: Ali, Anwar@Energy; Watson, Carol@Energy; Knight, Eric@Energy; Johnson, Roger@Energy; Winifred Perkins; Kenneth Stein; Tracey Johnson
Subject: Updated Genesis BBCS - revision 3

Eric and Amy

Attached is an updated Genesis BBCS. Please distribute to others as necessary. This version includes the changes that Eric and the group made during our meeting on January 14th. In addition, we also made edits to address the remaining issues that were outlined and discussed on January 14th. All substantive changes that were made following the January 14th meeting have a reviewer identified as "WEST Updated Jan 15" to make it a little easier to follow. Some formatting changes that were done after Jan. 14 are identified as reviewer A. Palochak, who is a technical editor for WEST.

I believe we are getting very close to a final acceptable BBCS and we hope to get it finalized as a result of our meeting on Wed. Feel free to call me if you have any questions prior to our field day on Wed. We are looking forward to the site visit and meeting. As always, if you have any questions, feel free to give me a call.

Regards,

Wallace Erickson

COO and Sr. Statistician

Environmental & Statistical Consultants

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From:	Watson, Carol@Energy
To:	Jody Fraser; Pagel, Joel; Thomas Dietsch; Sorensen, Pete; Rodriguez, Magdalena@Wildlife; Martine, Andrea@Energy
Subject:	FW: Updated Genesis BBCS - revision 3
Date:	Wednesday, January 28, 2015 1:59:29 PM
Attachments:	Genesis BBCS consolidated comments rev3.docx

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Best,
Carol

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Sent: Wednesday, January 28, 2015 1:22 PM
To: Veerkamp, Eric@Energy; Fesnock, Amy
Cc: Ali, Anwar@Energy; Watson, Carol@Energy; Knight, Eric@Energy; Johnson, Roger@Energy; Winifred Perkins; Kenneth Stein; Tracey Johnson
Subject: Updated Genesis BBCS - revision 3

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COO and Sr. Statistician

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From:	Lehong Chow
To:	Jody_fraser@fws.gov
Cc:	Kathy Simon
Subject:	FW: Sunlight ABPP
Date:	Monday, February 02, 2015 3:30:26 PM
Attachments:	20120119_08B0789-12TA0142 DSSF SCE ABPP 14Dec2011 FWS MB comments.docx

Hi Jody,

This is the version Crissy used for ABPP guidelines at Sunlight – it was the last iteration from comments in January 2012. Crissy also could not find a clean version, unfortunately.

Cheers,
Lehong

From: crissy slaughter [mailto:criffy@hotmail.com]
Sent: Monday, February 2, 2015 12:41 PM
To: Kathy Simon; Lehong Chow
Subject: ABPP

Hi guys,

Here is the ABPP that I used for reporting. I do not have a clean version either.

-Crissy

From: Kathy Simon
To: crissy slaughter; Brooks Hart; Fraser, Jody
Subject: ABPP final version I have
Date: Monday, February 02, 2015 3:44:39 PM
Attachments: Avian and Bat Protection Plan 112011.pdf

Voila - this is what I have for the final version

Kathryn Simon

President, Ironwood Consulting

Phone and fax 909-798-0330

Physical Address
1040 Nevada Street, Suite 301
Redlands, CA 92374

Mailing address
PO Box 10068
San Bernardino, CA 92423

From: Fraser, Jody
To: Kim Marsden; Magdalena Rodriguez; Pete Sorensen; Joel Pagel
Subject: Fwd: Desert Sunlight-Annual report for Interim SPUT permit
Date: Wednesday, February 04, 2015 7:39:58 AM
Attachments: DS_30Jan15_R8_SPUT_mortality reporting.xlsx
Fig_01 Avian_Bat_Mortality_20150105.pdf
Fig_ 02 GenTie_AvianMort_20150115.pdf

FYI

Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
jody_fraser@fws.gov

---------- Forwarded message ----------
From: **crissy slaughter** <criffy@hotmail.com>
Date: Tue, Feb 3, 2015 at 9:45 AM
Subject: Desert Sunlight-Annual report for Interim SPUT permit
To: "jody_fraser@fws.gov" <jody_fraser@fws.gov>
Cc: Kathy Simon <kathy@ironwoodconsultinginc.com>, Brooks Corvus <brooks@corvusecological.com>, Brian Sandstrom <bjerome30@hotmail.com>, "tamara.haynes@firstsolar.com" <tamara.haynes@firstsolar.com>, "armand.gonzales@wildlife.ca.gov" <armand.gonzales@wildlife.ca.gov>, "eduardo_nieves@fws.gov" <eduardo_nieves@fws.gov>, Ashley H <ashley@cvstrat.com>, "heather_beeler@fws.gov" <heather_beeler@fws.gov>, Thomas Dietsch <thomas_dietsch@fws.gov>, "fmcmenimen@blm.gov" <fmcmenimen@blm.gov>, "cperry@blm.gov" <cperry@blm.gov>, "pksharpgarcia@gmail.com" <pksharpgarcia@gmail.com>, "dave.sterner@firstsolar.com" <dave.sterner@firstsolar.com>, Therese Carpenter <therese.carpenter@firstsolar.com>, "myra.gardiner@nexteraenergy.com" <myra.gardiner@nexteraenergy.com>, "john.sakers@firstsolar.com" <john.sakers@firstsolar.com>, "Dobrzanski, Adam" <adam.dobrzanski@nexteraenergy.com>, "charlyn.mosley@nexteraenergy.com" <charlyn.mosley@nexteraenergy.com>, "idayna.stokes@nexteraenergy.com" <idayna.stokes@nexteraenergy.com>, "erin_dean@fws.gov" <erin_dean@fws.gov>

Hello All,

This email is intended to comply with the annual report requirements of the interim SPUT permits issued for the Desert Sunlight Solar Farm Facility, permit numbers MB20979B-2 and MB20960B-4.

Attachments include the SPUT mortality spreadsheet, and avian mortality figures for the solar farm and gen-tie.

Please let me know if you have any questions or require any additional information.

Thank you,

Crissy Slaughter
Ironwood Consulting Inc.

From:	Fraser, Jody
To:	Pete Sorensen; Joel Pagel; Kim Marsden
Cc:	Thomas Dietsch; Magdalena Rodriguez
Subject:	Fwd: DSL TAG Meeting Followup
Date:	Monday, March 09, 2015 1:18:40 PM
Attachments:	Desert Sunlight Technical Advisory Group Kickoff Meeting_26Feb2015_Notes.docx Desert Sunlight_TAG Kickoff_slides_feb262015.pdf DSL_BBCS_final_Feb26.pdf WEST Field Biologist Training Documentation.docx fence.pdf

---

FYI -- sorry, Tom and Mags, for the cross-post.

Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
jody_fraser@fws.gov

---------- Forwarded message ----------
From: **Wally Erickson** <werickson@west-inc.com>
Date: Fri, Mar 6, 2015 at 10:31 AM
Subject: DSL TAG Meeting Followup
To: Amy Fesnock <afesnock@blm.gov>, Thomas Dietsch <thomas_dietsch@fws.gov>, Magdalena Rodriguez <Magdalena.Rodriguez@wildlife.ca.gov>, "Goguts, Luke" <Luke.Goguts@nexteraenergy.com>
Cc: Kim Marsden <kmarsden@blm.gov>, Tracey Johnson <tjohnson@west-inc.com>, "Brickey, Amedee" <Amedee_Brickey@fws.gov>, "Fraser, Jody" <jody_fraser@fws.gov>, Kenneth Stein <Kenneth.Stein@nexteraenergy.com>, Winifred Perkins <winifred.perkins@nexteraenergy.com>, Pamela Bullard <pbullard@west-inc.com>

Desert Sunlight TAG Members and Others

As a followup to our February 26th TAG meeting, please find attached the draft minutes from the meeting and other followup items requested by the TAG:

1. Draft meeting notes
2. WEST Presentation
3. Documentation of field biologist training
4. Final DSL BBCS
5. Pictures of the fence lines on the west and southeast that are problematic for sampling
6. Strawperson TAG meeting schedule. We can work to start to select dates if the TAG members are ok with general scheduling time frames below.

Here is a quick thought for TAG meeting schedule. This gives us a little more than a month to get the quarterly reports completed.

mid July - covers 1st Qtr Monitoring (Spring)

mid October - covers 2nd Qtr Monitoring (Summer)

mid Jan - covers 3rd Qtr Monitoring (Fall)

mid April - covers Annual Report (Annual)

Let me know what you think about the schedule, and whether you have any questions or thoughts regarding the other material sent.

Regards

Wally Erickson
COO/Statistician/Biometrician/Senior Manager



Environmental & Statistical Consultants
415 W. 17th St. Suite 200
Cheyenne, WY 82001
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Please consider the environment before printing.

From:	Tonya Moore
To:	Massar, Mark; Magdalena Rodriguez; Fraser, Jody; Roy Skinner
Cc:	James Cook; sdawson@firstsolar.com; Joel Pagel; Pete Sorensen; Thomas Dietsch; Shankar Sharma; Lehong Chow
Subject:	For Review: Draft Quartzite Agency Meeting Notes (3/12/15)
Date:	Wednesday, March 18, 2015 11:58:39 AM
Attachments:	DRAFT Desert Quartzite Agency Mtg Notes 3-12-15.docx Quartzite Private Lands-acre Prelim Bio Assess Draft.pdf

Howdy everyone,

Hope everyone is enjoying their day. The desert is a great place to be this time of year. Warm days and nice crisp nights. My rather large and moody male tortoise is a little anxious by the fact he can see the female tortoise if he gets on top of his burrow but he cannot figure out how to get to her. Don't let anyone tell you that tortoises don't try to figure things out. They are great escape artists.

Attached are the drafting meeting notes. I would like to have any comments back by Wednesday (3/25) of next week. Once I incorporate the recommend changes, I will finalize the notes and resend.

Also, I have attached the draft bio assessment for the Private Lands portion of the project. If you have any comments or questions on it, please feel to contact me about it. Once the additional biological surveys (rare plants, MFTL habitat assessment and avian bird transects) are completed on the private lands portion, we will update this document with those results.

I was going to send the main resource contacts the shapefiles as per the meeting request; however, it dawned on me that not everyone has the capability to use those files. Would anyone like in the same data in a .kml file for use on Google Maps? Let me know.

Anything I missed? Need any other information? Just contact me.

Have a whimsical Wednesday. Enjoy life by laughing often.

Tonya Moore
Ironwood Consulting, Inc
(760) 646-6477
tonya@ironwoodbio.com

"Love, laughter and sunshine!"

From: Thomas Dietsch
To: Manuela Huso; Chris Nicolai
Subject: From today"s call
Date: Wednesday, March 18, 2015 5:16:00 PM
Attachments: Genesis BBCS.finalmar3.pdf
Draft_DSL_BBCS_updated_Dec24_clean.docx
FWS-ERIV -08B0789-15TA0228_Bird and Bat Conservation Strategy for Desert Sunlight_s03102015_kac.pdf
Beston et al 2015 - JWM - Insuff Samp to ID Spp Aff by Turb Collisions.pdf

---

Hi Manuela and Chris,

Here are the documents that we discussed on today's call. I haven't had a chance to review the Genesis BBCS, but I'll look at that next week. I included the Letter that we sent with our primary concerns on the Desert Sunlight plan. I'll spare you the line by line recommended changes. I've also attached the paper that I mentioned, which has Beston as the lead author, but Scott is a co-author.

Cheers, Tom

****

Thomas Dietsch, PhD
Migratory Bird Biologist
US Fish and Wildlife Service, Region 8
Carlsbad Fish and Wildlife Office
2177 Salk Ave, Suite 250
Carlsbad, CA 92008
(760) 431-9440 Ext. 214

****

From:	Pagel, Joel
To:	Jody Fraser; Pete Sorensen; Thomas Dietsch
Subject:	Fwd: For Review: Draft Quartzite Agency Meeting Notes (3/12/15)
Date:	Thursday, March 19, 2015 1:03:23 PM
Attachments:	DRAFT Desert Quartzite Agency Mtg Notes 3-12-15.docx Quartzite Private Lands-acre Prelim Bio Assess Draft.pdf

---

no avian discussions other than raven??

---------- Forwarded message ----------
From: **Tonya Moore** <tonya@ironwoodbio.com>
Date: Wed, Mar 18, 2015 at 11:57 AM
Subject: For Review: Draft Quartzite Agency Meeting Notes (3/12/15)
To: "Massar, Mark" <mmassar@blm.gov>, Magdalena Rodriguez <Magdalena.Rodriguez@wildlife.ca.gov>, "Fraser, Jody" <jody_fraser@fws.gov>, Roy Skinner <Roy.Skinner@firstsolar.com>
Cc: James Cook <JCook@firstsolar.com>, "sdawson@firstsolar.com" <sdawson@firstsolar.com>, Joel Pagel <joel_pagel@fws.gov>, Pete Sorensen <Pete_Sorensen@fws.gov>, Thomas Dietsch <thomas_dietsch@fws.gov>, Shankar Sharma <Shankar.Sharma@wildlife.ca.gov>, Lehong Chow <lchow@ironwoodbio.com>

Howdy everyone,

Hope everyone is enjoying their day. The desert is a great place to be this time of year. Warm days and nice crisp nights. My rather large and moody male tortoise is a little anxious by the fact he can see the female tortoise if he gets on top of his burrow but he cannot figure out how to get to her. Don't let anyone tell you that tortoises don't try to figure things out. They are great escape artists.

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Have a whimsical Wednesday. Enjoy life by laughing often.

Tonya Moore

Ironwood Consulting, Inc

(760) 646-6477

tonya@ironwoodbio.com

“Love, laughter and sunshine!”

From:	Heather Beeler
To:	Thomas Dietsch; Jody Fraser; Garcia, Justin@Wildlife
Subject:	FW: McCoy SPUT consturction permit
Date:	Tuesday, March 24, 2015 3:17:40 PM
Attachments:	McCoy SPUTS Construction issued 3_24_15.pdf Form 3-202-17.xlsm

FYI

****

Heather Beeler
Eagle Permit Coordinator
USFWS Pacific Southwest Region
2800 Cottage Way W-2606
Sacramento, CA 95825
(916) 414-6651
(916) 414-6486 (fax)

****

Pacific Southwest Region Eagle Permits webpage:
http://www.fws.gov/Cno/conservation/MigratoryBirds/EaglePermits.html

California and Nevada Golden Eagle Working Group webpage:
http://www.dfg.ca.gov/wildlife/nongame/GEWG/

From: Heather Beeler [mailto:heather_beeler@fws.gov]
Sent: Tuesday, March 24, 2015 3:11 PM
To: greg.schneck@nexteraenergy.com
Cc: Erin Dean; Pete Sorensen; Armand.Gonzales@wildlife.ca.gov; 'Rodriguez, Magdalena@Wildlife'; 'Charbonneau, Adrienne'
Subject: McCoy SPUT consturction permit

Mr. Schneck,

Attached is your new Special Purpose Utility Permit for Nextera's McCoy Solar, LLC project. The permit authorizes you and your subpermittees to collect, transport and temporarily possess carcasses and partial remains of birds protected under the Migratory Bird Treaty Act (16 U.S.C. 703 et seq.) found on project property and rights-of-way, in accordance with permit conditions. Please read your permit carefully. This permit authorizes you to pick up bird carcasses during project construction only as required for compliance with your Raven Management Plan.

Following the permit conditions, bird carcasses may be used for searcher efficiency and scavenger removal trials; carcasses used in trials must be reported to the Service as outlined in your permit conditions. You may also transfer carcasses to authorized entities as allowed by the terms of this permit. To comply with your permit reporting requirements, we ask that you submit your data using reporting form 3-202-17. It is attached for your convenience.

Please let me know if you have any questions.

Thank you,

Heather

****

Heather Beeler
Eagle Permit Coordinator
USFWS Pacific Southwest Region
2800 Cottage Way W-2606
Sacramento, CA 95825
(916) 414-6651
(916) 414-6486 (fax)

****

Pacific Southwest Region Eagle Permits webpage:

http://www.fws.gov/Cno/conservation/MigratoryBirds/EaglePermits.html

California and Nevada Golden Eagle Working Group webpage:

http://www.dfg.ca.gov/wildlife/nongame/GEWG/

From: Thomas Dietsch
To: Jody Fraser
Subject: FW: Desert Quartzite - GOEA Discussion - Meeting notes
Date: Thursday, March 26, 2015 4:07:22 PM
Attachments: QZ_GOEA Discussion_26MAR15_Notes.docx
QZ_GOEAInformation_26Mar15.docx

Notes from today's call FYI. I also attached the map that Brooks sent to us during the meeting which has some results. The bottom line is that there isn't much happening with GOEA in the project vicinity.

From: corvusbio@gmail.com [mailto:corvusbio@gmail.com] **On Behalf Of** Brooks Hart
Sent: Thursday, March 26, 2015 1:22 PM
To: Tonya Moore; Pagel, Joel; Thomas Dietsch
Subject: Desert Quartzite - GOEA Discussion - Meeting notes

Outline is attached -

Thank you for taking the time to discuss Project details earlier today.

All the best,

Brooks Hart
Corvus Ecological Consulting, LLC
(858) 922-3264
corvusecological.com

This email and any accompanying documents contain privileged and confidential information and are intended solely for the recipient. If you are not the intended recipient of this message, or if this message has been addressed to you in error, please immediately reply to the sender by reply e-mail or by phone and then delete this message, including any attachment. Any dissemination, distribution or other use of the contents of this message by anyone other than the intended recipient is strictly prohibited.

From:	Fraser, Jody
To:	Mark Massar
Subject:	Fwd: FW: Desert Quartzite - GOEA Discussion - Meeting notes
Date:	Thursday, April 02, 2015 10:50:19 AM
Attachments:	QZ_GOEA Discussion_26MAR15_Notes.docx QZ_GOEAInformation_26Mar15.docx

---

fyi

Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
jody_fraser@fws.gov

---------- Forwarded message ----------
From: **Thomas Dietsch** <thomas_dietsch@fws.gov>
Date: Thu, Mar 26, 2015 at 4:07 PM
Subject: FW: Desert Quartzite - GOEA Discussion - Meeting notes
To: Jody Fraser <jody_fraser@fws.gov>

Notes from today's call FYI. I also attached the map that Brooks sent to us during the meeting which has some results. The bottom line is that there isn't much happening with GOEA in the project vicinity.

From: corvusbio@gmail.com [mailto:corvusbio@gmail.com] **On Behalf Of** Brooks Hart
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From: Croft, Brian
To: Pete Sorensen; Jody Fraser
Subject: Fwd: Center scoping comments - Desert Quartzite
Date: Tuesday, April 07, 2015 8:22:31 AM
Attachments: CBD scoping comments DesertQuartzite 4-6-15 final.pdf
Barrows 1996 Ecol Model 4 Protection of Dune Ecosystem.pdf
Helix 2013. DPV2 MFTL Monitoring Summary 071113.pdf

---------- Forwarded message ----------
From: **Ileene Anderson** <IAnderson@biologicaldiversity.org>
Date: Mon, Apr 6, 2015 at 5:40 PM
Subject: Center scoping comments - Desert Quartzite
To: "blm_ca_desert_quartzite_solar_project@blm.gov" <blm_ca_desert_quartzite_solar_project@blm.gov>, "cperry@blm.gov" <cperry@blm.gov>, "lross@rctlma.org" <lross@rctlma.org>
Cc: "Brian_Croft@fws.gov" <Brian_Croft@fws.gov>, "KHunting@dfg.ca.gov" <KHunting@dfg.ca.gov>, "Plenys.Thomas@epa.gov" <Plenys.Thomas@epa.gov>, Lisa Belenky <lbelenky@biologicaldiversity.org>

Hi Mr. Perry and Mr. Ross,

Please find attached the Center for Biological Diversity's scoping comments on the proposed Desert Quartzite project. I am also including two referenced articles that are not readily available on line as part of these scoping comments. The remainder of these references are books, which we do not have as pdfs.

I will send a copy of this letter and references via snail mail to you as well.

Please feel free to contact me with any questions.

Respectfully submitted by

Ileene Anderson

Ileene Anderson

Senior Scientist/Public Lands Desert Director

Center for Biological Diversity

323-654-5943 (W)

323-490-0223 (C)

www.BiologicalDiversity.org

--
Brian Croft
Senior Biologist
U.S. Fish and Wildlife Service
777 East Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
Office: 760-322-2070 x210
Telework: 909-363-4499

From:	Sorensen, Pete
To:	Jody Fraser
Subject:	Fwd: Center scoping comments - Desert Quartzite
Date:	Tuesday, April 07, 2015 8:26:02 AM
Attachments:	CBD scoping comments DesertQuartzite 4-6-15 final.pdf Barrows 1996 Ecol Model 4 Protection of Dune Ecosystem.pdf Helix 2013. DPV2 MFTL Monitoring Summary 071113.pdf

dont know if Ken signed yet--when is it due? lets send Ilene, Stephanie, and Sarah our comments, when signed.
---------- Forwarded message ----------
From: **Croft, Brian** <brian_croft@fws.gov>
Date: Tue, Apr 7, 2015 at 8:22 AM
Subject: Fwd: Center scoping comments - Desert Quartzite
To: Pete Sorensen <Pete_Sorensen@fws.gov>, Jody Fraser <Jody_Fraser@fws.gov>

---------- Forwarded message ----------
From: **Ileene Anderson** <IAnderson@biologicaldiversity.org>
Date: Mon, Apr 6, 2015 at 5:40 PM
Subject: Center scoping comments - Desert Quartzite
To: "blm_ca_desert_quartzite_solar_project@blm.gov" <blm_ca_desert_quartzite_solar_project@blm.gov>, "cperry@blm.gov" <cperry@blm.gov>, "lross@rctlma.org" <lross@rctlma.org>
Cc: "Brian_Croft@fws.gov" <Brian_Croft@fws.gov>, "KHunting@dfg.ca.gov" <KHunting@dfg.ca.gov>, "Plenys.Thomas@epa.gov" <Plenys.Thomas@epa.gov>, Lisa Belenky <lbelenky@biologicaldiversity.org>

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--
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Senior Biologist
U.S. Fish and Wildlife Service
777 East Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
Office: 760-322-2070 x210
Telework: 909-363-4499

From:	Kim Quinn
To:	jody_fraser@fws.gov
Cc:	Rupal Patel; Kim Marsden; Vanessa Santistevan; Chris Knopp
Subject:	Blythe Mesa Solar Project BBCS
Date:	Thursday, April 09, 2015 12:30:58 PM
Attachments:	App_C4_ABPP_Mar_2014_REV_Sept. 2014.pdf

Hi Jody,

As discussed, for your ease of review, I am attaching the Blythe Mesa Solar Project Avian Bat and Protection Plan.

Please feel free to contact me should need you any additional information.

Thank you,

Kim Quinn
Environmental Planner

(714) 507-2730 direct
(714) 507-2713 office
(714) 507-2799 fax
kim.quinn@powereng.com

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Anaheim, CA 92805
www.powereng.com

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From:	Fraser, Jody
To:	Magdalena Rodriguez
Subject:	Fwd: Blythe Mesa Solar Project BBCS
Date:	Friday, April 10, 2015 4:21:20 PM
Attachments:	App_C4_ABPP_Mar_2014_REV_Sept. 2014.pdf

Hey Mags,
You may want to give this a look. It's the "final" BBCS that was included in the final EIR/EA. They addressed our comments by punting to adaptive management. Not good.
Happy Friday!
Jody

Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
jody_fraser@fws.gov

---------- Forwarded message ----------
From: **Kim Quinn** <kim.quinn@powereng.com>
Date: Thu, Apr 9, 2015 at 12:29 PM
Subject: Blythe Mesa Solar Project BBCS
To: "jody_fraser@fws.gov" <jody_fraser@fws.gov>
Cc: Rupal Patel <rpatel@renewablegroup.com>, Kim Marsden <kmarsden@blm.gov>, Vanessa Santistevan <vanessa.santistevan@powereng.com>, Chris Knopp <Chris.Knopp@powereng.com>

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From: Fraser, Jody
To: Magdalena Rodriguez; Kim Marsden; Thomas Dietsch; Pete Sorensen; Joel Pagel
Subject: Blythe Mesa BBCS
Date: Monday, April 13, 2015 9:50:14 AM
Attachments: 20150326_FEIR_EA_App_C4_ABPP_Mar_2014_REV_Sept2014_JSF.pdf

---

Hi everyone,
I've attached the final BBCS for the Blythe Mesa project with some comments in comment bubbles. I'm not sure how we can get these comments incorporated, but I'm concerned about how it's written and the deferred monitoring and mitigation. What do you guys think? Kim, can you help facilitate getting a more meaningful monitoring plan? And them getting a SPUT permit?
Jody
P.S. I only skimmed the BUOW stuff.

Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
jody_fraser@fws.gov

From:	Fraser, Jody
To:	Amedee Brickey; Bronwyn Hogan
Cc:	Thomas Dietsch; Pete Sorensen
Subject:	Fwd: Blythe Mesa Solar Project BBCS
Date:	Monday, April 13, 2015 2:51:48 PM
Attachments:	App_C4_ABPP_Mar_2014_REV_Sept. 2014.pdf BlytheMesaFEIR_EA_App_C4_ABPP_Mar_2014_REV_Sept2014_JSF.pdf

Hi there,
I forwarded the BBCS to Amedee and Tom last week and JUST got off the phone with folks at Riverside Co. conveying outstanding concerns with the document. They are going to adjust their conditions to reflect some flexibility that allows us to revisit the document prior to construction. I've attached the version with my comments in comment bubbles (I clipped out just the general avian portion -- the majority of the document focused on BUOW).

The main issues:
No pre-project surveys were conducted for the project because it is sited mainly in fallow ag. A desktop review was performed.

Despite the prevalence of incidental data from various solar projects, the risk assessment dismisses our comments about avian/bat impacts based on the lack of standardized data collection so only addresses the utility lines and not the solar panels.

The document dismisses the importance of agricultural habitats for water-associated species, in particular within or adjacent to the Lower Colorado River Valley (i.e., part of the Pacific Flyway).

There is no mortality monitoring component up front -- it is deferred until various thresholds are met. Any site monitoring would be performed by project staff.

There is no condition for obtaining a SPUT permit.

There is no effectiveness monitoring or metrics articulated for proposed avoidance and minimization measures, leaving the adaptive management component largely incomplete.

That's the gist of the concerns. Let me know if you have any questions.
Thanks,
Jody

Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
jody_fraser@fws.gov

---------- Forwarded message ----------
From: **Fraser, Jody** <jody_fraser@fws.gov>
Date: Thu, Apr 9, 2015 at 12:44 PM
Subject: Fwd: Blythe Mesa Solar Project BBCS

To: Amedee Brickey <amedee_brickey@fws.gov>, Thomas Dietsch <thomas_dietsch@fws.gov>

Hey Amedee,
Here's the BBCS that was incorporated into the final EIR/EA that was released on March 26. I have not looked at it yet to understand how our comments were addressed; the consultant who contacted me assured me that they were, in fact, addressed. I'll give it a look -- soon.
Let me know if you need anything else.
Thanks,
Jody

Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
jody_fraser@fws.gov

---------- Forwarded message ----------
From: **Kim Quinn** <kim.quinn@powereng.com>
Date: Thu, Apr 9, 2015 at 12:29 PM
Subject: Blythe Mesa Solar Project BBCS
To: "jody_fraser@fws.gov" <jody_fraser@fws.gov>
Cc: Rupal Patel <rpatel@renewablegroup.com>, Kim Marsden <kmarsden@blm.gov>, Vanessa Santistevan <vanessa.santistevan@powereng.com>, Chris Knopp <Chris.Knopp@powereng.com>

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From: Fraser, Jody
To: Heather Beeler
Subject: Fwd: Blythe Mesa Solar Project BBCS
Date: Tuesday, April 14, 2015 10:59:14 AM
Attachments: App_C4_ABPP_Mar_2014_REV_Sept. 2014.pdf
BlytheMesaFEIR_EA_App_C4_ABPP_Mar_2014_REV_Sept2014_JSF.pdf

Here is the email correspondence and my comments on Blythe Mesa -- just in case you didn't get these.
Let me know if you have questions.
Thx,
Jody

Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
jody_fraser@fws.gov

---------- Forwarded message ----------
From: **Fraser, Jody** <jody_fraser@fws.gov>
Date: Mon, Apr 13, 2015 at 2:51 PM
Subject: Fwd: Blythe Mesa Solar Project BBCS
To: Amedee Brickey <amedee_brickey@fws.gov>, Bronwyn Hogan <Bronwyn_Hogan@fws.gov>
Cc: Thomas Dietsch <thomas_dietsch@fws.gov>, Pete Sorensen <Pete_Sorensen@fws.gov>

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---------- Forwarded message ----------
From: **Kim Quinn** <kim.quinn@powereng.com>
Date: Thu, Apr 9, 2015 at 12:29 PM
Subject: Blythe Mesa Solar Project BBCS
To: "jody_fraser@fws.gov" <jody_fraser@fws.gov>
Cc: Rupal Patel <rpatel@renewablegroup.com>, Kim Marsden <kmarsden@blm.gov>, Vanessa Santistevan <vanessa.santistevan@powereng.com>, Chris Knopp <Chris.Knopp@powereng.com>

Hi Jody,

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Thank you,

Kim Quinn
Environmental Planner

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Anaheim, CA 92805
www.powereng.com

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From: Fraser, Jody
To: Jana Affonso
Subject: Fwd: Blythe Mesa Solar Project BBCS
Date: Wednesday, April 15, 2015 8:56:48 AM
Attachments: App_C4_ABPP_Mar_2014_REV_Sept. 2014.pdf
BlytheMesaFEIR_EA_App_C4_ABPP_Mar_2014_REV_Sept2014_JSF.pdf

Hey Jana,
In thinking about Blythe Mesa, I decided I should send this stuff to you as well since I'm not sure if it's you, Bronwyn, or Heather who will be conveying the info on the national energy call...let me know if you have questions.
Thanks!
Jody

Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
jody_fraser@fws.gov

---------- Forwarded message ----------
From: **Fraser, Jody** <jody_fraser@fws.gov>
Date: Tue, Apr 14, 2015 at 10:59 AM
Subject: Fwd: Blythe Mesa Solar Project BBCS
To: Heather Beeler <heather_beeler@fws.gov>

Here is the email correspondence and my comments on Blythe Mesa -- just in case you didn't get these.
Let me know if you have questions.
Thx,
Jody

Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
jody_fraser@fws.gov

---------- Forwarded message ----------
From: **Fraser, Jody** <jody_fraser@fws.gov>
Date: Mon, Apr 13, 2015 at 2:51 PM
Subject: Fwd: Blythe Mesa Solar Project BBCS
To: Amedee Brickey <amedee_brickey@fws.gov>, Bronwyn Hogan <Bronwyn_Hogan@fws.gov>
Cc: Thomas Dietsch <thomas_dietsch@fws.gov>, Pete Sorensen <Pete_Sorensen@fws.gov>

Hi there,

I forwarded the BBCS to Amedee and Tom last week and JUST got off the phone with folks at Riverside Co. conveying outstanding concerns with the document. They are going to adjust their conditions to reflect some flexibility that allows us to revisit the document prior to construction. I've attached the version with my comments in comment bubbles (I clipped out just the general avian portion -- the majority of the document focused on BUOW).

The main issues:
No pre-project surveys were conducted for the project because it is sited mainly in fallow ag. A desktop review was performed.

Despite the prevalence of incidental data from various solar projects, the risk assessment dismisses our comments about avian/bat impacts based on the lack of standardized data collection so only addresses the utility lines and not the solar panels.

The document dismisses the importance of agricultural habitats for water-associated species, in particular within or adjacent to the Lower Colorado River Valley (i.e., part of the Pacific Flyway).

There is no mortality monitoring component up front -- it is deferred until various thresholds are met. Any site monitoring would be performed by project staff.

There is no condition for obtaining a SPUT permit.

There is no effectiveness monitoring or metrics articulated for proposed avoidance and minimization measures, leaving the adaptive management component largely incomplete.

That's the gist of the concerns. Let me know if you have any questions.
Thanks,
Jody

Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
jody_fraser@fws.gov

---------- Forwarded message ----------
From: **Fraser, Jody** <jody_fraser@fws.gov>
Date: Thu, Apr 9, 2015 at 12:44 PM
Subject: Fwd: Blythe Mesa Solar Project BBCS
To: Amedee Brickey <amedee_brickey@fws.gov>, Thomas Dietsch <thomas_dietsch@fws.gov>

Hey Amedee,
Here's the BBCS that was incorporated into the final EIR/EA that was released on March 26. I have not looked at it yet to understand how our comments were addressed; the consultant who contacted me assured me that they were, in fact, addressed. I'll give it a look -- soon.

Let me know if you need anything else.
Thanks,
Jody

Jody Fraser, Biologist
Palm Springs Fish and Wildlife Office
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, CA 92262
760.322.2070 ph x207
jody_fraser@fws.gov

---------- Forwarded message ----------
From: **Kim Quinn** <kim.quinn@powereng.com>
Date: Thu, Apr 9, 2015 at 12:29 PM
Subject: Blythe Mesa Solar Project BBCS
To: "jody_fraser@fws.gov" <jody_fraser@fws.gov>
Cc: Rupal Patel <rpatel@renewablegroup.com>, Kim Marsden <kmarsden@blm.gov>, Vanessa Santistevan <vanessa.santistevan@powereng.com>, Chris Knopp <Chris.Knopp@powereng.com>

Hi Jody,

As discussed, for your ease of review, I am attaching the Blythe Mesa Solar Project Avian Bat and Protection Plan.

Please feel free to contact me should need you any additional information.

Thank you,

Kim Quinn
Environmental Planner

(714) 507-2730 direct
(714) 507-2713 office
(714) 507-2799 fax
kim.quinn@powereng.com

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From: Lehong Chow
To: kmarsden@blm.gov; Jody_fraser@fws.gov; Magdalena Rodriguez
Cc: Kathy Simon; Dobrzanski, Adam
Subject: Desert Sunlight Q1 2015 O&M bio report
Date: Tuesday, April 21, 2015 9:14:43 PM
Attachments: Desert Sunlight O&M Q1 2015 bio report_Ironwood.pdf

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Hi Kim, Jody, and Magdalena,

Please find as attached the Q1 O&M bio report for Desert Sunlight. If you have any further questions regarding this report, please do not hesitate to contact us.

Hope all is well with everyone and you're enjoying the spring!

Thanks,
Lehong

Lehong Chow
Biologist, Deputy Project Manager
Ironwood Consulting, Inc
Subcontractor

P: (909)798-0330 ext. 5
C: (626)375-1064
E: lchow@ironwoodbio.com

From:	Smith, Kristin
To:	felicia_sirchia@fws.gov; thomas_dietsch@fws.gov
Cc:	Merbouche, Mouloud (HO); michael.cookson@kruger.com; Matuzak, Greg; Venkat, Manjunath
Subject:	Seville Solar Complex Project Bird and Bat Conservation Strategy
Date:	Friday, April 24, 2015 2:58:32 PM
Attachments:	Seville Solar Complex BBCS_4.24.15.pdf

Tom and Felicia,

On behalf of Kruger Energy and Stantec, attached is the pre-final version of the Seville Solar Complex Project BBCS addressing your comments.

We look forward to your final approval. Please let us know if you have any questions.

Thank you,

Kristin E. Smith
Project Biologist
Stantec
290 Conejo Ridge Avenue, Thousand Oaks CA 91361
Phone: (805) 719-9306
Cell: (623) 570-4906

Kristin.Smith@stantec.com



From:	Sorensen, Pete
To:	Brock Ortega
Cc:	Jody Fraser; Thomas Dietsch; Joel Pagel
Subject:	Re: Blythe Solar Power Project - SPUT Permit MB58483B-0
Date:	Friday, May 08, 2015 10:29:29 AM
Attachments:	SPUT_MB58483B-0_Blythe_Solar_5_7_15.xlsm FWSIMR2015MB58483B-01.pdf FWSIMR2015MB58483B-02.pdf FWSIMR2015MB58483B-03.pdf FWSIMR2015MB58483B-04.pdf FWSIMR2015MB58483B-05.pdf FWSIMR2015MB58483B-06.pdf FWSIMR2015MB58483B-07.pdf

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Thnx Brock - please include Jody, Tom and Jeep too in future reporting. What is the "non-project related wire" referring to--another nearby powerline or fence? were they within the Blythe right-of-way or incidentally found elsewhere? I sounds like some of the birds were being scavenged by ravens--is that right? Could you please provide a map as well for where these fatalities occurred? The others may have some follow-up questions too. thnx, Pete

---------- Forwarded message ----------
From: **Brock Ortega** <bortega@dudek.com>
Date: Fri, May 8, 2015 at 9:59 AM
Subject: Blythe Solar Power Project - SPUT Permit MB58483B-0
To: "heather_beeler@fws.gov" <heather_beeler@fws.gov>, Pete Sorensen <Pete_Sorensen@fws.gov>
Cc: David Hochart <dhochart@dudek.com>, Brock Ortega <bortega@dudek.com>

Good morning Heather and Pete,

In accordance with the Migratory Bird Special Purpose Utility Permit (SPUT) issued for the Blythe Solar Power Project (MB58483B-0), the permit holder is to report a “Significant Mortality Event” which is defined as a discovery of 6 or more migratory birds that have been killed within a 24 hour period. Provided attached is the excel spreadsheet that includes the data requested by USFWS in accordance with Section E of the SPUT. As seen in the attached excel sheet two yellow warblers, two Wilson warbler and two Townsend warblers were identified on May 7th during day-to-day construction monitoring associated with construction of the gen-tie for the Blythe Solar Power Project.

Please let me know if you have any additional comments or questions,

Very truly yours,

BROCK A. ORTEGA
PRINCIPAL/SENIOR WILDLIFE BIOLOGIST

DUDEK | *Natural Resource Management | Infrastructure Development | Regulatory*

Compliance

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bortega@dudek.com

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From:	Brock Ortega
To:	Pete Sorensen; "heather_beeler@fws.gov"
Cc:	Jody Fraser; Thomas Dietsch; Joel Pagel; David Hochart; Brock Ortega
Subject:	RE: Blythe Solar Power Project - SPUT Permit MB58483B-0
Date:	Monday, May 11, 2015 8:22:23 AM
Attachments:	SPUT Permit MB58483B-0.pdf

Good morning Pete,
We will be sure to include Jody, Tom and Jeep on future reporting related to the Blythe Solar Power Project SPUT Permit.

Provided below are responses to the questions presented below.

- **What is the "non-project related wire" referring to--another nearby powerline or fence?**
  - The Blythe Solar Power Project 230 kV transmission line is co-located along the same transmission structures as the McCoy Solar Energy Project. Provided attached is an exhibit that shows the alignment of the 230 kV transmission line for both the McCoy and Blythe projects. The McCoy Solar Energy Project transmission line is complete and currently the Blythe Solar Power Project 230 kV transmission line is under construction.
- **Were they within the Blythe right-of-way or incidentally found elsewhere?**
  - The mortalities are located within the Blythe right-of-way.
- **It sounds like some of the birds were being scavenged by ravens--is that right?**
  - That is correct, USFWS ID 04 and 05 were being scavenged by ravens at the time of discovery by the construction monitor.
- **Could you please provide a map as well for where these fatalities occurred?**
  - Yes. Please see attached.

Please let me know if you have any additional questions.
Best,

Brock

From: Sorensen, Pete [mailto:pete_sorensen@fws.gov]
Sent: Friday, May 08, 2015 10:29 AM
To: Brock Ortega
Cc: Jody Fraser; Thomas Dietsch; Joel Pagel
Subject: Re: Blythe Solar Power Project - SPUT Permit MB58483B-0

Thnx Brock - please include Jody, Tom and Jeep too in future reporting. What is the "non-project related wire" referring to--another nearby powerline or fence? were they within the

Blythe right-of-way or incidentally found elsewhere? I sounds like some of the birds were being scavenged by ravens--is that right? Could you please provide a map as well for where these fatalities occurred? The others may have some follow-up questions too. thnx, Pete

---------- Forwarded message ----------
From: **Brock Ortega** <bortega@dudek.com>
Date: Fri, May 8, 2015 at 9:59 AM
Subject: Blythe Solar Power Project - SPUT Permit MB58483B-0
To: "heather_beeler@fws.gov" <heather_beeler@fws.gov>, Pete Sorensen <Pete_Sorensen@fws.gov>
Cc: David Hochart <dhochart@dudek.com>, Brock Ortega <bortega@dudek.com>

Good morning Heather and Pete,

In accordance with the Migratory Bird Special Purpose Utility Permit (SPUT) issued for the Blythe Solar Power Project (MB58483B-0), the permit holder is to report a "Significant Mortality Event" which is defined as a discovery of 6 or more migratory birds that have been killed within a 24 hour period. Provided attached is the excel spreadsheet that includes the data requested by USFWS in accordance with Section E of the SPUT. As seen in the attached excel sheet two yellow warblers, two Wilson warbler and two Townsend warblers were identified on May 7th during day-to-day construction monitoring associated with construction of the gen-tie for the Blythe Solar Power Project.

Please let me know if you have any additional comments or questions,

Very truly yours,

BROCK A. ORTEGA
PRINCIPAL/SENIOR WILDLIFE BIOLOGIST
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From:	Childers, Jeffery
To:	Tera Baird; Marsden, Kim L
Subject:	Addendum to McCoy BA
Date:	11/19/2012 02:35 PM
Attachments:	MSEP_BA figure binder draft 11 16 12.pdf MSEP_BA supplemental info 11 16 12_to BLM.docx

Tera,

Attached is the addendum to the BA for McCoy. Sorry this didn't get to you by Friday, but I tried to get the applicant to produce it faster. These numbers are the same that will be presented in the FEIS and I have ESA working to make sure they are current and accurate with the project description in the document.

I will be in the field tomorrow and off the rest of the week. Feel free to call my cell tomorrow if you have any questions.

Jeffery K. Childers
Project Manager
RECO California Desert District Office
22835 Calle San Juan de Los Lagos
Moreno Valley, CA 92553
Office: 951-697-5308
Cell: 951-807-6737

DEPARTMENT OF THE ARMY
HEADQUARTERS, UNITED STATES ARMY GARRISON
FORT IRWIN, CA 92310-5000

REPLY TO
ATTENTION OF:

IMWE-IRW-PW

3 February 2012

Diane Noda
US Fish and Wildlife Service
Ventura Fish and Wildlife Office
2493 Portola Rd, Ste. B
Ventura, California 93003

SUBJECT: Biological Opinion Annual Reporting

Dear Ms. Noda,

The United States Garrison (USAG) Fort Irwin is submitting the attached annual reports per requirements outlined in two active active biological opinions. These two biological opinions (BO) are:

1. Reinitiation of Formal Consultation on the Army's Current Mission at the National Training Center, Fort Irwin, California (1-8-95-F-16R).

2. Proposed Off-Road Vehicle Area. U.S. Anny National Training Center, Fort Irwin. San Bernardino County. California (1-8-00-F-78).

The attached reports provide information in accordance with the reporting requirements outlined in each of the two biological opinions. The annual report for BO #1-8-03-F-48, Proposed Addition to Maneuver Training Lands at Fort Irwin, California, was previously submitted by separate correspondence

Should you have any questions regarding these reports please contact Clarence Everly. Fort Irwin Natural and Cultural Resources Program Manager. at (760) 380-3740, or via email at clarence.everly@us.army.mil.

Sincerely,

Lance K. Toyofuku
Director of Public Works
Fort Irwin, California

2 Attachments

Attachment 1

Biological Opinion # 1-8-95-F-16R
15 September 1995
Re-initiation of Formal Consultation on the Army's Current Mission at the National Training Center, Fort Irwin, California

INTRODUCTION

Pursuant to submission of a biological assessment identifying the potential effects of military training activities on threatened, endangered and sensitive species within the original boundaries of Fort Irwin and the National Training Center, the US Fish and Wildlife Service rendered a biological opinion. The Service stated in its opinion that the effects of military training activities described were not likely to jeopardize the continued existence of the desert tortoise or adversely modify critical habitat. The opinion further requires Fort Irwin submit an annual report summarizing:

1. the number of desert tortoises moved by authorized biologists
2. the number of desert tortoises killed or injured providing the specific information for each tortoise described in term and condition 12 of the opinion
3. any new ITAM program data
4. recommendations for modifying the terms and conditions to enhance desert tortoise protection
5. acreage disturbed, if any, below the UTM 90 line

RESULTS

Fort Irwin Directorate of Public Works (DPW) natural resources personnel conducted fifty-five (55) survey/monitoring efforts in support of projects on the installation during the reporting period. During this period there were thirty-seven (37) incidental observations of desert tortoises, twelve (12) of which were harassment takes involving movement of tortoises out of harm's way. There was one (1) desert tortoise mortality take during the reporting period.

Per the Biological Opinion for the Army's Current Mission at the National Training Center, Fort Irwin, California, Table 1 provides a listing of all desert tortoise encounters within the original Fort Irwin boundary reported to Fort Irwin personnel during calendar year 2011. In addition to recording these observations, DPW natural resources personnel, in accordance with term and condition 9, marked eight (8) previously un-marked tortoises encountered within the original boundaries of Ft Irwin using a uniquely numbered Floy tag. The purpose of this program is to allow for a passive system of monitoring Fort Irwin tortoises encountered by personnel throughout the installation. ID numbers of animals thus marked are included in Table 1. A total of fourteen (14) tortoises have been tagged since the program's inception (2010). Since tagging, none of these individuals have been reported within the training area. At such time that tagged individuals are re-observed, the animals' locations in relation to location at time of tagging will be plotted in GIS and included in subsequent reports.

Attachment 1

In 2011, there were a total of thirty-seven (37) incidental observations of live tortoises within the original boundaries of Fort Irwin as reported to DPW. Twenty-four (24) of these incidents involved strictly observation with no further action taken. Two (2) incidents involved floy-tagging unidentified tortoises but with no further handling; Six (6) incidents involved floy-tagging with short-distance (≤150m) relocations out of immediate harm's way (primarily out of roadways); four (4) long-distance (> 150m) tortoise relocations away from active training maneuvers and one (1) incident involving a juvenile tortoise recovered from the housing area on garrison. The origin of this tortoise (whether wild or captive) could not be confirmed and the animal was turned over to the High Desert Chapter of the Turtle and Tortoise Club (P.O. Box 163, Victorville, CA 92392) in accordance with direction from USFWS (personal communication with Mr. Ray Bransfield and Mr. Roy Averill-Murray).

Table 1. Desert tortoise encounters by DPW staff on the NTC & Fort Irwin in 2011.
UTM coordinates reported in Zone 11, NAD 83

Date (2010)	Easting	Northing	Age/Sex	ID#	Activity / Status/ Comments
3/15/2011	550800	3908100	Unknown	Unknown	In roadway - observed, not relocated.
3/22/2011	541900	3891300	Adult male	None	Near side of road but in no danger – observed, not relocated.
3/22/2011	544000	3907200	Adult male	None	Moving south near Tiefort mountain. Observed – not relocated.
3/30/2011	523344	3890038	Adult male	None	Observed north side of SEA fence line.
3/30/2011	525704	3888873	Adult male	4387	Observed north side of SEA fence line.
3/30/2011	526230	3888546	Adult female	4396	Observed south side of SEA fence line.
3/30/2011	528776	3887808	Adult	None	Observed south side of SEA fence line.
3/30/2011	528457	3887911	Adult	4302	Observed south side of SEA fence line.
4/4/2011	594000	3896900	Adult	Unknown	Observed along WEA fence line.
4/4/2011	520300	3898300	Adult female	None	Observed near Gemini antennae. Not relocated.
4/6/2011	514400	3894200	Adult female	5099	Observed in LMMV Conservation Area. Not relocated.
4/12/2011	560725	3918725	Adult	Unknown	Reported by contractor. Observed, not relocated.
4/14/2011	560072	3919523	Adult	Unknown	Reported by contractor. Observed, not relocated.
4/16/2011	529000	3895000	Adult	Unknown	Reported by training unit. Observed, not relocated.
4/22/2011	514600	3893900	Adult	5099	Observed in Brinkman Wash LMMV conservation area. Not relocated.

Attachment 1

4/23/2011	526800	3902200	Subadult	NTC1144	Tortoise recovered from roadway on garrison. Animal was relocated approximately 3 miles to Goldstone land.
4/23/2011	527500	3903500	Subadult	NTC1149	Tortoise recovered from housing area while resting beneath a parked vehicle. Relocated to nearest parcel of habitat west of garrison.
4/25/2011	521600	3913100	Subadult	NTC1016	Tortoise reported by soldiers in training area. Observed, tagged but did not relocate.
4/30/2011	522580	3921940	Adult female	None	A female tortoise was found in a burrow by OPS group. A 50-meter buffer zone was created to protect the burrow and potential eggs using seibert stakes.
4/30/2011	522580	3921940	Adult male	None	Tortoise reported by soldiers in training area. Observed but did not disturb animal.
5/6/2011	514875	3920371	Adult male	NTC1139	Tortoise walking along busy MSR roadway in training area. Tagged and relocated animal a safe distance (≤150 m) from MSR.
5/9/2011	504547	3895808	Subadult	5518	Observed by DPW biologists. Small adult tortoise with a transmitter. Did not disturb.
5/12/2011	527700	3913800	Adult	Unknown	Called-in observation by downrange personnel - could not contact to confirm details.
5/17/2011	551105	3908786	Hatchling	Unknown	Responded to a call from soldier during a maneuver. Determined that the hatchling tort was not in immediate harms way and was left in situ inside a shallow burrow.
5/19/2011	516710	3899301	Adult female	NTC1050	This animal had originally been recovered from the Jackrabbit Park and was relocated as per USFWS instruction to conservation lands (UTM reflects current location).
5/23/2011	533841	3916209	Adult male	NTC1055	Tortoise called in by soldier on training maneuvers. Animal was tagged and relocated out of immediate training area.
5/25/2011	523450	3992980	Adult	Unknown	Soldiers on maneuvers called in observation of adult tortoise. Animal was not disturbed.

Attachment 1

5/25/2011	523960	3891520	Adult	Unknown	Soldiers on maneuvers called in observation of adult tortoise. Animal was not disturbed.
6/20/2011	520680	3900199	Subadult	NTC1134	Animal reported on busy, paved roadway. Biologists responded to tag and relocate animal out of harm's way (≤150 m).
6/20/2011	523818	3895511	Adult	None	Tortoise reported by soldiers. Observed animal but did not disturb.
8/15/2011	540213	3898314	Adult	None	Tortoise was crossing trail during a vehicle convoy; tortoise was moved 100 meters in direction of travel by an ECT soldier trained in short-distance tortoise relocations; tortoise did not void its bladder.
8/20/2011	524300	3897800	Subadult	None	Tortoise reported near front gate crossing busy roadway. Animal was relocated 150 meters west in direction of travel.
8/24/2011	523796	3897080	Subadult	NTC1175	Tortoise observed on "wrong" side of tortoise fence bordering Ft Irwin road. Animal was placed on protected side of tortoise fencing and tagged.
9/17/2011	560000	3910400	Adult	Unknown	Tortoise recovered from construction project area by tortoise monitor. Moved out of harm's way ~150 m from activity.
9/19/2011	545500	3907500	Unknown	Unknown	Tortoise reported by contract personnel. Observed but did not disturb.
9/20/2011	528341	3915302	Adult female	NTC1051	Tortoise reported by soldiers on patrol. Observed and tagged animal but did not relocate.
11/8/2011	528000	3902000	Juvenile (~2 yr old)	None	Recovered from housing area. Could not confirm status as a wild tortoise and animal was relinquished to High Desert Chapter of the Tortoise Club.

Summary of 2011 Survey and Monitoring Efforts within the original boundaries of Fort Irwin

Listed below is a consecutive summary of all 2011 construction-related tortoise survey and monitoring efforts conducted within the original boundaries of Fort Irwin. All construction related survey and monitoring efforts for the year resulted in no (0) live tortoise encounters. Three (3) potential tortoise burrows were identified during three pre-construction survey efforts. These burrows were not active at the time of survey. Two (2) carcasses both consisting of

disarticulated bone were seen during two surveys. Both were more than a year old and had no signs of take due to military training.

- On January 18, 2011 two biologists conducted a pre-construction survey adjacent to the southern buildings of Diffat AlBahaira al Jaff where waste water and kitchen pits were being installed. The site was highly disturbed with little vegetation, as it was located next to a MOUT site and adjacent to a main supply route (MSR). No desert tortoises or their sign were encountered.

- On January 20, 2011 two biologists surveyed a two hundred by two hundred meter area before the installation of a shade structure on one of the buildings at Eastgate. Although the project area is close to undisturbed habitat where tortoises could be present, no desert tortoises or their sign were observed.

- On February 4, 2011 two biologists surveyed an area one hundred by one hundred meters near Granite Mountain where a trench was to be dug for splicing cables. The soil was very rocky and granite boulders littered the site. Neither desert tortoises nor their sign were encountered in the action area.

- On February 17, 2011 three biologists surveyed a site of a potential roadway construction project extending from Bruno Cave down into the northwest part of Drinkwater Valley. No desert tortoises were encountered during the survey; however, a category 5 burrow, which is a burrow in deteriorated condition possibly belonging, at one point, to a desert tortoise, was encountered. This project was later cancelled.

- On February 18, 2011 two biologists surveyed the future site of a walled compound with five buildings constructed on piers on a 50 m by 50 m plot of land east of Challenger Canyon. The soil type on site was poorly suited to burrowing. No desert tortoises or their sign were encountered during the survey.

- On February 20, 2011 two biologists surveyed the proposed locations of 12 target pits around TF Urban. No desert tortoises, their sign, or other sensitive species were observed however, three of the target pits were constructed prior to the biologists' arrival on the sites, and no determination could be made about the presence of desert tortoises in these areas.

- On February 21, 2011 two biologists surveyed the proposed location of eight target pits near Challenger Canyon. All of the proposed target pit sites are found in relatively rocky areas with soils and plant communities poorly suited to desert tortoises. No desert tortoises or their sign were encountered during the survey.

- On February 25, 2011 two biologists surveyed an existing trench which was slated to be repaired at Refrigerator Gap Strongpoint. The soil type at the site was considered poorly suited to the desert tortoise. No desert tortoises were encountered during the survey; however, a category 5 burrow, which is a burrow in deteriorated condition, not occupied but possibly belonging to a desert tortoise, was encountered.

- During the week of February 28, 2011 two biologists surveyed eight sites prior to the installation of target pits near Refrigerator Gap. The soil type was poorly suited to the desert tortoise. No desert tortoises were seen but a category 4 burrow, which is a burrow in good condition possibly belonging at one point to a desert tortoise, was encountered and determined not to be occupied or in current use.

- During the week of February 28, 2011 two biologists surveyed 8 target pit locations near TF Rural. All of the target sites had disturbances present in the form of vehicle tracks, UXOs (unexploded ordinance), fire damage, and bullet casings. No desert tortoises, their sign, or other sensitive species were encountered during the survey.

- During the week of February 28, 2011 two biologists surveyed the east end of Echo Valley prior to the installation of a 64 meter trench called Grassy Knoll Strongpoint. The soil type on site was considered poorly suited to the desert tortoise. No desert tortoises, sign, or other sensitive species were observed.

- On March 4, 2011 two biologists surveyed an area northeast of Limaville. The area had already been disturbed by military training and was located on a steeply sloping hillside. No desert tortoises or their sign were observed.

- On March 4, 2011 two biologist surveyed an area south of Drinkwater Lake prior to the construction of a small training village. The proposed action area is located south of Drinkwater Lake, in an area which has already been significantly disturbed by military training. Multiple roads run through the action area and existing target pits were observed at the eastern portion of the site. No desert tortoises, or their sign, were observed.

- On March 11, 2011 three biologists surveyed along the fence line between Drinkwater Lake and Leach Lake Pass, before the reduction of an existing berm. The closest historical desert tortoise sighting was less than 1 kilometer from the site, but no tortoises or their sign were seen during the survey.

- On March 16, 2011 two biologists surveyed an area north of Medina Jabal prior to the installation of kitchen grey water pits. The area had been disturbed by military training and multiple roads ran through the action area, which had very little vegetation growing anywhere on. No desert tortoises or sign were encountered.

- On March 17, 2011 two biologists surveyed a 100 x 100 meter area prior to the installation of kitchen pits at Abar Layla. The area was highly disturbed and no flora or fauna was observed. No desert tortoises or their sign were seen.

- On March 18, 2011 two biologists preformed a survey prior to the digging of grey water kitchen pits at al Sharq. The area was almost entirely devoid of vegetation, and the vegetation that remained was damaged due to vehicle tracks and training activities. No desert tortoises or their sign were encountered during the survey.

- On March 23, 2011 three biologists surveyed an area west of Matterhorn Mountain prior to a re-vegetation project. The action area is on a soil type suited to desert tortoises; however, it has become so disturbed that it is no longer suitable habitat for tortoises. No desert tortoises or their sign were observed during the survey.

- On April 21-23, 2011 four biologists surveyed an area of 490,000 square meters that would be graded for ammunition storage. The surveyed area is located in a large wash which would become inundated with water after major rain events. No desert tortoises or their sign were observed during the survey.

- On April 22, 2011 two biologists surveyed the FOB New York site. The area had numerous vehicle tracks, cleared areas, trash, and other signs of training throughout the site. Heavy training had damaged much of the vegetation. No desert tortoises or their sign were encountered during the survey.

- On April 22-28, 2011 four biologists surveyed an area slated for ammunition storage located east of Eastland. The soil type at the site was considered poorly suited to the desert tortoise. No desert tortoises or their sign were encountered during the survey.

- On May 2, 2011 three biologists surveyed ten target pit sites in Challenger Canyon. The area had numerous UXOs and other military readiness training remnants, such as bullet casings and blast holes. No desert tortoises or their sign were encountered during the survey.

- On May 19, 2011 two biologists surveyed a well drilling sight southwest of the Whale. Vegetation and the soil at the site appeared suited to the desert tortoise but no individuals or their sign were seen.

- On May 20, 2011 two biologists surveyed a well drilling site north of Bitter Springs MSR. The site was very sandy and thus not conducive to burrows of the desert tortoise. No desert tortoises or their sign were seen.

- On June 14, 2011 four biologists surveyed a well drilling site located on the NASA Goldstone Complex near the Goldstone Air Strip. The habitat appeared well suited to the desert tortoise however no desert tortoises or their sign were encountered during the survey.

- On June 14, 2011 four biologists surveyed a well drilling site located on the NASA Goldstone Complex near the western expansion area northern fence line. One desert tortoise carcass, consisting of parts of a bleached shell with several scutes, was found during the survey. Biologists estimated the tortoise had died at least one year previously.

- On June 14, 2011 four biologists surveyed a well drilling site on the NASA Goldstone Complex near the Mojave site. The site was dominated by saltbush. No desert tortoises or their sign were observed.

Attachment 1

- On June 14, 2011 four biologists surveyed a well drilling site located on the NASA Goldstone Complex on the north side of Goldstone Lake. It was located in a saltbush dominated plant community. No desert tortoises or their sign were observed.

- On June 14, 2011 three biologists surveyed a well drilling site located south of Langford Lake MSR and west of the Whale. The dominant perennial was creosote bush and existing roads crossed the area. No desert tortoises or their sign were encountered during the survey.

- On June 15, 2011 two biologists surveyed a well drilling site located just south of Pioneer/Debnam Pass MSR and west of Medina Wasl MOUT site. The vegetation on site was creosote bush scrub. No desert tortoises, their sign, or other sensitive species were seen.

- On June 15, 2011 two biologists surveyed a well drilling site located between the west edge of Nelson Lake and al Jaff MOUT site. The plant community on site was saltbush scrub and there were numerous vehicle tracks crossing the area due to military training. No desert tortoises or their sign were seen.

- On June 15, 2011 two biologists surveyed a well drilling site located just north of Pioneer/Debnam Pass MSR and east of FOB Seattle. The soil on site is considered poorly suited to the desert tortoise. No desert tortoises or their sign were encountered during the survey.

- On June 15, 2011 two biologists surveyed a well drilling site located just north of Pioneer/Debnam Pass MSR and west of Nelson Lake. The plant community was creosote scrub and vehicle tracks from military training crossed the site. No desert tortoises or their sign were encountered during the survey.

- On June 15, 2011 two biologists surveyed a well drilling site located north of Medina Wasl. Existing roads and vehicle tracks were common across the action area, where the dominant perennial was saltbush. No desert tortoises or their sign were observed.

- On June 15, 2011 two biologists surveyed a well drilling site located south of East Range Road MSR and northwest of Central Well. The action area was situated in a large wash which contained many roads and vehicle tracks. No desert tortoises or their sign were observed.

- On June 15, 2011 three biologists surveyed a well drilling site located north of Bitter Spring and Bitter Springs MSR. The action area was situated in a large wash containing roads and vehicle tracks. The dominant perennial was creosote. No desert tortoises or their sign or were observed.

- On July 8, 2011 two biologists surveyed a soil sampling site on Range 18, off of Barstow Road MSR. The survey area was near large disturbed areas and several berms on Range 18. No desert tortoises or their sign were encountered during the survey.

- On July 11, 2011 two biologists surveyed a soil sampling site on Range 17 off of Barstow Road MSR in the training area, surrounding the Range 17 tower. The area was originally a creosote scrub community but has been converted into a parking area for firing range activity on Range 17. No desert tortoises or their sign were observed.

- On July 26 and 27, 2011 four biologists surveyed the site of the eastward expansion of FOB Denver. The action area was situated in a large sandy area, where vegetation has been greatly reduced and disturbance included trash, UXOs, bullet shells, and roads crossing the area. Desert tortoise sign in the form of disarticulated bone was seen at the site; however, no burrows, scat, or individuals were encountered.

- On August 24, 2011 two biologists surveyed the earthen berms at FOB King prior to their de-construction. The site was northwest of Medina Wasl. The survey area was completely graded and surrounded by large, dirt berms. No desert tortoises or their sign were encountered during the survey.

- On September 1, 2011 two biologists surveyed several dirt roads between MOUT site Medina Wasl and FOB Seattle where a regarding effort was planned. The soil on site was considered poorly suited to the desert tortoise. No desert tortoises or their sign were observed.

- On September 8, 2011 two biologists surveyed 33 miles of trail slated to be improved in the G1-G3 training areas. All trails wind through creosote scrub where there are several denuded areas with no vegetation. No desert tortoises or their sign were observed.

- On September 8, 2011 two biologists surveyed trails in the LF4-LF5 training area. All trails pass through creosote scrub communities. No desert tortoises or their sign were encountered during the survey.

- On September 8, 2011 two biologists surveyed 22 miles of trails in the LF6-LF7 training areas. The existing trails pass through creosote scrub communities and several washes. No desert tortoises or their sign were encountered during the survey.

- On September 9, 2011 two biologists surveyed FOB Denver prior to the installation of kitchen pits to support a temporary mess facility. The action area is situated in a large sandy area, where vegetation has been greatly reduced. No desert tortoise burrows, scat, or individuals were encountered.

- On September 9, 2011 two biologists surveyed the proposed location where grounding for a radio broadcast tower was to be installed. The site was very disturbed with trash, discarded wood, wire, bullet shells, and an excess of roads across the area. No desert tortoise burrows, scat, or individuals were encountered.

- On September 12, 2011 two biologists surveyed existing trails in the E1-E2 training area. All surveyed trails go through creosote scrub communities where there were several areas denuded of vegetation. No desert tortoises or their sign were observed.

- On September 12, 2011 two biologists surveyed along an existing travel route, prior to the creation of a crater in John Wayne Pass, for a rotational training scenario. The action area is situated in a rocky canyon which is not conducive to desert tortoise burrows. No burrows, scat, or individual desert tortoises were encountered.

- On September 14, 2011 two biologists surveyed an existing roadway prior the creation of AinGhar Crater. The action area was situated in a mountainous area, in the middle of an existing trail, with rocky hills on either side. No burrows, scat, or individual desert tortoises were encountered on site.

- On September 15, 2011 three biologists surveyed prior to the construction of a trail ten meters wide, up a wash from 1STG Wadi, to a hill and along the adjoining ridge. The action area was situated in a large sandy wash and there were some vehicle tracks in the area. No burrows, scat, or individual desert tortoises were encountered.

- On November 9 and 15, 2011 two biologists surveys the trails of Hidden Valley prior to slated trail improvements. The survey area was dominated by creosote bush scrub. No burrows, scat, or individual desert tortoises were encountered.

- On November 10, 15, and 21, 2011 two biologists surveyors an area slated for trail improvements in areas G3 and H1 of the training range. The entire project area had been moderately to heavily disturbed by military vehicles. No desert tortoises or their sign were observed during the survey.

- On December 2, 2011 one biologist reviewed the site of an emergency rock removal from a roadway due to a vehicle fatality. Two large boulders were apparently pushed from mid-route approximately 10 meters onto the shoulder. The disturbance did not result in apparent impacts to desert tortoises or their habitat. The area is already highly disturbed due to ground training activity. .

One (1) desert tortoise mortality was recorded in the NTC training area and was likely a result of military training activity. The observation of a deceased tortoise on a two track trail was initially reported by military personnel. DPW biologists estimated the carcass to be approximately 2 to 3 months old. Given the location of the carcass in relation to the two track trail the apparent cause of death was vehicle strike. Given the condition of the carcass it was not possible to determine whether the tortoise had expired prior to being run over or if mortality actually occurred as the result of being run over.

There is no new ITAM program data to report at this time.

Fort Irwin has no recommendations or modifications to suggest at this time to improve or enhance desert tortoise protection.

No disturbance of lands occurred below the UTM 90 line as a result of training activities during this reporting period.

Attachment 2

Biological Opinion # 1-8-00-F-78
Proposed Off-Road Vehicle Area,
U.S. Army National Training Center,
Fort Irwin, San Bernardino County, California

INTRODUCTION

Fort Irwin established an ORV Area for military personnel and their dependents to use in their leisure time. There was no authorized area for this type of activity on Fort Irwin. As a result, some soldiers and/or their dependents used various areas of the installation for ORV activity. The availability of a single, officially sanctioned location for ORV use will ensure that other areas of the installation are not further damaged by this type of activity, thereby protecting the desert tortoise and other sensitive species. The established ORV Area is the only authorized area on post upon which this activity is allowed. Established in 2003, the ORV area encompasses approximately 70 acres. It is completely enclosed by triple strand smooth wire and tortoise proof fencing.

Pursuant to a review of the current status of the desert tortoise, the environmental baseline for the action area, the effects of the proposed Outdoor Recreation Vehicle (ORV) Area and cumulative effects, the US Fish and Wildlife Service rendered a biological opinion. The Service stated in its opinion that the ORV Area, as proposed, is not likely to jeopardize the continued existence of the desert tortoise. The opinion further requires Fort Irwin submit an annual report summarizing:

1. Compliance with NTC and Fort Irwin Regulation 350-3 detailing the amount of use occurring at the ORV Area
2. Types and occurrences of violations, such as breaches of the perimeter fence
3. Corrective measures taken to prevent further violations if any occurred

RESULTS

The Fort Irwin Outdoor Recreation Center reported a total of one hundred one (101) users of the OHV area representing forty-two (42) days of use during calendar year 2011. Use has increased from 2010 as a result of the course being re-opened after a long closure in 2010 to effect safety improvements. However, the OHV area is again closed (October, 2011) indefinitely due to a lack of maintenance funding.

No desert tortoise encounters were reported within the boundaries of the OHV area. No violations of NTC and Fort Irwin Regulation 350-3 were reported or observed.

USGS
science for a changing world

An Annual Report for the Fort Irwin Desert Tortoise Translocation Project

2009 Progress



Prepared for:
U.S. Army National Training Center
Directorate of Public Works

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY
WESTERN ECOLOGICAL RESEARCH CENTER

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By K. Kristina Drake, Todd C. Esque, Kenneth E. Nussear, Brian M. Jacobs, Katherine M. Nolte, and Philip A. Medica
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AR073050

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By K. Kristina Drake, Todd C. Esque, Kenneth E. Nussear, Brian M. Jacobs, Katherine M. Nolte, and Philip A. Medica

ABSTRACT

The threatened status of the Mojave population of the desert tortoise (*Gopherus agassizii*), in conjunction with the expansion of Fort Irwin National Training Center necessitated the development of a Translocation Plan (Esque *et al*. 2005). The Translocation Plan and the Recovery Plan (FWS 1994) outlined the need for baseline studies on resident tortoises within release areas to be accomplished prior to translocation in order to evaluate the current status of resident populations, and to provide a point of reference for later evaluation of the success of the translocation efforts. From 2005-2007, the USGS initiated studies researching movements, habitat use, behavior, and physiological characteristics of tortoises that would serve as residents and controls during impending translocations (Drake *et al*. 2006, Walden *et al*., 2007). Habitat condition was also characterized (2005, 2007-2009), using annual and perennial plant surveys on randomly located transects throughout the Translocation Area.

In March 2008, the USGS translocated 38 desert tortoises as part of a much larger translocation effort at Fort Irwin (Drake *et al.* 2008). These translocated tortoises, along with a subset of resident and control tortoises within the Translocation Area, have been closely monitored to determine whether there are any measurable physiological stresses that may be associated with translocation of this species. These efforts have included tracking via radio telemetry and monthly blood collection during months of above-ground activity (April-October). In 2009, we continued to monitor the physiological affects of translocation among translocated and resident tortoises in comparison to controls throughout the study area.

Over the past five years, scientists from the USGS Las Vegas Field station have worked in collaboration with scientists from several universities, Department of Interior agencies, and other field offices within USGS to broaden the knowledge obtained from the study animals and about the habitat in which they live, and much of this work has been published in peer reviewed literature. These studies include: research on using GIS decision support systems to prioritize translocation sites (Jill Heaton; University of Nevada-Reno, Thomas Leuteritz and other; Redlands Institute; Heaton et al. 2008), research on health and disease status (Kristin Berry, USGS), a study on the potential risk of predation due to ravens throughout the Translocation Area (Wendy McIntyre, Redlands Institute, University of Redlands; McIntyre et al. 2007, comparisons of the efficiency and cost effectiveness of trained dog search teams (K9) and human search teams (Mary Cablk, Desert Research Institute; Jill Heaton, University of Nevada-Reno; Nussear et al. 2008), laboratory analysis for physiological parameters of stress (Richard Tracy, Ken Hunter, Amy Barber, and Sally DuPre-University of Nevada-Reno) as well as understanding the effects of human population density, resource variability and subsidized predators on desert tortoise populations (Andrew Walde, Peter Woodman, William Boarman-ITS-QinetiQ; Roy Averill-Murray-U.S. Fish and Wildlife Service; Jeremy Mack, Kristin Berry-USGS; and Jill Heaton- University of Nevada-Reno; Esque et al. In Review).

INTRODUCTION

The desert tortoise (*Gopherus agassizii*) was listed as a threatened species by the U.S. Fish and Wildlife Service (FWS) in 1990, and critical habitat for the Mojave population was designated in 1994. In 2004, President George W. Bush signed the Fort Irwin Military Lands Withdrawal Act of 2001, authorizing Fort Irwin to expand its training activities into 110,000 acres of public land that had been designated as critical habitat, some of which were previously used for military training prior to the listing of the desert tortoise. As mitigation for disturbance of desert tortoise critical habitat, the U.S. Army and the FWS determined that all tortoises inhabiting the proposed UTM 90 Area (hereafter Southern Expansion Area or SEA, 23,214 acres), and Superior Valley (70,045 acres) would be translocated prior to military activity. Work described in this report includes some tortoises that originally resided in the SEA and were translocated in the Spring of 2008, and others that reside in the Translocation Area where tortoises from the SEA were moved.

Throughout this report we refer to three different experimental populations of desert tortoises: resident tortoises, control tortoises, and translocated tortoises. The distinction is important because one premise of this study is that each experimental population may respond to translocation differently and the research design is planned to test several hypotheses about multiple responses. Tortoises that originated in the SEA are referred to as translocated tortoises, and will keep that designation throughout the life of the study. This includes an estimated 640 adult tortoises, and 300 sub-adult and juvenile tortoises that were moved to 13 release sites in the Superior Cronese Desert Wildlife Management Area (DWMA), within the general area described in the Translocation Plan (Esque *et al*. 2005).

Tortoises residing in the Translocation Area were considered to be control tortoises prior to March 27th, 2008, when translocation occurred. From that date forward, kernel utilization distributions were calculated each month to identify spatial overlap between translocated and control tortoises. If a control tortoise was found to overlap spatially with the distribution of translocated tortoises, its treatment type was changed to resident. Once a tortoise was designated as a resident, it will keep that designation in perpetuity, even if it moves outside the range of any translocated tortoises. A population of over 300 resident and control tortoises residing in the translocation area has been part of our research prior to and after translocation for the last five field seasons.

Previous studies on translocation of desert tortoises have examined movements, site fidelity, survivorship, reproduction, habitat use, and pre-release conditions (Nussear 2004, Field 1999). Additional ecological parameters that were recommended for potential study in the Translocation Plan as a result of Fort Irwin expansion included stress, growth, incidence of disease, nesting success, recruitment, nutritional ecology, behavior, social interaction, and habitat characteristics including vegetation and geomorphology (Esque *et al*. 2005). Physiological stress may be particularly useful in measuring the potential effects of translocation on both translocated and resident tortoises in comparison with their control counterparts.

Animals respond physiologically to an array of external noxious or stressful stimuli, including predation attempts, harsh weather, habitat change and anthropogenic disturbances, through a rapid cascade of endocrine secretions within the hypothalamic-pituitary-adrenal (HPA) axis (Axelrod and Reisine 1984, Wingfield *et a*l. 1997). While the stress response is complex and involves a variety of endogenous mediators, the glucocorticoid hormones (corticosterone or

cortisol) generated via the HPA axis are most often associated with the stress response. In particular, elevated levels of cortisol or corticosterone (CORT) are seen in both acute and chronic stress, and these hormones have been used as "biomarkers" of an altered physiological state.

Capture, handling, and restraint of wild animals (which are all activities that occur during translocation to new habitats) have all been shown to cause rapid elevations in CORT. These elevated levels of CORT typically decrease within a short period of time following release, and may or may not have cascading impacts on immune function or other physiological factors; however this has not been studied in depth, especially in this species. Indeed, there is a dearth of research quantifying the long-term effects of translocations on CORT levels, and almost none correlating these protracted elevations in CORT (chronic stress) on the function of the immune system or long-term key life history factors. Thus, a very important element of assessing stress in desert tortoises as a function of translocation is making an explicit connection in the physiology of stress as assessed by endocrine markers to immune competence as measured by ability to mobilize immune mechanisms over time. We suspect that if an animal's physiology is altered due to chronically elevated stress then we would expect to see impacts to ecological performance, such as reproduction, movements and habitat use, and behavior.

It seems likely that the translocation may cause acute stress in tortoises and that CORT levels may be elevated as a result. However, it is unknown whether this acute stress is important to the immune competence of translocated tortoises or if translocation will cause a more chronic stress to translocated tortoises as they continue to adjust in their new environments. It is also unknown what stress (acute or chronic) might occur in resident tortoises whose population has been supplemented by translocated tortoises or if any of the acute or chronic stresses affecting translocated or resident tortoises will result in a loss of immune competence or long term ecological compromise; although previous translocation studies have documented equivalent reproductive effort between residents and translocated tortoises (Nussear 2004). If any of these stressors compromise immunity or key life history factors, then the process of translocation could subject individual tortoises to increased vulnerability.

The Fort Irwin Translocation Project has facilitated a wealth of information on the ecology, behavior, habitat use, and distribution of desert tortoises. Through extensive coordination with Kristin Berry (USGS) and ITS-QinetiQ, collectively more than 48,000 tortoise observations have been recorded over the past five seasons. Thanks to such cooperation, this comprehensive dataset has enabled us to understand habitat use and movements of both translocated and resident populations to an extent that would otherwise not have been possible.

MATERIALS AND METHODS

Study Area

The Translocation Area is an ~ 1000 km^2 area of the Superior-Cronese Desert Wildlife Management Area (DWMA), located within the Western Mojave Recovery Unit. It is bounded on the south by Interstate 15, on the north by the southernmost boundary of Fort Irwin, on the west by the 508000 East Universal Transverse Mercator (UTM) line, and on the east by the

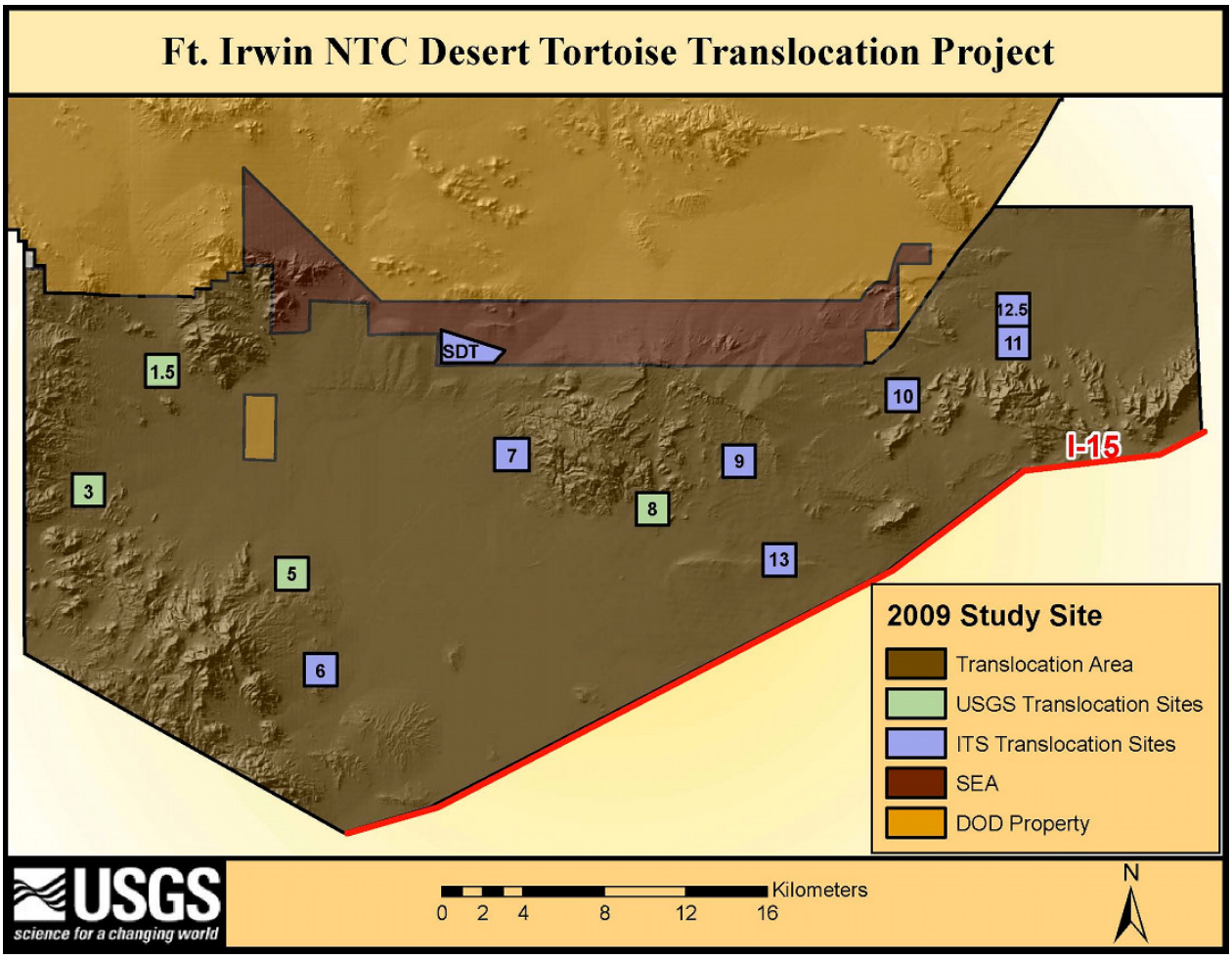

Figure 1. Map of the Translocation Area study area utilized in 2009.

568000 East UTM line (Figure 1). The Translocation Plan originally discussed 12 figurative plots of 1.6 km^2 (1 mi^2) that were to serve as release sites for 50 to 70 translocated tortoises each (Esque *et al*. 2005*)*. These plots were originally established in 2006 (Drake et al. 2005), but due to changes in landscape use, property ownership, prevalence of disease and site accessibility prior to translocation, several of these sites were removed as release sites. The USGS utilized plots 1.5, 3, 5, and 8 as research sites. Additional plots (6, 7, 9, 10, 11, 12.5, 13, and SDT) were also used by ITS as release sites for translocated tortoises.

The Southern Expansion Area (SEA) is bounded on the north by the 3890000 North UTM line, on the south by the 3887000 North UTM line, on the east by the 550000 East UTM line, and on the west by the 523000 East UTM line (Figure 1).

Study Animals

During 2005 and 2006, 306 tortoises were encountered and measured by USGS personnel to establish a robust sample of resident and control populations in the translocation area. Most of these were originally marked in 2005 (n=258) with an additional 48 being added in 2006. These tortoises were tracked monthly using radio telemetry as required by FWS and the California

Department of Fish and Game (CDFG) permits and blood was collected from a subset to begin ascertaining baseline stress values. In 2007, to reduce interference with concurrent research projects, we re-focused our efforts to monitor and collect blood from a subset of 120 tortoises (80 control and 40 translocated). Blood samples were collected from our study animals during these three years and should provide a representative baseline for stress levels that can be compared with post-translocation levels.

In 2008, we continued to monitor these animals and added an additional 6 tortoises to the study for a new population of 126 (86 control and 40 translocated). On March 27, 2008, USGS personnel translocated 38 tortoises from the SEA to four release plots (1.5, 3, 5 and 8) within the Translocation Area. Tracking commenced daily for the translocated tortoises for a period of 4 weeks, followed by weekly tracking of all tortoises in the study. In 2009, we continued monitoring these animals (11 control, 46 resident, 21 translocated) as well as collecting blood once a month from April-October. Monitoring animals across a large study site has provided the opportunity to simultaneously learn about ecological parameters, including movement, habitat use and their general behavior, while collecting data that address physiological parameters such as stress.

A total of 364 tortoises have been encountered and measured throughout the study area over the last five years. In addition to the 306 tortoises found in 2005-2006, 44 tortoises that had previously been marked by other researchers were incorporated into the stress assessment. In 2009, an additional 14 tortoises were added to the study; eight transferred from ITS and 6 from the inclusion of newly found individuals. Data gathered over the last five years has allowed us to compare resident and control responses to the translocation over the short and long term tenure of the program as defined in the Translocation Plan.

Animal Capture

1. Data Collection and Measurements

Data collected upon each encounter with a tortoise included date, time, observer, local climate, microhabitat, and geographic location. Some encounters resulted in the handling of animals for the purposes of measurement, transmitter attachment or maintenance, or blood sampling. For those encounters we also recorded temperature, data on the measurements of the mass and shell dimensions of animals, information associated with transmitter attachment and/or the collection of blood samples (Appendix 1).

Data were recorded using Garmin Ique 3600 PDAs or Trimble Juno SB Handheld Computers running Pendragon Software (v 5.3) as well as on paper datasheets.

2. Physical Measurements and Marking

Physical measurements of tortoises were taken during their initial capture and/or at the beginning of the activity season for each year. All tortoises were captured when temperatures were below 95° F within 5 cm of the shaded ground surface. These measurements included several shell dimensions measured using metal calipers, including: midline carapace length (CL), the length of the plastron between the notches of the gular and anal scutes, the shell width between the fifth and sixth marginals, and the maximum shell height. Tortoises were also weighed to the nearest 5 g using a field portable digital scale. A uniquely numbered paper tag was attached with epoxy to a depressed portion of a vertebral scute for identification.

In May 2008, most tortoises in our study were notched using the Highly Modified Honegger System (Honegger 1979, Appendix 2) with notching methods derived from Cagel (1939). It is a modification of a system developed by Froese and Burghardt (1975) and uses numbers 1, 2, 4 and 7 along the marginal scutes. There were some exceptions with animals used in a previous study with non-numeric designations (ADG, ABR and BCI). These tortoises have been assigned a numerical identification and will be notched in the upcoming season.

3. General Health Assessment
Each tortoise was visually inspected for injuries, morphological anomalies, ectoparasites (e.g., ticks), and obvious symptoms of shell disease (cutaneous dyskeratosis), osteoporosis, and upper respiratory tract disease (URTD) when first marked, and upon each encounter if the tortoise was visible. This basic health assessment was recorded for general characterization only. A more thorough health assessment of these animals was conducted by Kristin Berry (USGS).

4. Habitat Assessment
Several microhabitat characteristics were recorded upon each encounter with a tortoise. These included general characteristics of the tortoise's location (hill, wash, open scrub, etc.), soils (cobble, sandy loam, sand, etc.), and specific microhabitat (sun, shade, burrow, etc.), and the tortoise's behavior (basking, eating, etc.; Appendix 1). When the microhabitat of the tortoise was associated with perennial vegetation, the species and dimensions of the vegetation were recorded for later analysis.

In order to determine patterns of burrow use, burrows used by tortoises were identified by a uniquely numbered non-reflective burrow tag attached with epoxy to a rock near the burrow. Burrow azimuth and associated perennial vegetation species were also recorded.

5. Transmitters
Transmitters were attached to all tortoises included in the stress study (CL $\geq$ 180 mm). The mass of the attached transmitter was 9.7 g, 13.8-15.0g, 17.0 g, 19.5g, or 25.5-27.5 g depending on the size of the tortoise and availability of transmitters. The different transmitter sizes were due to different battery configurations, where larger and heavier batteries provide longer transmitter life.

During 2009, transmitters were only attached to the first costal scute with putty epoxy, and only one segment of plastic tubing was used to attach the antenna to the second costal scute (Figure 2). The rest of the antenna was allowed to trail freely. A small dab of silicone sealant was placed between the head of the transmitter and the first tubing segment to reduce the risk of entanglement (e.g., with low lying branches of shrubs).



Figure 2. Desert tortoise. Photo taken by B. Jacobs – USGS.

If a transmitter that had already been attached to a tortoise was discovered to be functioning improperly, it was removed by carefully levering the putty off of the scute while avoiding damage to the carapace. Once the transmitter was safely removed, all remaining putty was removed and a new transmitter was affixed.

6. Blood Collection

Blood samples were collected to examine reproductive and seasonal endocrine patterns to aid in understanding the baseline levels and physiological parameters of stress. During 2009, attempts were made to collect samples monthly (April-October) from individual tortoises within each experimental population (resident, control and translocated) based on availability.

Blood samples were collected within the first 15 minutes following initial disturbance of the animal. Between May 10, 2005 and July 25, 2006, a subset of blood samples were collected using a 1.91 cm, 25-gauge needle-IV infusion set and 3 cc sterile syringe to obtain blood from the jugular vein (Jacobson *et al*. 1992). Between May 11, 2006 and October 3, 2009, blood samples were collected using a 3.81 cm, 23-gauge or 25-gauge needle and 3 cc sterile syringe coated in heparin to obtain blood from the subcarapacial sinus (Hernandez-Divers *et al*. 2002). Once collected, blood was transferred into labeled microtainers® containing lithium heparin to prevent coagulation. Throughout 2009, less than 0.5 ml of blood was collected from each

individual most months and a maximum of 1.2 ml of blood was collected from select individuals in which additional blood was requested for health screening. Blood samples were immediately stored on ice in small field portable coolers for no more than five hours. The samples were then centrifuged at 3400 rpm for ten minutes to separate the plasma from the red blood cells. Plasma and red blood cells were then extracted using a micropipette and placed into labeled cryogenic vials, which were immediately stored in liquid nitrogen. All samples were stored at field stations in Barstow, California and Las Vegas, Nevada until they were transported to the University of Nevada-Reno for analysis.

Notes were recorded at the time of blood collection describing the sample color, consistency and unusual characteristics. After blood processing, the estimated percentage of packed red blood cells (hematocrit) and percentage of lymphatic fluid present in each sample were recorded. These notes were used to categorize plasma samples based upon the estimated amount of lymphatic fluid present: free (0%), low (1-15%), medium (16-30%), high (31%+), or undetermined (field notes inconclusive).

7. Plasma Analysis

Plasma samples yielded from most plasma samples collected from 2005-2009 from wild tortoises were analyzed for total CORT concentration using a commercially available ^{125}I radioimmunoassay (RIA) from MP Biomedicals (Costa Mesa, CA; cat. no.: 07-120-102), which is comparable to commercial enzyme-immunoassays (EIA). This RIA kit has been used successfully in a variety of non-laboratory species including birds, reptiles and mammals (Martin *et al*. 2007). This assay is highly specific, having low cross-reactivity with other steroids. Unlike older RIA protocols, this assay does not require laborious steroid extraction steps and includes a CORT binding globulin (CBG) blocking agent, allowing the concentration of total CORT to be measured, without additional chemical or heating steps to denature the CBG protein.

The MP Biomedicals RIA has been validated for the measurement of total CORT in the desert tortoise. The assay can detect concentrations of CORT in the high pg/ml to low ng/ml range, sufficiently sensitive for measurements of total CORT in the desert tortoise, which typically show plasma CORT concentrations < 10 ng/ml most times of the year (Lance et al. 2001). The average intra-assay coefficient of variation was 6.5%, demonstrating that the same sample within the assay results in similar values.

8. Animal Movements

Each transmittered tortoise involved in our stress research study (n=83) was tracked at least monthly from January to December 2009. However, the tracking schedule was not constant for all tortoises. Some tortoises traveled further from their last known location than was detectable by telemetry and thus we required longer periods of time to locate them. Regular attempts to track problematic animals were made and recorded at least monthly. No animals previously tracked by USGS personnel were considered "lost" to the study due to transmitter or tracking failure in 2009.

Movement patterns were characterized for each experimental population using the mean 'Start To End' distance (defined as the distance between the first and last observations for the year) and the 'Maximum Annual Distance' (defined as the maximum distance moved from first location during the entire year). Movement patterns were analyzed with an analysis of variance using R statistical software (2.10.1, R Development Core Team 2009).

9. Treatment Designation
Prior to translocation, experimental treatment populations were limited to control tortoises (those originally residing in the Translocation Area) and translocated tortoises (those residing in the SEA). After translocation, all tortoise locations (n=48,000) collected from collaborating researchers were used to calculate monthly kernel utilization distributions in R using the package adehabitat v 1.8.2 (Calenge 2006) for each experimental treatment group (control and translocated). We used the ad hoc method to calculate a smoothing parameter (h) and a 95% confidence level. Utilization distributions were then imported into ArcGIS and evaluated for spatial overlap between treatment groups. If the spatial distribution for a control tortoises was found to intersect the translocation distribution on the landscape, its treatment type was reclassified as a "resident" tortoises. Once a tortoise became a resident, it retained that designation thereafter.

Locations were also used to estimate home-ranges for each animal in R using the package adehabitat v 1.8.2 (Calenge 2006). We calculated an individual based smoothing parameter (h), and home range area based on a 95% confidence level.

Vegetation Characterization

Annual Vegetation Sampling
Transects were sampled from March 23 to April 9, 2009 to determine annual plant productivity. In the Mojave Desert, winter annuals tend to set seed and die by June (Went 1948), so sampling was completed before the annual plants began to senesce. Starting points for the vegetation transects in 2009 were chosen from the same set of random points that were used for vegetation analysis in 2005 and 2008. Each transect was 200 m in length and extended in a random direction consistent with the line sampled in previous years (Figure 3).

Twenty quadrats measuring 1 m^2 were sampled at random distances along each transect. The amount of annual vegetation (biomass) in each quadrat was ranked using calibration methods similar to those of Andariese and Covington (1986) and Tausch (1989). In this method, the amount of vegetation in each quadrat was subjectively ranked on a scale of 0 to 10 by ocular estimation where 0 = absolute absence of any annual plant material and 10 = complete cover within that 1 m^2.

To confirm that the subjective ranks could be used to quantify production, a calibration curve based on the biomass of plants, in mass per unit area, was determined by clipping the above ground vegetation from two representative quadrats (10%) along each transect. Subsequently, standing annuals were clipped and sorted by phenological condition (i.e. those from the current year and those suspected to be from previous years' growth) for each quadrat. Calibration curves were constructed separately for each phenological condition and for each team of observers. After an initial weighing, all plants for each clipped quadrat were dried at 50ºC for 48 hours to remove all moisture before being weighed a final time. The mass of the new plants in each clipped quadrat was regressed against the observers' subjective ranks to generate an equation expressing those ranks as a function of measured plant biomass (Andariese and Covington 1985, Singh *et al*. 1990). This calibration value was then used to estimate the biomass for all quadrats that were sampled.

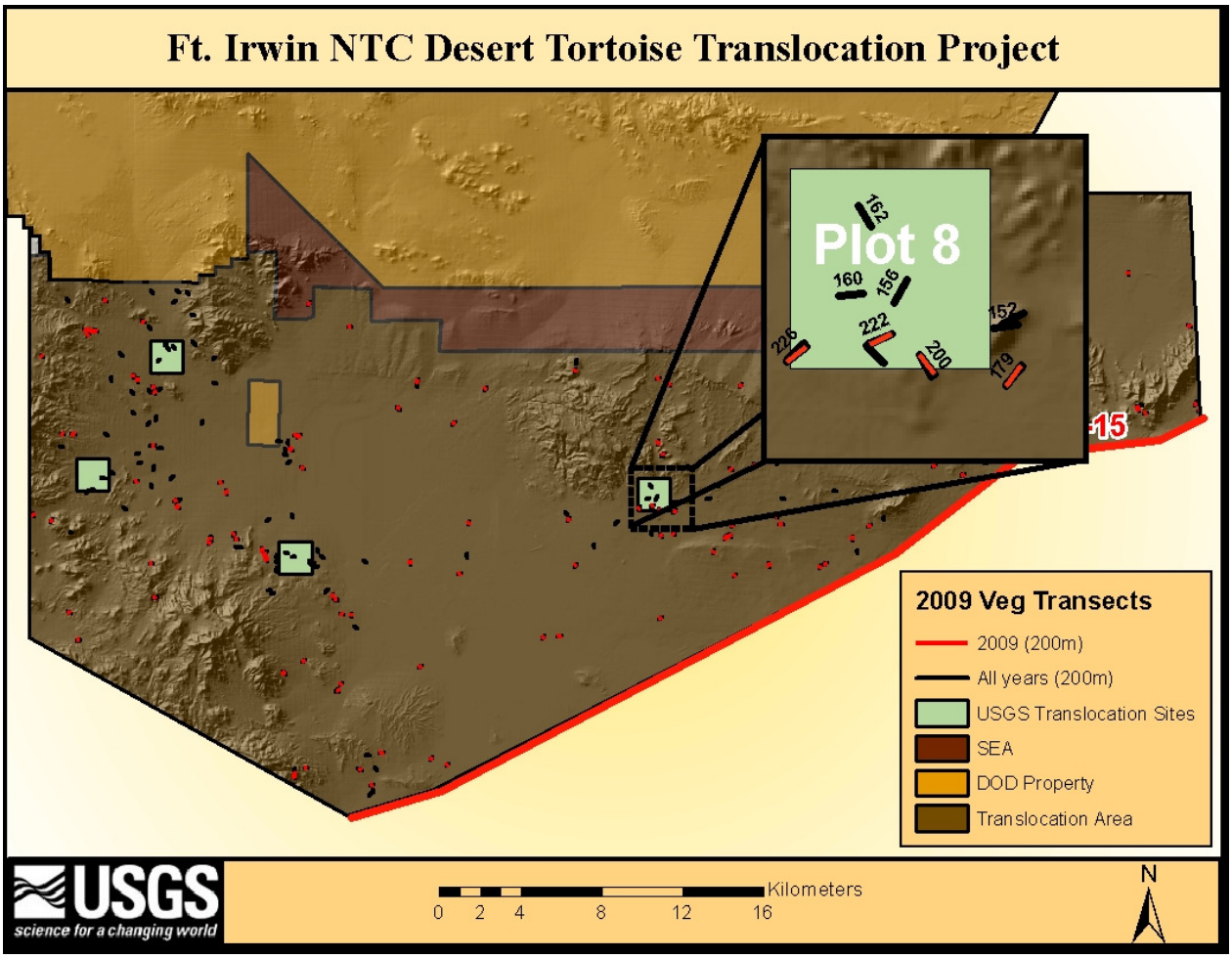

Figure 3. Vegetation transects for four years of sampling.

RESULTS

Results for this project from May 9, 2005 through December 12, 2005 (2005) were reported in Drake *et al*. 2006. Results from December 13, 2005 through October 31, 2006 (2006) were reported in Walden *et al.* 2007. Results March 27, 2007 through December 6, 2007 (2007) were reported in Drake *et al*. 2008. Results from January 14, 2008 through December 5, 2008 (2008) were reported in Drake *et al*. 2009. This report includes results from January 6, 2009 through November 23, 2009 (2009). However, some results from 2005, 2006, 2007 and 2008 have been included within select figures and tables for comparison among years and are indicated where applicable.

Summary of Encounters

In 2009, our research focused on monthly monitoring and sampling of a select group of tortoises within each experimental population. In January 2009, these tortoises included 11 control tortoises, 46 resident tortoises, and 21 translocated tortoises (Figure 4; Table 1). All further

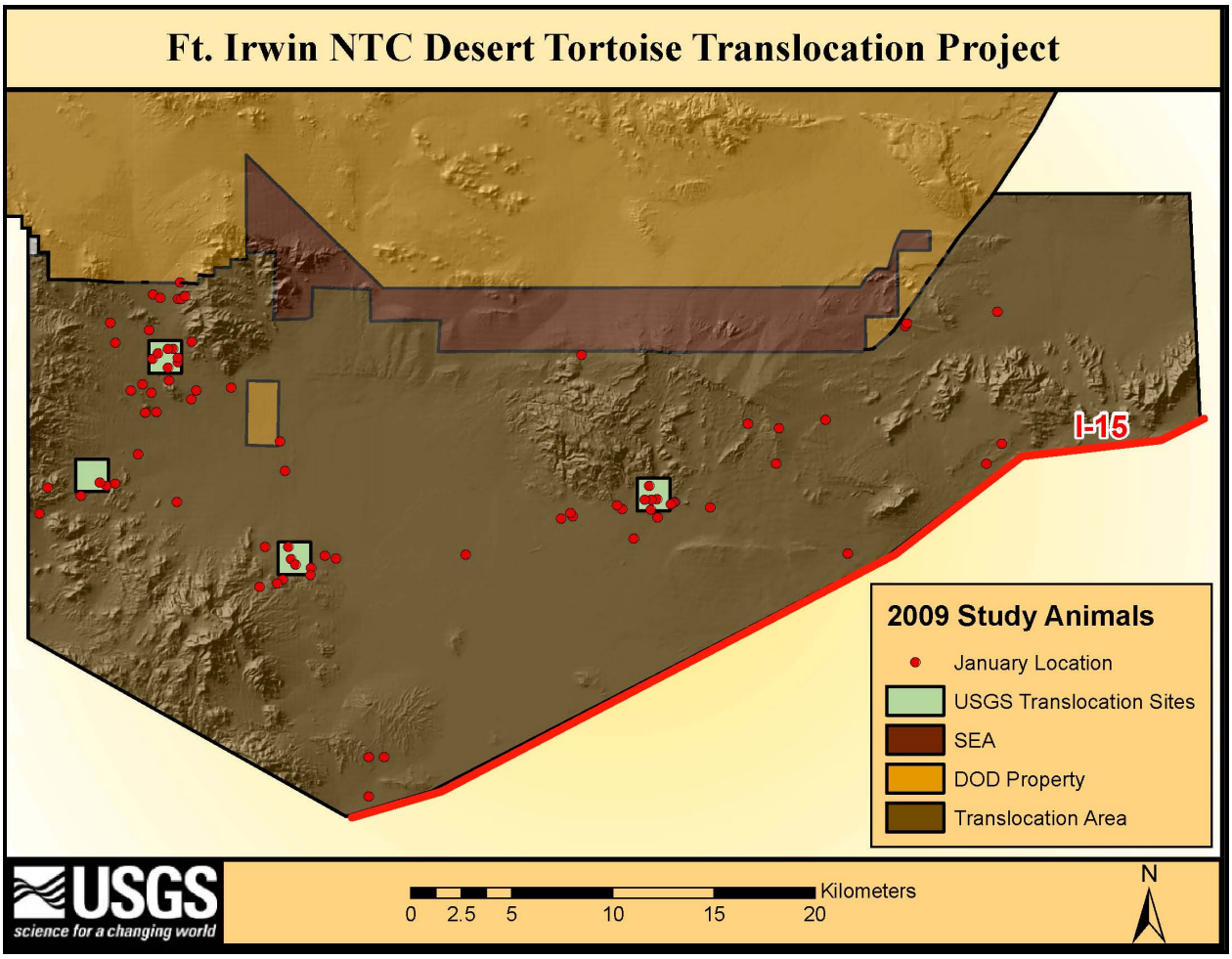

Figure 4. Map of USGS stress research tortoise populations in January 2009.

analyses in this report will use population designations as of January unless otherwise noted. In 2009, tortoises in our study ranged from 194 mm to 286 mm in carapace length.

Table 1. Number of tortoises utilized in each experimental population in January and November 2009.

	Populations in January 2009			Population in November 2009		
Sex	Control	Resident	Translocated	Control	Resident	Translocated
Female	3	14	9	1	14	2
Male	8	32	12	7	25	8
Total	**11**	**46**	**21**	**8**	**39**	**10**

Marking Desert Tortoises

In 2009, six new tortoises were found and added to the study. Based on their proximity to translocated tortoises, four of these were classified as control and two as residents. Floy® tags (in the FW-3500 to FW-3531 range) and transmitters were attached to all. An additional 23 transmitters were replaced throughout the year due to expected battery failure. A detailed list of transmitter serial numbers, frequencies, and associated tortoises is provided in Appendix 3.

Animal Movement

Each tortoise was tracked at least monthly in 2009, resulting in 2,461 observations between January 6, 2009 and November 5, 2009. To assist in understanding tortoise movement patterns, all observations from 2005-2009 (n=11,880) were incorporated into the analyses illustrating mean number of encounters (Table 2), or distances moved from original encounter site (Table 3,4). All locations associated with deceased tortoises were excluded from analysis. Some dead tortoises were located distances greater than 1 km away from the last known location and we suspect but cannot be certain that predators or scavengers may have relocated the carcass.

Table 2. Mean number of location observations for Resident, Control and Translocated desert tortoises each year.

Year	Resident & Control	Translocated
2005	7.97	7.48
2006	8.76	8.71
2007	7.92	8.84
2008	8.96	56.13
2009	32.67	27.86

Movement patterns were analyzed for experimental populations by calculating the mean Start To End Distance (Table 3), the Maximum Annual Distance (Table 4), and mean home-ranges using a kernel utilization distribution (Tables 5). Prior to translocation Start To End distances for male tortoises were significantly higher than female tortoises ($F_{1,514}=64.84$, $p<0.05$). In 2008 (the first year after translocation), no differences were observed between male and female tortoises ($F_{1,68}=3.7$, $p=0.06$) however, Start To End distances were observed to increase within the translocation treatment in comparison with resident and controls ($F_{2,67}=19.1$, $p<0.001$). During the following year (2009), males moved more than females ($F_{1,53}=4.1$, $p<0.05$), but no difference was observed among treatment groups ($F_{2,52}=0.4$, $p=0.7$). Analyses of Maximum Annual Distance' movements revealed that differences were not observed between male and female tortoises in 2008 ($F_{1,69}=0.2$, $p=0.65$) and 2009 ($F_{1,53}=3.2$, $p=0.08$). However, translocated tortoises had greater maximum annual distance movements compared to that of resident and control tortoises ($F_{2,68}=18.4$, $p<0.001$). Differences among treatment groups were not observed in 2009 ($F_{2,52}=0.4$, $p=0.64$).

Table 3. Mean (m) ± SE Start to End Distance for Control, Resident (Non-Translocated) and Translocated desert tortoise populations.

	Sex	2005	2006	2007			2008	2009
Non-Translocated	Female	241 ± 25	180 ± 20	151 ± 19	Control	Female	346 ± 35	
						Male	393 ± 124	370 ± 204
	Male	291 ± 25	358 ± 28	241 ± 27		**Pooled**	**379 ± 89**	**324 ± 183**
					Resident	Female	149 ± 24	111 ± 23
	Pooled	**272 ± 18**	**291 ± 20**	**193 ± 17**		Male	579 ± 78	296 ± 60
						Pooled	**452 ± 63**	**231 ± 42**
Translocated	Female	335 ± 60	386 ±95	263 ±39	Translocated	Female	1020 ± 222	230 ± 141
	Male	332 ± 41	331 ± 44	275 ± 46		Male	1649 ± 317	352 ± 284
	Pooled	**333 ± 35**	**346 ± 41**	**269 ± 30**		**Pooled**	**1374 ± 213**	**317 ± 200**

Table 4. Mean (m) ± SE Maximum Distance Movement for Control, Resident (Non-Translocated) and Translocated desert tortoise populations. ***indicates that a mean value could be calculated due to a low sample size (n=1) at end of 2009 season.

	Sex	2005	2006	2007			2008	2009
Non-Translocated	Female	413 ± 28	375 ± 34	300 ± 27	Control	Female	358 ± 85	***
						Male	585 ± 107	711 ± 190
	Male	608 ± 35	614 ± 37	432 ± 40		**Pooled**	**517 ± 84**	**691 ± 166**
					Resident	Female	714 ± 366	594 ± 132
	Pooled	**534 ± 25**	**526 ± 28**	**364 ± 25**		Male	763 ± 73	757 ± 61
						Pooled	**748 ± 122**	**700 ± 61**
Translocated	Female	446 ± 57	532 ±84	437 ±48	Translocated	Female	1660 ± 310	322 ± 55
	Male	558 ± 33	718 ± 57	415 ± 38		Male	2449 ± 354	1083 ± 376
	Pooled	**534 ± 29**	**668 ± 49**	**426 ± 30**		**Pooled**	**2103 ± 254**	**865 ± 295**

Table 5. Mean (ha) ± SE Home-range Size for Control, Resident (Non-Translocated) and Translocated desert tortoise populations. ***indicates that sufficient data was not available to accurately calculate home range size.

	Sex	2005	2006	2007			2008	2009
Non-Translocated	Female	25 ± 5	20 ± 3	9 ± 1	Control	Female	23 ± 13	18 ± 2
						Male	36 ± 14	49 ± 13
	Male	64 ± 7	92 ± 37	33 ± 6		**Pooled**	**30 ± 10**	**43 ± 11**
					Resident	Female	27 ± 11	19 ± 4
	Pooled	**50 ± 5**	**66 ± 23**	**21 ± 3**		Male	67 ± 13	47 ± 8
						Pooled	**55 ± 10**	**36 ± 5**
Translocated	Female	***	58 ± 17	24 ± 4	Translocated	Female	172 ± 95	15 ± 6
	Male	***	87 ± 12	34 ± 8		Male	370 ± 123	203 ± 141
	Pooled	***	**79 ± 10**	**29 ± 5**		**Pooled**	**289 ± 83**	**130 ± 87**

Blood Sample Collection

Monthly blood samples were collected from April 6, 2009 through October 6, 2009. A total of 419 blood samples were collected via subcarapacial venipuncture (Table 6). In 2009, attempts were made to sample each individual monthly from April through October (Table 7). A detailed list of collected blood samples and associated tortoises is provided in Appendix 4.

Table 6. Venipuncture site and number of blood samples collected.

Year	Jugular	Subcarapacial
2005	138	0
2006	3	223
2007	0	795
2008	0	605
2009	0	419

Table 7. Blood samples were collected over 3 seasonal periods in the Translocation Area in 2005, over 5 months in the Translocation Area and SEA in 2006, over 7 months in the Translocation Area and the SEA in 2007, and over 7 months in the Translocation Area in 2008 and 2009.

Year	Season/Month	Collection Date (mm/dd/yyyy)	Samples
2005	Spring	05/10/2005 -05/25/2005	11
	Summer	06/20/2005 -08/11/2005	79
	Fall	08/31/2005 -09/16/2005	48
	2005	**05/10/2005 -09/16/2005**	**138**
2006	May	05/11/2006 05/25/2006	53
	June	06/12/2006 06/21/2006	44
	July	07/19/2006 -07/25/2006	37
	August	8/16/2006 – 08/22/2006	47
	September	09/18/2006 09/21/2006	45
	2006	**05/11/2006 09/21/2006**	**226**
2007	April	04/03/2007 04/10/2007	117
	May	05/01/2007 05/11/2007	116
	June	06/05/2007 06/08/2007	114
	July	07/02/2007 07/10/2007	112
	August	08/06/2007 08/09/2007	113
	September	09/04/2007 09/11/2007	115
	October	10/02/2007 10/04/2007	108
	2007	**04/3/2007 – 10/04/2007**	**795**
2008	April	04/02/2008 -04/09/2008	96
	May	05/05/2008 -05/08/2008	99
	June	06-02-2008 -06/05/2008	91
	July	06/30/2008 -07/02/2008	85
	August	08/04/2008 -08/07/2008	80
	September	09/02/2008 -09/04/2008	79
	October	10/01/2008 -10/03/2008	75
	2008	**04/02/2008 -10/03/2008**	**605**
2009	April	04/06/2009-04/09/2009	73
	May	05/04/2009-05/06/2009	64
	June	06/08/2009-06/14/2009	63
	July	07/06/2009-07/07/2009	55
	August	08/03/2009-08/04/2009	50
	September	09/08/2009-09/09/2009	61
	October	10/05/2009-10/06/2009	53
	2009	**04/06/2009-10/06/2009**	**419**
Combined	**2005-2009**	**5/10/2005-10/06/2009**	**2183**

Plasma Analysis

Laboratory analyses to measure plasma total corticosterone (CORT) were completed for most blood samples (n=2,180) collected throughout the tenure of this project (2005-2009). We analyzed CORT values with respect to venipuncture sampling technique, tortoise sex, lymph presence in sample, number of needle insertions required to collect sample, tortoise handling time in minutes, time of sample procession in minutes, month, year, tortoise activity, tortoise microhabitat location, ambient air temperature, habitat type, treatment group, and animal movement patterns (home-range size). Analyses for additional parameters potentially influencing

CORT (e.g. winter precipitation, annual forage, perennial cover) are still ongoing. The data were analyzed using a weighted linear mixed-effect model allowing weighting for the inverse quantity of lymph present in each sample such that samples noted to contain higher lymph contents had reduced influence in the analysis. As reported in Drake et al. 2007, samples collected from the jugular vein in 2005 resulted in higher CORT levels, and increased handling time and animal manipulation. As a result, all samples collected from the jugular vein in 2005 are considered elevated and therefore incomparable and were excluded from further analysis.

In 2006-2009, CORT values collected via subcarapacial venipuncture in female desert tortoises ranged from 0.15 to 33.63 ng/ml, and male values ranged from 0.50 to 41.20 ng/ml. Mean values in males (6.39 ± 0.14 SE) were higher ($F_{1,1717}=3200.6, p<0.01$) than mean values measured in females (5.31 ± 0.15 SE; Figures 5-7). Season variation in CORT was observed for both male and female desert tortoises (Figures 5-7). Female CORT levels tended to increase in late spring (May) coinciding with the period in which egg production typically occurs (Figure 7; Lance et al. 2001). Male CORT levels tended to increase at the end of summer (August) coinciding with known changes in behavior (increase in mating and antagonistic behavior) as well as physiological reproductive changes (e.g. spermatogenesis, Lance et al. 2001). Annual variations were also observed for CORT values; 2007 (year of low annual forage and annual rainfall) was significantly lower than other years compared to 2008 (year of higher annual forage and rainfall) which was higher than other years.

The model explaining the most variation among all those tested included sex and the year in which CORT samples were collected while accounting for and weighting by the amount of lymph present in the samples (model 1; Table 8, 9). None of the other covariates and factors of interest contributed toward explaining the variation in CORT that we observed. AIC_C increased by more than 200 points with the inclusion of: the number of needle insertions required to collect sample; tortoise handling time in minutes; sample processing time in minutes; ambient air temperature; tortoise activity; tortoise location; and general habitat category.

To evaluate any potential interaction between stress and animal movement, specifically home-range size, mean CORT values were calculated for each animal each year (2006-2009). Model selection yielded a model where CORT levels were best explained by tortoise sex and the year in which the samples were collected (Model 1, 2; Table 10, 11). Home-range size did not contribute significantly to the model (e.g. there was an increase in AICc over the best model by >20 points on inclusion of home range as a factor).

To evaluate any potential influence of translocation on stress in desert tortoises, mean CORT values were calculated for each animal for each year before and after translocation (2007 and 2008, respectively). Model selection yielded a model where CORT levels were best explained by tortoise sex and the year in which the samples were collected (Model 1,2; Table 12,13). Neither home-range size nor experimental treatment group (Resident, Control, and Translocated; Figure 8,10) provided a significant contribution to the model (e.g. there was an increase in AICc over the best model by >16 points on inclusion of those factors; Figure 11).

To more closely evaluate any the potential influence of translocation as this was the primary variable of interest to our study, we analyzed several variables of potential influence for 2008 and 2009 (both samples years post translocation). Model selection resulted in a model where CORT levels after translocation were best explained by the relative amount of lymph in the

sample and the year in which the samples were collected (Model 1; Table 14,15). Neither month nor experimental treatment group (Resident, Control, and Translocated) provided a significant contribution to the model (e.g. there was an increase in AICc over the best model by >9 points on inclusion), indicating that translocation had no statistical differences in the measured physiological effect on stress values (as measured by CORT) in desert tortoises (Figures 8, 9, 11). Mean CORT values in 2008 did not vary between treatment group (Figure 11). However, in 2009 CORT values for translocated tortoises were significantly lower than resident or control tortoises, and this difference is the opposite direction to our hypotheses, and is likely a statistical artifact due to drastically reduced sample sizes resulting from predation events (Esque et al. *In Review*) that may have isolated some of the sample groups into different habitat areas.

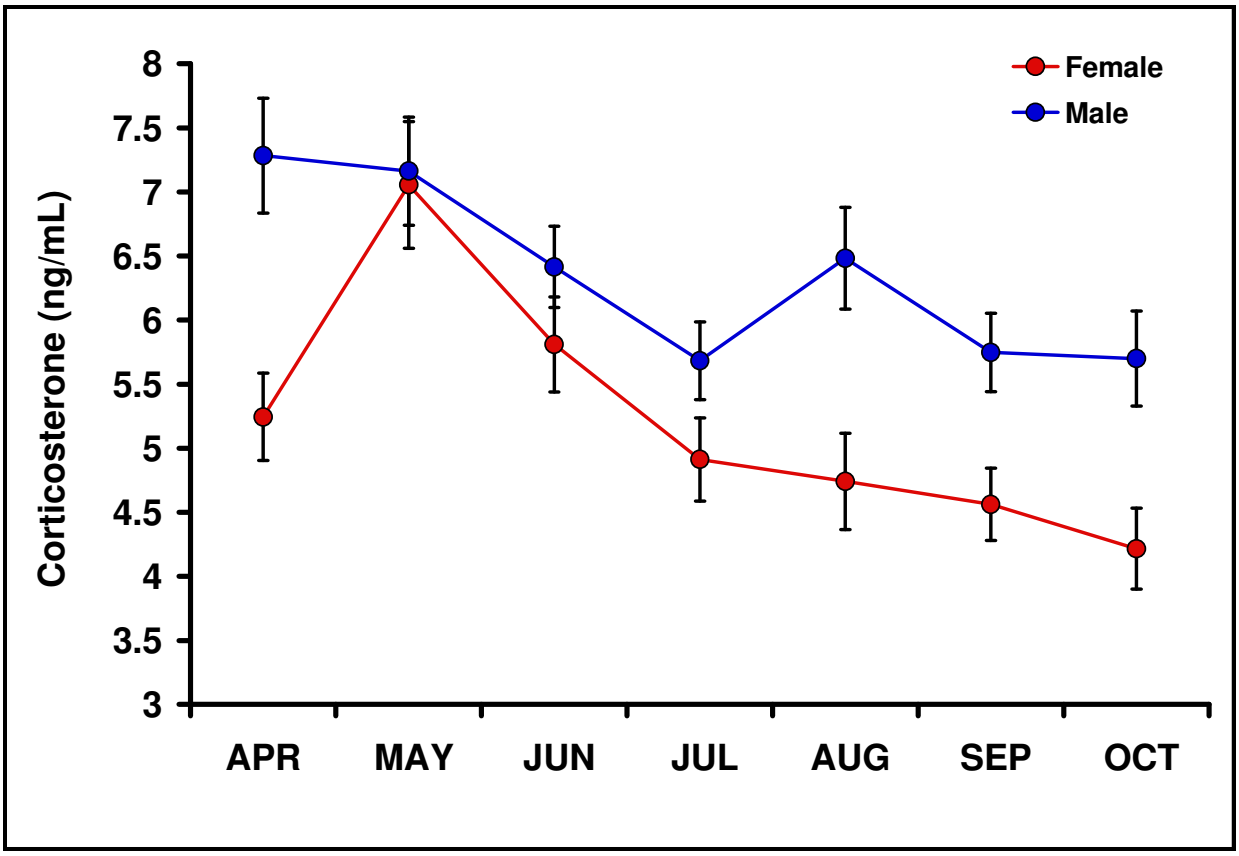

Figure 5. Monthly mean total plasma corticosterone levels ± 1 SE indicating seasonal influences for both male and female desert tortoises throughout the activity season (April-October) for samples collected in 2006-2009.

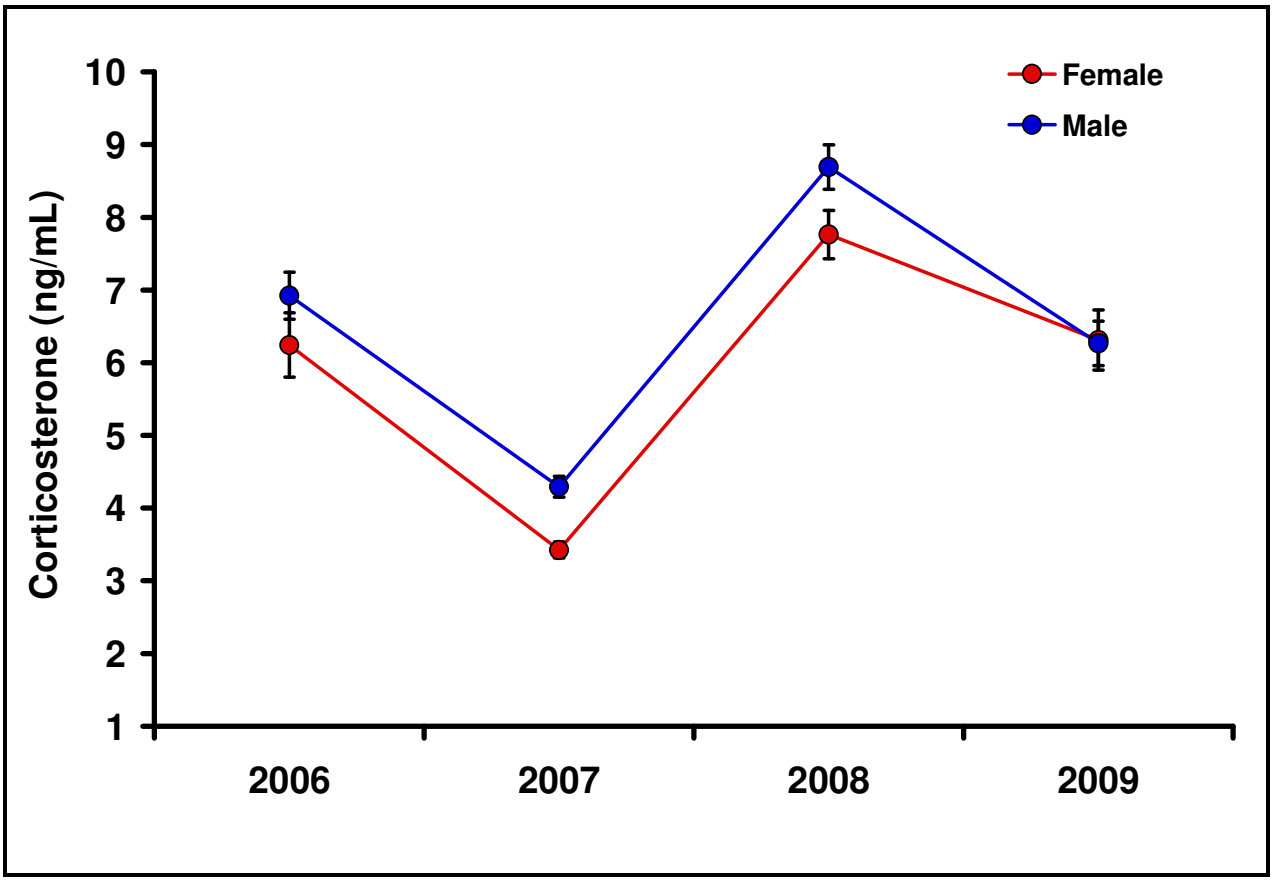

Figure 6. Annual mean total plasma corticosterone levels ± 1 SE for female and male desert tortoises at Ft. Irwin in 2006-2009. Annual values were lower in 2007 and higher in 2008.

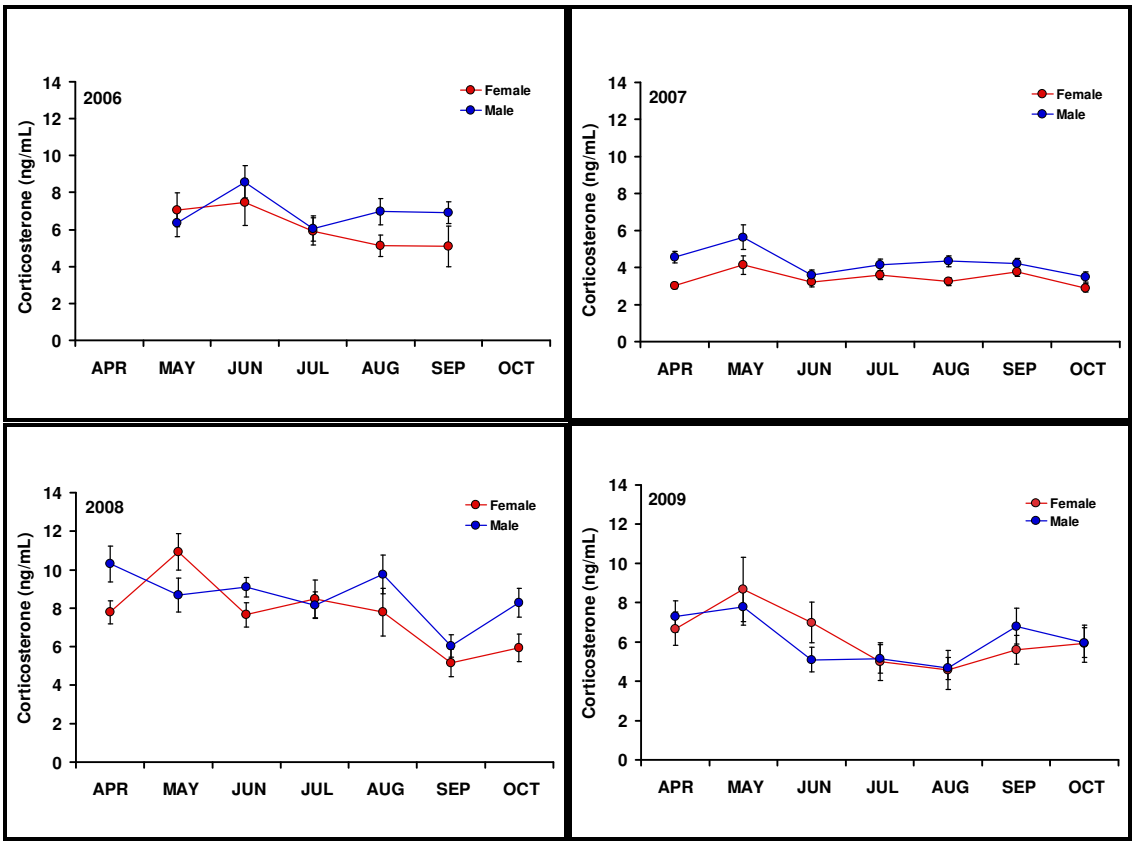

Figure 7. Monthly mean total plasma corticosterone levels ± 1 SE for female and male desert tortoises sampled in 2006, 2007, 2008, and 2009 at Fort Irwin, California.

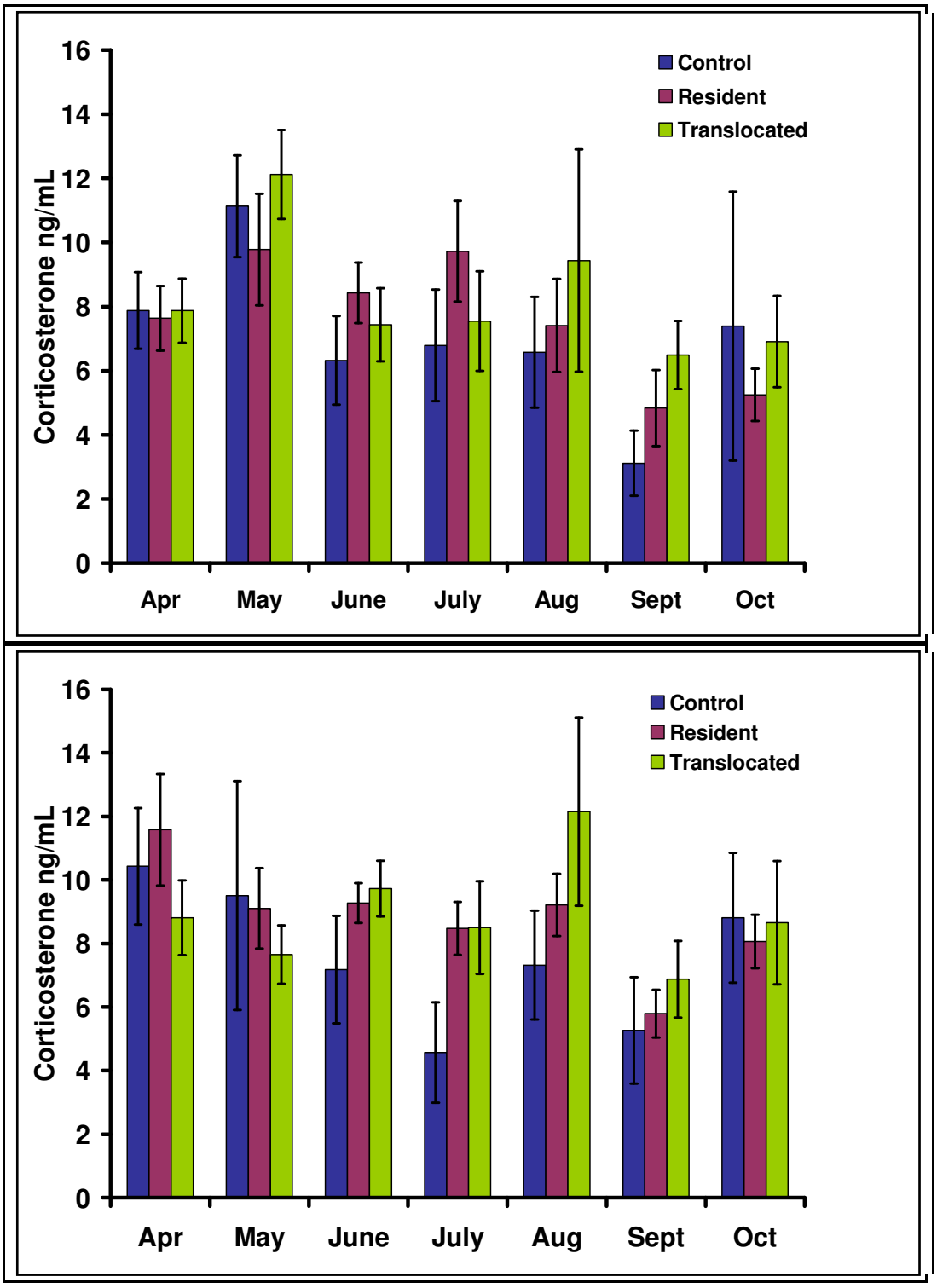

Figure 8. Monthly mean total plasma corticosterone levels ± 1 SE for each experimental population for female (top) and male (bottom) desert tortoises after translocation in 2008. Overall differences were not observed between the treatment groups throughout 2008.

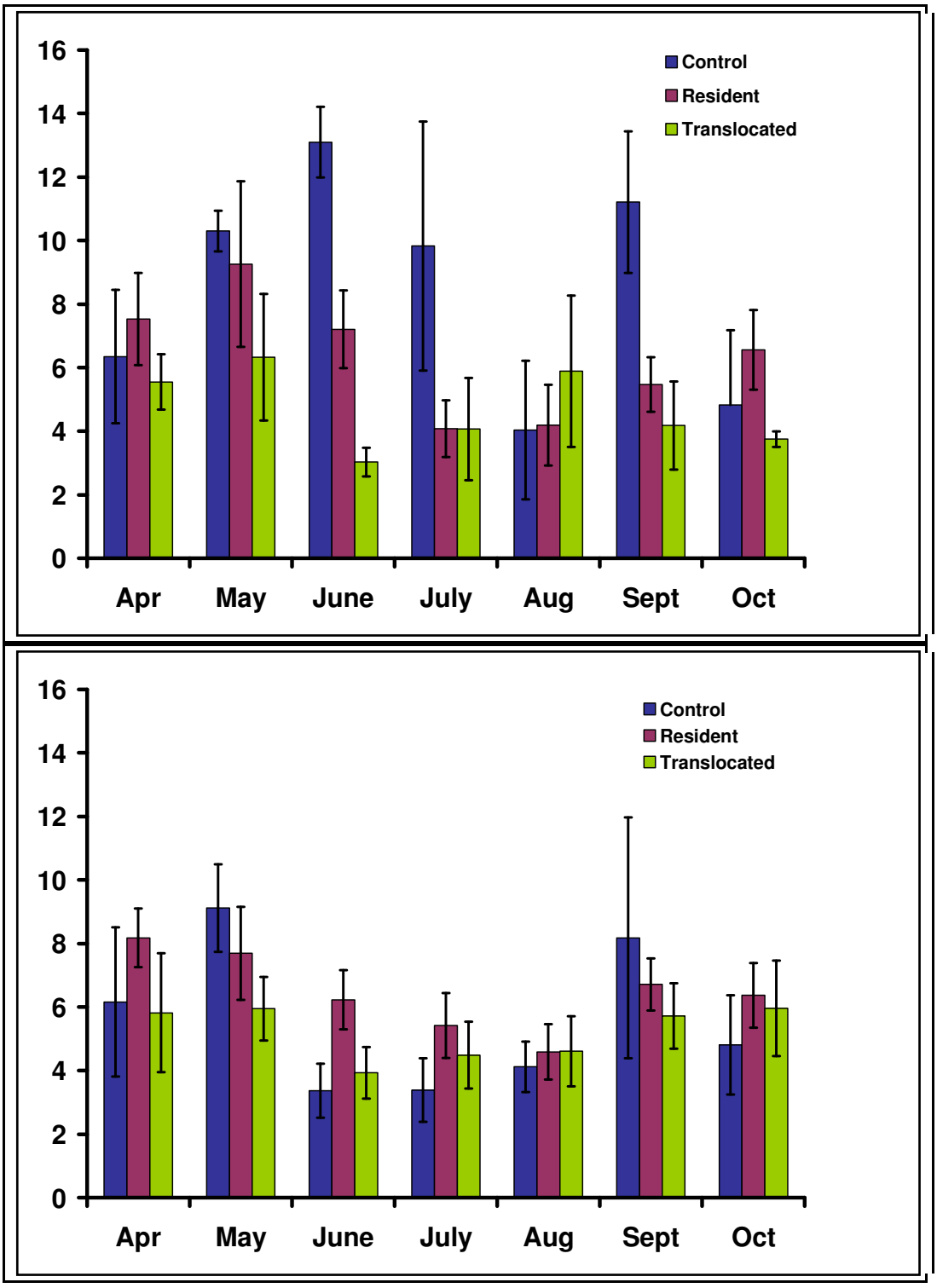

Figure 9. Monthly mean total plasma corticosterone levels ± 1 SE for each experimental population for female (top) and male (bottom) desert tortoises in 2009.

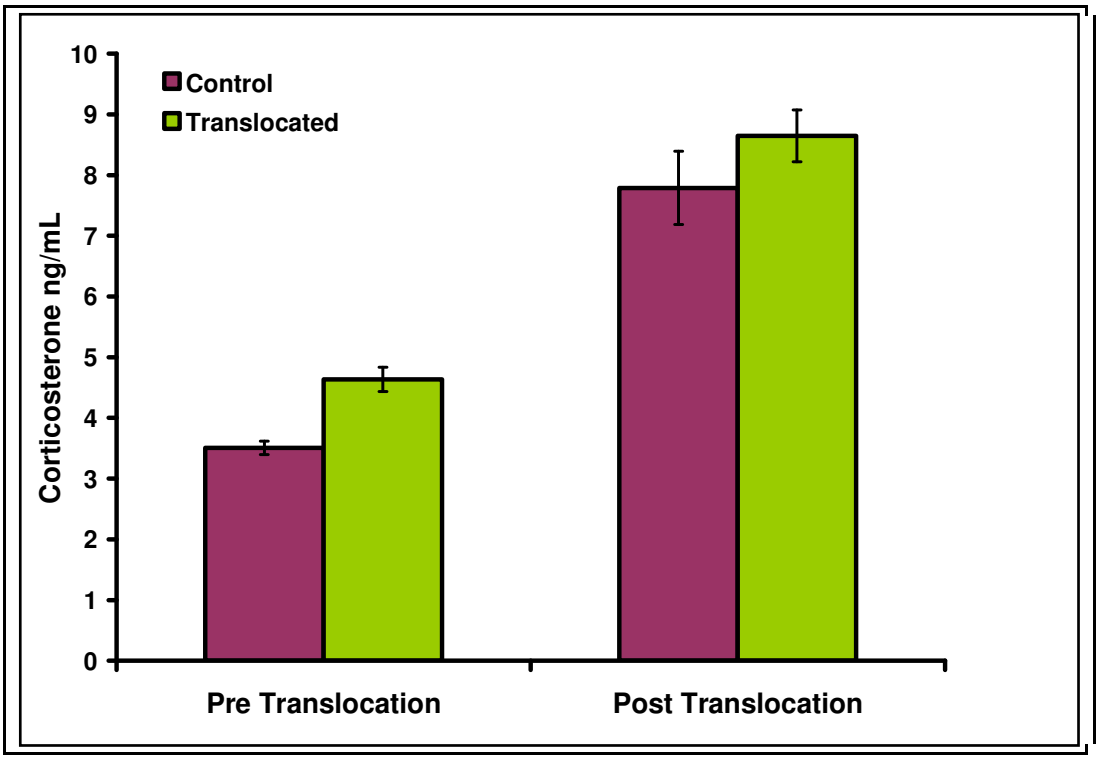

Figure 10. Mean total plasma corticosterone levels in 2007 (Pre Translocation) and 2008 (Post Translocation) ± 1 SE for control and translocated experimental populations.

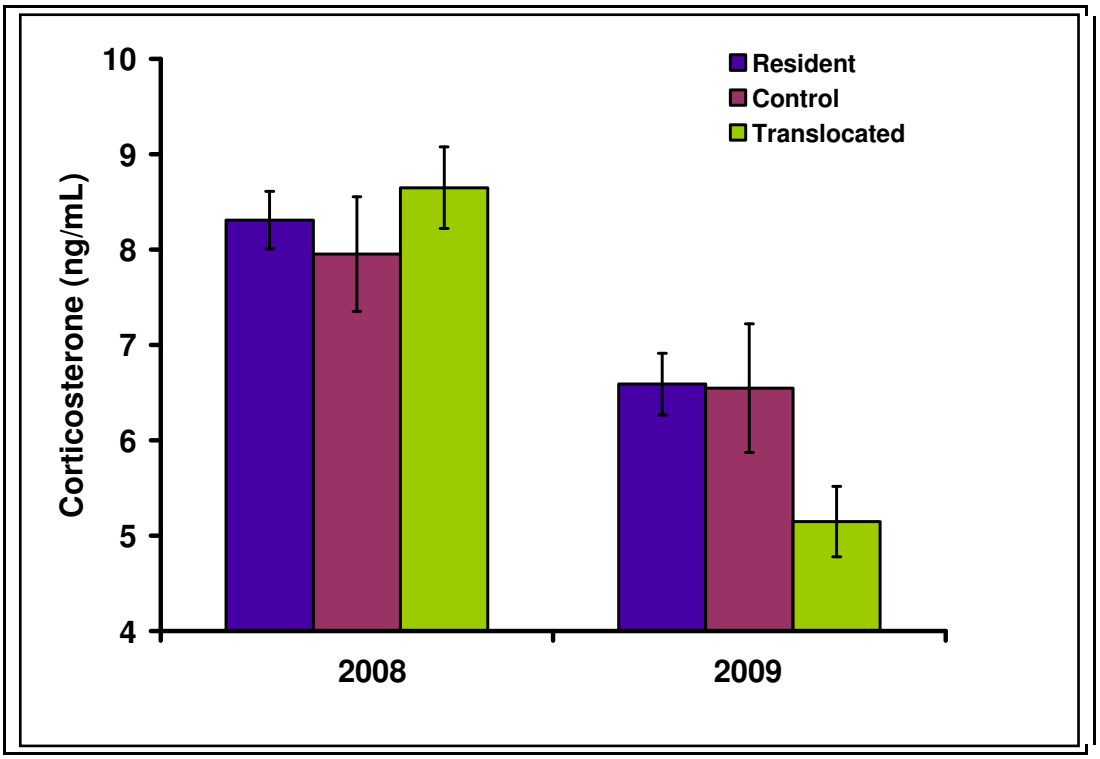

Figure 11. Mean total plasma corticosterone levels in 2008 and 2009 ± 1 SE for resident, control and translocated experimental populations.

Table 8. Models considered and ranked according to AICc and change in AICc (ΔAICc); w_i is Akaike weight. Where models were similarly performing, the model with the fewest factors was preferred. Factor abbreviations are: Lym- lymph presence in sample (None, Low, Medium, High), Sex – sex of animal, Mon – month in which blood sample was collected, Yr-year in which blood sample was collected, Numst- number of needle insertions required to collect sample, Handlemin-animal handling time in minutes required to collect sample, Coolermin-number of minutes between sample collection and sample procession, Tair- ambient air temperature at time of sample collection, Beh-animal behavior (resting, eating, etc), Loc-animal location (burrow, open, etc), and Hab-habitat description that animal was utilizing at time of sample. Includes all data from 2006-2009.

Model	AICc	(ΔAICc)	w_i
1. {Lym + Sex +Yr}	4018.2	0.0	0.8
2. {Lym + Yr}	4021.1	2.9	0.2
3. {Lym + Sex*Yr}	4031.7	13.5	0.0
4. {Lym + Sex*Mon+Yr}	4045.6	27.5	0.0
5. {Lym + Sex}	4234.8	216.7	0.0
6. {Lym + Sex +Mon}	4242.2	224.0	0.0
7. {Lym + Tair}	4249.4	231.2	0.0
8. {Lym + Loc}	4250.9	232.8	0.0
9. {Lym + Mon}	4251.9	233.7	0.0
10. {Lym + Numst}	4253.0	234.8	0.0
11. {Lym + Handlemin}	4253.0	234.8	0.0
12. {Lym + Beh}	4253.1	235.0	0.0
13. {Lym + Hab}	4255.0	236.9	0.0
14. {Lym + Coolermin}	4259.9	241.7	0.0
15. {Lym + Sex*Mon}	4260.1	241.9	0.0
16. {Null}	4352.8	334.6	0.0

Table 9. ANOVA table showing model coefficients and significance tests for the weighted mixed effects model best describing stress patterns (CORT) in desert tortoises from 2006-2009.

Coefficients	numDF	denDF	F value	p value
(Intercept)	1	1714	3754.7	<0.01
Lymph	1	1714	536.6	<0.01
Sex	1	217	18.8	<0.01
Year	3	1714	83.7	<0.01

Table 10. Models considered and ranked according to AICc and change in AICc (ΔAICc); w_i is Akaike weight. Where models were similarly performing, the model with the fewest factors was preferred. Factor abbreviations are: Sex – sex of animal, Yr-year in which blood sample was collected, and HR-annual animal home-range size. Includes annual mean values for tortoises sampled in 2006-2009.

Model	AICc	(ΔAICc)	w_i
1. {Sex +Yr}	519.7	0.0	0.6
2. {Yr}	520.8	1.1	0.4
3. {Sex*Yr}	528.7	9.0	0.0
4. {Yr + HR}	540.1	20.4	0.0
5. {Yr*HR}	582.6	63.0	0.0
6. {Sex + Yr + HR}	583.0	63.3	0.0
7. {Sex*Yr*HR}	639.1	119.4	0.0
8. {Sex}	650.8	131.1	0.0
9. {Null}	658.1	138.4	0.0
10. {HR}	673.3	153.6	0.0
11. {Sex*HR}	683.4	163.7	0.0

Table 11. ANOVA table showing model coefficients and significance tests for the mixed effects model best describing stress patterns (CORT) in desert tortoises from 2006-2009.

Coefficients	numDF	denDF	F value	p value
(Intercept)	1	208	4797.1	<0.01
Sex	1	208	16.3	<0.01
Year	3	208	61.3	<0.01

Table 12. Models considered and ranked according to AICc and change in AICc (ΔAICc); w_i is Akaike weight. Where models were similarly performing, the model with the fewest factors was preferred. Factor abbreviations are: Sex – sex of animal, Yr-year in which blood sample was collected, HR-annual animal home-range size, and Treat-tortoise experimental treatment population (Resident, Control, or Translocated). Includes annual mean values for tortoises sampled in 2007 and 2008 (before and after translocation).

Model	AICc	(ΔAICc)	w_i
1. {Sex +Yr}	140.6	0.0	0.5
2. {Sex * Yr}	140.8	0.2	0.5
3. {Yr}	147.8	7.2	0.0
4. {Sex + Yr + HR+ Treat}	157.3	16.7	0.0
5. {Sex + Yr + HR}	160.0	19.4	0.0
6. {Sex + Yr * HR + Treat}	166.5	25.9	0.0
7. {Yr + HR}	167.1	26.5	0.0
8. {Yr*HR}	170.3	29.7	0.0
9. {SEX*Yr*HR}	195.0	54.4	0.0
10. {Sex*YR*HR*Treat}	304.9	164.3	0.0
11. {Treat}	305.1	164.5	0.0
12. {Sex}	319.9	179.3	0.0
13. {HR+Treat}	320.5	179.9	0.0
14. {Null}	329.7	189.1	0.0
15. {HR}	342.1	201.5	0.0
16. {HR*Treat}	345.4	204.8	0.0
15. {Sex*HR}	349.6	209.0	0.0

Table 13. ANOVA table showing model coefficients and significance tests for the mixed effects model best describing stress patterns (CORT) in desert tortoises before and after translocation (2007 and 2008).

Coefficients	numDF	denDF	F value	p value
(Intercept)	1	147	5204.8	<0.01
Sex	1	147	37.8	<0.01
Year	1	61	314.7	<0.01

Table 14. Models considered and ranked according to AICc and change in AICc (ΔAICc); w_i is Akaike weight. Where models were similarly performing, the model with the fewest factors was preferred. Factor abbreviations are: Lym- lymph presence in sample (None, Low, Medium, High), Sex – sex of animal, Mon-month in which sample was collected, Yr-year in which blood sample was collected, and Treat-tortoise experimental treatment population (Resident, Control, or Translocated). Includes all values for tortoises sampled in 2008 and 2009 (post-translocation).

Model	AICc	(ΔAICc)	w_i
1. {Lym + Yr}	2008.3	0.0	0.8
2. { Lym + Sex +Yr }	2011.5	3.2	0.2
3. { Lym + Sex *Yr }	2013.3	5.0	0.1
4. { Lym + Yr + Treat }	2018.0	9.7	0.0
5. { Lym + Yr * Treat }	2022.7	14.4	0.0
6. { Lym+ Sex+ Mon+ Yr +Treat}	2025.3	17.0	0.0
7. { Lym + Sex *Treat +Yr}	2028.2	19.9	0.0
8. { Lym + Sex * Mon +Yr}	2032.7	24.4	0.0
9. { Lym + Sex *Mon +Yr +Treat}	2041.5	33.2	0.0
10. { Lym + Sex * Mon *Yr}	2048.0	39.7	0.0
11. { Lym + Sex }	2088.4	80.1	0.0
12. { Lym + Mon }	2090.3	82.0	0.0
13. { Lym + Sex * Mon*Treat+Yr}	2090.7	82.4	0.0
14. { Lym + Treat}	2093.2	84.9	0.0
15. { Lym + Sex+Mon}	2093.5	85.2	0.0
16. { Lym + Sex * Mon}	2096.9	88.6	0.0
17. { Lym + Sex * Treat }	2102.9	94.6	0.0
18. { Lym + Sex * Mon}	2111.5	103.2	0.0
19. { Lym + Sex * Mon*Yr*Treat}	2132.1	123.8	0.0
20. { Null}	2133.1	124.8	0.0

Table 15. ANOVA table showing model coefficients and significance tests for the weighted mixed effects model best describing stress patterns (CORT) in desert tortoises before and after translocation (2007 and 2008).

Coefficients	numDF	denDF	F value	p value
(Intercept)	1	798	2684.7	<0.01
Lymph	1	798	217.5	<0.01
Year	1	798	86.3	<0.01

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Vegetation Sampling

In 2009, transects (n=110) were sampled to estimate annual plant production throughout the study area. Sampling occurred for twenty quadrats (1 m^2) at random distances along each transect length for a total of 2,200 quadrats. The estimated mean annual plant production in 2009 was 16.4 g/m^2 ± 5.4 SE, the highest level of plant production in four years of sampling (Figure 13). Winter rainfall (October–February) was closer to the 100 year historical average (81.79 mm) and may have contributed to the increased production measured in 2009 (NOAA 2008, Table 16).

Table 16. Annual plant production in g/m^2 ± SE for four years of sampling. Annual plant production was not recorded in 2006.

Year	Plant Production (g/m^2)	SE	# Transects	Winter Precipitation (mm)
2005	1.96	0.6	89	132.08
2006				41.91
2007	1.71	1.84	30	21.08
2008	11.46	4.67	99	57.40
2009	16.4	5.38	110	58.17

Tortoise Mortality

In 2009, tortoise mortality rates were lower than the previous year (Appendix 6). In 2009, 32 tortoises were found dead (6 control, 15 resident, 11 translocated), compared to 59 in 2008(Table 17). Although fifteen of the deaths had evidence of canid presence (eg. scat, hair, burrow excavations, etc.), in most cases it was impossible to determine whether the death was due to a canid attack or if scavenging took place after a death by natural or other causes. Using a 3-sample test for equality of proportions, the number of tortoises found dead within each experimental population was not statistically different ($X^2=3.79$, $df=2$, $p=0.15$).

Table 17. Number of tortoises found dead in 2008 and 2009 throughout the Fort Irwin Study Area.

Year	Dead	Evidence of Canid Presence	Total Population in Study
2008	59	42	126
2009	32	15	86

DISCUSSION AND RECOMMENDATIONS

Discussion

The major focus of our research during 2005 was to track, locate and mark as many resident and control tortoises as possible, while simultaneously collecting information on their ecology, physiology, habitat use, and habitat condition. Because we were able to mark a robust sample size of animals in 2005, our research focus in 2006 was to acquire blood samples, as well as locating and monitoring of all tortoises. In 2007-2009, we streamlined our efforts to include a more intensive sampling effort each month to collect blood for tortoises within the three

experimental popuations throughout the active season (April to October). Efforts were made to capture and sample each animal during optimal temperatures and periods of expected activity throughout the day. As a result of this combined effort, we encountered, weighed, and measured 338 tortoises and attached transmitters to 241 tortoises throughout the study area. On March 27, 2008, we translocated 38 study animals located in the SEA into four selected release sites within the translocation area.

To evaluate potential physiological effects (e.g. increased stress) of translocation on desert tortoise populations, we evaluated adrenal glucocortoicoids, specifically corticosterone (CORT) for three years prior and two years after translocation. Blood samples were collected from 240 tortoises for a total of 2,183 samples over the past five years to determine physiological stress with each treatment group (resident, control, and translocated). Repeated measurements of individuals are vitally important to understanding individual responses to translocation. Repeated measurements on animals make it possible to detect changes in the status of tortoises relative to stress, site fidelity, movements, disease, and a number of other factors while accounting for the predicted changes of endocrine levels and associated parameters.

Glucocorticoids are a class of steroid hormones released from the adrenal glands in reptiles during a wide variety of stress stimuli and conditions, including harsh weather, animal manipulation (Romero and Wikelski 2001), and disturbances in habitat (Moore et al. 2003). These steroid hormones have been shown to elevate in chelonians during both acute and chronic stress events (Valverde et al. 1999); making it a good biomarker for assessing changes in physiological condition such as increased stress. We hypothesized that translocation of wild tortoises may cause a potentially chronic physiological stress response in both resident and translocated animals and this response may result in changes in behavior, habitat use, and movement patterns. Previous translocation studies have documented equivalent reproductive effort (Nussear 2004) and survivorship (Field et al. 2007) between residents and translocated tortoises; however, this is the first attempt to quantify physiological changes relative to translocation for desert tortoise populations.

Our analysis of CORT revealed that samples collected via jugular venipuncture increased handling time and animal manipulation resulting in higher CORT values compared to samples collected via subcarapacial venipuncture (Drake et al. 2007). Overall, CORT values collected using subcarapacial venipuncture for male tortoises were higher than values measured in females each month throughout the period of activity (April-October). Elevated levels of CORT in reptiles are believed to be associated with increased metabolism and increased activity or exposures to external noxious stimuli. Our results demonstrate that seasonal and annual variations in CORT occur for both male and female desert tortoises. Each year, we observed an increase in female CORT in late spring (May) coinciding with ovulation, egg production, and nesting as previously reported in Lance et al. 2001. In most years, male CORT increased at the end of summer (August and September) coinciding with known changes in behavior (increased male-male combat and mating activity; Ruby and Niblick, 1994) as well as the time of year when testosterone is highest and spermatogenesis is at a peak (Rostal et al. 1994, Lance et al. 2001).

After evaluation of possible influences on CORT (e.g. tortoise sex, lymph presence in sample, number of needle insertions required to collect sample, tortoise activity, habitat type, treatment group, etc.) variations in CORT values were best explained by tortoise sex and year in which in the sample was collected while accounting for and weighting by the amount of lymph present in

the sample. Annual variations in CORT values for both male and female tortoises suggest that environmental factors (e.g. rainfall, plant production) or behavioral changes (e.g. increased male-male combat, movement, or mating) may be influencing CORT. CORT values in 2007 (a year of low annual forage and annual rainfall) were significantly lower than other years; conversely in 2008 (a year of higher annual forage and rainfall) CORT values were significantly higher than other years. During periods of inadequate rainfall, low food production may result in tortoises reducing their energetic expenditure by spending less time of the surface, and searching for food and/or males. Hence, we would expect to observe lower stress values during this period of reduced activity. Conversely, when rainfall and food is abundant, tortoises will spend more time on the surface foraging, mating, and fighting which may result in an increase in CORT.

To evaluate the potential influence of translocation on stress patterns in desert tortoises, we examined CORT values for each treatment group (resident, control, and translocated) both before and after translocation and concluded that neither home-range size or treatment group significantly contribute to the variation in stress patterns. To more closely evaluate any potential influence of translocation as this was the primary variable of interest to our study, we analyzed potential variables of influence for 2008 and 2009 (years after translocation). We concluded that after translocation, differences in CORT were not observed among treatment groups, indicating that translocation did not cause a measurable physiological stress response within the first year of translocation. However, in 2009 CORT values for translocated tortoises were lower than resident or control tortoises, which was inconsistent with our *a priori* predications. However, the outcome is likely a statistical artifact due to drastically reduced sample sizes resulting from predation events (Esque et al. *In Review*) that may have isolated some of the sample groups into different habitat areas. Analyses for additional parameters (e.g. winter precipitation, annual forage, perennial cover, and elevation) potentially influencing these annual fluctuations in CORT are still ongoing.

As reported in Drake et al. 2009, tortoise mortality increased starting in January 2008 resulting in suspected deaths from canid species (coyotes and/or wild dogs). Tortoise mortality decreased from 59 tortoises in 2008 to 32 tortoises in 2009. While ravens are a common cause of juvenile predation amongst desert tortoises (Bjurlin and Bissonette 2004), no tortoise deaths were attributed to ravens. The lack of raven attack is likely due to the absence of juvenile tortoises in our study group. It is inherently difficult to determine the cause of death of desert tortoises, as most predator species of the desert tortoise are also scavengers. It was noted that with the increase in tortoise deaths, incidence of predator sign (e.g. scat, hair, tracks, burrow excavations, etc.) also increased. Also, many of the tortoise carcasses were disarticulated or had signs of canid tooth marks on the shell and radio transmitter (Figure 12).

With three years of below average rainfall (NOAA 2006, 2007, 2008), an increase in predation may have resulted from changes in environmental conditions influenced by drought. Periods of drought may indirectly increase mortality through increased predation on adult tortoises as the result of a functional response (prey switching) of predators to a decrease in prey availability (Woodbury and Hardy, 1948; Peterson, 1994). Small mammals such as lagomorphs (Clark 1972, and Saethre 1994, 1995) and rodents, may be particularly vulnerable and are known to decrease to densities as low as 1/ha (Whitford 1976, Chew and Butterworth, 1964, Brown and Harney 1993; Esque et al. *In Review*), due to extensive drought conditions the previous year.



Figure 12. Tortoise mortality with canid presence discovered this year in the Translocation Area.

Expanded research on tortoise mortality in the Mojave Desert (Esque et al. *In Review*) indicated a landscape wide relationship between drought, anthropogenic impacts to habitat and predation levels for desert tortoise populations. Specifically, at Fort Irwin patterns of coyote kills were strongly associated with the size of nearby human populations and terrain features, with potential associations with distance to urbanization and the density of roads. There was no evidence that translocation influenced the high predation rates on tortoises at Fort Irwin (Esque et al. In Review).

In 2010, we plan to continue to monitor and collect blood from all study animals involved in our stress research. We plan to complete laboratory analysis for plasma total corticosterone and testosterone values for all samples, and investigate the potential for cascading impacts of stress on immune function and other physiological factors. We will continue habitat characterization (i.e., primary production, annual vegetation structure, etc.) so that differences in habitat among the translocation sites are well documented. Due to an increase in tortoise predation over the last two years, we plan to locate and incorporate additional tortoises into the study in spring 2010 to generate a robust sample size for each treatment group.

Recommendations

We recommend a standardized format for data submission (i.e., web portal for weekly or monthly data uploads) that would allow all participating researchers the ability to gain necessary project information quickly. Due to high levels of movements by translocated animals necessitated some of our “control” animals may be more appropriately classified as “resident” animals. To assist in analyzing data for movement patterns, stress levels, etc. between experimental populations, we need to access a comprehensive data set that includes all encounter information for each tortoise from all researchers.

To maximize productivity, we also recommend that the Army or management agencies elect a research coordinator with access to the master database to facilitate daily ground activities and disseminate pertinent information in a timely fashion.

ACKNOWLEDGEMENTS

This research would not have been possible without the help of the U.S. Geological Survey, U.S. Department of the Army-Ft. Irwin, U.S. Fish and Wildlife Service, California Department of Fish and Game and the Bureau of Land Management. Our thanks are extended to our collaborators Richard Tracy, Ken Hunter, Amy Barber, and Salley DuPre. We would also like to thank Clarence Everly, Mickey Quillman, Andrew Walde, Peter Woodman, William Boarman, Kat Darst, Roy Averill-Murray, Becky Jones, and Charles Sullivan, for providing project guidance and expertise to the research design and data collection, and Julie Yee for her statistical support and expertise. We thank our field staff assistants: Richard Inman, Bryant Reynolds, Martin Kang, Alison Terry, Claire Phillips, Robert Kunicki, Felicia Chen, Justin Jay, Angela Klapperich, Chris Standley and Andrew Jones for their hard work and assistance throughout this project. In addition, we would like to thank the following Student Conservation Association volunteers: Pat Babbin, Fahimeh Baziari, Tim Barwise, Felicia Chen, Jackie Dearborn, Julia DeFranco, Adrienne DeSmet, Andrea Drager, Erin Driver, Ignacio Flores, Emily Frankel, Ryan Hess, Gloria Howerton, Maria Immel, Emily Jeffreys, Nicole Labutong, Alex Lewis, Emily Loew, Dean Posposil, Megan Ring and Emma Stewart.

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APPENDICES

Appendix 1. Sample of data sheet completed for each desert tortoise encounter in the Translocation Area and SEA in 2005-09 (Attached Separately)

Appendix 2. Highly Modified Honegger System notching diagram (Attached Separately)

Appendix 3. List of radio transmittered tortoises monitored in 2009 throughout the study area. (Attached Separately)

Appendix 4. List of blood samples collected in the study area in 2009 (Attached Separately)

Appendix 5. List of desert tortoise home-ranges from 2005-2009 (Attached Separately)

Appendix 6. List of tortoise mortalities in 2009 (Attached Separately)

UTM NAD 83 PDA Proof_____DataBase Proof ____

Ft. Irwin Tortoise Encounter

Tracking Attempted Only (Could not Locate Animal)

Tortoise_____
Date_____
Time_____
Observer_____
Easting_____
Northing_____
AirTemp._____(°F)

TortTemp. Neck_____(°F)
TortTemp. Tail _____(°F)
Location Description_____

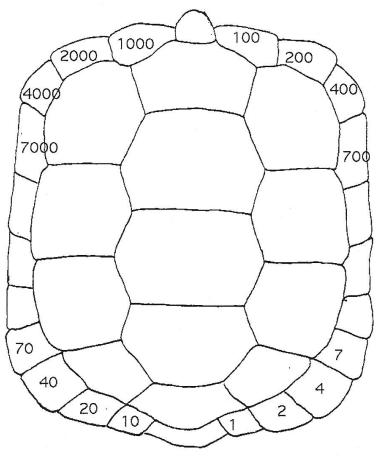
Gender_____
Mass Pre____lbs_____oz
Mass Post ____lbs____oz
Carapace Length_____mm
Tort Width_____ mm
Tort Height_____mm
Plastron Length_____ mm

RadioFreq._____
Factory Freq._____
Radio Serial_____
PIT Tag #_____
Notched Yes or No
Notched Number_____
Burrow Number_____
Burrow Azimuth_____
Photo Taken: _____

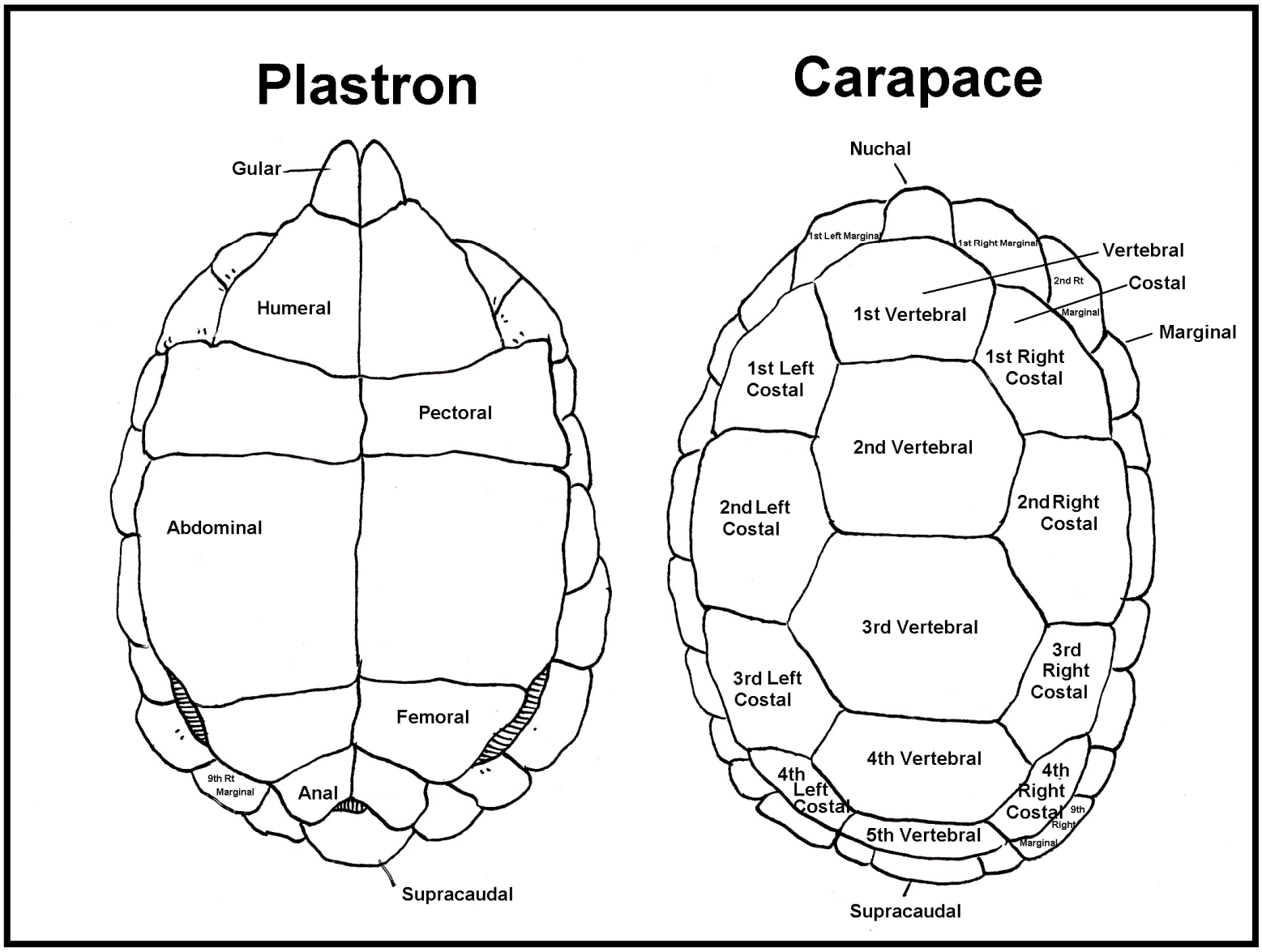
Location · Burrow · Mouth · Pallet · Veg · Open-Sun · Open-Shade · Other_____
Veg Species_____Height (cm)_____Width 1 (cm)_____Width 2 (cm)_____
Behavior · Inact ·At Rest-act · Eat · Move · Antagonist · Sex ·Drink · Dig · Bask ·Dead
Habitat · Pavement · Open Scrub · Sm Wash · Lg Wash · Hill · Road
Condition · Good · Poor Shell · Poor Eyes · Poor Nares · Head Not Visible · Tort Not Visible · Dead · Notes_____
Soil · Sand · Sandy Loam · SL+C ·Cobble · Rock · Caliche
Weather · Clear · Partly Cloudy · Overcast · Dry · Rain · Hail · Calm · Wind · Breeze
Blood · Yes ·No · Attempted · Tapped
Death Cause · Canid · Heat Stress · Natural · Moribund · Unknown-Shell Intact · Vehicle
Encounter Notes:_____
_____
_____
_____

Blood Information
Tortoise _____
Date _____
Bled By _____
Location Subcarp/___
Stick Side Center/____
# of Sticks _____
Filter Papers _____
Field Blood Notes:
_____
_____
_____

Sample 1 Time Bled_____
Sample 1 Volume_____
Sample 1 Lymph Yes / No
Sample 1 Time on Ice_____
Sample 1 # Microtainers_____
~~~~~~~~~~~~~~~~~~
Sample 2 Time Bled_____
Sample 2 Volume_____
Sample 2 Lymph Yes / No
Sample 2 Time on Ice_____
Sample 2 # Microtainers_____

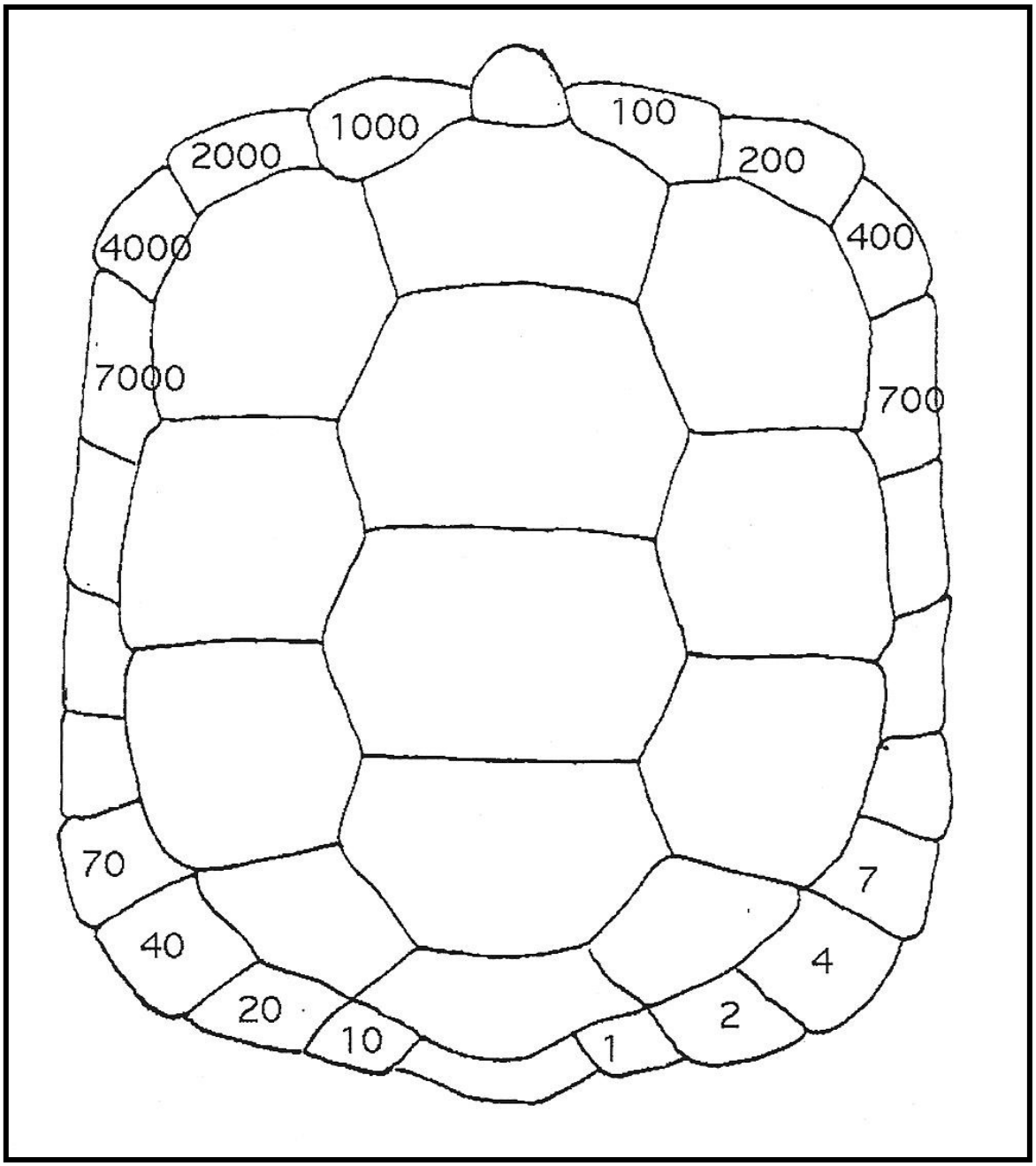


Processor	Plasma Color	Hematocrit	Plasma	Lymph
	☐ Dark Yellow	☐ Normal	☐ Normal	☐ None
Time Processed	☐ Yellow	☐ Low	☐ Thick	☐ Low (1-15%)
	☐ Light Yellow	☐ High	☐ Watery	☐ Medium (16-30%)
1 2 3 **RBC Vials**	☐ Clear			☐ High (31%+)
1 2 3 **Plasma Vials**	☐ Hemolyzed			
~~~~~~~~~~~~~~~~~~



Commonly misspelled terms: cutaneous dyskeratosis, scute, subcarapacial, osteoporosis

Appendix 2. Highly Modified Honegger System notching diagram



Appendix 3. Transmitters 2009

Fed. Permit No.	Expiration Date (mm/dd/yy)	Permittee	State	County	DWMA	Tortoise ID Number	SEX	MCL (mm)	Tortoise Weight (g)	Transmitter Weight (g)	Manufacturer	Model Number	Original Battery Life (Weeks)	Pulse	Serial #	Frequency	Installed (mm/dd/yy)	Removed (mm/dd/yy)	Last Map Name	Known Map Scale	UTM Zone	NAD	Last Easting	Last Northing	Date Last Seen (mm/dd/yy)	Condition of Transmitter	Anticipated Battery Death (mm/dd/yy)	Current Location	Floy Tag Attached	PIT Tag Attached	Notes
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	793	F	236	2381	14.2	Holohil Systems Ltd	RI-2B	96	0.61	127054	167.032	5/8/2008				11 S	83	509792	3888121	10/14/09	Functional	2/8/2010	Tortoise	793	None	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	2035	F	228	2183	14.2	Holohil Systems Ltd	RI-2B	96	0.62	127006	164.953	8/28/2008	04/21/09			11 S	83				Recovered		FI-DPW	FW-2035	None	Tortoise found deceased, transmitter recovered.
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	2041	F	230	2183	14.2	Holohil Systems Ltd	RI-2B	96	0.63	126999	164.633	5/5/2008	09/16/09			11 S	83				Recovered		FI-DPW	FW-2041	None	Tortoise found deceased, transmitter recovered.
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	2042	F	242	2353	14.2	Holohil Systems Ltd	RI-2B	96	0.63	127005	164.932	5/5/2008				11 S	83				Functional	2/5/2010	Tortoise	FW-2042	None	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	2418	M	264	3147	14.0	Holohil Systems Ltd	RI-2B	96	0.64	126456	165.871	5/5/2008				11 S	83				Functional	2/5/2010	Tortoise	FW-2418	None	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3003	M	238	2381	14.0	Holohil Systems Ltd	RI-2B	96	0.65	126468	166.413	5/6/2008	04/06/09			11 S	83				Recovered		FI-DPW	FW-3003	7F7D175876	Tortoise found deceased, transmitter recovered.
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3005	M	270	3402	25.5	Holohil Systems Ltd	RI-2C2	144	0.65	118101	166.423	7/2/2008				11 S	83				Functional	3/6/2011	Tortoise	FW-3005	7F7D1E321B	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3007	F	238	2296	25.5	Holohil Systems Ltd	RI-2C2	144	0.64	117966	162.903	4/19/2007	04/02/09			11 S	83				Recovered		FI-DPW	FW-3007	7f7d224d02	Tortoise found deceased, transmitter recovered.
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3008	F	224	1786	9.7	Holohil Systems Ltd	RI-2B	48	0.64	117615	166.404	5/11/2007				11 S	83	513488	3879470	01/15/09	Recovered		FI-DPW	FW-3008	7F7D174403	Transmitter fell off tortoise between 1/15/09 and 2/12/09
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3012	M	291	4309	25.5	Holohil Systems Ltd	RI-2C2	144	0.64	118087	166.003	4/8/2008				11 S	83				Functional	12/11/2010	Tortoise	FW-3012	None	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3013	F	212	2041	17.0	Holohil Systems Ltd	RI-2C	96	0.63	117789	164.073	5/8/2007	04/16/09			11 S	83				Recovered		FI-DPW	FW-3013	7F7D1B6A1E	
TE102235-13	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3013	F	212	2041	15	Holohil Systems Ltd	RI-2B	96	0.63	134204	164.072	4/16/2009	05/06/09			11 S	83				Recovered		FI-DPW	FW-3013	7F7D1B6A1E	Tortoise found deceased, transmitter recovered.
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3015	M	286	4763	25.0	Holohil Systems Ltd	RI-2C2	144	0.63	118152	167.624	2/21/2008				11 S	83				Functional	10/25/2010	Tortoise	FW-3015	7F7D226257	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3021	M	248	2410	14.2	Holohil Systems Ltd	RI-2B	96	0.61	127056	167.094	5/6/2008				11 S	83				Functional	2/6/2010	Tortoise	FW-3021	7F7D1D433E	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3022	F	230	2155	17.0	Holohil Systems Ltd	RI-2C	96	0.63	117809	165.031	5/8/2007	04/06/09			11 S	83				Recovered		FI-DPW	FW-3022	7F7D225A4B	
TE102235-6	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3022	F	230	2155	15	Holohil Systems Ltd	RI-2B	96	0.61	134252	165.031	4/6/2009				11 S	83				Functional	1/7/2011	Tortoise	FW-3022	7F7D225A4B	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3025	M	242	2608	25.5	Holohil Systems Ltd	RI-2C2	144	0.66	118099	166.355	11/5/2007	04/06/09			11 S	83				Recovered		FI-DPW	FW-3025	None	Tortoise found deceased, transmitter recovered.
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3027	M	255	3289	14.2	Holohil Systems Ltd	RI-2B	96	0.62	127043	166.592	5/7/2008	04/06/09			11 S	83				Recovered		FI-DPW	FW-3027	7F7D174C14	Tortoise found deceased, transmitter recovered.
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3033	M	225	2495	14.0	Holohil Systems Ltd	RI-2B	96	0.63	126500	167.555	10/3/2008				11 S	83				Functional	7/6/2010	Tortoise	FW-3033	7F7D175272	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3035	M	264	3062	25.5	Holohil Systems Ltd	RI-2C2	144	0.63	118086	165.962	5/7/2007				11 S	83				Functional	1/8/2010	Tortoise	FW-3035	7F7D17491F	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3049	M	231	2211	15.0	Holohil Systems Ltd	RI-2B	96	0.62	116131	166.062	7/1/2008	04/08/09			11 S	83				Recovered		FI-DPW	FW-3049	7F7D17391A	Tortoise found deceased, transmitter recovered.
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3050	M	266	3657	15.0	Holohil Systems Ltd	RI-2B	96	0.64	116161	166.489	7/2/2008				11 S	83				Functional	4/4/2010	Tortoise	FW-3050	7F7D17413F	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3051	M	272	3459	25.5	Holohil Systems Ltd	RI-2C2	144	0.63	117968	162.944	4/20/2007	01/08/09			11 S	83				Recovered		FI-DPW	FW-3051	7F7D224D57	Tortoise found deceased, transmitter recovered.
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3058	F	217	2155	17.0	Holohil Systems Ltd	RI-2C	96	0.62	117790	164.135	6/8/2007	04/06/09			11 S	83				Recovered		FI-DPW	FW-3058	None	
TE102235-8	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3058	F	217	2155		Holohil Systems Ltd	RI-2B	96		134207	164.133	4/6/2009	10/20/09			11 S	83				Recovered		FI-DPW	FW-3058	None	Tortoise found deceased, transmitter recovered.
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3059	M	271	2835	14.2	Holohil Systems Ltd	RI-2B	96	0.62	126997	164.571	4/3/2008	04/30/09			11 S	83				Recovered		FI-DPW	FW-3059	7F7D226533	Tortoise found deceased, transmitter recovered.
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3061	F	200	1786	17.0	Holohil Systems Ltd	RI-2C	96	0.65	117835	166.172	4/29/2007				11 S	83	511847	3880987	03/28/08	Recovered		FI-DPW	FW-3061	7F7D170B60	Transmitter found with bite marks, but no sign of tortoise-possibly dead.
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3066	M	210	1701	14.9	Holohil Systems Ltd	RI-2B	96	0.61	117666	165.115	4/26/2007	04/06/09			11 S	83				Recovered		FI-DPW	FW-3066	7F7D176064	
TE102235-5	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3066	M	210	1701	15	Holohil Systems Ltd	RI-2B	96	0.60	133762	165.116	4/6/2009				11 S	83	553780	3881658	10/05/09	Functional	1/7/2011	Tortoise	FW-3066	7f7d176064	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3071	F	228	1984	17.0	Holohil Systems Ltd	RI-2C	96	0.63	117849	166.811	5/8/2007	04/08/09			11 S	83				Recovered		FI-DPW	FW-3071	7F7D173F1F	
TE102235-12	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3071	F	228	1984	15	Holohil Systems Ltd	RI-2B	96	0.63	134341	166.811	4/8/2009	10/05/09			11 S	83				Recovered		FI-DPW	FW-3071	7F7D173F1F	Tortoise found deceased, transmitter recovered.
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3079	M	263	2863	14.2	Holohil Systems Ltd	RI-2B	96	0.62	127032	166.071	5/6/2008	07/16/09			11 S	83				Recovered		FI-DPW	FW-3079	7F7D172839	Tortoise found deceased, transmitter recovered.
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3081	M	207	1389	17.0	Holohil Systems Ltd	RI-2C	96	0.63	117836	166.232	5/8/2007	04/16/09			11 S	83				Recovered		FI-DPW	FW-3081	7F7D1B703F	
TE102235-17	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3081	M	209	1503	15	Holohil Systems Ltd	RI-2B	96	0.62	134290	165.792	4/16/2009				11 S	83				Functional	1/17/2011	Tortoise	FW-3081	7f7d1b703f	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3083	M	262	2381	25.5	Holohil Systems Ltd	RI-2C4	144	0.63	118111	166.722	3/3/2008	04/21/09			11 S	83				Recovered		FI-DPW	FW-3083	7F7D174470	Tortoise found deceased, transmitter recovered.
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3089	F	222	1984	14.2	Holohil Systems Ltd	RI-2B	96	0.64	127022	165.651	5/5/2008				11 S	83				Functional	2/5/2010	Tortoise	FW-3089	None	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3091	F	236	2070	14.3	Holohil Systems Ltd	RI-2B	96	0.66	126421	164.353	2/22/2008	10/06/09			11 S	83				Recovered		FI-DPW	FW-3091	7F7D17404A	
TE102235-26	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3091	F	239	2353	15	Holohil Systems Ltd	RI-2B	96	0.61	134218	164.349	10/6/2009				11 S	83				Functional	7/9/2011	Tortoise	FW-3091	None	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3093	M	276	3912	25.5	Holohil Systems Ltd	RI-2C8	144	0.66	118154	167.661	2/22/2008				11 S	83				Functional	10/26/2010	Tortoise	FW-3093	7F7D1D1054	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3099	F	254	3232	25.5	Holohil Systems Ltd	RI-2C2	144	0.66	118057	165.104	4/21/2007	10/06/09			11 S	83				Recovered		FI-DPW	FW-3099	7F7D226339	
TE102235-30	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3099	F	257	3232	15	Holohil Systems Ltd	RI-2B	96	0.63	133811	165.601	10/6/2009				11 S	83				Functional	7/9/2011	Tortoise	FW-3099	7f7d226339	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3108	M	282	3657	25.5	Holohil Systems Ltd	RI-2C5	144	0.67	118114	166.804	2/22/2008				11 S	83				Functional	10/26/2010	Tortoise	FW-3108	7F7D174623	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3109	M	252	2551	14.2	Holohil Systems Ltd	RI-2B	96	0.62	126991	164.312	8/7/2008	05/14/09			11 S	83	508958	3880150	05/05/09	Recovered		FI-DPW	FW-3109	7F7D174558	Transmitter found damaged, deatched from tortoise
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3117	M	267	3742	25.5	Holohil Systems Ltd	RI-2C2	144	0.65	118082	165.842	7/10/2007				11 S	83				Functional	3/13/2010	Tortoise	FW-3117	7F7D175B12	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3123	M	271	2948	14.2	Holohil Systems Ltd	RI-2B	96	0.61	127052	166.969	4/2/2008				11 S	83				Functional	1/3/2010	Tortoise	FW-3123	7F7D173C49	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3125	M	261	2807	25.5	Holohil Systems Ltd	RI-2C2	144	0.64	118091	166.122	5/11/2007	09/24/09			11 S	83				Recovered		FI-DPW	FW-3125	7F7D1E310F	Tortoise found deceased, transmitter recovered.
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3140	M	260	3714	14.2	Holohil Systems Ltd	RI-2B	96	0.63	126987	164.173	5/7/2008				11 S	83				Functional	2/7/2010	Tortoise	FW-3140	7F7D162E2F	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3151	M	253	2551	14.3	Holohil Systems Ltd	RI-2B	96	0.63	126429	164.672	2/21/2008	01/08/09			11 S	83				Recovered		FI-DPW	FW-3151	7F7D171512	Tortoise found deceased, transmitter recovered.
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3163	M	237	2693	14.2	Holohil Systems Ltd	RI-2B	96	0.61	126981	163.992	5/6/2008	08/26/09			11 S	83				Recovered		FI-DPW	FW-3163	7F7D225C72	Tortoise found deceased, transmitter recovered.
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3171	M	251	2466	14.0	Holohil Systems Ltd	RI-2B	96	0.64	126495	167.393	8/12/2008				11 S	83				Functional	5/15/2010	Tortoise	FW-3171	7F7D175360	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3178	M	223	2211	14.0	Holohil Systems Ltd	RI-2B	96	0.65	126488	167.195	10/3/2008	02/04/09			11 S	83	517434	3877204	01/08/09	Recovered		FI-DPW	FW-3178	7F7D226A17	Transmitter found damaged, deatched from tortoise
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3203	M	257	3090	25.5	Holohil Systems Ltd	RI-2C2	144	0.65	117973	163.043	4/25/2007	10/05/09			11 S	83				Recovered		FI-DPW	FW-3203	7F7D176476	
TE102235-31	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3203	M	259	2835	15	Holohil Systems Ltd	RI-2B	96	0.65	101654	165.917	10/5/2009				11 S	83				Functional	7/8/2011	Tortoise	FW-3203	7F7D176476	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3204	M	288	3487	25.5	Holohil Systems Ltd	RI-2C2	144	0.64	118116	166.862	3/4/2008				11 S	83				Functional	11/6/2010	Tortoise	FW-3204	7F7D174926	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3213	M	272	3487	14.5	Holohil Systems Ltd	RI-2B	96		114783	165.383	7/1/2008				11 S	83				Functional	4/3/2010	Tortoise	FW-3213	7F7D174C63	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3218	M	257	2608	9.7	Holohil Systems Ltd	RI-2B	48	0.65	117596	164.482	3/3/2008	04/07/09			11 S	83				Recovered		FI-DPW	FW-3218	7F7D173274	
TE102235-9	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3218	M	257	2608	15	Holohil Systems Ltd	RI-2B	96	0.62	134224	164.472	4/7/2009				11 S	83				Functional	1/8/2011	Tortoise	FW-3218	7f7d173274	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3220	F	238	2240	17.0	Holohil Systems Ltd	RI-2C	96	0.63	117804	164.794	5/9/2007	04/06/09			11 S	83				Recovered		FI-DPW	FW-3220	7F7D172C4F	
TE102235-7	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3220	F	238	2240	15	Holohil Systems Ltd	RI-2B	96	0.63	134240	164.791	4/6/2009				11 S	83				Functional	1/7/2011	Tortoise	FW-3220	7F7D174578	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3228	M	269	3800	25.0	Holohil Systems Ltd	RI-2C2	144	0.64	118158	167.745	5/6/2007				11 S	83	553861	3882161	10/05/09	Functional	1/7/2010	Tortoise	FW-3228	7F7D1D3F46	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3230	M	211	1417	17.0	Holohil Systems Ltd	RI-2C	96	0.65	117826	165.792	5/8/2007	04/07/09			11 S	83				Recovered		FI-DPW	FW-3230	7F7D17755B	Tortoise found deceased, transmitter recovered.
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3234	M	249	2760	17.0	Holohil Systems Ltd	RI-2C	96	0.62	117799	164.532	7/17/2008				11 S	83				Functional	4/19/2010	Tortoise	FW-3234	7F7D225055	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3236	F	211	1276	14.9	Holohil Systems Ltd	RI-2B	96	0.65	117676	166.009	5/7/2007	04/07/09			11 S	83				Recovered		FI-DPW	FW-3236	7F7D173633	
TE102235-10	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3236	F	211	1276	15	Holohil Systems Ltd	RI-2B	96	0.61	134301	166.012	4/7/2009				11 S	83				Functional	1/8/2011	Tortoise	FW-3236	7F7D173633	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3237	M	258	2750	14.3	Holohil Systems Ltd	RI-2B	96	0.65	126515	167.988	10/7/2008	11/05/09			11 S	83				Recovered		FI-DPW	FW-3237	7F7D174F65	Tortoise found deceased, transmitter recovered.
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3241	F	257	2863	14.2	Holohil Systems Ltd	RI-2B	96	0.61	127038	166.372	8/7/2008				11 S	83				Functional	5/10/2010	Tortoise	FW-3241	7F7D176320	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3283	M	265	4026	27.0	Holohil Systems Ltd	RI-2C2	144	0.61	101466	166.691	4/19/2007	07/23/09			11 S	83				Recovered		FI-DPW	FW-3283	7F7D1D5B5E	
TE102235-28	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3283	M	269	3459	15	Holohil Systems Ltd	RI-2B	96	0.68	101717	166.706	7/23/2009	10/5/2009			11 S	83				Recovered		FI-DPW	FW-3283	7f7d1dsb5e	
TE102235-29	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3283	M	269	3459	15	Holohil Systems Ltd	RI-2B	96	0.62	134310	166.192	10/5/2009				11 S	83				Functional	7/8/2011	Tortoise	FW-3283	7f7d1dsb5e	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3300	M	221	2155	25.5	Holohil Systems Ltd	RI-2C2	144	0.66	118097	166.302	5/7/2007				11 S	83				Functional	1/8/2010	Tortoise	FW-3300	7F7D22277B	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3308	M	253	3628	26	Holohil Systems Ltd	RI-2C2	148	0.66	126726	164.383	10/7/2008				11 S	83				Functional	7/9/2011	Tortoise	FW-3308		
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3309	M	238	2579	18.5	Holohil Systems Ltd	RI-2C	96	0.65	126621	167.712	10/8/2008				11 S	83				Functional	7/11/2010	Tortoise	FW-3309	None	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3401	F	237	2438	25.5	Holohil Systems Ltd	RI-2C2	144	0.66	118014	163.863	9/26/2007	05/06/09			11 S	83				Recovered		FI-DPW	FW-3401	None	
TE102235-19	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3401	F	238	2778	15	Holohil Systems Ltd	RI-2B	96	0.63	134141	168.902	5/6/2009				11 S	83				Functional	2/6/2011	Tortoise	FW-3401	None	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3402	M	244	3250	26.0	Holohil Systems Ltd	RI-2C2	96	0.64	126668	162.503	9/26/2007	07/06/09			11 S	83				Recovered		FI-DPW	FW-3402	None	
TE102235-22	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3402	M	244	3250	15	Holohil Systems Ltd	RI-2B	96	0.61	133509	162.581	7/6/2009				11 S	83				Functional	4/8/2011	Tortoise	FW-3402	None	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3427	F	228	2324	14.3	Holohil Systems Ltd	RI-2B	96	0.62	126395	163.550	9/22/2008				11 S	83				Functional	6/25/2010	Tortoise	FW-3427	None	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3438	F	239	2721	14.3	Holohil Systems Ltd	RI-2B	96	0.63	126374	162.934	9/23/2008				11 S	83				Functional	6/26/2010	Tortoise	FW-3438	None	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3445	M	197	1219	14.4	Holohil Systems Ltd	RI-2B	96	0.63	126408	163.954	10/5/2007	07/06/09			11 S	83				Recovered		FI-DPW	FW-3445	None	
TE102235-23	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3445	M	197	1219		Holohil Systems Ltd	RI-2B	96		133646	163.951	7/6/2009				11 S	83				Functional	4/8/2011	Tortoise	FW-3445	None	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3447	F	214	1786	17.0	Holohil Systems Ltd	RI-2C	96	0.63	117910	168.696	10/6/2007	07/09/09			11 S	83				Recovered		FI-DPW	FW-3447	None	
TE102235-24	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3447	F	214	1786	15	Holohil Systems Ltd	RI-2B	96	0.60	134120	168.690	7/9/2009				11 S	83				Functional	4/11/2011	Tortoise	FW-3447	None	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3451	F	252	2353	18.5	Holohil Systems Ltd	RI-2C	96	0.64	126556	162.493	10/5/2007	07/06/09			11 S	83				Recovered		FI-DPW	FW-3451	None	Tortoise found deceased, transmitter recovered.
TE102235-32	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3501	M	272	4026	15	Holohil Systems Ltd	RI-2B	96	0.63	133821	165.701	3/16/2009				11 S	83				Functional	12/17/2010	Tortoise	FW-3501	None	
TE102235-16	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3503	M	234	2665	15	Holohil Systems Ltd	RI-2B	96	0.60	134292

TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3525	F	229	2608	14	Holohil Systems Ltd	RI-2B	96	0.63	126494	167.374	9/26/2008				11 S	83				Functional	6/29/2010	Tortoise	FW-3525	None	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3529	M	200	1616	14	Holohil Systems Ltd	RI-2B	96	0.66	126491	167.268	9/27/2008				11 S	83	551169	3887264	4/6/2009	Recovered	6/30/2010	FI-DPW	FW-3529	None	Transmitter found detached from tortoise
TE102235-21	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3531	F	194	1531	15	Holohil Systems Ltd	RI-2B	96	0.62	134234	164.671	6/2/2009	8/4/2009			11 S	83				Recovered		FI-DPW	FW-3531	None	Tortoise found deceased, transmitter recovered.
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3563	F	209	1899	14.2	Holohil Systems Ltd	RI-2B	96	0.63	127061	167.252	9/27/2008				11 S	83				Functional	6/30/2010	Tortoise	FW-3563	None	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	3669	M	266	3855	26	Holohil Systems Ltd	RI-2C2	148	0.66	126734	164.742	9/27/2008				11 S	83				Functional	6/29/2011	Tortoise	FW-3669	None	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	4016	F	219	1701	17.0	Holohil Systems Ltd	RI-2C	96	0.62	117859	167.171	7/3/2007	04/16/09			11 S	83				Recovered		FI-DPW	FW-4016	7F7D174B33	
TE102235-15	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	4016	F	219	1701	15	Holohil Systems Ltd	RI-2B	96	0.62	134367	167.331	4/16/2009	04/26/09			11 S	83				Recovered		FI-DPW	FW-4016	7F7D174B33	Tortoise found deceased, transmitter recovered.
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	4072	M	269	3430	14.0	Holohil Systems Ltd	RI-2B	96	0.65	126493	167.335	9/4/2008	05/27/09			11 S	83				Recovered		FI-DPW	FW-4072	7F7D17573C	Tortoise found deceased, transmitter recovered.
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	4091	F	224	2098	15.0	Holohil Systems Ltd	RI-2B	96	0.66	107144	164.754	10/3/2007	06/17/09			11 S	83	541737	3883641	06/08/09	Recovered		FI-DPW	FW-4091	7F7D22486D	Transmitter found with bite marks, but no sign of tortoise-possibly dead.
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	4107	M	207	1531	25.5	Holohil Systems Ltd	RI-2C2	144	0.65	118035	164.441	7/4/2007	05/27/09			11 S	83				Recovered		FI-DPW	FW-4107	None	Tortoise found deceased, transmitter recovered.
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	4119	F	227	2126	25.5	Holohil Systems Ltd	RI-2C2	144	0.66	118090	166.084	7/3/2007				11 S	83				Functional	3/6/2010	Tortoise	FW-4119	None	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	4121	M	250	3118	14.2	Holohil Systems Ltd	RI-2B	96	0.65	127007	164.991	5/5/2008				11 S	83				Functional	2/5/2010	Tortoise	FW-4121	None	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	4125	M	251	2948	15.0	Holohil Systems Ltd	RI-2B	96	0.61	116155	166.193	2/13/2008				11 S	83				Functional	11/15/2009	Tortoise	FW-4125	None	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	4163	M	253	2863	14.3	Holohil Systems Ltd	RI-2B	96	0.66	126508	167.794	8/13/2008	12/01/09			11 S	83				Recovered		Tortoise	FW-4163	7F7D17361B	Tortoise found deceased, transmitter recovered.
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	4169	M	258	2580	14.2	Holohil Systems Ltd	RI-2B	96	0.65	127004	164.852	5/6/2008				11 S	83				Functional	2/6/2010	Tortoise	FW-4169	None	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	4177	M	266	3374	14.2	Holohil Systems Ltd	RI-2B	96	0.63	127021	165.612	5/6/2008	05/13/09			11 S	83				Recovered		FI-DPW	FW-4177	7F7D174446	Tortoise found deceased, transmitter recovered.
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	4185	F	227	2041	14.2	Holohil Systems Ltd	RI-2B	96	0.63	127044	166.611	5/6/2008	09/30/09			11 S	83				Recovered		FI-DPW	FW-4185	7F7D1B7378	Tortoise found deceased, transmitter recovered.
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	4246	M	265	3374	14.2	Holohil Systems Ltd	RI-2B	96	0.62	127012	165.193	5/7/2008				11 S	83				Functional	2/7/2010	Tortoise	FW-4246	7f7d224925	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	4251	M	291	3884	14.0	Holohil Systems Ltd	RI-2B	96	0.65	126448	165.512	8/13/2008				11 S	83				Functional	5/16/2010	Tortoise	FW-4251	7F7D174015	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	4264	M	242	2296	14.2	Holohil Systems Ltd	RI-2B	96	0.62	127025	165.791	5/7/2008				11 S	83				Functional	2/7/2010	Tortoise	FW-4264	None	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	4276	F	249	2126	14.2	Holohil Systems Ltd	RI-2B	96	0.61	127018	165.470	5/6/2008	04/21/09			11 S	83				Recovered		FI-DPW	FW-4276	None	Tortoise found deceased, transmitter recovered.
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	4365	M	190	1162	17.0	Holohil Systems Ltd	RI-2C	96	0.61	117850	166.870	7/3/2007	02/03/09			11 S	83				Recovered		FI-DPW	FW-4365	7F7D173B7C	Tortoise found deceased, transmitter recovered.
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	ABR	M	248	3118	14.0	Holohil Systems Ltd	RI-2B	96	0.63	126449	165.535	3/4/2008	10/05/09			11 S	83				Recovered		FI-DPW	ABR	7F7D172F12	
TE102235-27	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	ABR	M	247	3062	15	Holohil Systems Ltd	RI-2B	96	0.61	134277	165.533	10/5/2009				11 S	83				Functional	7/8/2011	Tortoise	ABR	None	
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	ADG	M	244	2580	14.2	Holohil Systems Ltd	RI-2B	96	0.63	126983	164.052	5/7/2008	06/29/09			11 S	83				Recovered		FI-DPW	ADG	7F7D073365	Tortoise found deceased, transmitter recovered.
TE102235-3	04/10/09	U.S. Dept. of the Army, Ft. Irwin	CA	San Bernardino	Superior Cronese	BCI	F	234	2410	14.3	Holohil Systems Ltd	RI-2B	96	0.64	126501	167.573	8/13/2008	08/24/09			11 S	83				Recovered		FI-DPW	BCI	7F7D1B7941	Tortoise found deceased, transmitter recovered.

Appendix 4. Blood Samples Collected in 2009

Tortoise Number	Date Collected	Gender	UTM NAD 83 Easting	UTM NAD 83 Northing	Total Blood Volume Collected (mL)	Stick Location	Comments	Transferred Plasma Volume (mL) to K. Berry
793	04/07/2009	F	509715	3888380	1	Subcarapacial		
793	05/05/2009	F	509580	3888496	0.6	Subcarapacial		
793	06/09/2009	F	509844	3888195	0.5	Subcarapacial		
793	07/07/2009	F	509782	3888110	0.5	Subcarapacial		
793	08/04/2009	F	509787	3888114	0.5	Subcarapacial		
2035	04/07/2009	F	521071	3876707	0.7	Subcarapacial		
2041	04/07/2009	F	512051	3886568	0.9	Subcarapacial		
2041	05/05/2009	F	511738	3886516	0.45	Subcarapacial		
2041	07/07/2009	F	511944	3886510	0.45	Subcarapacial		
2041	08/04/2009	F	511951	3886544	0.5	Subcarapacial		
2041	09/09/2009	F	511818	3886581	0.2	Subcarapacial		
2042	04/07/2009	F	512999	3886423	1	Subcarapacial		
2042	06/09/2009	F	513096	3886521	0.6	Subcarapacial		
2042	07/07/2009	F	513184	3886578	0.5	Subcarapacial		
2042	08/04/2009	F	513113	3886536	0.6	Subcarapacial		
2042	09/09/2009	F	512973	3886407	0.7	Subcarapacial		
2042	10/06/2009	F	513000	3886421	0.7	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
2418	04/07/2009	M	512644	3885399	1	Subcarapacial		
2418	05/05/2009	M	512662	3885441	0.6	Subcarapacial		
2418	06/09/2009	M	512660	3885430	0.5	Subcarapacial		
2418	07/07/2009	M	512677	3885421	0.5	Subcarapacial		
2418	08/04/2009	M	512670	3885419	0.1	Subcarapacial		
2418	09/09/2009	M	512666	3885430	0.5	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3005	04/07/2009	M	509970	3887105	1	Subcarapacial		
3005	05/05/2009	M	509888	3887107	0.7	Subcarapacial		
3005	06/09/2009	M	510219	3886933	0.5	Subcarapacial		
3005	08/04/2009	M	510221	3886944	0.5	Subcarapacial		
3005	09/09/2009	M	509902	3887095	0.35	Subcarapacial		
3005	10/06/2009	M	509906	3887353	0.5	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3012	04/06/2009	M	544935	3883098	1.2	Subcarapacial		
3012	05/04/2009	M	545305	3883678	0.6	Subcarapacial		
3012	07/06/2009	M	545224	3883061	0.5	Subcarapacial		
3012	08/03/2009	M	545222	3883079	0.5	Subcarapacial		
3012	09/08/2009	M	545062	3883433	0.6	Subcarapacial		
3012	10/05/2009	M	545100	3883333	0.8	Subcarapacial	Approximately 0.05 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.05
3013	04/07/2009	F	532943	3886276	0.8	Subcarapacial		
3015	04/06/2009	M	549460	3888583	0.4	Subcarapacial		
3015	05/04/2009	M	549089	3888083	0.5	Subcarapacial		
3015	09/08/2009	M	549334	3887964	0.5	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3015	10/05/2009	M	549171	3888260	0.5	Subcarapacial		
3021	04/07/2009	M	511663	3884591	0.1	Subcarapacial		
3021	05/05/2009	M	511422	3884630	0.6	Subcarapacial		
3021	07/07/2009	M	511688	3884860	0.5	Subcarapacial		
3021	09/09/2009	M	511485	3884658	0.5	Subcarapacial	Approximately 0.05 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.05
3021	10/05/2009	M	511794	3884813	0.6	Subcarapacial		
3022	04/06/2009	F	527381	3876669	0.5	Subcarapacial		
3022	05/05/2009	F	527279	3876867	0.5	Subcarapacial		
3022	06/08/2009	F	527355	3876834	0.7	Subcarapacial		
3022	07/06/2009	F	527434	3876914	0.5	Subcarapacial		
3022	08/03/2009	F	527429	3876918	0.45	Subcarapacial		
3022	09/08/2009	F	527445	3876922	0.5	Subcarapacial	Approximately 0.05 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.05
3022	10/06/2009	F	527541	3876741	0.4	Subcarapacial		
3033	04/06/2009	M	546255	3876713	0.5	Subcarapacial		
3033	05/04/2009	M	546377	3876775	0.6	Subcarapacial		
3033	06/08/2009	M	546230	3877099	0.5	Subcarapacial		
3033	07/06/2009	M	546213	3877068	0.5	Subcarapacial		
3033	08/03/2009	M	546209	3877070	0.6	Subcarapacial		
3033	09/08/2009	M	546558	3876726	0.7	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3033	10/05/2009	M	546456	3877081	6	Subcarapacial		
3035	04/07/2009	M	512941	3889685	0.5	Subcarapacial		
3035	05/05/2009	M	513156	3889534	0.5	Subcarapacial		
3035	06/09/2009	M	513502	3889723	0.5	Subcarapacial		
3035	07/07/2009	M	513502	3889719	0.5	Subcarapacial		
3035	08/04/2009	M	513494	3889728	0.5	Subcarapacial		
3035	09/09/2009	M	513405	3890031	0.7	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3035	10/06/2009	M	513407	3890021	0.5	Subcarapacial		
3050	04/09/2009	M	518673	3877116	0.8	Subcarapacial		
3050	05/05/2009	M	518562	3877215	0.5	Subcarapacial		
3050	06/09/2009	M	518651	3876665	0.5	Subcarapacial		
3050	07/07/2009	M	518651	3876679	0.6	Subcarapacial		
3050	08/03/2009	M	518627	3876674	0.6	Subcarapacial		
3050	09/08/2009	M	518648	3876659	0.3	Subcarapacial		
3050	10/05/2009	M	518950	3876567	0.6	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3058	04/06/2009	F	553718	3888868	1	Subcarapacial		
3058	05/04/2009	F	553585	3888805	0.5	Subcarapacial		
3058	06/08/2009	F	553685	3888778	0.5	Subcarapacial		
3058	07/06/2009	F	553635	3888820	0.6	Subcarapacial		
3058	08/03/2009	F	553647	3888837	0.5	Subcarapacial		
3058	09/08/2009	F	553633	3888806	0.6	Subcarapacial		
3058	10/05/2009	F	553545	3888775	0.6	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3059	04/07/2009	M	507042	3878962	0.6	Subcarapacial		
3066	04/06/2009	M	553116	3881400	0.5	Subcarapacial		
3066	05/04/2009	M	554110	3881910	0.5	Subcarapacial		
3066	06/08/2009	M	553782	3881655	0.5	Subcarapacial		
3066	07/06/2009	M	553782	3881655	0.5	Subcarapacial		
3066	08/03/2009	M	553774	3881661	0.6	Subcarapacial		
3066	10/05/2009	M	553780	3881658	0.5	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3071	04/06/2009	F	537122	3879214	1	Subcarapacial		
3071	06/08/2009	F	537774	3879480	0.7	Subcarapacial		
3071	07/06/2009	F	537754	3879535	0.5	Subcarapacial		
3071	09/08/2009	F	537746	3879500	0.4	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3079	04/07/2009	M	511484	3883648	0.06	Subcarapacial		
3079	05/05/2009	M	510836	3884121	0.3	Subcarapacial		
3079	06/09/2009	M	510943	3884082	0.8	Subcarapacial		
3081	04/07/2009	M	511844	3883605	0.7	Subcarapacial		
3081	05/05/2009	M	512339	3884012	0.55	Subcarapacial		
3081	06/09/2009	M	511873	3883593	0.6	Subcarapacial		
3081	07/07/2009	M	511876	3883610	0.5	Subcarapacial		
3081	08/04/2009	M	511867	3883597	0.7	Subcarapacial		
3081	09/09/2009	M	512464	3883963	0.6	Subcarapacial		
3081	10/06/2009	M	512460	3883951	0.7	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3083	04/07/2009	M	509465	3880728	0.8	Subcarapacial		
3089	04/07/2009	F	511909	3889863	0.5	Subcarapacial		
3089	05/05/2009	F	511879	3889423	0.5	Subcarapacial		
3089	06/09/2009	F	512044	3889582	0.5	Subcarapacial		
3089	08/04/2009	F	511812	3889658	0.6	Subcarapacial		
3089	09/09/2009	F	511817	3889662	0.6	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3089	10/06/2009	F	511877	3889638	0.4	Subcarapacial		
3091	04/07/2009	F	513251	3889553	0.5	Subcarapacial		
3091	05/05/2009	F	513142	3889615	0.5	Subcarapacial		
3091	06/09/2009	F	513286	3889360	0.4	Subcarapacial		
3091	07/07/2009	F	513350	3889386	0.5	Subcarapacial		

Appendix 4. Blood Samples Collected in 2009

Tortoise Number	Date Collected	Gender	UTM NAD 83 Easting	UTM NAD 83 Northing	Total Blood Volume Collected (mL)	Stick Location	Comments	Transferred Plasma Volume (mL) to K. Berry
3091	08/04/2009	F	513326	3889369	0.4	Subcarapacial		
3091	09/09/2009	F	513295	3889464	0.6	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3093	04/07/2009	M	512931	3889253	0.5	Subcarapacial		
3093	05/05/2009	M	512257	3889324	0.25	Subcarapacial		
3093	06/09/2009	M	512242	3889516	0.5	Subcarapacial		
3093	07/07/2009	M	512242	3889514	0.5	Subcarapacial		
3093	08/04/2009	M	512603	3889398	0.6	Subcarapacial		
3093	09/09/2009	M	512677	3889138	0.6	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3093	10/06/2009	M	513179	3890151	0.6	Subcarapacial		
3099	06/09/2009	F	513153	3890194	0.5	Subcarapacial		
3099	07/07/2009	F	513181	3890170	0.5	Subcarapacial		
3099	09/09/2009	F	513172	3890178	0.6	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3099	10/06/2009	F	513179	3890151	0.7	Subcarapacial		
3108	04/07/2009	M	509481	3880304	0.7	Subcarapacial		
3108	05/05/2009	M	509445	3880460	0.6	Subcarapacial		
3108	06/09/2009	M	510023	3880311	0.5	Subcarapacial		
3108	07/07/2009	M	510018	3880351	0.3	Subcarapacial		
3108	08/04/2009	M	510021	3880348	0.6	Subcarapacial		
3108	09/09/2009	M	509522	3880356	0.6	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3108	10/05/2009	M	509444	3880376	0.8	Subcarapacial		
3109	04/07/2009	M	510316	3880795	0.4	Subcarapacial		
3109	05/05/2009	M	508958	3880150	0.5	Subcarapacial		
3117	04/06/2009	M	550152	3887351	0.5	Subcarapacial		
3117	05/04/2009	M	550224	3887813	0.5	Subcarapacial		
3117	06/08/2009	M	550001	3887635	0.8	Subcarapacial		
3117	07/06/2009	M	550070	3887668	0.6	Subcarapacial		
3117	08/03/2009	M	548655	3887987	0.5	Subcarapacial		
3117	09/08/2009	M	549943	3887491	0.7	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3117	10/05/2009	M	550152	3887656	0.5	Subcarapacial		
3123	04/07/2009	M	512055	3887028	1	Subcarapacial		
3123	05/05/2009	M	512185	3886852	0.7	Subcarapacial		
3123	06/09/2009	M	512171	3886847	0.5	Subcarapacial		
3123	07/07/2009	M	512160	3886840	0.5	Subcarapacial		
3123	08/04/2009	M	512160	3886843	0.4	Subcarapacial		
3123	09/09/2009	M	512394	3887170	0.7	Subcarapacial		
3123	10/06/2009	M	512133	3886888	0.7	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3125	04/07/2009	M	513083	3879424	0.5	Subcarapacial		
3125	05/05/2009	M	512862	3879296	0.7	Subcarapacial		
3125	06/09/2009	M	512689	3879255	0.6	Subcarapacial		
3125	07/06/2009	M	512685	3879253	0.6	Subcarapacial		
3125	08/03/2009	M	512683	3879253	0.6	Subcarapacial		
3125	09/08/2009	M	512679	3879254	0.8	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3140	04/08/2009	M	519662	3876491	0.7	Subcarapacial		
3140	05/05/2009	M	519294	3876102	0.6	Subcarapacial		
3140	06/09/2009	M	519575	3876227	0.4	Subcarapacial		
3140	07/07/2009	M	519569	3876232	0.5	Subcarapacial		
3140	09/08/2009	M	519644	3876286	0.55	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3140	10/05/2009	M	518826	3875852	0.5	Subcarapacial		
3171	04/07/2009	M	511532	3887892	1	Subcarapacial		
3171	05/05/2009	M	511673	3887990	0.5	Subcarapacial		
3171	06/09/2009	M	511684	3887928	0.6	Subcarapacial		
3171	07/07/2009	M	511691	3887920	0.5	Subcarapacial		
3171	08/04/2009	M	511664	3887913	0.55	Subcarapacial		
3171	09/09/2009	M	511770	3887888	0.55	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3171	10/06/2009	M	511682	3887921	0.55	Subcarapacial		
3203	04/06/2009	M	537501	3879194	1.1	Subcarapacial		
3203	05/04/2009	M	537707	3879407	0.5	Subcarapacial		
3203	06/08/2009	M	537692	3879409	0.6	Subcarapacial		
3203	07/06/2009	M	537666	3879446	0.5	Subcarapacial		
3203	08/03/2009	M	537697	3879424	0.5	Subcarapacial		
3203	09/08/2009	M	537677	3879419	0.5	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3204	04/06/2009	M	532378	3878668	1	Subcarapacial		
3204	05/04/2009	M	532021	3878574	0.5	Subcarapacial		
3204	06/08/2009	M	531892	3878551	0.7	Subcarapacial		
3204	07/07/2009	M	531904	3878533	0.1	Subcarapacial		
3204	08/03/2009	M	531887	3878557	0.7	Subcarapacial		
3204	09/08/2009	M	532614	3878813	0.7	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3204	10/05/2009	M	532064	3878593	0.6	Subcarapacial		
3213	04/06/2009	M	532513	3878690	0.6	Subcarapacial		
3213	05/04/2009	M	532209	3878634	0.5	Subcarapacial		
3213	09/08/2009	M	532691	3879025	0.6	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3213	10/05/2009	M	532681	3879009	0.5	Subcarapacial		
3218	04/07/2009	M	512739	3886984	1.1	Subcarapacial		
3218	05/05/2009	M	512720	3887105	0.7	Subcarapacial		
3218	06/09/2009	M	512846	3887022	0.6	Subcarapacial		
3218	07/07/2009	M	512886	3887020	0.6	Subcarapacial		
3218	09/09/2009	M	512689	3887004	0.6	Subcarapacial		
3218	10/06/2009	M	512810	3886941	0.5	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3220	04/06/2009	F	532246	3878634	0.7	Subcarapacial		
3220	05/04/2009	F	532211	3878619	0.5	Subcarapacial		
3220	06/08/2009	F	532112	3878619	0.5	Subcarapacial		
3220	07/07/2009	F	532120	3878610	0.8	Subcarapacial		
3220	08/03/2009	F	532112	3878617	0.5	Subcarapacial		
3220	09/08/2009	F	532218	3878636	0.7	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3220	10/05/2009	F	532534	3878705	0.6	Subcarapacial		
3228	04/06/2009	M	553828	3882126	0.5	Subcarapacial		
3228	05/04/2009	M	553782	3881941	0.5	Subcarapacial		
3228	06/08/2009	M	554037	3882227	0.5	Subcarapacial		
3228	09/08/2009	M	554074	3882191	0.55	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3228	10/05/2009	M	553861	3882161	0.6	Subcarapacial		
3234	04/07/2009	M	513470	3887477	1	Subcarapacial		
3234	06/09/2009	M	513634	3887189	0.8	Subcarapacial		
3234	07/07/2009	M	513841	3887409	0.6	Subcarapacial		
3234	08/04/2009	M	513848	3887417	0.6	Subcarapacial		
3234	09/09/2009	M	513511	3887316	0.5	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3234	10/06/2009	M	513741	3887391	0.5	Subcarapacial		
3236	04/07/2009	F	512746	3887066	1	Subcarapacial		
3236	05/05/2009	F	512790	3887101	0.6	Subcarapacial		
3236	06/09/2009	F	512662	3886970	0.35	Subcarapacial		
3236	07/07/2009	F	512751	3887025	0.6	Subcarapacial		
3236	08/04/2009	F	512738	3887026	0.6	Subcarapacial		
3236	09/09/2009	F	512970	3886406	0.6	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3237	04/07/2009	M	517927	3882418	0.75	Subcarapacial		
3237	05/05/2009	M	518153	3882415	0.5	Subcarapacial		
3237	06/09/2009	M	518183	3882401	0.2	Subcarapacial		
3237	07/06/2009	M	518171	3882404	0.5	Subcarapacial		
3237	09/08/2009	M	518374	3882380	0.5	Subcarapacial		
3237	10/06/2009	M	517934	3882427	0.4	Subcarapacial		
3241	04/06/2009	F	537615	3879385	1	Subcarapacial		
3241	06/08/2009	F	537689	3879428	0.6	Subcarapacial		
3241	07/06/2009	F	537610	3879398	0.1	Subcarapacial		
3241	09/08/2009	F	537675	3879419	0.8	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1

Appendix 4. Blood Samples Collected in 2009

Tortoise Number	Date Collected	Gender	UTM NAD 83 Easting	UTM NAD 83 Northing	Total Blood Volume Collected (mL)	Stick Location	Comments	Transferred Plasma Volume (mL) to K. Berry
3241	10/05/2009	F	537695	3879404	0.4	Subcarapacial		
3283	08/04/2009	M	510899	3885136	0.7	Subcarapacial		
3283	09/09/2009	M	510935	3885088	0.5	Subcarapacial		
3283	10/05/2009	M	510982	3884971	0.4	Subcarapacial		
3300	04/07/2009	M	513784	3890603	0.5	Subcarapacial		
3300	05/05/2009	M	513159	3889558	0.5	Subcarapacial		
3300	06/09/2009	M	513136	3889765	0.4	Subcarapacial		
3300	08/04/2009	M	513465	3889603	0.6	Subcarapacial		
3300	09/09/2009	M	513202	3890158	0.6	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3300	10/06/2009	M	513462	3889618	0.3	Subcarapacial		
3308	04/06/2009	M	553331	3888535	1	Subcarapacial		
3308	05/04/2009	M	553136	3888414	0.6	Subcarapacial		
3308	06/08/2009	M	553789	3889124	0.5	Subcarapacial		
3308	07/06/2009	M	553788	3889118	0.7	Subcarapacial		
3308	09/08/2009	M	553198	3889846	0.6	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3308	10/05/2009	M	553669	3888869	0.5	Subcarapacial		
3309	04/06/2009	M	553896	3887319	0.6	Subcarapacial		
3309	05/04/2009	M	553971	3887155	0.7	Subcarapacial		
3309	09/08/2009	M	554114	3886846	0.7	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3309	10/05/2009	M	554255	3887016	0.5	Subcarapacial		
3401	04/06/2009	F	536585	3879570	1	Subcarapacial		
3401	05/06/2009	F	536642	3879409	0.6	Subcarapacial		
3401	06/08/2009	F	536786	3879747	0.5	Subcarapacial		
3401	07/06/2009	F	536784	3879566	0.6	Subcarapacial		
3401	08/03/2009	F	536784	3879563	0.5	Subcarapacial		
3401	09/08/2009	F	536720	3879617	0.44	Subcarapacial		
3402	04/06/2009	M	536784	3879208	0.8	Subcarapacial		
3402	05/04/2009	M	536288	3879444	0.6	Subcarapacial		
3402	06/08/2009	M	536441	3879179	0.5	Subcarapacial		
3402	07/06/2009	M	536515	3879332	0.55	Subcarapacial		
3402	08/03/2009	M	536414	3879319	0.4	Subcarapacial		
3402	09/08/2009	M	536548	3879298	0.5	Subcarapacial		
3402	10/05/2009	M	536543	3879299	0.7	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3427	04/06/2009	F	553921	3888923	1	Subcarapacial		
3427	05/04/2009	F	553951	3888939	0.7	Subcarapacial		
3427	06/08/2009	F	554065	3889020	0.8	Subcarapacial		
3427	07/06/2009	F	553930	3889210	0.5	Subcarapacial		
3427	08/03/2009	F	553879	3889156	0.55	Subcarapacial		
3427	09/08/2009	F	553895	3889138	0.6	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3427	10/05/2009	F	553832	3889169	0.35	Subcarapacial		
3438	04/06/2009	F	554310	3888606	0.8	Subcarapacial		
3438	05/04/2009	F	554092	3888228	0.6	Subcarapacial		
3438	06/08/2009	F	554111	3888357	0.5	Subcarapacial		
3438	07/06/2009	F	554095	3888324	0.7	Subcarapacial		
3438	08/03/2009	F	554110	3888335	0.45	Subcarapacial		
3438	09/08/2009	F	554099	3888335	0.6	Subcarapacial	Approximately 0.075 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.075
3438	10/05/2009	F	554149	3888502	0.6	Subcarapacial		
3445	04/06/2009	F	537062	3880275	0.8	Subcarapacial		
3445	05/04/2009	F	536358	3879744	0.5	Subcarapacial		
3445	06/08/2009	F	536325	3879655	0.2	Subcarapacial		
3445	07/06/2009	F	536343	3879661	0.5	Subcarapacial		
3445	08/03/2009	F	536310	3879644	0.5	Subcarapacial		
3445	09/08/2009	F	536330	3879669	0.6	Subcarapacial		
3445	10/05/2009	F	536380	3879814	0.5	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3447	04/06/2009	F	536340	3879045	0.9	Subcarapacial		
3447	05/04/2009	F	536503	3879181	0.5	Subcarapacial		
3447	06/08/2009	F	536400	3879106	0.6	Subcarapacial		
3447	07/06/2009	F	536545	3879301	0.5	Subcarapacial		
3447	08/03/2009	F	536551	3879299	0.5	Subcarapacial		
3447	09/08/2009	F	536410	3879090	0.6	Subcarapacial		
3447	10/05/2009	F	536564	3879263	0.5	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3451	04/06/2009	F	536606	3880113	1.1	Subcarapacial		
3451	05/04/2009	F	536828	3880191	0.65	Subcarapacial		
3451	06/08/2009	F	536995	3879955	0.5	Subcarapacial		
3501	04/08/2009	M	542206	3883024	0.5	Subcarapacial		
3501	05/04/2009	M	542069	3882830	0.75	Subcarapacial		
3501	06/08/2009	M	542002	3882798	0.6	Subcarapacial		
3501	07/06/2009	M	541952	3882760	0.7	Subcarapacial		
3501	08/03/2009	M	542030	3882814	0.7	Subcarapacial		
3501	09/08/2009	M	542165	3882990	0.6	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3501	10/05/2009	M	542007	3882936	0.1	Subcarapacial		
3503	05/06/2009	M	505829	3879167	0.55	Subcarapacial		
3503	06/09/2009	M	506016	3879333	0.5	Subcarapacial		
3503	07/07/2009	M	506030	3879359	0.6	Subcarapacial		
3503	08/04/2009	M	506038	3879341	0.6	Subcarapacial		
3503	09/09/2009	M	506014	3879331	0.4	Subcarapacial		
3503	10/05/2009	M	506055	3879341	0.5	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3504	05/05/2009	M	511519	3881519	0.5	Subcarapacial		
3504	06/09/2009	M	511326	3881458	0.5	Subcarapacial		
3504	07/07/2009	M	511482	3881466	0.6	Subcarapacial		
3504	08/04/2009	M	511444	3881458	0.6	Subcarapacial		
3504	09/09/2009	M	510885	3881824	0.4	Subcarapacial		
3504	10/05/2009	M	511034	3881635	0.5	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3505	05/06/2009	M	542442	3882742	0.6	Subcarapacial		
3505	06/08/2009	M	542611	3882725	0.9	Subcarapacial		
3505	07/06/2009	M	542439	3882745	0.5	Subcarapacial		
3505	08/03/2009	M	542439	3882739	0.5	Subcarapacial		
3505	09/08/2009	M	542598	3882742	0.4	Subcarapacial		
3505	10/05/2009	M	542595	3882733	0.7	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3511	06/09/2009	M	507764	3885885	0.7	Subcarapacial		
3511	08/04/2009	M	507759	3885886	0.5	Subcarapacial		
3511	09/09/2009	M	507767	3885886	0.5	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3511	10/05/2009	M	508192	3885662	0.7	Subcarapacial		
3525	04/06/2009	F	554193	3889065	0.5	Subcarapacial		
3525	05/04/2009	F	554190	3889195	0.5	Subcarapacial		
3525	06/08/2009	F	554226	3889138	0.5	Subcarapacial		
3525	07/06/2009	F	554231	3889152	0.5	Subcarapacial		
3525	08/03/2009	F	554229	3889164	0.45	Subcarapacial		
3525	09/08/2009	F	554226	3889171	0.4	Subcarapacial		
3525	10/05/2009	F	554296	3889245	0.7	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3529	04/06/2009	M	551169	3887264	0.6	Subcarapacial		
3531	06/09/2009	F	505964	3878300	0.5	Subcarapacial		
3531	07/07/2009	F	505947	3878143	0.2	Subcarapacial		
3563	04/08/2009	F	553887	3890531	0.6	Subcarapacial		
3563	05/04/2009	F	553556	3890480	0.5	Subcarapacial		
3563	06/08/2009	F	553716	3890502	0.6	Subcarapacial		
3563	07/06/2009	F	553717	3890501	0.6	Subcarapacial		
3563	09/08/2009	F	553829	3890507	0.5	Subcarapacial		
3563	10/05/2009	F	553829	3890601	0.5	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
3669	04/06/2009	M	554518	3890444	0.7	Subcarapacial		
3669	05/04/2009	M	554633	3890564	0.5	Subcarapacial		
3669	06/08/2009	M	554919	3889911	0.6	Subcarapacial		

Appendix 4. Blood Samples Collected in 2009

Tortoise Number	Date Collected	Gender	UTM NAD 83 Easting	UTM NAD 83 Northing	Total Blood Volume Collected (mL)	Stick Location	Comments	Transferred Plasma Volume (mL) to K. Berry
3669	07/06/2009	M	554908	3889918	0.7	Subcarapacial		
3669	08/03/2009	M	554588	3890341	0.5	Subcarapacial		
3669	09/08/2009	M	554627	3890370	0.6	Subcarapacial		
3669	10/05/2009	M	554328	3890206	0.55	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
4005	10/06/2009		513001	3886420	0.8	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
4016	04/06/2009	F	535157	3879055	1	Subcarapacial		
4072	04/07/2009	M	518393	3880953	1	Subcarapacial		
4072	05/05/2009	M	518323	3880928	0.5	Subcarapacial		
4091	04/06/2009	F	541364	3883207	1	Subcarapacial		
4091	05/04/2009	F	541922	3883690	0.5	Subcarapacial		
4091	06/08/2009	F	541737	3883641	0.7	Subcarapacial		
4107	04/06/2009	F	535149	3877706	1	Subcarapacial		
4107	05/05/2009	F	535292	3877910	0.6	Subcarapacial		
4119	04/08/2009	F	536824	3878648	0.8	Subcarapacial		
4119	05/04/2009	F	536970	3878824	0.5	Subcarapacial		
4119	06/08/2009	F	536785	3878969	0.8	Subcarapacial		
4119	08/03/2009	F	536801	3879027	0.4	Subcarapacial		
4119	09/08/2009	F	536790	3878966	0.4	Subcarapacial		
4119	10/05/2009	F	536797	3879027	0.5	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
4121	04/07/2009	M	513362	3886257	1.1	Subcarapacial		
4121	05/05/2009	M	513367	3886252	0.5	Subcarapacial		
4121	06/09/2009	M	513373	3886259	0.8	Subcarapacial		
4121	07/07/2009	M	513358	3886252	0.6	Subcarapacial		
4121	08/04/2009	M	513355	3886265	0.66	Subcarapacial		
4121	09/09/2009	M	513336	3886348	0.5	Subcarapacial		
4121	10/06/2009	M	512784	3886684	0.5	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
4125	04/07/2009	M	513997	3884312	1	Subcarapacial		
4125	05/05/2009	M	513887	3884663	0.5	Subcarapacial		
4125	06/09/2009	M	513775	3884488	0.5	Subcarapacial		
4125	07/07/2009	M	513786	3884498	0.6	Subcarapacial		
4125	08/04/2009	M	513789	3884517	0.55	Subcarapacial		
4125	09/09/2009	M	513787	3884490	0.5	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
4163	04/07/2009	M	519373	3876019	0.75	Subcarapacial		
4163	06/09/2009	M	519483	3875672	0.4	Subcarapacial		
4163	07/07/2009	M	519473	3875674	0.4	Subcarapacial		
4163	08/04/2009	M	519471	3875668	0.6	Subcarapacial		
4163	09/08/2009	M	519446	3875758	0.5	Subcarapacial	Approximately 0.05 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.05
4163	10/05/2009	M	519636	3875947	0.2	Subcarapacial		
4169	04/07/2009	M	506862	3879797	0.8	Subcarapacial		
4169	05/05/2009	M	507204	3880010	0.75	Subcarapacial		
4169	09/09/2009	M	506787	3880031	0.5	Subcarapacial	Approximately 0.05 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.05
4169	10/05/2009	M	506683	3880130	0.5	Subcarapacial		
4177	04/07/2009	M	515546	3884985	1.1	Subcarapacial		
4177	05/05/2009	M	515506	3885181	0.6	Subcarapacial		
4185	04/08/2009	F	519427	3876746	0.7	Subcarapacial		
4185	05/05/2009	F	519431	3876779	0.5	Subcarapacial		
4185	06/09/2009	F	519201	3876693	0.5	Subcarapacial		
4185	07/07/2009	F	519197	3876690	0.6	Subcarapacial		
4185	08/03/2009	F	519185	3876679	0.5	Subcarapacial		
4185	09/08/2009	F	519404	3876789	0.6	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
4246	04/08/2009	M	522149	3874501	1	Subcarapacial		
4246	05/05/2009	M	521391	3875244	0.75	Subcarapacial		
4246	07/07/2009	M	521089	3875650	0.5	Subcarapacial		
4246	08/04/2009	M	521104	3875651	0.5	Subcarapacial		
4246	09/08/2009	M	521084	3875657	0.5	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
4251	05/06/2009	M	523639	3875439	0.5	Subcarapacial		
4251	06/08/2009	M	527040	3873427	0.8	Subcarapacial		
4251	07/06/2009	M	527026	3873421	0.6	Subcarapacial		
4251	09/08/2009	M	526994	3873337	0.6	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
4251	10/06/2009	M	525247	3873612	0.6	Subcarapacial		
4264	04/09/2009	M	538524	3879033	1	Subcarapacial		
4264	06/08/2009	M	538781	3880388	0.5	Subcarapacial		
4264	07/06/2009	M	538788	3880403	0.5	Subcarapacial		
4264	08/04/2009	M	538784	3880449	0.55	Subcarapacial		
4264	09/08/2009	M	538786	3880401	0.5	Subcarapacial	Approximately 0.05 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.05
4264	10/05/2009	M	538787	3880404	0.5	Subcarapacial		
4276	04/08/2009	F	508823	3880154	0.3	Subcarapacial		
ABR	04/06/2009	M	542739	3883109	1	Subcarapacial		
ABR	05/04/2009	M	542828	3882983	0.6	Subcarapacial		
ABR	06/08/2009	M	542660	3883095	0.6	Subcarapacial		
ABR	07/06/2009	M	542721	3882950	0.6	Subcarapacial		
ABR	08/03/2009	M	542752	3882956	0.5	Subcarapacial		
ABR	10/05/2009	M	542746	3883023	0.7	Subcarapacial	Approximately 0.1 mL of collected plasma was transferred to Kristin H. Berry (USGS) for health analysis.	0.1
ADG	04/06/2009	M	535150	3879560	1	Subcarapacial		
ADG	05/04/2009	M	537351	3880236	0.6	Subcarapacial		
ADG	06/08/2009	M	537720	3879601	0.3	Subcarapacial		
BCI	04/06/2009	F	542572	3881153	1	Subcarapacial		
BCI	05/04/2009	F	542588	3881161	0.5	Subcarapacial		
BCI	06/08/2009	F	542692	3881230	0.6	Subcarapacial		
BCI	07/06/2009	F	542681	3881244	0.5	Subcarapacial		
BCI	08/03/2009	F	542701	3881357	0.5	Subcarapacial		

Appendix 5. Tortoise Homerange (ha)

Tortoise	Sex	Year				
		2005	2006	2007	2008	2009
055	M		7.35	24.27		
793	F				18.76	12.42
2034	M			11.67	343.87	
2035	F				115.67	
2041	F			8.41	30.58	7.40
2042	F			41.91	70.45	6.15
2418	M	32.01	17.77	30.62	5.33	0.37
3001	F	14.99	6.03	9.21		
3002	F	8.49		2.97		
3003	M	40.28			40.41	
3004	F	6.68	6.97	6.42		
3005	M	16.12	43.99		10.95	26.94
3006	F	19.48	17.83	18.90		
3007	F	23.61	33.71		27.04	
3008	F	4.58	8.55	6.22		
3009	M	31.42	4.28			
3010	F	42.97	43.55			
3011	F	11.53	16.17	6.30		
3012	M	34.75	122.45	33.79	62.53	107.68
3013	F	8.07	10.73	28.27	10.82	
3014	F	9.19	0.35			
3015	M	36.27	46.71	50.92	77.68	63.15
3016	M	27.26	75.41			
3017	F	0.43				
3018	F	15.72	16.86	18.72	24.45	
3019	F	6.26	0.88	8.41		
3020	M	48.86	74.59	71.50		
3021	M	108.04	53.57		94.73	21.12
3022	F		9.22	4.42	6.48	19.21
3023	M	128.05	50.78			
3024	M	17.78	13.17	3.85		
3025	M	85.91	55.97	2.69	1.66	
3026	F	35.41	16.78	3.09		
3027	M	43.70	16.46		21.82	
3028	F	51.01	12.68	12.89		
3029	F	47.59	5.81	15.35		
3030	F	25.30	24.57			
3031	M	15.41	11.76			
3032	F	17.47	47.63		3.44	
3033	M	25.81	27.17	2.70	38.05	23.46
3034	M	86.38	71.08	20.21		
3035	M	141.86	112.98	8.92	52.36	43.37
3036	F		49.78	2.83		
3037	M	14.99	61.12	22.86		
3038	F		10.33			
3042	F		15.62			
3046	F	18.66	0.76	3.00		
3047	M	25.10	22.35	10.70		
3048	M	45.07	8.30			
3049	M	20.96	78.35		33.99	
3050	M	46.01	53.63		72.39	48.15
3051	M	32.48	64.80		69.75	
3052	M	59.00	99.67	109.93		
3058	F	13.97	27.51	4.95	3618.26	2.77
3059	M		81.45	79.21	3.17	
3060	M		72.21	87.20		
3061	F		5.25			
3062	M	119.91	68.11			
3063	M	14.06	4.06	0.92		
3064	M	35.85	42.06			
3066	M	75.99	2.08		8.17	39.24
3067	M	0.78	4.85	3.18		
3068	M	222.00	102.70			
3069	F	15.22	20.01			
3070	M		69.12			
3071	F		7.15	31.07	135.45	50.53
3075	M		5.51			
3077	F	11.23	14.60			
3078	M	43.98	88.20			
3079	M	86.31	63.39		137.65	57.38
3080	F	26.20	34.67			
3081	M	10.06	56.96	10.58	35.43	41.88
3083	M	42.18	24.22	14.45	24.81	
3089	F	9.28	7.77	5.10	17.86	16.21
3090	M	60.39	14.45			
3091	F	11.11	49.54		16.76	8.07
3093	M	51.79	104.31	91.74	199.99	117.51
3094	M	156.80	126.25	5.57		
3095	F	30.66	23.49	29.91		
3096	M	20.37	28.88			
3097	M	57.09	18.43	0.49		
3098	F	13.85	14.35	10.20		
3099	F	4.61	4.48		6.96	43.29

Tortoise	Sex	Year				
		2005	2006	2007	2008	2009
3100	M	44.04	46.12			
3101	F	63.95	49.10	3.37		
3102	F	51.84	11.80			
3103	M	26.91	11.81	23.24		
3104	F	31.73	34.14	12.86		
3107	F	7.28	8.99	0.68		
3108	M	52.92	66.40	21.90	78.74	38.16
3109	M	75.59	52.31		198.94	
3110	F	75.94	19.00	11.28		
3111	M		97.69			
3112	M		107.63			
3113	M	82.93	35.55	41.10		
3116	M	65.87	23.84			
3117	M	121.73	80.81		25.06	82.07
3119	M	11.81				
3120	M	103.66				
3123	M		30.70	56.84	17.31	16.67
3124	M	241.28	199.92			
3125	M	14.96	23.39	15.69	18.90	13.26
3126	F	25.89	113.25	2.49		
3127	M	24.43	24.78			
3128	M	28.74	35.15	25.30		
3129	F		2.33	1.81		
3132	F	20.88	9.85			
3134	M	26.51	7.78			
3137	M	10.66	21.34			
3138	F	10.57				
3140	M	209.69	80.60		13.40	113.37
3141	M	13.54	20.98	9.06	8.29	
3142	M	40.48	8.44	0.80		
3146	M	57.81	42.15			
3147	F		16.76			
3148	M		74.37			
3149	M		22.85			
3151	M	10.94	3.29	16.38	31.32	
3159	F	4.86	17.30			
3160	F	7.06	45.37	5.84		
3161	M	14.46	25.01			
3163	M	59.78	104.84		137.34	
3165	M	44.05	45.53			
3168	F	7.39	17.86	4.79		
3170	F			7.79	1.52	
3171	M		63.52		16.30	5.59
3174	F	171.01				
3175	F	65.59	0.72			
3177	M	173.40	66.21		35.73	
3178	M	66.31	31.74		362.41	
3184	M	13.20	34.91			
3185	M	217.92	78.14	8.49		
3201	F	17.02	13.92	6.94		
3202	F		38.62			
3203	M		10.34		1.27	4.82
3204	M		72.84	17.69	115.58	32.08
3208	M	15.98	21.94			
3213	M		47.90		71.10	44.68
3217	M		47.83			
3218	M	142.54	110.45	122.42	192.27	14.46
3219	M			134.48		
3220	F		25.74	9.36	5.01	16.47
3222	M		23.92	16.88		
3223	M		162.41			
3224	M	18.18	95.51			
3225	F		44.38	12.11		
3226	M		3501.80			
3227	M	30.73	23.94			
3228	M	12.74	19.71		10.10	20.83
3229	F		1.43	2.08		
3230	M		77.12	20.15	53.92	
3234	M		5.48		46.47	25.29
3235	M	44.04	81.34			
3236	F		46.81	7.09	3.60	9.03
3237	M		21.90		13.90	21.23
3241	F		14.97	1.76	3.56	2.77
3242	F		8.08			
3244	M		41.28			
3281	F			7.49		
3282	M			32.79		
3283	M				11.35	47.44
3285	M		50.21			
3286	M		14.81			
3287	F		13.36	15.71		
3288	F		11.11	25.48		
3298	F			17.96	97.79	

Tortoise	Sex	Year				
		2005	2006	2007	2008	2009
3299	M	276.38	605.57			
3300	M	128.67	10.46	40.95	53.89	46.47
3308	M					184.41
3309	M					51.34
3366	F				88.35	
3401	F				8.11	12.96
3402	M				26.70	19.66
3427	F					18.71
3438	F					17.78
3445	F				7.86	40.02
3447	F				9.16	9.24
3451	F				114.10	50.92
3501	M					11.83
3503	M					126.10
3504	M					70.97
3505	M					16.88
3511	M					25.91
3525	F					4.23
3531	F					19.76
3563	F					16.57
3669	M					73.36
4016	F		26.98	10.95	0.17	1.42
4043	F		10.56	57.94		
4047	M		21.36			
4072	M		36.03	12.54	390.47	2.15
4076	M		23.48			
4088	F		110.95			
4091	F		20.69	17.13	1392.70	46.97
4097	M		98.56	21.90	359.97	
4098	M		131.92			
4100	M		230.35			
4107	F		24.67	0.56	73.67	5.82
4119	F		18.42	49.60	105.37	7.90
4121	M		157.83	125.53	251.05	6.74
4124	M		86.69			
4125	M		18.98	20.73	182.01	3.98
4137	F			16.38		
4141	M		11.86			
4142	M		214.47	12.23	251.48	
4144	M		84.93			
4152	F		10.98	13.88		
4155	M		163.30			
4156	M		14.16			
4163	M		82.63	42.10	88.25	16.06
4165	F		254.89	23.29	17.85	
4169	M		160.83	76.98	2609.03	19.02
4177	M		52.36	21.69	115.30	7.84
4181	M		13.96			
4184	M		35.82			
4185	F		60.54	35.64	71.76	28.82
4186	M		49.75	5.79	65.38	
4195	M		99.41			
4204	M		32.60			
4209	M		42.21	3.63	8.76	
4212	F		64.98	20.53	36.55	
4215	F			17.34		
4222	M		58.99			
4224	M		36.11			
4229	M		122.37			
4237	M			24.83	251.49	
4246	M		283.30	126.81	509.69	99.80
4249	M		20.11			
4251	M		151.78	7.37	226.96	1547.29
4253	M		80.87			
4254	F		51.19	26.86	34.99	
4256	M		58.21			
4261	M		108.78			
4262	M		25.40	7.07	622.79	
4264	M		31.74	61.05	318.20	66.34
4267	M		177.60	10.57		
4276	F		142.12	51.73	118.65	
4277	M		17.18	44.70	279.25	
4278	M		46.44			
4279	M		95.08			
4280	F		21.82	10.10		
4352	F		11.49			
4359	F		45.43	5.68	240.04	
4365	M		16.02	27.56	274.88	
ABD	M	63.93	40.13			
ABR	M	53.73	16.73	24.28	21.86	16.95
ADG	M		357.81	15.68	250.52	465.19
BCI	F		4.28	2.71	13.59	7.06

Appendix 6: Tortoise Mortality

Tortoise #	Date	Easting	Northing	Location	Encounter Notes	Cause of Death
2035	04/21/2009	520774	3876632	Plot 5	Brown residue on plastron under chin (may have come from nose). Appendages and shell intact. When tortoise was flipped right side up, brown liquid poured down left rear leg and from eye/neck region. Transmitter removed.	Unknown-Shell Intact
2041	09/16/2009	511716	3886547	Plot 1.5	Most of carapace torn away (plastron intact), scutes and unidentified internal organ scattered around; head, limbs, and interior gone. Apparent cause of death predation, possibly mountain lion. Transmitter removed by C. Phillips.	Canid
3003	04/06/2009	522471	3864871	Minneola	Transmitter ripped off, shell found nearby, coyote scat nearby. Left marginals chewed-2nd and 4th.	Canid
3007	04/02/2009	509132	3885047	Plot 2	Tortoise dead, most of carapace missing, all bones/tissue gone. Kill looks recent-blood remains on plastron. Transmitter removed.	Canid
3013	05/06/2009	532686	3886415	Ft. Irwin Tortoises	Cracked transmitter found alone. Teeth indentations on exposed casing. Searched area around transmitter and last known location for carcass. No sign found. Presumed canid predation.	Canid
3025	04/06/2009	522696	3866233	Minneola	Shell upside-down. Canine marks 25-26mm apart. Legs broken off, body remains except for head.	Canid
3027	04/06/2009	522931	3866574	Minneola	Transmitter still attached, pelvic girdle intact. Gular and phagial chewed, legbone fragments remain.	Canid
3049	04/08/2009	512112	3881849	East of Plot 3	Found plastron side up. All limbs missing. Transmitter removed. Found 1 km from last known location.	Unknown-Shell Intact
3051	01/08/2009	520381	3876770	Plot 5	All limbs missing. Transmitter batteries showing, antenna broken and	Canid
3058	10/20/2009	553636	3888824	Plot 11	Tortoise looks normal except for sunken eyes. Weight feels normal. No sign of depredation. Transmitter removed by B. Jacobs.	Natural
3059	04/30/2009	507059	3878975	West of Plot 3	Tort found dead, on back. Missing hind legs and head, with no visible bite marks.	Unknown-Shell Intact
3071	10/05/2009	537749	3879498	Plot 8	Found dead in burrow with maggots. Part of gular missing, head detached from body. Scat found in burrow. Shell really brittle with most of inside decomposed. 3rd right costal has dime sized hole.	Unverified
3079	07/15/2009	510513	3883832	Plot 2	Found flipped on carapace, covered in ants. Missing all limbs and alm	Unknown-Shell Intact
3083	04/21/2009	509498	3880761	Plot 3	No sign of predation.	Unknown-Shell Intact
3109	05/14/2009	509078	3880093	Plot 3	Located transmitter, unattached to tortoise. Several cracks in transmi	Unverified
3125	09/24/2009	512776	3879305	North of Plot 4	Found flipped over. All limbs intact. Emptied bowels. Maggots on head/ in eyes.	Unknown-Shell Intact
3132	05/14/2009	513003	3876626	Plot 4	Tim Gowan and Kristin Berry found dead on 14 May 09. Evidence of c	Canid
3151	01/08/2009	518036	3875406	Plot 5	All limbs missing. Transmitter antenna detached from shell, possible canid depredation. Transmitter removed by M. Ring.	Canid
3163	08/26/2009	518171	3876966	Plot 5	Recovered transmitter (Body only, tail of antenna missing). Trace amo	Unknown-Shell Intact
3230	04/07/2009	512635	3886051	Plot 1.5	Tortoise found dead inside burrow. No damage to carapace. Limbs all intact, head missing. B. jacobs removed transmitter.	Unknown-Shell Intact
3237	11/05/2009	517967	3881952	Motherload	Covered in ants. Carapace filled with dirt. Missing head and limbs. Puncture marks on underside of gular and on right pectoral scute. Blood spatters on carapace. Transmitter removed from field. **First found dead by Kristin Berry on 10/30/09.	Unverified
3451	07/01/2009	536941	3879837	Plot 8	Unsure of cause of death. Limbs & head missing. Tortoise may have been found & placed underneath creosote by other trackers. Two eggs inside.	Unverified
3531	08/04/2009	505926	3878048	West of Plot 3	Limbs missing. Shell upside down. Transmitter chewed on.	Canid
4016	04/29/2009	535100	3879055	Plot 8	Tortoise found dead with all limbs and head attached, right-side up. F	Unknown-Shell Intact
4072	05/27/2009	518296	3880954	Motherload	Tortoise overturned on flat, open ground. No visible damage to carapace, but legs and head removed. Transmitter removed.	Unknown-Shell Intact
4107	05/27/2009	535284	3877900	Plot 8	Tortoise intact. Moisture/void still damp beneath tortoise. Eyes gone but no other visible signs of distress.	Unknown-Shell Intact
4163	12/01/2009	519497	3875533	Plot 5	Last known burrow has been dug up and is now a coyote den/burrow with coyote scat at entrance. Tortoise found dead w/ all limbs and head missing, completely cleaned out. Puncture marks and scrapes around limbs. Transmitter removed from field.	Canid
4177	05/13/2009	515585	3885137	Plot 1.5	Tortoise found flipped upside down with canid feces and urine covering body. No other evidence of predation. Body and limbs intact. Photo 0513090823.	Unknown-Shell Intact
4185	09/30/2009	518399	3875587	Plot 5	Probable canid depredation or at least scavenging. Flipped on back.	Canid
4276	04/21/2009	508836	3880198	Plot 3	No sign of predation	Unknown-Shell Intact
4361	04/13/2009	536288	3879155	Plot 8	Found dead, flipped on back. No transmitter. Shell empty but intact. Some kind of fresh scat was on the plastron with similar dried pieces scattered around the shell.	Unknown-Shell Intact
4365	02/03/2009	513950	3884808	Plot 1.5	Tortoise found dead, canid attack suspected. All limbs and head rem	Canid
ADG	06/29/2009	537726	3879590	Plot 8	Found dead. Death attributed to heat stress. All limbs intact, but eyes sunken. Transmitter removed by F. Chen.	Heat Stress
BCI	08/24/2009	542705	3881356	Powerline	Tortoise found dead. Eyes sunken, foaming around mouth, all limbs intact. Recovered two transmitters; original attached by USGS and new duct-taped transmitter attached by Andrew Walde. Cause of death likely due to heat stress.	Heat Stress

Desert Tortoises Surveys and Research in the Southern and Western Expansion Areas of Fort Irwin 2008 Summary Report

by

Andrew D. Walde, A. Peter Woodman, William I. Boarman

ITS Corporation a QinetiQ North America Company

29 January 2008

Introduction

The expansion of the National Training Center, Fort Irwin California was approved on 21 December 2000 when President Clinton signed legislation. Charis Corporation (subsequently acquired by ITS Corp. which was subsequently acquired by QinetiQ Corp.) was tasked to estimate numbers of desert tortoises (*Gopherus agassizii*) on two of the three expansion areas: the Southern Expansion Area (SEA) and the Western Expansion Area (WEA), the latter formerly referred to as the Superior Valley Parcel. Dr. Alice Karl conducted the surveys for Charis Corp. (Karl 2001 and 2002) and the results indicated that a range of 1152 – 1223 desert tortoises likely occurred in the SEA and WEA combined. Karl's estimates were used to develop the Biological Opinion (BO, USFWS 2004) and the Desert Tortoise Translocation Plan (USGS 2005).

As part of the permitting process Fort Irwin agreed to translocate all tortoises found in the SEA and conduct studies to assess the effects on the translocated tortoises, the recipient population, and control population. Based on habitat and land ownership, U.S. Geological Survey (USGS) selected 12 translocation sites south and west of Fort Irwin on which to place tortoises found in the SEA. Three groups were selected to conduct research for the Fort Irwin translocation: USGS-Henderson is assessing the effects of translocation on stress levels, USGS-Moreno Valley is looking at health effects, and ITS is studying other issues related to translocation. Fort Irwin also agreed to translocate all tortoises found in the WEA, but did not need to conduct research on the success of the translocation.

In October 2006, ITS Corp was contracted by the US Army to initiate clearance surveys on the SEA. Clearance surveys on the SEA were completed in Fall 2007 by ITS. In addition to the ITS effort, USGS conducted clearance surveys in Fall 2005 on 10 sq. km when testing the efficacy of dogs versus people at finding desert tortoises. Approximately 550 immature and adult desert tortoises were fitted with radio-transmitters during the ITS and USGS clearance surveys. As much as possible, each tortoise was relocated monthly as required by the BO and Translocation Plan. An additional ~90 juvenile desert tortoises were translocated from the field to the Fort Irwin Study Site (FISS) to await translocation to the translocation area.

In early 2008, ITS was contracted by the US Army to translocate all tortoises on the SEA, propose and conduct research to study effect(s) of translocation on the translocated tortoises, a control population, and recipient population for four years. Funding limitations narrowed the proposed research down to three main research questions: movement, reproduction, and habitat use. In spring 2008, ITS Corp. was also selected to conduct clearance surveys in the WEA.

Methodology

Translocation

Translocation of the desert tortoises involved four steps: preparation, collection, transportation, and release. Preparation involved the task of selecting the location and treatment (if any) of each released tortoise. Release types included: going to one of four research translocation sites, one of three non-research translocation sites, or carried over the fence and then released under a shrub (hard release) or at an artificially constructed burrow (soft release), or in an enclosed pen. The four research sites were labeled 6, 10, 13, and Short Distance. Five-hectare pens were constructed near each of three sites: 6, 10, and 13. The pens were round and the fence was one by two inch wire mesh fencing material. The bottom six inches was toed in to the pen, laid onto the ground and covered with dirt. Translocation occurred during the mornings of April 1 to 18, 2008. Paper and electronic data forms were completed during each step: collection, processing, and release.

Four collection sites were established in the SEA to process tortoises prior to translocation. Approximately five to seven personnel staffed each site. On a daily basis each site received a list of tortoises to be translocated. On the day before translocation fieldworkers would collect the tortoises from the field. At the processing center each tortoise was weighed, measured, health assessed, transmitter changed if necessary, and photographed. Each tortoise was presented with water for a minimum of 30 minutes, most much longer, and after soaking tortoises were removed from their bins and allowed to walk around, forage, and dry off. All tortoises were handled with a new pair of nitrile gloves. All equipment was sterilized in bleach after use with each tortoise. Each tortoise was then placed in a plastic Sterilite container for holding at the processing center and for translocation. If a tortoise voided or defecated in the

container, the animal was rinsed off and the container cleaned before the animal was returned. Each container was washed with bleach and thoroughly dried prior to reuse.

A Bell helicopter was used to transport tortoises from the collection point to the release site. Special metal bins were fabricated so the Sterilite containers fit snugly and would not move during the flight. The bins were attached to the helicopter skids. (for results-longest flight from the far east to Site 6 took 12 minutes).

Tortoises were transported from the landing zones to their actual release point by hand. Tortoises were released approximately 50 m apart, generally in a grid. All tortoises were released into the shade of a shrub or into an artificial burrow. Any tortoises that voided during transport were washed with water prior to release.

Dispersion

After translocation, all translocated, resident, and control tortoises at Sites 6, 10, 13, and Short Distance were relocated a minimum of once per day for the first week, three times per week for two weeks, and twice per week through December 1. After December 1, each tortoise was radio-tracked twice per month. In addition to this structured sampling, numerous tortoises were relocated once per day for several weeks due to the long distances they were traveling daily. At each encounter a paper and electronic data form were completed and data collected included: ID number, time, date, location, burrow number (if applicable), and activity. Each burrow used by a transmittered tortoise was numbered with a pre-stamped numbered tag. Information collected for each burrow included: burrow and tortoise ID number, date, time, length, width, height, exposure, and nearby shrub characteristics.

Reproduction

Each transmittered female tortoise at the four study sites was radiographed every fourteen days between mid-April and mid-July. All tortoises were radiographed within 25 meters of their location with a portable, battery-operated x-ray machine. Actual handling time for each tortoise was less than five minutes. A paper and electronic data form was completed for each encounter recording: Tortoise ID, date, time, and radiograph exposure settings.

Genetics

Samples of red blood cells were collected from almost 1000 desert tortoises to look at genetic variation throughout the SEA and translocation area. The samples were taken from blood collected by USGS-Moreno Valley for health assessments. Analysis was conducted by Dr. Rob Fleisher at the Smithsonian Institution.

Western Expansion Area

In May 2008, clearance surveys were conducted on approximately 20 km^2 in the eastern portion of the WEA. Transects were walked in a north-south direction spaced at 10 meter intervals. Each tortoise that was located was fitted with a Holohil RI-2B transmitter, assigned an identification number, weighed, measured, and health assessed. Paper and electronic data forms were completed and photographs taken. Each transmittered tortoise was relocated once per month.

In October 2008, ITS Corp. continued the clearance surveys for four days before receiving a cease and desist order from the Army. After the stop work order ITS was tasked to verify estimates of density determined by Dr. Alice Karl (2002) in the WEA. For this effort ITS

crews walked clearance surveys but did not process or place transmitters on tortoises that were located.

Results

This past year, 2008, was a very busy and productive year for the Fort Irwin Translocation Project. The year started with the decision to translocate all animals that had tested negative for or were not in the vicinity of a tortoise that tested positive for exposure to *Mycoplasma agassizii or M. testudinae* from the Southern Expansion Area (SEA).

Translocation

The ITS team began translocation from the SEA on 31 March 2008, and moved the last scheduled group of juvenile tortoises on 18 April 2008 (Table 1). Health results were received in early May and 9 additional juvenile animals that were being held at DPW Environmental office were transmittered and released 11 May 2008. All animals translocated to sites 7, 9, and "Fence" were released without transmitters and are not a part of the analysis.

Table 1. Sex/size and location of translocated animals from the SEA at Fort Irwin.

	Sex				
Translocation Site	Male	Female	Immature	Juvenile	Total
6	31	27	16	14	88
7	39				39
9	17		1		18
10	34	25	20	11	90
13	36	25	20	11	92
Fence*	21		2		23
Short Distance	12	10	3		25
Total	190	87	62	36	375

*Translocation Site "Fence" is when an animal was found within 100 meters of the southern boundary fence, it was picked up and moved 100 meters south of the fence.

Dispersion

The ITS team began the research portion of the project with the translocation. Many animals were moved that still needed to have additional health assessments conducted. At the time of translocation many animals of the SEA needed an additional health assessment but health assessments cannot be conducted until May 1. The results of the health assessments were needed by ITS to make decisions as to the future status of each tortoise; if they would remain as research animals or released without transmitters. The results of those health assessments were never received, therefore the ITS team ended up with many more animals than planned to be used in the translocation studies. However, this turned out to be a mixed blessing as there has been quite a bit of mortality, particularly at site 6. A decision was made during the early fall that the ITS team would just utilize all currently monitored animals for their research. As we come into the 2009 season we are currently tracking a well balanced research design with more animals than we had originally proposed to study (Table 2), hopefully this will help to compensate for future attrition of study animals.

Table 2. Total number of live translocated animals at each translocation site as of 1 January 2009 separated by size/sex and research group for the ITS research studies.

Translocation Site	Sex	Study Group			Total
		Control	Resident	Translocated	
6	Male	9	10	19	38
	Female	10	6	13	29
	Immature			9	9
	Juvenile			8	8
10	Male	17	6	21	44
	Female	9	15	25	50
	Immature			20	20
	Juvenile			5	5
13	Male	11	12	22	45
	Female	11	6	24	41
	Immature			19	19
	Juvenile			9	9
Short Distance	Male	12	19	12	43
	Female	7	11	8	26
	Immature		1	2	3
	Total	86	86	216	389

Dispersal distances were calculated for all animals that had complete data over the time period of early April through hibernation. The distance that was calculated is the straight linear distance between their early spring location (~1 April; controls and residents) or translocation release point and their final, winter, location (~15 November). Distances moved for each sex/size category separated by study site and experimental types are presented in Table 3. No data are presented for the animals released in the pens as their movements were restricted. As was expected, the translocated animals moved greater distances than the residents and controls. The most notable difference in the data is the animals released at the short distance translocation

plot have moved much smaller distances. The greatest straight line distance moved by any tortoise during this first year was 23 kilometers.

Table 3. Dispersal distances (straight line) moved by translocated, control, and resident tortoises separated by site and sex. All distances are in meters presented as mean (range).

Experimental Type	Sex	Release Site				
		6	10	13	Average	Short Distance
Hard Release	Male	3528 (84-11649)	2213 (229-7254)	2033 (204-7404)	2613 (84-11649)	619 (116-1473)
	Female	2163 (677-4758)	1611 (289-2931)	1041 (315-2227)	1512 (289-4758)	298 (73-589)
	Immature	1502 (53-9328)	2949 (71-9509)	1349 (58-8833)	2014 (53-9509)	
	Juvenile	140 (15-400)	796 (26-1799)	196 (28-1033)	320 (15-1799)	
Soft Release	Male	4040 (691-12614)	2890 (484-11288)	5640 (163-23002)	4190 (163-23002)	
	Female	2631 (1165-3590)	1217 (554-2297)	3077 (524-8979)	2289 (524-8979)	
Control	Male	1597 (86-5291)	505 (107-1145)	389 (24-808)	612 (24-1145)	337 (41-691)
	Female	195 (177-231)	246 (2-519)	285 (3-799)	251 (37-799)	117 (69-175)
Resident	Male	2757 (107-15239)	256 (98-374)	1281 (24-6850)	1423 (24-6850)	297 (3-654)
	Female	234 (179-320)	1551 (12-13301)	135 (27-313)	934 (27-313)	240 (11-925)

Reproduction

The original study plan included 138 females, however 6 were removed as 2 were salvaged, 1 was lost, and 3 died early on in the study. The study therefore consisted of 132

female tortoises; 36 controls, 38 residents, 42 free-roaming translocatees, and 16 penned translocatees. Each tortoise was x-rayed once every two weeks between mid April and late July. The first gravid females were observed on 19 April (n=2), but the majority of eggs began appearing in larger numbers after 5 May. Second clutches did not begin until the very end of May and first clutches were still being detected until mid to late June.

Tortoises in all study groups developed eggs and some tortoises even laid second and third clutches. There are several early trends, but the differences we found are not likely to be statistically significant. A greater proportion of short-distance (SD) translocatees had first clutches (89 % vs 79 % in the other three sites combined; Table 4). Sites were pretty similar, but more translocatees at site 6 laid no eggs than the other sites (40% vs. 12.5% in other three sites combined). Slightly more control females laid eggs than others (86% vs. 79% of the other three groups combined), but in the proportion of non-penned translocatees that were gravid was surprisingly similar to controls (86%) and residents (82%). Only 69% of penned translocated females developed eggs. Treatment may have had the greatest effect on 2nd clutches: only 6% of penned animals and 14% of non-penned translocatees laid 2nd clutches, whereas 37% of residents and 39% of controls laid 2nd clutches. Clutch sizes were similar for all groups at approximately 3.5 eggs/clutch. The largest clutches were by a resident (n=8) and a control (n=7).

Table 4. Percentage of desert tortoises that had 1 and 2 clutches at the different study sites separated out by research group. Data presented as % (# gravid/total #).

Clutch	Study group	Site 6	Site 10	Site 13	Short Distance	Total
1	Control	77.8 (7/9)	80.0 (8/10)	88.9 (8/9)	100 (8/8)	86.1 (31/36)
	Resident	70.0 (7/10)	75.0 (9/12)	80.0 (4/5)	100 (11/11)	81.6 (31/38)
	Penned	60.0 (3/5)	80.0 (4/5)	66.6 (4/6)	--	68.8 (11/16)
	Translocated	60.0 (6/10)	91.7 (11/12)	81.8 (9/11)	88.9 (8/9)	81.0 (34/42)
2	Control	33.3 (3/9)	30.0 (3/10)	55.6 (5/9)	37.5 (3/8)	38.9 (14/36)
	Resident	20 (2/10)	41.7 (5/12)	33.3 (2/6)	45.5 (5/11)	36.8 (14/38)
	Penned	0.0 (0/5)	20.0 (1/5)	0.0 (0/5)	--	6.3 (1/16)
	Translocated	0.0 (0/10)	16.7 (2/12)	27.3 (3/11)	11.1 (1/9)	14.3 (6/42)

Genetics

Genetic analyses will ultimately be used to evaluate family relationships between hatchlings and adults to determine if translocatees are mating with residents. In preparation for that, we are evaluating the genetic structure of the Fort Irwin tortoise population to determine the amount of variability and presence or absence of genetic subpopulations. Initial non-spatial and spatial analyses have been performed on almost 1000 samples from the SEA, WEA, and translocation area.

The non-spatial genetic analysis did not reveal any subpopulations within the dataset. This could be because there are no subpopulations, or because we lack the resolution to detect them.

The spatial genetic analysis has tentatively revealed 2 subpopulations: A and B. The analysis has not been fine-tuned yet, so it may change, but the preliminary results are presented in Figure 1. The "islands" of higher probability are mostly surrounded by areas with greater ambiguity but the Subpopulation A in the northwest bisects two adjacent Subpopulation B areas. There appears to be a fairly strong break near the middle of the SEA, roughly where Manix Trail enters the SEA (very close to coordinate 530000, 3890000). This map may change a bit – other analyses are ongoing, we just wanted to include here some of the patterns that arose during these initial analyses. The strong break may be an artifact of the settings used in the analysis; modifying these settings in a sensitivity analysis may actually reveal a continuum where individuals are related in an isolation-by-distance pattern (direct relationship between genetic and geographic distance whereby genetically similar individuals occur close together and genetically distant individuals are found far apart).

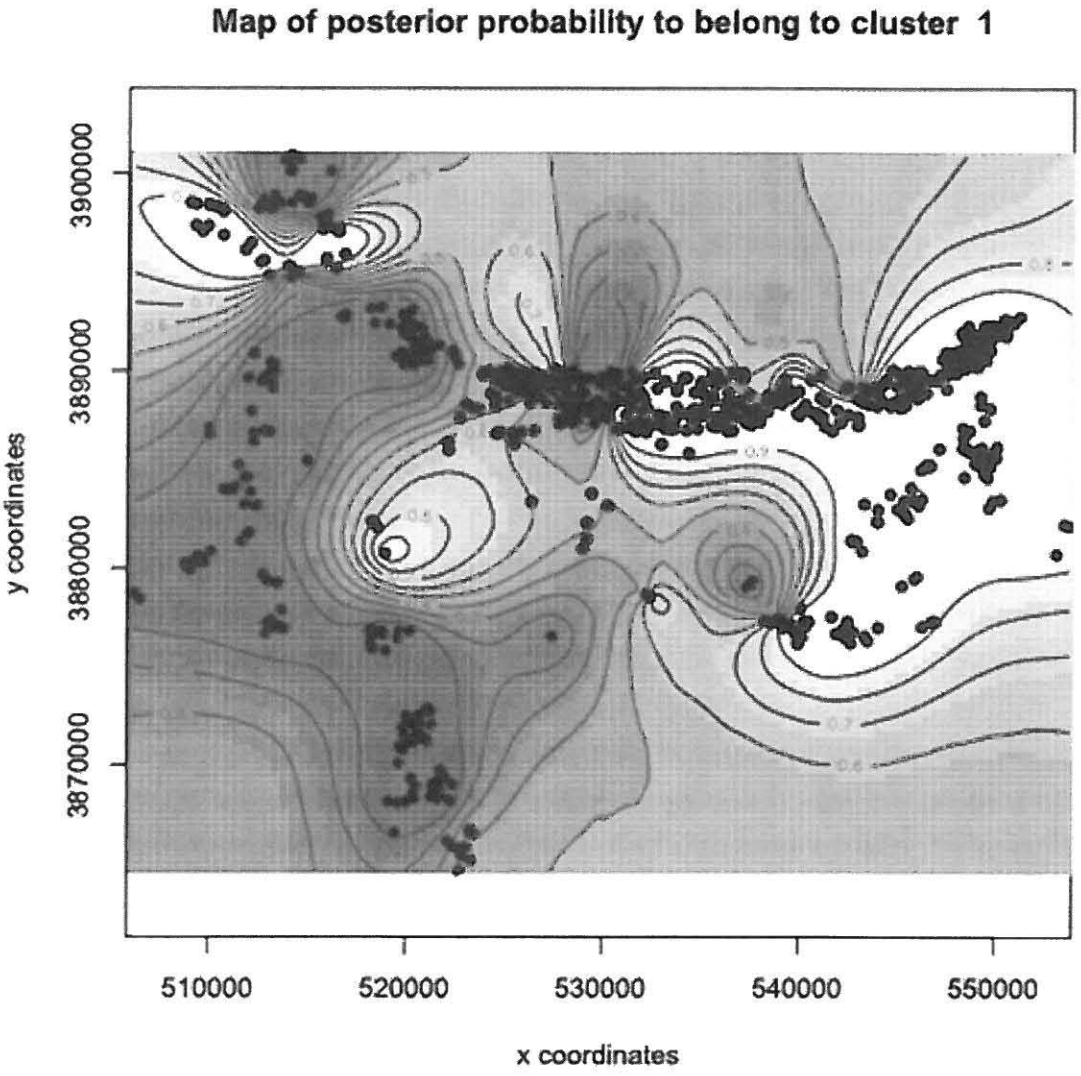


Figure 1. Map of spatial genetic analyses depicting the posterior probability of belonging to genetic cluster 1. Black dots are individually sampled desert tortoises. White indicates a high probability of belonging to Subpopulation A, red indicates a high probablity of belonging to Subpopulation B and the shading depicts varying grades of probablity of belonging to Subpopulations A or B.

Western Expansion Area

In May and October 2008, transmitters were placed on 80 desert tortoises in the WEA. Subsequently three of those tortoises have been found dead so 77 tortoises reside in the WEA with working transmitters. Four juveniles were located and transferred to FISS. Each of the WEA tortoises in the WEA are being tracked monthly. The data for the validation study have been presented in another separate report to the Army.

AVIAN MORTALITIES AT SOLAR FACILITIES

Amedee Brickey

April 14, 2014

Background

- CA/NV Desert – Few facilities prior to 2009
- Solar Development driven by:
  - Financing incentives (Grants, Loans Guarantee, Tax Breaks)
  - State RE Portfolio Standards

Background

- Older Solar Facilities (prior to 2009)
  - Mostly on private land
  - No systematic mortality monitoring
  - No reporting requirements

California RE Action Team

- Renewable Energy Action Team (REAT)
  - Established in 2009
  - Streamline agency review and permitting
- FWS worked with BLM and CEC
  - Require development of ABPP/BBCs
  - Agency review of documents

Project-level Avian Plans

- ABPP/BBCS include:
  - Measures to avoid take during construction
  - Systematic mortality monitoring
  - Reporting requirements
  - Some include adaptive management

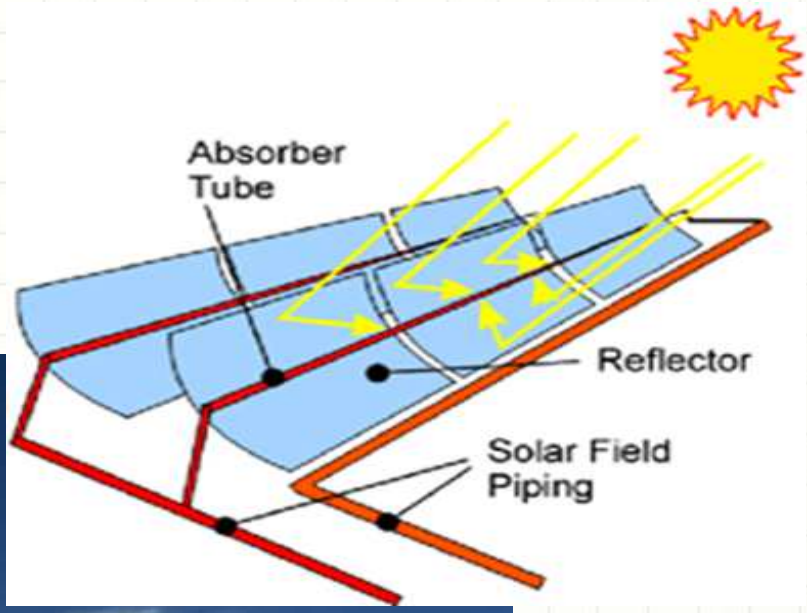
Mortality Information

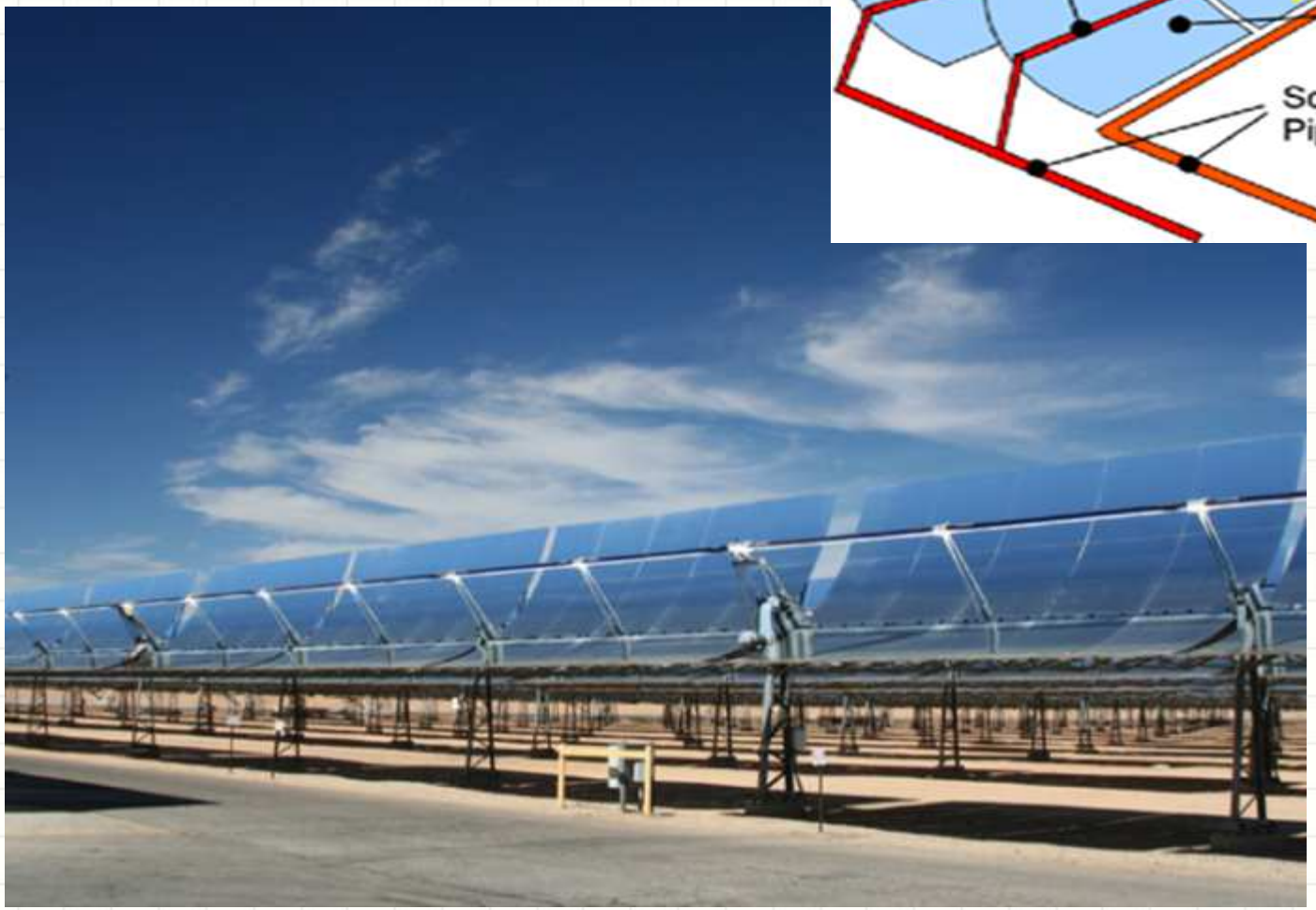
- Database created to track injury and mortality
- Collisions will panels and other project features
  - All 3 solar technology types
  - Wide range of avian species affected

Photovoltaic



Parabolic Trough





Power Tower



Concentrated Solar Flux Effects

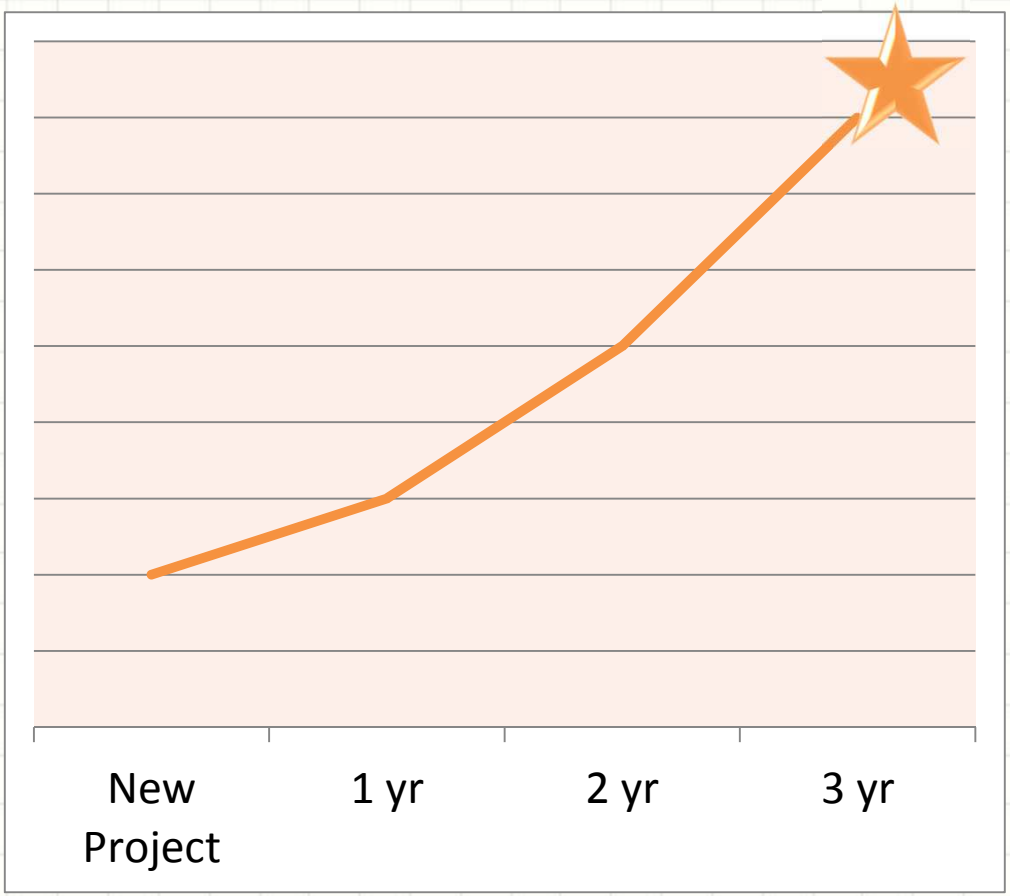
- ISEGS fully operational for less than 6 months
- Incidental reporting (raptors, passerines, humming birds, butterflies, etc.)
- First quarterly report expected in May 2014

Concentrated Solar Flux Effects



Why - Cause and Effect

Our learning curve



It may take 2-3 years to answer some questions

Status

- Meetings with Solar Developers
  - September 2013
    - Discussed avian mortality concerns
  - February 2014
    - Discussed avian mortality data summary
    - Discussed research needs
    - Encouraged developers to get organized and help collect needed information to address avian collisions.

Summary

- Collaboration between industry and agencies will be needed to address the avian mortality issue.
- A framework that includes funding for research, adaptive management, and the eventual development of best management practices.
- Other stakeholders will need to be included.

QUESTIONS?

PROGRESS REPORT FOR 2010

Health Status of Selected Desert Tortoises (*Gopherus agassizii*) in Ft. Irwin's Southern and Western Expansion Areas in 2010 with Recommendations for Future Actions

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January 5, 2011

Abstract. The 2010 data on health for five groups of desert tortoises in Ft. Irwin projects are summarized in this report: 1) 48 tortoises remaining within and near the confines of Ft. Irwin's boundaries in the Southern Expansion Area (SEA); 2) two tortoises in short distance research projects; 3) 12 tortoises living on or associated with Plots 6, 10, and 13; 4) eight resident stress tortoises; and 5) 52 tortoises resident in the Western Expansion Area (WEA). Most tortoises had not been previously evaluated for health. One hundred fourteen different tortoises were serologically tested for *Mycoplasma agassizii* and *M. testudineum* using ELISA tests. Two tortoises were seropositive for *M. testudineum*, one in the short distance research project and one on Plot 10. Three tortoises were suspect for *M. agassizii*; two were in the SEA and one was in the WEA. One tortoise in the WEA was suspect for *M. testudineum*. One unmarked resident tortoise was salvaged from the Irwin/Ft. Irwin road junction after being killed by a vehicle in 2009. Necropsy results indicated high levels of lead and the confirmed presence of herpesvirus. Three tortoises in the Western Expansion Translocation Area with potential health problems were re-evaluated in fall of 2010, and one was salvaged for necropsy. Recommendations are presented for disposition of tortoises currently remaining within or adjacent to the confines of Ft. Irwin's boundaries in the SEA.

INTRODUCTION

During 2010, the tasks for the U.S. Geological Survey's (USGS) health research team changed several times to meet requirements of various government agencies. The most critical task was to prepare tortoises remaining within the confines of Ft. Irwin's boundaries in the Southern Expansion Area (SEA) for translocation, first in fall of 2010, then, as plans changed, in spring of 2011. Another important task was to conduct health evaluations on research tortoises with no prior history of health evaluations, such as tortoises with previously existing radio transmitters in the Western Expansion Area (WEA); some tortoises on or associated with Plots 6, 10, and 13 and in the stress research program in the SEA; tortoises with previous moderate to severe clinical signs of upper respiratory tract disease (URTD) and/or suspect or positive ELISA tests for *Mycoplasma agassizii* or *M. testudineum* in the SEA; and tortoises with other moderate to severe clinical signs of disease in the SEA or Western Expansion Translocation Area (WETA). In addition, a continuing assignment was to report on tortoises salvaged because of death by road kill or ill health or other reasons.

For ease of reporting, this report is separated into six parts: 1) evaluation of tortoises remaining within the confines of Ft. Irwin's boundaries in the SEA; 2) tortoises in short distance research projects; 3) tortoises living on or associated with Plots 6, 10, and 13; 4) tortoises resident in the WEA; 5) eight resident stress tortoises; and 6) results for salvaged and necropsied tortoises.

METHODS

Desert tortoises previously had been fitted with radio transmitters by field workers from ITS/QinetiQ Corporation, the USGS stress research project, and USGS

health research project. The identification numbers, locations, frequencies of the radio transmitters, and other information were provided by ITS/QinetiQ Corporation and the Ft. Irwin office to the U.S. Geological Survey's Health/Research Team. Each tortoise was sought in spring and/or fall of 2010 and a health evaluation was conducted if the tortoise could be found. The health evaluations included unique identification number, size (carapace length at the mid-line in mm, MCL), weight, sex, posture, behavior, activity, recent trauma, and clinical signs of disease (e.g., URTD and cutaneous dyskeratosis) on the eyes, beak, nares, integument, and shell using a standardized seven-page form modified from an appendix in Berry and Christopher (2001). Digital photographs were taken of the eyes, beak, nares, plastron, carapace, and any unusual trauma or lesion.

During health evaluations, samples of blood were drawn primarily from the subcarapacial site, and if unsuccessful, by brachial venipuncture, using standard protocols (Hernandez-Divers et al. 2002, Berry et al. 2006). Samples of blood that were estimated to contain 10% or more of lymph were considered to be suboptimal because of the potential negative impact of dilution (e.g., Gottdenker and Jacobson 1995). Where possible, such samples were repeated with an objective of obtaining 90–100% blood with no lymph or only a trace of lymph (Berry et al. 2005). A nasal lavage was taken using standard protocols (Berry et al. 2006). All blood plasma (90–100% blood) and nasal samples were shipped to the Mycoplasma Laboratory at the University of Florida to determine the presence of antibodies to *Mycoplasma agassizii* or *M. testudineum* using enzyme-linked immunoassay (ELISA) tests developed to include multiple strains of each species (Schumacher et al. 1993; Brown et al. 1994, 2004; Wendland et al. 2007, 2010). The nasal samples were cultured, and when the test was positive, polymerase chain reaction (PCR) was used to amplify the *Mycoplasma* so that it could be identified to species (Brown et al. 2002). Samples retained at the USGS laboratory in Riverside include: red blood cells, lymph samples, and mixed plasma and lymph considered to be of poor quality. As part of the quality assurance and control protocols, the health evaluation data sheets and digital images were compared and changes were made to the data base where necessary.

In 2010 health evaluations were conducted between May 1 and 24 and between September 7 and October 10. Three databases were constructed for the potential SEA translocatees. One database contains the monthly monitoring data and has been included with excel files submitted to the permit holder, Clarence Everly, for the annual permit report to the U.S. Fish and Wildlife Service. The second database summarizes tissue samples obtained and includes data on type of samples obtained (blood plasma, plasma/lymph, and nasal lavage), date of collection, volume of samples, results of ELISA tests for *M. agassizii* and *M. testudineum*. The third database contains the health evaluation data sets and is undergoing quality control. This third database will also become part of the permanent database for the Ft. Irwin project but is not ready for archiving. The databases described above are provided separately to Clarence Everly, the permit holder, and are not included herein.

RESULTS, DISCUSSION, AND RECOMMENDATIONS

SEA Tortoises within or on the Boundaries of Ft. Irwin

Background

The Desert Tortoise Translocation Project at the National Training Center (NTC), Ft. Irwin, was initiated in 2005 in the SEA (Esque et al. 2005) with sampling of potential translocatees, resident tortoises, and control tortoises for health status. In spring of 2008, several hundred tortoises were translocated from within the boundaries of Ft. Irwin to study plots. After spring translocation in 2008, an estimated 96 tortoises still remained within Ft. Irwin boundaries and needed to be translocated, removed, or the disposition determined. Of the 96, 24 had received health evaluations in 2006 and 2007. The 96 tortoises had not been translocated for one or more reasons: 1) they were missing and could not be located; 2) the transmitters had become detached and the tortoises were lost; 3) the tortoises had tested suspect or positive with ELISA tests for either or both of the pathogens (*Mycoplasma agassizii*, *M. testudineum*) that cause URTD; 4) the tortoises had one or more moderate to severe clinical signs of URTD; and/or 5) the tortoises had not previously been evaluated for health status.

2010 Data

The objectives of the health research team for this part of the SEA were to provide sufficient information for determining if each tortoise was suitable for translocation in fall of 2010 or spring of 2011. Thus we conducted health evaluations in spring of 2010 on all tortoises remaining within Ft. Irwin boundaries that could be located, including recently discovered tortoises that had not received health evaluations. We also re-evaluated each tortoise with suspect or positive ELISA tests for *Mycoplasma* spp. and re-evaluated each tortoise with significant clinical signs of URTD. Several tortoises were missing (Table 1) and might still be alive and in the area. One tortoise, 4232, was missing and then located again in late October, too late for a health evaluation. Tortoise 4232 was the "fence gap" tortoise described in the previous year's report (Berry and Gowan 2010).

Forty-eight tortoises within the confines of Ft. Irwin or along the boundaries were evaluated for health (Table 2; Figures 1a, 1b). Two tortoises, 4066 and 4676, were ELISA suspect for *M. agassizii* in spring; tortoise 4066 was negative in fall and 4676 was not re-tested. No tortoises were ELISA suspect or positive for *M. testudineum*.

Health Status of Tortoises Monitored Regularly by the USGS Team

The USGS Health Team has attempted to monitor several tortoises on a regular basis since Fall of 2007. The current status is two dead, eight alive, and six missing (Table 3). In 2010, the Health Team continued to monitor eight tortoises (Table 1). One of these tortoises, 4232 has had a history of being intermittently missing. It was located in August and September 2009, disappeared again in October of 2009, was missing for most

of 2010, but was re-located in October of 2010 with a different radio frequency than on the official list. Five tortoises previously reported as missing include 4483, 4560, 4144, 4289, and 4616. An additional tortoise, 4525, has been missing since March 2010. The six missing tortoises and the one recently re-discovered tortoise were not evaluated in 2010.

The 2010 data on laboratory tests and clinical signs of disease are shown in Table 2 for seven of the eight live tortoises. Two tortoises (3111 [Plot 1.5/WEA] and 3405) are not of concern for translocation spring of 2011, because of their locations. None of the tortoises (in Table 2) sampled in 2010 had suspect or positive lab tests for mycoplasmosis. None of the SEA tortoises potentially scheduled for translocation in spring of 2011 had signs of a purulent nasal discharge or discharge typically associated with URTD.

General Findings about Health Evaluations of Tortoises in the SEA

Most tortoises that the USGS Health team has evaluated for the Ft. Irwin project since 2005 have had one or more clinical signs of URTD (mild edema of palpebrae, mild crusts on the palpebrae). These clinical signs have been mild and probably fall within normal limits of healthy tortoises. Of more interest and concern are tortoises with moderate to severe clinical signs of the ocular and nasal area. For the ocular area, these signs include mucoid drainage from the eyes (when dried, manifested as crusts), inflammation of the conjunctiva, eyes that are closed or nearly closed, and accompanied by other moderate to severe ocular signs. For the beak and nares, clinical signs of concern are those with moisture in or on the beak caused by drainage from the nares, discharge (especially purulent) from the nares, and nares occluded by a wet or dried discharge. Tortoises with signs of a nasal discharge are more likely to have mycoplasmosis, herpes virus infections, or another infectious disease than tortoises without these clinical signs. The probability of a tortoise have an infectious disease is less clear for moderate to severe ocular signs of disease.

Since a tortoise with mycoplasmosis may have a nasal discharge intermittently (Jacobson et al. 1995), we rely on such signs as occluded or partially occluded nares, embedded mucus and dirt on the beak and around the nares, and eroded nares with peeling scales. These clinical signs provide an indication of a nasal discharge. Several tortoises had partially occluded nares and embedded dirt and/or mucus on the beak and face. Interpretation of the cause(s) of the occluded nares was complicated in spring of 2010 by plant material from foraging. Many tortoises had green stains on the beak and remnants of sticky plant sap and plant parts on the beak. For some tortoises, the nares were partially occluded; the source of occlusion may have been plant sap or food but was not clear. When these tortoises were examined in later, in fall, they had no signs of purulent nasal discharges.

Recommendations for Tortoises Remaining Within the Confines of Ft. Irwin Boundaries

The following recommendations are for the disposition of tortoises, regardless of whether alive and locations are known or whether missing. These recommendations are made with caveats: each tortoise should be examined for clinical signs of health and disease prior to translocation in spring of 2011, a health form should be completed, and digital photographs should be taken. Special attention should be given to the presence of mold or fungus (because of wet soils and the wet winter), shell disease or other diseases of the integument, and signs of URTD. That status may have changed from 2010 to early 2011.

1. In the report for 2009 (Berry 2009), I noted that several SEA tortoises had not been sampled for health status since 2006 or 2007. This list has been updated with the 2010 data (Table 1). In addition to the tortoises listed in Table 1, the following are missing tortoises: 2006, 4012, 4352, 4394, 4395, 4397, 4406, 4437, 4600, 4670, and 4736. The missing tortoises listed in Table 1 and in this paragraph have not received a 2010 health evaluation. If they are found, they should be evaluated and tested before being translocated.

2. Tortoises 2519, 2244, and 3405 are often located outside the boundaries of Ft. Irwin (see Figure 1) and thus are not candidates for translocation based on location alone. In October 2009, tortoise 2244 had an unusual clinical sign during the health evaluation: a dried brown drainage from the left side of the mouth sufficient to stain the beak, mandible, and integument ventrally. In 2010, tortoise 2244 did not have the brown drainage; mild to moderate ocular signs of URTD were apparent, including a wet discharge from both eyes, mild to moderate edema of palpebrae and upper periocular area of both eyes, crusts on palpebrae and lower periocular areas, and significant closure of the left eye. No signs of a purulent discharge were apparent. The health status of this tortoise should continue to be monitored, and the oral cavity should be evaluated periodically for signs of herpesvirus lesions and plaques. In 2010, clinical signs of URTD for tortoise 3405 included crusts, edema, and wet discharge associated with both eyes. In 2010, clinical signs of URTD for tortoise 2519 included moderate edema associated with both eyes, but no other signs. These three tortoises were seronegative for *M. agassizii* and *M. testudineum.*

3. Tortoise 3111 is on the boundary of Plot 1.5 and the Western Expansion Area (WEA) and, in December 2009, was 100 m into the WEA. In 2010, this tortoise tested ELISA negative for *M. agassizii* and *M. testudineum.* However, it has three prior seasons of positive and suspect tests for *M. agassizii,* as well as some mild clinical signs of URTD (but no nasal discharge). It is not a suitable candidate for translocation, but will not be considered for translocation until the translocation of WEA tortoises occurs.

4. Tortoise 4232, should not be translocated in 2011 until it is evaluated for health. Tortoise 4232 was last evaluated for health in fall of 2008; it was missing in spring of 2009, found and monitored briefly during summer of 2009, and disappeared again prior to the fall health evaluation in 2009. Tortoise 4232 was missing for most of 2010, but has recently been located. The most recent health evaluation occurred in fall of 2008, at which time the tortoise had a wet glob (4 to 6 mm in diameter) of whitish-yellow mucus

on the gular horn, apparently from the nares. Other clinical signs of URTD were also present.

10. In 2010, tortoise 4676 had a suspect ELISA test for *M. agassizii* and a negative ELISA test for *M. testudineum*. This tortoise needs to be re-evaluated and re-tested prior to translocation.

11. Tortoises with moderate to severe clinical signs of disease and trauma may merit additional monitoring and tracking. The tortoises listed below are noted in Table 2 for continued monitoring and possible salvage:

a. trauma: 2453, 4066, 4088, 4256
b. clinical signs of URTD: 4374, 4748
c. severe lesions (disease) of integument: 4521

12. There still is confusion about which group is tracking which tortoise for some tortoises remaining within the boundaries of Ft. Irwin (Table 1 and 3). Fewer tortoises may be missing than those listed in Table 1 and in Recommendation 1 above. This topic is best resolved by Ft. Irwin personnel, working with the research teams.

Tortoises in the Short Distance Translocation Project

Two adult male tortoises, 2625 and 4759, were evaluated and tested in May of 2010 (Figure 2). Male 2625 had a high positive titer (≥256) for *M. testudineum* antibodies. Clinical signs of mycoplasmosis included: nares rimed with dried and moist discharge; potentially constricted nares; embedded dirt and/or plant material on the beak and around the nares; moderate swelling of the palpebrae; wet and watery globe; wet and dry ocular discharge; and moderate yellowish crusts on palpebrae and periocular areas. Both eyes were about 60% open. Based on the location and condition of this tortoise, it should be salvaged.

Although male 4759 had negative ELISA tests for mycoplasmosis, numerous clinical signs suggestive of disease were evident. The signs included a very dry appearing and flaky integument on the carapace and potential cutaneous dyskeratosis on parts of the forelegs; moderately occluded right nare and beak with embedded light-colored, powdery material; moderate edema of the upper periocular area and mild to moderate edema of the palpebrae; moderate to severe discharge, mucus, and crusts on the periocular area in the left eye and moderate in the right eye; moderate crusts on palpebrae; peeling scales on the periocular area; and conjunctiva 5% exposed on the left eye.

Recommendation:

Based on location and condition of tortoise 2625, it should be salvaged for necropsy.

Tortoises on Plots 6, 10, and 13 in the SEA

Identification numbers and locations of 12 male tortoises were provided for sampling in spring of 2010. Although other tortoises with radio transmitters were on these plots and the tortoises had not been evaluated for health previously, the ITS/Qinetique and USGS Stress research teams did not provide identities and locations because of the nature of the research programs and the desire that their tortoises not be handled by the Health Team.

With one exception, the 12 tortoises from Plots 6 (4 tortoises), 10 (6 tortoises), and 13 (2 tortoises) were evaluated in spring. The exception was tortoise 3184, which was evaluated in both spring and fall. Of the 12, one tortoise (3593) from Plot 10 was seropositive for *M. testudineum* (Fig. 2). All other tortoises were negative for both *M. agassizii* and *M. testudineum*. Tortoise 3593 has severe ocular signs of URTD, including the following: moderate edema of the upper palpebrae and severe edema of the lower palpebrae; mild to moderate edema of the periocular area; mild to moderate crusts, moisture, mucus, and discharge with moderate crusts on the lower periocular area; moderate to severe peeling of scales on the upper and lower periocular areas, especially of right eye; nares open and with signs of erosion and peeling scales, embedded material on beak; and eyes 30% open. This tortoise should be salvaged for necropsy. Other tortoises from Plot 10 also had similar ocular signs but not quite as numerous or severe as 3593. On Plot 13, tortoise 4080 also had numerous severe ocular signs (moderate to severe edema of palpebrae and periocular areas with discharge and crusts); the eyelids and periocular areas were so swollen that the eyes were 30% open. Tortoises on Plot 6 also had numerous ocular signs, but few of the severity observed on Plots 10 and 13. Some tortoises had evidence of cutaneous dyskeratosis on the forelegs and shell.

Recommendation:

Tortoise 3593 should be salvaged for necropsy.

USGS Stress Tortoises

The Health Team evaluated eight tortoises in the stress research program but did not have samples of plasma to send to the University of Florida for testing for *M. agassizii* and *M. testudineum*. All eight tortoises are located to the east northeast of the Minneola off ramp and are close to I-15 (Figure 2). All eight tortoises had one or more clinical signs of disease, particularly mild to severe ocular signs (mild to moderate edema of the palpebrae and periocular area accompanied by mild to moderate wet and dry crusts and discharge; peeling of scales from the periocular area; mild to moderate mucus on the globe, fornix or lids). Tortoise 3804 was of concern: dried blood was evident between scales of the left periocular area and on the forelimbs. The beaks of most tortoises were embedded with dirt and/or a combination of dirt and mucus. Nares were mildly occluded or with flaking skin or scales on a few. One nare of tortoise 3819 was >50% occluded with discolored brown material, potentially dried blood and mucus. Three tortoises (3800, 3806, 3819) had previous, partially healed damage to the gular horn and other areas from

gnawing and chewing by predators. Most tortoises had signs of cutaneous dyskeratosis with ringing of scales on the forelimbs.

Recommendation:

Plasma samples should be sent to the Mycoplasma Laboratory for ELISA testing.

WEA Tortoises

The Health Team evaluated 51 tortoises that had not been previously evaluated for health, and tortoise 3111 that has moved from SEA Plot 1.5 in and out of the WEA (Figure 3). One female tortoise, 5130, was suspect for *M. testudineum* with the ELISA test. Another female tortoise, 5252, was suspect for *M. agassizii*. The rest of the tortoises had negative ELISA tests for both *M. testudineum* and *M. agassizii*. Female 5130 had moderate edema of the lower palpebrae and periocular areas of both eyes, moderate crusts, eyes that were partially open (10-15%) apparently due to edema, a yellowish dried discharge on lids and periocular area, and healed trauma from a predator attack to the gular and other parts of the carapace. Female 5252 had mild to moderate edema of the lower palpebrae and periocular areas with a moderate to severe drainage and mucus in the right eye; she also had evidence of active cutaneous dyskeratosis on the plastron.

WETA Tortoises

Three tortoises, first evaluated in fall 2009, were sought in fall of 2010. During a review of the health evaluations for WETA tortoises evaluated in 2009 (Berry et al. 2010), the Health Team identified three tortoises with clinical signs of sufficient interest and severity for follow-up visits. Although none of the tortoises had been fitted with radio transmitters, they were found quickly. The tortoises were female 7277 (eye lesion, possibly a periorbital abscess as per Dr. Elliott Jacobson), young male 7279 (ocular signs), and female 7280 (peeling and shedding carapacial scutes). For female 7277, clinical signs evident in fall of 2009 were no longer present in October of 2010; she had mild to moderate edema of the palpebrae and periocular area, mild crusts, and dried discharge with mildly peeling scales of the periocular area of the left eye. No action was taken on this tortoise. Male 7279 may have a problem with the right eye, holds the head to the right, and appears to use the left eye for observation. Both eyes have moderate edema of the lower palpebrae and exposed conjunctiva (40% in the right eye, 10% in the left). The conjunctiva in the right eye appeared abnormal, did not change position, and appeared to be thick and fleshy with an uneven and textured surface. The right eye was 40% closed. The tortoise had recent chewing injuries to the plastron. No action was taken on male 7279. Tortoise 7280 had areas with detached and loose scutes on the carapace. In the year since the tortoise was first evaluated for health in fall of 2009, more scutes had become detached. By fall of 2010, >50% of the vertebral and costal scutes had been shed or were loose. This tortoise was salvaged for necropsy (see below).

Necropsies

A report is now available for two tortoises salvaged for necropsy in fall of 2009: a road kill from Ft. Irwin, and a Daggett tortoise in the epidemiology program (Jacobson and Berry 2010). The report was submitted to Clarence Everly in December 2010. The former tortoise (road kill) is of importance for future planning. This large adult male tortoise was salvaged during death from the junction of the Irwin and the Ft. Irwin roads. Notable findings were the high content of lead in scute, bone, and other organs. DNA extracted from a swab specimen of the tongue was tested by PCR for presence of herpesvirus using primers that amplify sequences of the herpesvirus genome. The amplification product was homologous to a herpesvirus previously reported in a captive desert tortoise, thus confirming the first evidence of herpesvirus DNA in a free-ranging tortoise. Christopher et al. (2003) reported that ill wild tortoises from the eastern Mojave Desert were observed to have oral lesions typical of herpesvirus, but confirmatory testing was not conducted at that time. This new finding is very important.

Results of laboratory and toxicology testing and histology are not yet available for tortoise 7280, which was salvaged in October 2010. The gross necropsy indicated that the tortoise was moderately anemic, had a small liver and a nodule in the liver. The amount of fat was good.

Recommendation:

The Health Team recommends that swabs of the tongue of desert tortoises should be routinely collected and tested by PCR for herpesvirus infection. There are numerous cases where this recommendation should be applied, including translocation projects.

Acknowledgements: Dr. Mary Brown and Dr. Lori Wendland of the University of Florida are collaborators on this project. They provided valuable advice on interpretations and will be co-authors on any future publications for the open literature. Dr. Elliott Jacobson, also of the University of Florida at Gainesville, is the pathologist. For tracking, monitoring, and conducting health evaluations of tortoises, we thank Tim Gowan, Nate Newman, Marcella Waggoner, Ashley Emerson, Kemp Anderson, Kevin Lucas, Rafe McGuire, Sally Boisvert, Cynthia Furman, Tonya Rasmussen, Trevor Ose, Sara Hanner, John Boswell, Ben Kirkpatrick, Chris Hatton, John Hillman, and Brenda Hanley. Todd Esque coordinated fieldwork with USGS scientists at the Las Vegas Field Station. Thanks are due to S. Jones for review and to C. Everly for assistance advice. The National Training Center, Ft. Irwin, provided financial support.

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Table 1. Dead and missing tortoises within or adjacent to the boundaries of the National Training Center, Fort Irwin, in 2010. This list is incomplete. Please see text.

Tort ID	Status	2010 Status	Notes from Clarence Everly
31	Lost	not found	no data; lost Mar 07
3311	Lost	not found	no data; lost Sept 2007; no fences at this time
3318	Lost	not found	no data; lost Sept 2007; no fences at this time
3453	Dead	none	dead between Oct 2008 and Apr 2009
4076	Lost	not found	no data; lost Aug 2008
4144	Lost	not found	missing since May 2009
4203	Lost xmtr	not found	no data; found transmitter only
4227	Dead	none	
4289	Lost	not found	missing since Nov 2009
4349	Lost	not found	no data; lost Apr 2009
4353	Lost	not found	no data; lost Feb 2009
4371	Lost	not found	no data; lost Mar 2008
4382	Lost	not found	no data; lost Sept 2007
4385	Lost	not found	no data; lost Jul 2008
4425	Lost xmtr	not found	no data; lost transmitter Apr 2008
4427	Dead	none	dead, May 2010
4430	Lost	not found	no data; lost Nov 2009
4483	Lost	not found	missing since Oct 2008
4516	Lost	not found	no data; lost Mar 2009
4525	Lost	not found	no data; lost Mar 2010
4527	Lost	not found	no data; lost Mar 2008
4560	Lost	not found	no data, lost May 2008, detached radio found
4571	Lost	not found	no data; lost Oct 2007
4616	Lost	not found	missing since July 2009
4659	Lost	not found	no data; lost Feb 2008
4662	Lost	not found	no data; lost Sept 2009
4687	Lost	not found	no data; lost Feb 2008
4724	Dead	none	dead Oct 2009
4105	?	none	no data
4211	?	none	no data; USGS health team couldn't find May 2010
4259	?	none	no data; USGS health team couldn't find May 2010
4268	?	none	no data; USGS health team couldn't find May 2010
4467	?	none	no data; USGS health team couldn't find May 2010
4519	?	none	no data; USGS health team couldn't find May 2010

Table 2. Clinical signs of disease for tortoises within and adjacent to the National Training Center (NTC) boundaries of Ft. Irwin in 2010. The table includes tortoises 2519, 3405, and 3111 which were outside the boundaries of the NTC. Tortoise 3111 was within the WEA during 2010, but frequently can be found on Plot 1.5 in the SEA. Tortoise 4232 was missing throughout most of 2010 and was located too late in the year to sample.

Tort ID	Status & PI 2010	2010 Sample date ddmmmyyyy	2010 ELISA results: *Ma/Mt*	Clinical signs noted in 2010.
35 M Ad		14-May-10	neg/neg	Nares open; staining of integument around nares from food, soil or other. Both eyes: mild/moderate edema of palpebrae and mild/moderate crusts on palpebrae and periocular area; moderate wet and dry mucus; peeling of scales in periocular area. Conjuctiva exposed ~5% in R eye. Ringing of scales on forelegs.
2244 M Ad	USGS-health	18-May-10	neg/neg	White rime or embedded white material within and on edges of nares (not occluding nares). Both eyes: mild/moderate edema of palpebrae; wet and dry mucus and discharge with moderate crusts on lids and periocular area; L eye 30% closed and with eye appearing sunken. A very dirty face. Ringing of scales on forelegs.
2519 M Ad		15-May-10	neg/neg	R and L nares mildly occluded (white deposits and possibly flakes of skin) and area around nares with white deposits, embedded in integument; mild/mod edema of palpebrae and mild edema of periocular area, discoloration of scales on upper periocular area; mucus (mild) in fornix of R eye. White deposits at fornix of both eyes. Sclera inflamed in L eye. Active CD on forelegs.
2543 M Ad		15-May-10	neg/neg	Mod edema of palpebrae both eyes; mild/mod crusts on lids and periocular area, both eyes; dried ocular discharge (white deposits); several mm mucus on L eye near fornix; Conjunctiva 25% exposed in R eye, R eye 50% open. Dirt and/or plant sap on beak with white deposits embedded near and around nares. SEVERE TRAUMA (not healed) in limited area of humeral and pleural scute junction: necrotic tissue? **Should track and monitor, at minimum.**
2543 M Ad		8-Sep-10	neg/neg	Some staining on forelegs from eye/chin/wipes. Nares open, R eye with mild edema of palpebrae, mild wet and cry crusts and discharge on palpebrae and lower periocular area, and 5-10% conjunctiva exposed. L eye: mild edema of palpebrae, mild crusts on palpebrae and lower periocular area (wet and dry). Peeling of scales on upper periocular area of both eyes. SEVERE TRAUMA (not healed) in limited area of humeral and pleural scute junction: necrotic tissue? K **Berry wants to track after translocated.**

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Table 2, continued.

Tort ID	Status & PI 2010	2010 Sample date ddmmmyyyy	2010 ELISA results: *Ma/Mt*	Clinical signs noted in 2010.
2570 M Ad		14-May-10	neg/neg	Nares mildly occluded with dirt/plant sap/deposits; erosion between nares. Mild edema of L palpebrae and mild/mod edema of R palpebrae and upper periocular area; mild peeling of scales on periocular area; 5% of conjuctiva exposed. Deposits embedded in integument of beak. Cutaneous dyskeratosis on plastron and forelegs.
3111 M Ad	USGS/Health; WEA/SEA	3-May-10	neg/neg	Nares mildly occluded with plant sap. Mild edema and crusts on upper and lower palpebrae and perioculars of both eyes. Eyes have wet discharge and conjunctiva is visible in both. Cutaneous dyskeratosis on plastron and forelegs. Severe old healed trauma to gular, humeral scutes and four marginal scutes.
3186 M Ad		8-Sep-10	neg/neg	R nare mildly, partially occluded with whitish staining surrounding nares. Both eyes: mild edema of palpebrae with crusts and discharge (mild) and peeling scales on periocular area. Conjunctiva 5% exposed, eyes 5% closed. Healing trauma to scales of R foreleg. Mild cutaneous dyskeratosis at midline of plastron; scales of forelegs ringed.
3405 M Ad	USGS-health	17-May-10	neg/neg	Mild discoloration, edema and crusts on upper and lower palpebrae and perioculars of both eyes. Dried discharge from both eyes. Beak and nares have dried white exudate. Cutaneous dyskeratosis on plastron and forelegs. Healed trauma to gular, some old healed chips on carapace, and a few damaged scales on limbs.
4003 M Ad		17-May-10	neg/neg	Beak and face very dirty with plant sap and deposits; nares mildly occluded (cobwebs, whitish deposits) and some erosion. Moderate to severe discharge from eyes; R eye with mild/mod edema of palpebrae, crusts moderate on periocular area; mild peeling of scales on periocular area. Conjunctiva exposed 25% on R eye and 15% on L eye. L eye 80% closed.
4066 M Subad		18-May-10	suspect/neg	Nares mildly occluded with plant sap/dirt/mucus (?). Beak dirty from foraging; embedded material in integument. Moderate edema of left palpebrae and periocular area; R eye inflamed and may have lesions on the sclera or mucus bubbles, appears cloudy; mild to moderate edema of R palpebra and upper periocular area. Previously attacked by carnivore (chewed gular, ant. carapace, ant plastron) but not healed. Integument on forelegs shows moderate signs of cutaneous dyskeratosis. RETEST. Don't translocate.

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Table 2, continued.

Tort ID	Status & PI 2010	2010 Sample date ddmmmyyyy	2010 ELISA results: *Ma/Mt*	Clinical signs noted in 2010.
4066 M Subad		9-Sep-10	neg/neg	Nares open, normal. Both eyes: palpebrae and periocular area mildly discolored from peeling scales and crusts; mild edema, wet and dried crusts, and discharge associated with globe and palpebrae; conjunctiva 5% exposed. Tortoise healing from multiple old wounds of predator attack, **potential areas of blacked or dark necrotic tissue. Size and previous trauma are likely to make this tortoise less likely to survive translocation.**
4071 imm		16-May-10	neg/neg	Nares moderately occluded with combination of dirt/cobwebs/plant sap and potentially mucus. Thick layer/lip of plant material on beak. Mod edema of palpebrae and none to mild of periocular area; mod crusting on palpebrae and periocular area with deposits. Ocular discharge with mucus in L eye. Eyes 80% open. Conjunctiva 5% exposed in L eye. Rapidly growing young tortoise with evidence of CD on forelegs.
4088 F Ad		17-May-10	neg/neg	Clean nares. L eye; mod to severe edema of palpebrae, also mod edema of upper periocular area, eye 80% closed due to edema; mucus in fornix. R eye: mod edema of palpebrae, eye 30% closed. Both eyes: mod peeling of scales on periocular area. **Trauma on gular, potentially necrotic areas.**
4100 M Ad		17-May-10	neg/neg	**L nare mildly occluded with unknown material.** Mild deposits on beak, face. Mod edema of palpebrae, mod edema of upper periocular area; mild crusts on palpebrae, mod on periocular area, peeling of scales on periocular area. Mild drainage from L eye. Conjunctiva exposed 10% of R eye and 5% on L eye.
4100 M Ad		9-Sep-10	neg/neg	Faint foraging stains; mil dirt on beak and R nare. Mild edema and crusts on palpebrae of both eyes; mild edema of lower periocular area and mild/mod crusts of periocular area of both eyes; mildly peeling scales of upper periocular of both eyes. Eyes 5% closed, conjunctiva 15% exposed. Mild healed trauma to limbs, gular, and plastron.
4145 F Ad		19-May-10	neg/neg	L nare mod occluded with dirt or other materials; white deposits embedded in integument around nares. Both eyes have mild crusts and mild/mod peeling scales on periocular area. Conjunctiva exposed 5% on R eye. L eye open 15-20%. CD on forelegs.
4145 F Ad		10-Sep-10	vial cracked; sample lost	Mild swelling of chin glands. Mild greenish stains on beak; mild discoloration of lower palpebra R eye and palpebrae of L eye. Mild/mod edema of palpebrae and periocular area of both eyes; peeling scales (mild) on periocular area of both eyes. Eyes 15% closed. Mild to moderate trauma (healed) on limbs gular horn, carapace and plastron. Cutaneous dyskeratosis on forelegs.

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Table 2, continued.

Tort ID	Status & PI 2010	2010 Sample date ddmmmyyyy	2010 ELISA results: *Ma/Mt*	Clinical signs noted in 2010.
4147 F Ad		19-May-10	neg/neg	Nares open, mild, limited white deposits embedded in integument on beak. Mild/mod edema of palpebrae; mod discharge from both eyes; severe wet and dry crusts of mucus and dirt on palpebrae and extending onto periocular area; mild peeling of scales on periocular area of both eyes; mucus present in both eyes.
4181 M Ad		15-May-10	neg/neg	Nares open, scales peeling and eroding ventrally; beak dirty. L eye: mild edema of lower palpebra, dried mucus on both lids, conjunctiva exposed 5%, peeling of scales on lower periocular area. R eye: mod. edema of lower palpebrae, wet/dry mucus on lids, conjunctiva exposed 15%, eye wet with drainage onto lower periocular area and lids, peeling scales on both upper and lower periocular area; eye 25% closed due to edema. Severe lesions on plastron (pleural and abdominal scutes).
4190 imm		19-May-10	neg/neg	Nares open; scales peeling and cracking around nares; beak and area around nares and mouth are dirty with dried and embedded materials. Mild to mod. edema of palpebrae and upper periocular area of both eyes, also lower periocular area of L eye, mod. peeling of periocular area; Wet/dried mucus and crusts present in fornix and on lids. Young and rapidly growing tortoise.
4191 M Ad		18-May-10	neg/neg	Nares open, beak embedded with dirt; face very dirty; thick white deposits. R and L eyes: mild/mod edema of palpebrae, mild edema of upper periocular area; mild/mod crusts and sand on palpebrae with mucus in fornix of L eye and in posterior part of R eye. Mild peeling of scales on periocular area. Conjunctiva exposed 10% on R eye and 15% on L eye.
4201 unk		13-May-10	neg/neg	Nares open, beak dirty with scales peeling around nares; face dirty but not severely so. L eye: mild to mod edema of palpebrae; both eyes have mild wet and dry crusts and peeling scales on periocular area. CD on forelegs; a growing juvenile.
4214 M Ad		13-May-10	neg/neg	Face moderately to severely dirty with plant sap/dirt and possible mucus; nares open, beige/sandy rime or deposits adjacent. Both eyes: mild to mod edema of palpebrae and mild edema of lower periocular area. Mild crusts on palpebrae and periocular area with moderate peeling of scales. Conjunctiva exposed 5% in both eyes.
4217 M Ad	USGS Health	10-Aug-10	ng/neg	Beak: dried dark colored stains on beak; palpebrae and periocular area mildly discovered, mild edema of palpebrae in R eye and L lower palpebrae, crusts on R upper palpebrae and L periocular area; mildly peeling scales in periocular area with mildly sunken eyes. Cutaneous dyskeratosis (mild) on forelimbs, carapace and plastron.
4231 M Ad		24-May-10	neg/neg	Nares open with peeling scales adjacent. Very dirty, matted face with embedded dirt, plant matter, and white deposits. L and R eyes: mild edema of lower palpebrae and periocular area, peeling scales on upper and lower periocular area, mild mucus (wet/dried) on palpebrae and globe; conjunctiva 10% exposed in L eye and 20% in R eye.

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Tort ID	Status & PI 2010	2010 Sample date ddmmmyyyy	2010 ELISA results: *Ma/Mt*	Clinical signs noted in 2010.
4232 M Ad	USGS Health?		no data	Found in October--transmitter changed (no health evaluation done)
4256 M Ad		16-May-10	neg/neg	Nares occluded partially or with combination of distorted openings; beak very dirty with embedded dirt and/or plant matter and/or mucus. R and L eyes: mod. edema of palpebrae, mild edema of upper periocular area; mucus in fornix, conjunctiva exposed 10% in L eye, 5% in R eye; mild peeling of scales on upper and lower periocular area. Severe past trauma to R posterior carapace; vehicle hit/crushing.
4256 M Ad		9-Sep-10	neg/neg	Mild swelling of both chin glands, mild drainage of R gland. R and L eyes: mild. edema of palpebrae and periocular area (mod to lower R periocular area); mild crusts on lower palpebra and periocular of R eye upper palpebrae and periocular area of L eye; dried discharge both eyes. Conjunctiva exposed 15% in both eyes, R eye 5% closed, L eye 15% closed; plant material in L fornix. Severe past trauma to R posterior carapace; vehicle hit/crushing. **When translocated, K Berry wants to track and monitor.**
4259 M Ad		10-Sep-10	neg/neg	Chin glands mildly swollen and draining; mild normal green foraging stains on beak. Eyes with mild discoloration and edema of palpebrae (both eyes) and mild edema of upper periocular area. Mild to moderate crusts present on lower palpebrae and periocular area of both eyes. Eyes 5% closed and conjunctiva 5% exposed. Mild trauma to limbs, gular, and carapace.
4374 M Ad		13-May-10	neg/neg	**R nare open, L nare possibly 80% occluded**; very dirty face and beak embedded with dirt. Mod edema of palpebrae, mod wet and dry crusts with wet mucus, mild ocular discharge; peeling of lower periocular area.
4374 M Ad		8-Sep-10	neg/neg	Foraging stains on beak; nares with dried whitish material and white material embedded in integument of beak. Mild edema of R palpebrae and periocular area and discharge at fornix, with damp crusts. Mild/mod edema of L palpebrae and periocular area with mild crusts and wet discharge at fornix; eyes 15% closed. Old trauma to L foreleg. Mod/severe cutaneous dyskeratosis on plastron and moderate and active on forelegs.
4387 M Ad		13-May-10	neg/neg	Nares open, scales peeling around nares; moderately to severely dirty beak. Mild edema of R and L palpebrae with mod wet and dry mucus and crusts on palpebrae and periocular area; wet ocular discharge; peeling scales on lower periocular area. Conjunctiva exposed in both eyes.
4396 M Ad		14-May-10	neg/neg	Nares open and rimed with whitish deposits and possibly mucus. Dirty beak. Mild/mod edema of palpebrae and periocular area; mild/mod crusts on both eyes; wet and dried mucus discharge at fornix of both eyes; peeling scales in periocular area. Large sand grains on lower lid and fornix of L eye. Conjunctiva exposed 10% and 5% in R and L eyes, respectively. Cutaneous dyskeratosis on forelegs, mild on plastron.

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Table 2, continued.

Tort ID	Status & PI 2010	2010 Sample date ddmmmyyyy	2010 ELISA results: *Ma/Mt*	Clinical signs noted in 2010.
4404 F Ad		14-May-10	neg/neg	Nares open, rimed with white deposits, scales peeling adjacent. Dirt on beak. Very mild edema of palpebrae; mild/mod wet and dry crusts and mucus; mild peeling of scales from periocular area. Conjunctiva exposed 5% in both eyes. Cutaneous dyskeratosis on forelegs. Yound, rapidly growing tortoise.
4438 F Sad		16-May-10	neg/neg	Nares open, rimed with white deposits; compared to other tortoises in spring, face relatively clean. Both eyes: very mild edema of palpebrae, trace of mucus on globe and dried on palpebrae. Conjunctiva exposed 5% in R eye. Cutaneous dyskeratosis on forelegs, young tortoise.
4521 M Ad		16-May-10	neg/neg	Material (unknown) partially occluding R nare; both nares with erosion, dirt, plant sap/mucus on beak. R and L eyes: upper periocular partially covers over and obscures upper palpebrae. Mild crusts on palpebrae; mild peeling scales on periocular area; both eyes may be mildly sunken. Eating Eriogonum! **POTENTIAL SALVAGE:** Large patches of scales have peeled away from forelegs.
4604 F Ad		20-May-10	neg/neg	Nares open, white deposits on scales of beak. Mild dirt on beak. Mild to moderate edema of palpebrae; fine power or sand and crusts present on palpebrae of both eyes. Scales peeling on periocular area. R eye: mucus and/or lesions on globe, conjunctiva 10% exposed.
4617 imm		14-May-10	neg/neg	Nares open with peeling and cracking of adjacent scales, also white deposits on beak. Mild edema of palpebrae with mild mucus (wet and dried). Dried mucus near L fornix; peeling scales on periocular area. Cutaneous dyskeratosis on forelegs. Young, growing juvenile.
4625 F Ad		12-May-10	neg/neg	Nares open, scales peeling adjacent, embedded white deposits in beak. Mild edema and mild wet/dry mucus and crusts on palpebrae and periocular area. Conjunctiva 10-15% exposed both eyes.
4626 F Ad		12-May-10	neg/neg	Nares open, peeling scales adjacent; dirty beak. Both eyes: mild/mod edema and wet/dry mucus crusts on palpebrae, peeling scales on periocular area; mild ocular discharge. Conjunctiva exposed 2% in R eye.
4642 M Ad		12-May-10	neg/neg	Mild dried white dry rime present in both nares (**field workers report exudate, I don't see it in photo)**, with potential erosion of nares or peeling of scales; matted and embedded material adhering to exudate or plant sap on beak. Mild/moderate edema and wet/dry crusts on palpebrae and periocular area; peeling scales on periocular area. Conjunctiva exposed 5% L eye.

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Tort ID	Status & PI 2010	2010 Sample date ddmmmyyyy	2010 ELISA results: *Ma/Mt*	Clinical signs noted in 2010.
4642 M Ad		7-Sep-10	neg/neg	Mild dried white dry rime present in both nares, with potential erosion of nares. R eye: mild edema of lower palpebra, mild crusts on palpebrae and periocular area; peeling scales on upper periocular area; conjunctiva 10% exposed. L eye: mod edema of palpebrae and mild edema of periocular area, crusts on lower periocular area with mildly peeling scales on upper periocular area; mucus present, conjunctiva 5% exposed. Old trauma to L foreleg. Potential cutaneous dyskeratosis on integument of forelegs.
4646 M Ad		8-Sep-10	neg/neg	Chin glands mildly swollen, no drainage; evidence of foraging. Embedded white rime in nares and around scales on beak and mouth. R eye: mild edema of lower palpebra and periocular area, mild discharge and crusts (wet and dry) on palpebrae and lower periocular area; mucus in fornix; eye 20% closed. L eye: mild/mod edema of palpebrae and mild edema of periocular area; mild to moderate wet and dry crusts (mod on lower palpebrae; eye 40% closed. Left side of face with damp whitish . material posterior to mouth. Ringing of foreleg scales typical of cutaneous dyskeratosis.
4652 M Ad		19-May-10	neg/neg	Nares open, white rime, erosion and white deposits present; dirty beak and face. **Fieldworkers reported mild brown dried nasal exudate present (KB does not see this in digital photo).** Mild/mod edema of palpebrae, mild/mod edema of upper periocular areamild to moderate wet and dry crusts on palpebrae; eyes mildly recessed with dirt in fornix.
4653 M Ad		12-May-10	neg/neg	Nares open, some erosion, peeling of scales; dirty beak and face with dirt mixed with plant sap,possibly mucus, on and in nares. Mild to moderate edema and crusts on palpebrae and globe (moderate, L eye); peeling scales on periocular area.
4673 M Ad		12-May-10	neg/neg	**Nares open, eroded; moisture on integument above, below and to L side of naris and within entry.** Mild dirt on and in nares. Mild/moderate edema of palpebrae; mild/mod wet ocular discharge; mild wet/dry mucus and crusts on palpebrae; conjunctiva of both eyes 5% exposed; dirt in fornix of both eyes.
4673 M Ad		7-Sep-10	neg/neg	Chin glands mildly swollen, with mild clear drainage, both nares damp/moist on first observation, dried immediately; green foraging stains barely evident on beak. R eye with mild/mod edema and crusts on palpebrae; mild crusts on lower palpebrae, moderate wet to dry discharge, mucus in fornix, conjunctiva 10% exposed. L eye mild/mod edema and crusts with wet and dry discharge on palpebrae and lower periocular area. Upper periocular area with mild edema, conjunctiva 5% exposed. Scales peeling on periocular area of both eyes. Mild ringing of scales on forelegs, typical of cutaneous dyskeratosis.
4674 F Ad		12-May-10	neg/neg	Nares open; beak dirty with embedded plant sap, dirt and possibly mucus. Mild to moderate edema of palpebrae; mild edema of periocular area dried discharge at fornix and on palpebrae; mild peeling of scales in periocular area. Mucus in fornix of both eyes.

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Tort ID	Status & PI 2010	2010 Sample date ddmmmyyyy	2010 ELISA results: *Ma/Mt*	Clinical signs noted in 2010.
4676 M Ad		13-May-10	suspect/neg	Nares open with white, dried rime; very mild embedded material on beak. Mild edema of lower palpebrae; mod crusts from mucus on palpebrae; peeling scales on periocular area; conjunctiva exposed 10 and 5%, respectively.
4677 M Ad		14-May-10	neg/neg	Nares constricted and/or eroded and L mildly, partially occluded; some adjacent scales peeling. Beak with embedded dirt and/or plant matter/mucus. Mild to mod. edema of palpebrae, mild dried/wet mucus on lids, mild peeling of scales in the upper and lower periocular area, conjunctiva 5% exposed in R eye; nares constricted and/or eroded and partially occluded; beak with embedded dirt and/or plant matter.
4679 F Ad		13-May-10	neg/neg	Nares open, **R nare damp**, scales peeling. Moderately dirty beak. Mild to mod edema of lower palpebrae and periocular area, both eyes; mod/severe wet and dried mucus and crusts on palpebrae and periocular area; mod wet/dried discharge; mild peeling scales on periocular area. L eye mildly swollen; eyes 30% open.
4679 F Ad		8-Sep-10	neg/neg	Nares mildly occluded with white rime, white staining on beak around nares. R eye with mild edema of lower palpebrae, mild wet and dry crusts, moderate mucus in strings on globe and lids; L eye with mild wet and dry crusts and mucus strings on palpebrae. Both eyes have peeling scales in periocular area and are closed or partially so. Trauma (healing) to scales of R foreleg; R hind leg deformed and or repaired old damage.
4686 F SAd		19-May-10	neg/neg	Nares open, scales peeling; beak mildly dirty with embedded plant sap/dirt/mucus (?); mod edema of palpebrae and upper periocular area and with sand on lids; mod wet/dried mucus in eyes; scales peeling on periocular area; conjunctiva exposed 10 R eye and 5% L eye.
4699 M Ad		18-May-10	neg/neg	Nares open, scales peeling away, beak dirty from plant sap/dirt/mucus (?) combined. Both eyes bulging laterally, mod edema of palpebrae and lower periocular area; mod wet and dry crusts and mucus; scales peeling from periocular area; R eye 30% open, L eye 70% open. Mucus on globe.
4704 M Ad	USGS Health	13-May-10	neg/neg	Beak: dirt adhering to plant sap. Mild edema of upper R palpebra and periocular, L upper periocular; crusts (mild) in both eyes, mildly peeling scales in periocular area, conjunctiva 10% exposed, mild trauma (chewing) on post. R marginal scutes.
4734 F Ad		15-May-10	neg/neg	L nare mildly occluded; moderate dirt on/in beak and nares. Mild/ mod edema of palpebrae and periocular area; lids with sand and dried mucus/dirt; both eyes mildly bulging; eyes 70, 90% open; conjunctiva 10% exposed.
4748 M Ad		17-May-10	neg/neg	L and R nares mildly occluded, white rime evident, peeling scales; some embedded dirt/plant sap/mucus (?). Mild/moderate edema of palpebrae; **very severe yellowish crusts on periocular area** (especially R eye), crusts mild on palpebrae; mildly peeling scales on periocular area of both eyes. R eye 20% open. Mild white edges in seams between all scutes on plastron.

Berry, K.H. 2011. Health status of selected desert tortoises in Ft. Irwin's Southern and Western Expansion Areas in 2010… This is a draft of the 2010 progress report, is under agency review, and is not for distribution.

Table 2, continued.

Tort ID	Status & PI 2010	2010 Sample date ddmmmyyyy	2010 ELISA results: *Ma/Mt*	Clinical signs noted in 2010.
4748 M Ad		9-Sep-10	neg/neg	Nares appear to be mildly rimed with white and may have mildlly peeling scales at opening; beak with mild foraging stains. **Upper and lower palpebrae of both eyes discolored from yellowish wet to dry crusts and discharge (mild) on palpebrae and periocular area (mod/severe) of both eyes**. Mildly peeling scales on both eyes (periocular area); conjunctiva 5% explosed in both eyes. Eyes appear to be mildly sunken, possibly because crusts on periocular area area heavy. Plastron is peeling on humeral, pleural, and abdominal scutes, possibly from cutaneous dyskeratosis, old fungus, etc.
4749 F Ad		12-May-10	neg/neg	Nares open, scales potentially peeling adjacent; face very white/grey dirty with combination of plant sap, dirt, and possibly mucus. Large lower "lip" of plant sap on beak. Mild edema of palpebra; mod edema of periocular area; mild crusts (wet/dry) on palpebrae and periocular area; mild peeling of scales on periocular area. Conjunctiva exposed 10%
4999 M Ad		15-May-10	neg/neg	Nares open with mild, white rime; embedded dirt/sap/etc. on beak. Mild wet/dry mucus and dirt crusts on palpebrae and periocular area; moderate peeling of scales in periocular area. Conjunctiva exposed 5% in each eye.

Berry, K.H. 2011. Health status of selected desert tortoises in Ft. Irwin's Southern and Western Expansion Areas in 2010… This is a draft of the 2010 progress report, is under agency review, and is not for distribution.

Table 3. Summary of ELISA test results for *Mycoplasma agassizii* and *M. testudineum* of desert tortoises currently located in the Southern Expansion Area and currently monitored by the USGS Health team. Green cells represent negative status on ELISA tests, orange cells represent suspect status, and red cells represent positive test results

		M. agassizii							*M. testudineum*						
Tortoise ID	**Status**	**Fall 07**	**Spring 08**	**Fall 08**	**Spring 09**	**Fall 09**	**Spring 10**	**Fall 10**	**Fall 07**	**Spring 08**	**Fall 08**	**Spring 09**	**Fall 09**	**Spring 10**	**Fall 10**
2244	Alive														
3111 A)	Alive	N/A	Sus>Pos						N/A						
3405	Alive														
3453	Dead	N/A		N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A
4144	Missing	N/A		N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A
4217	Alive														
4227	Dead	N/A				N/A	N/A	N/A	N/A				N/A	N/A	N/A
4232	FOUND				N/A	N/A	N/A	N/A				N/A	N/A	N/A	N/A
4289	Missing						N/A	N/A						N/A	N/A
4438	Alive		Sus>Neg												
4483	Missing				N/A	N/A	N/A	N/A				N/A	N/A	N/A	N/A
4525	Missing						N/A	N/A						N/A	N/A
4560	Missing		N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A
4616	Missing					N/A	N/A	N/A					N/A	N/A	N/A
4625	Alive	N/A				N/A			N/A				N/A		
4704	Alive														

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Figure 1a. Locations of tortoises given health evaluations in 2010 within the boundaries of the National Training Center, Fort Irwin, Southern Expansion Area. The western portion of the expansion area is in Figure 1a and the eastern portion is in Figure 1b.

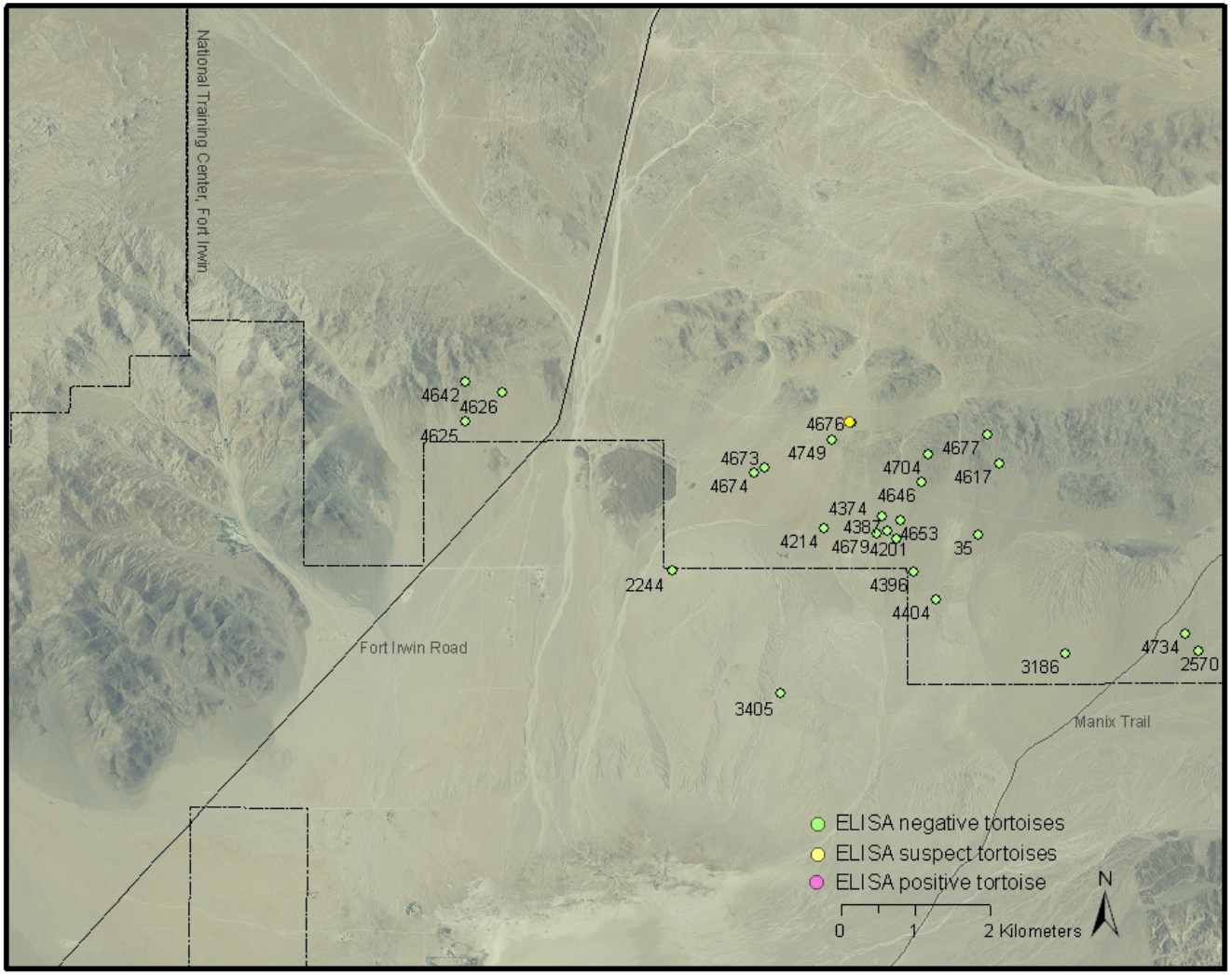

Figure 1b. Locations of tortoises given health evaluations in 2010 within the boundaries of the National Training Center, Fort Irwin, Southern Expansion Area. The western portion of the expansion area is in Figure 1a and the eastern portion is in Figure 1b. Tortoise 4066 had a suspect ELISA test in spring but not in fall.

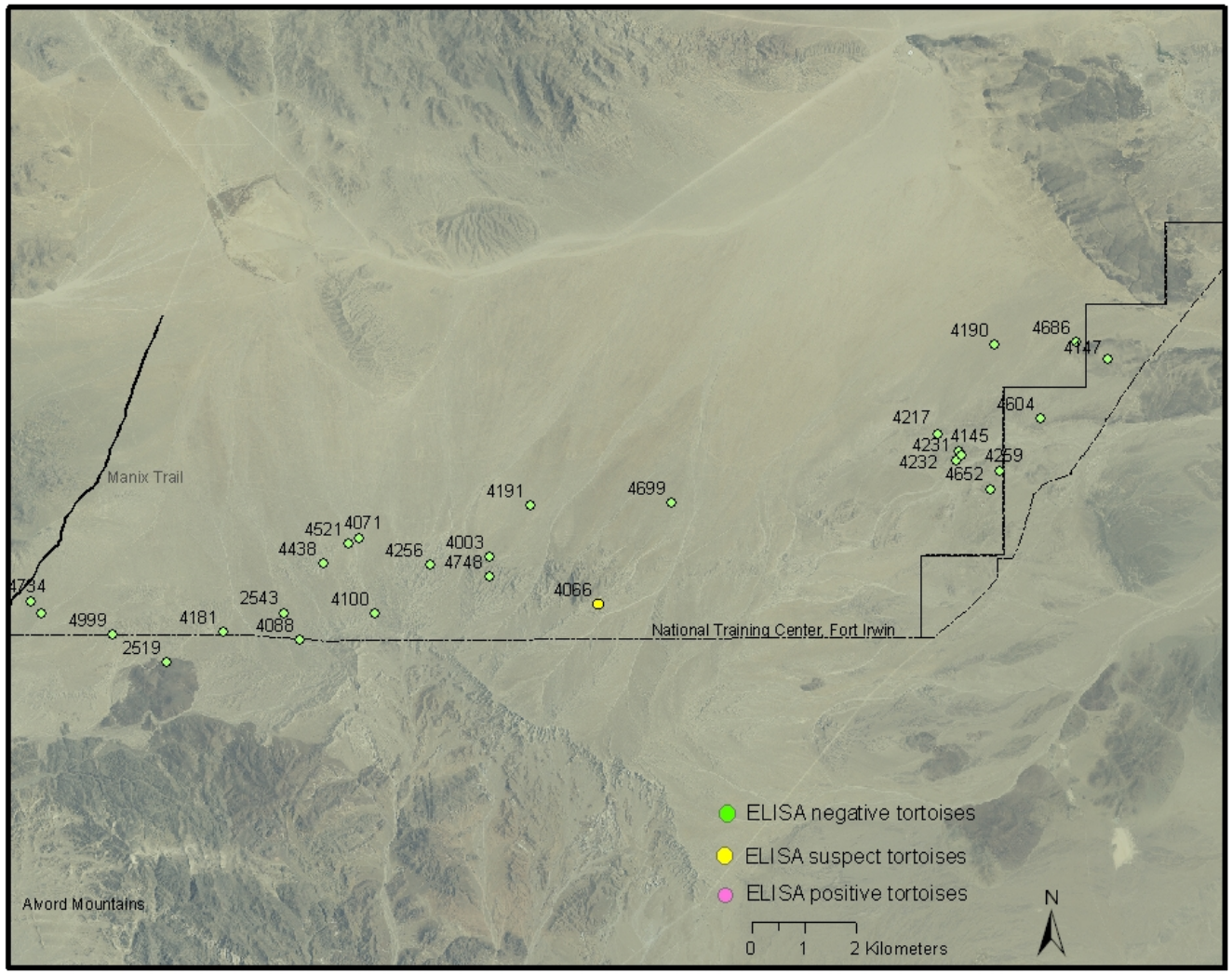

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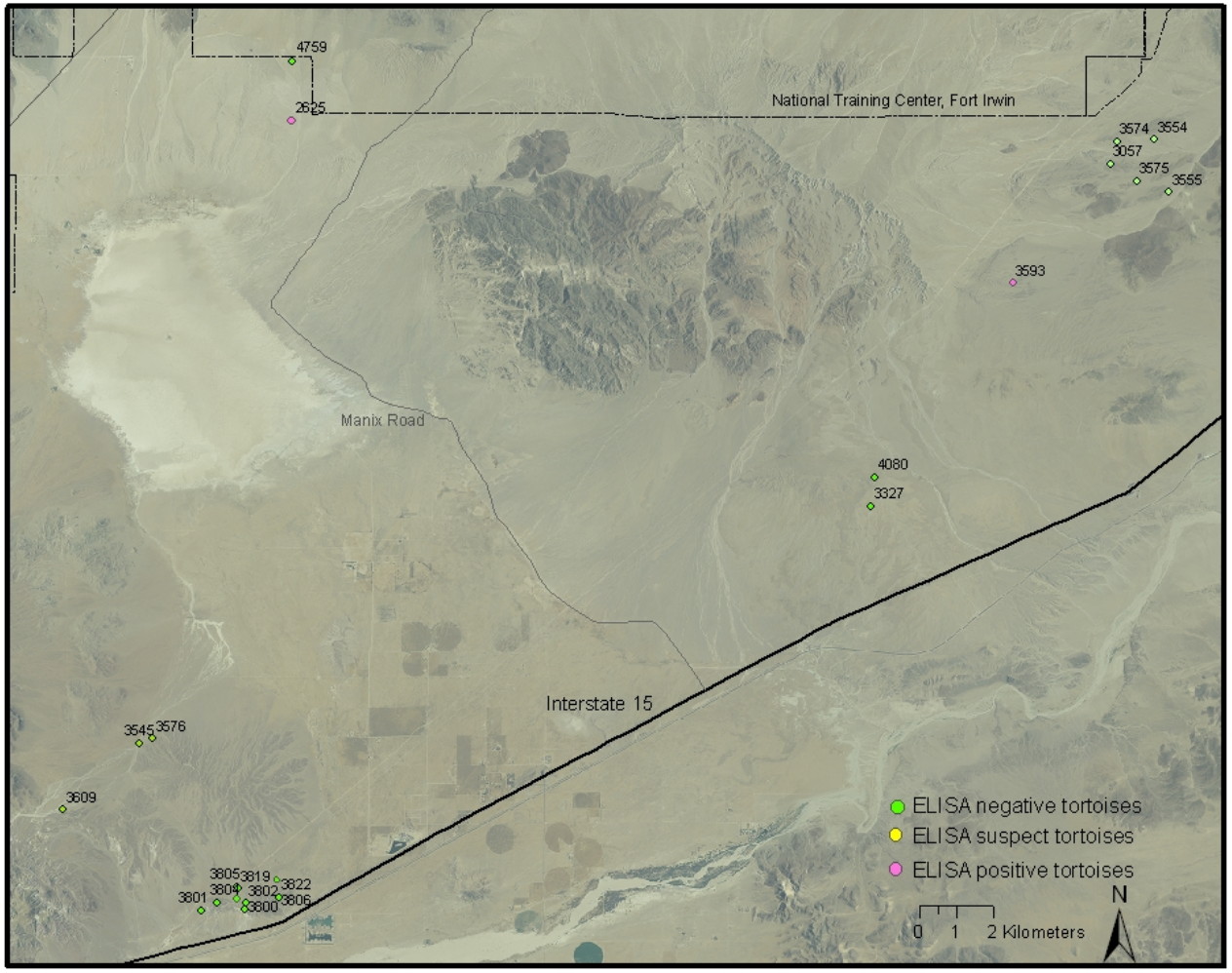
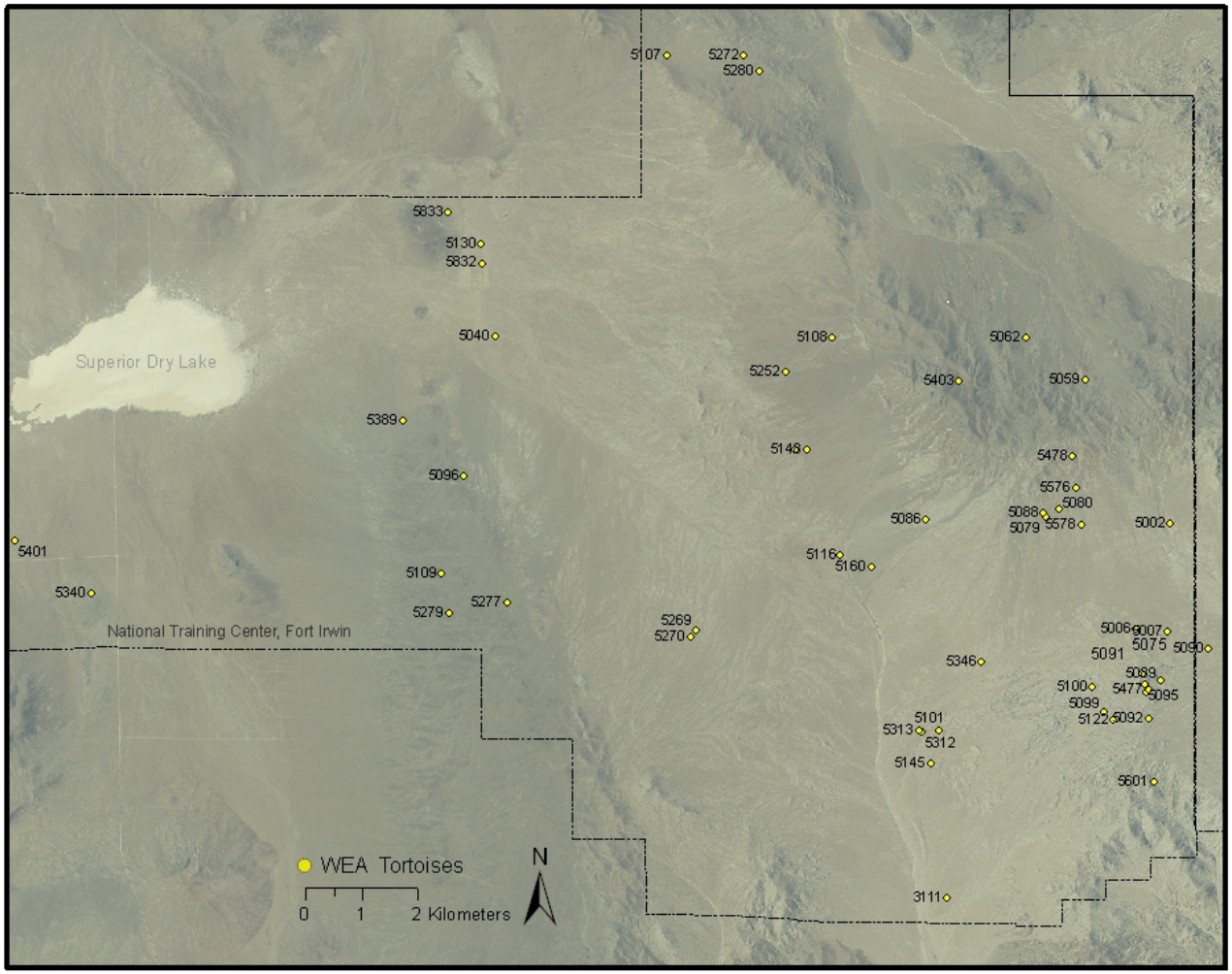
Figure 2. Locations of tortoises given health evaluations in 2010 within the Southern Expansion Area. Locations of tortoises are shown for individuals that were sampled in 2010 in the short distance translocation project, on Plots 6, 10, and 13, and in the stress research projects.



Berry, K.H. 2011. Health status of selected desert tortoises in Ft. Irwin's Southern and Western Expansion Areas in 2010… This is a draft of the 2010 progress report, is under agency review, and is not for distribution.

Figure 3. Locations of tortoises that received health evaluations in the Western Expansion Area during spring of 2010.



THE STATUS OF YUMA CLAPPER RAIL AND YELLOW-BILLED CUCKOO ALONG PORTIONS OF THE VIRGIN RIVER AND MUDDY RIVER IN SOUTHERN NEVADA, WITH INCIDENTAL OBSERVATIONS OF THE SOUTHWESTERN WILLOW FLYCATCHER: 2008 FINAL

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February 2009

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INTRODUCTION

The Clapper Rail (*Rallus longirostris*) is a marsh obligate species whose range includes saltwater marshland from New England south to Texas along the Atlantic coast and from San Francisco south to Baja California along the Pacific coast (Bent 1926). The Yuma Clapper Rail subspecies (*Rallus longirostris yumanensis*) is found in freshwater habitats along the Colorado River, associated drainages, and isolated regions of the Salton Sea, California (Phillips, et al. 1964, Alcorn 1988, Eddleman 1989). In addition, Yuma Clapper Rail are currently known to occupy areas along the Muddy and Virgin Rivers in southern Nevada (McKernan and Braden 1999, 2001a, 2001b, McKernan and Carter 2002, Rathbun and Braden 2003, Braden et al. 2005, Miller et al. 2006, Braden et al. 2007, 2008).

The breeding season for Clapper Rail extends from mid-March through August. Nests are placed on elevated ground within the marsh and are constructed of plant stems and grasses. The nests are concealed with live vegetation pulled over the nest to form a canopy. A clutch of 8 to 11 eggs is laid in the nest, but may occasionally be as few as 4 or as many as 14 eggs. Both male and female Clapper Rail incubate the eggs for 20 to 24 days. Both parents attend to the nestlings. Nestlings can swim within a day after hatching, are independent of parents in 35 to 42 days, and can fly by 63 to 70 days after hatching (Baicich and Harrison 1997).

Yellow-billed Cuckoo (*Coccyzus americanus*) are found in stream-side willow and alder groves, open woodlands, parklands, gardens and orchards from British Columbia east to Newfoundland and south into South America (Alcorn 1988, Baicich and Harrison 1997). The breeding range of the Yellow-billed Cuckoo in the United States includes isolated areas of Idaho, Utah, California, Arizona, southern Nevada, and throughout most of the continent east of the Rocky Mountains to the Atlantic coast (Mulroy 2002). The distribution of the western race of the Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*) has contracted in recent years. The western race of Yellow-billed Cuckoo has been considered a rare and transient summer resident in Nevada where the breeding populations in the western and southern portion of the state are considered to be nearly extinct (Alcorn 1988).

The breeding season for the Yellow-billed Cuckoo extends from late May through early August. Nests are concealed in a bush or tree from 2 to 20 feet above the ground and are constructed of a variety of plant materials. A clutch of 3 to 4 eggs are laid in the nest, but may be as few as 1 or as many as 5 eggs. The female incubates the eggs for 9 to 11 days, with occasional help from the male. The nestlings are tended by both parents and can fly about 21 days after hatching (Baicich and Harrison 1997).

The Muddy and Virgin Rivers in southern Nevada both contain multiple and dynamic areas of suitable breeding habitat for both Yuma Clapper Rail and the Western Yellow-billed Cuckoo. This report details the continuation of focused Yuma Clapper Rail and Yellow-billed Cuckoo surveys by the San Bernardino County Museum conducted along the Virgin and Muddy Rivers in southern Nevada since 2000.

METHODS

Yuma Clapper Rail (YCRA) - Field surveys were conducted from March through June 2008 to determine the presence of YCRA. The surveys were conducted between 5:00 AM and 12:00 PM and consisted of walks through and around suitable habitat. Surveyors stopped every 20 to 40 meters to play digital (MP3) audio recordings of YCRA vocalizations including "keks", "clatters", and agitated "kek'ing". The recording was played for up to 2 minutes, with a pause of up to three minutes after each broadcast to listen for a response. Surveys were conducted from March through June and four to seven visits per site. The surveys exceed the U.S. Fish and Wildlife protocol standards for this race.

Yellow-billed Cuckoo (YBCU) - Field surveys were conducted from June through August 2008 to determine the presence of YBCU. The surveys were conducted between 5:15 AM and 12:00 PM and consisted of walks through suitable habitat. Surveyors stopped at regular and opportunistic intervals to play digital (MP3) recordings of YBCU vocalizations, primarily the "ka ka ka ka kow kow kowlp kowlp" call, which was played for 30 to 45 seconds with a 2-minute pause after each play to listen for a response. Surveys were conducted weekly, when possible, from late June to early August, resulting in four surveys at all but one site. A standard survey protocol has yet to be established for YBCU.

YCRA and YBCU longterm trends - YCRA and YBCU surveys began in 2000. YBCU and YCRA survey results are summarized for the Virgin/Muddy River complex.

Other rails, bitterns and Moorhens - Surveys of other rails were conducted coincident with Yuma Clapper Rail surveys. Surveys consisted of broadcasting digital (MP3) audio recordings of Virginia Rail, Sora, Black Rail, Least Bittern and American Bittern coincident with but secondary to Yuma Clapper Rail broadcasts. The sequence of broadcasts were variable. Common Moorhen were noted when observed.

Southwestern Willow Flycatcher - Southwestern Willow Flycatcher (WIFL) were noted when detected. Detections did not adhere to FWS protocol surveys nor were formal surveys conducted. Regardless, a significant number of WIFL were incidentally detected at the Warm Springs Natural Area. Incidental WIFL findings are summarized and discussed below.

Incidental observations - Species lists of incidental birds were constructed from visual and aural detections during survey events. Incidental bird observations are not comprehensive and should be not be over interpreted. Incident bird species observations indicate presence only and should not be interpreted as absence of any one species.

Survey Site Descriptions:

An overview of survey sites for YCRA and YBCU Cuckoo are mapped in Figure 1. Individual sites and surveyed polygons are delineated in figures specific to the survey site. Coordinates for the survey sites are listed in Table 1. Specific site descriptions are as follows:

Virgin River Sites

The Virgin River flows south from Utah and terminates on the Overton arm of Lake Mead. The perennial river flow is largely unaltered with the exception of a few erosion control structures in the town of Mesquite and several minor irrigation diversions. Consequently, the river is susceptible to flooding during warm winter storms or heavy spring runoff. The marsh vegetation along the river, when present, is dominated by cattail (*Typha* spp.) and bullrush (*Scirpus* spp.), with intermixed components of Goodding black willow (*Salix gooddingii*), sandbar willow (*S. exigua*) and tamarisk (*Tamarix* spp.). Wooded areas are present in conjunction with most of the survey sites and are comprised of willow, tamarisk, Fremont cottonwood (*Populus fremontii*), and honey mesquite (*Prosopis glandulosa*).

The survey sites along the Virgin River (Figures 1 through 5) are in the vicinity of Littlefield, Arizona and Mesquite, Mormon Mesa, and the Virgin River Delta in southern Nevada. Survey site coordinates are listed in Table 1. Survey site descriptions and habitat suitability for YCRA and YBCU in the 2008 survey season are reported below. YCRA and YBCU habitat suitability and site occupancy along the Virgin River can and does change dramatically over the years. Readers are strongly encouraged to consult previous reports for a comprehensive perspective of habitat dynamics and suitability for both species.

Desert Springs

The Desert Springs site was established in 2006. The site is located along the Virgin River mesa cut near Littlefield, Arizona approximately 850 meters upstream of the Littlefield North survey site (see below and Figure 2). Habitat at the site is not suitable for YCRA and only marginal for YBCU. Habitat consists of a 350 meter long and up to 80 meter wide isolated strip of mature cottonwoods along the southeastern margin of the Virgin River mesa cut. The overstory is mature Fremont cottonwood on a dry substrate, likely an historical remnant of the Virgin River. The understory consists of tamarisk and honey mesquite, with isolated small patches of yerba mansa (*Anemopsis californica*) and Arizona grape (*Vitis arizonica*). Subterranean springs are the likely water source that maintains the cottonwoods, since several such springs reach the surface downstream of the site near the Interstate 15 overpass.

Desert Springs was not surveyed for YBCU in 2008 due to poor habitat quality.

Littlefield North

Littlefield North is located northwest and adjacent to the Interstate 15 bridge (Figure 2). The site is probably best known for the pair of Common Black-Hawk which have nested there for at least the last ten years, and did so again in 2008. YCRA habitat at Littlefield North has never recovered from the floods of 2005. Suitable rail habitat remains substandard in Beaver Dam Wash and the Beaver Dam Wash/Virgin River confluence. Significantly better YCRA habitat occurs further upstream in Beaver Dam Wash on private property. Littlefield North was assessed for suitability in 2008 but not surveyed due to the lack of habitat. Suitable YCRA (and YBCU) habitat in the upstream areas of Beaver Dam Wash were not surveyed due to private property constraints.

In contrast to the YCRA habitat, YBCU habitat at Littlefield North is still quite suitable. The habitat consists of approximately 10 acres of gallery Fremont cottonwood with a sand bar willow and tamarisk understory. The understory is dry and damaged by range cattle. Additional

YBCU habitat (on private property) contagious with Littlefield North along Beaver Dam Wash and upstream of the site extends the suitable YBCU habitat by at least 40 acres. YBCU surveys were conducted in 2008, but were restricted to public access areas.

Littlefield South

Habitat at Littlefield South (Figure 2) has matured significantly since the 2007 surveys. The irrigation canal that arcs around the north and west perimeter of the site is active and beavers have once again constructed a dam on the site border with the Virgin River on the south. The hydrology at the site has been significantly improved by seepage from the now unlined canal and water retention behind the beaver dam. Consequently the YCRA habitat has re-established in the center of the site, albeit only a quarter (about 2 acres) of its size prior to the 2005 floods. The existing habitat is excellent. YCRA habitat consists of dense cattail and *Scirpus* surrounded by cottonwood, Goodding black willow and tamarisk, in that order. The site was surveyed for YCRA in 2008.

YBCU habitat has likewise established at the site. The habitat now is larger (about 5 acres) and more robust than its original state (before the 2005 floods). Fremont cottonwood now dominates the site, and reaches heights of 10+ meters. Significant amounts of Goodding's black willow and sandbar willow are also present, the former reaching heights of 7+ m. Tamarisk cover has been substantially reduced. The site was surveyed for YBCU in 2008. This was the first time habitat was suitable for YBCU at this site since surveys began in 2000.

Range cattle, no more than a dozen, were present in both YCRA and YBCU habitats at the start of the survey season (March) but were gone by mid-May. There had been little damage.

Mesquite Bridge

YCRA habitat at the Mesquite Bridge site (Figure 3) is excellent, but there have been significant encroachments on the habitat from golf courses and associated urban developments downstream of the bridge. High quality cattail and *Scirpus* habitats have been reduced by approximately 50% in the downstream area. The remaining habitat at the same downstream location remains separated from the main Virgin River channel by dikes constructed after the 2005 floods. Thus the remaining habitat is still largely linear, interposed between the improvised dike structure to the south and urban/golf course expansions to the north. The habitat still appears to be watered by subsurface flows, golf and agricultural runoff, and other unidentified drains originating in the town of Mesquite.

On the upstream side of the bridge, the YCRA habitat is intact, consisting of dense cattail marshes averaging 3 meters tall in ponds approximately 10 hectares in size (combined) outside of but adjacent to the main flow channel. Cottonwood and black willow are beginning to infiltrate areas immediately at and upstream of the bridge. The perennial structure, composition and hydrology of the habitat in this area of the site easily qualified as high quality WIFL habitat in 2008, and should be likewise for WIFL and YBCU in 2009.

The Mesquite site was surveyed for YCRA in 2008. The site was not surveyed for YBCU due to lack of habitat. There were no incidental WIFL detections at this site in 2008, though the habitat is excellent.

Mesquite Bridge 3

The Mesquite Bridge 3 site (Figure 3) was established for YCRA in 2007. Habitats are generally linear, variable in height, occur both along the main flow channel and outside of the improvised flood dikes, and include a large nonlinear water impoundment at the northwest upstream portion of the survey area. Habitats are dominated by cattail and sedges. Cattails range from 1 to 3 meters tall. Perennial habitats consist predominately of black willow with lesser amounts of cottonwood. Emergent perennial habitats occur along the length of the survey area and range from 2 to 4 meters tall. The best rail habitats are at the upstream portion of the site, just below and above a concrete control structure that bisects the Virgin River. Aside form normal habitat maturation, habitats at Mesquite Bridge 3 are essentially unchanged from 2007. Excellent rail habitat, though somewhat patchy, occurs throughout the survey site. The site was surveyed for Yuma Clapper Rail in 2008. Habitats were not yet suitable for Yellow-billed Cuckoo, but likely to become suitable by 2009.

Mesquite Bridge 2

YBCU habitat at the Mesquite Bridge 2 site (Figure 3) is essentially unchanged from the previous year. The downstream half of the site burned several years back, and the habitat is still in recovery stages. In general, the habitat consists of a long linear grove of mature black willow and cottonwood positioned between the southeast high waterline of the Virgin River and adjacent agricultural fields. Willows are upwards of 7 m, cottonwoods are up to 15 m. The understory is tamarisk and sandbar willow. WIFL were present and breeding at this site from 1997 through 2000. There is no Yuma Clapper Rail habitat at the site. The YBCU habitat is excellent and the site was surveyed in 2008.

Big Marsh

Big Marsh is located along the northwestern side of the Virgin River near Mormon Mesa (Figure 4). The marsh is fed by a spring as well as seasonal inflow from the Virgin River, the later depending on the alignment of the river and largely confined to winter and early spring. There was no surface connection between the Virgin River channel and the marsh by early June of 2008. This is the same condition as occurred in 2007.

Overall, habitats along and adjacent to Big Marsh have stabilized since the 2005 floods, but the habitats are complex, both in composition and stature. The margins of the marsh are composed of small strips and patches of sedges and cattail, but primarily dominated by tamarisk. Beyond the margins, the east and southeast habitats are dominated by dense tamarisk stands from 1 to 3 m tall. Beyond the north and northeastern margins, the habitat gradient starts with dense tamarisk and blends into dense stands of Goodding, black, and sandbar willow with a tamarisk understory. The Goodding willow exceeds 7+ m in some areas. The habitat is poor quality for YCRA on the southeast and western margins of the marsh, but moderate on the northern portion of the marsh. A 150 m long “finger” of high quality YCRA habitat, composed entirely of dense cattail, begins approximately 300 m upstream of the confluence of the marsh with the Virgin River. Technically, this “finger” is not part of Big Marsh but rather the northern high water edge of the Virgin River channel.

YBCU habitat also occurs at Big Marsh, but the extent, composition and distribution is likewise complex. Generally speaking, the black willow at Big Marsh extends beyond the

YCRA surveyed area and continues down both banks of the Virgin River (see Figure 4). There are large areas of black willow blending with mature tamarisk on both sides of the Virgin River, that overlap and extend far beyond the YCRA survey area at Long Marsh. Collectively, the YBCU habitat is excellent, and Big Marsh, Long Marsh and associated areas were surveyed concurrently, as in previous years, for YBCU in 2008.

Long Marsh

In previous years, Long Marsh was a 1.5 kilometer linear stretch of marsh habitat that ran parallel to, and down the center of, the Virgin River channel near Mormon Mesa (Figure 4). Aside from large flood events, the active portion of the Virgin River channel has been some distance (approximately 500 m) to the east of Long Marsh since 2005. Historically the habitat was complex. Extensive and robust cattail patches were distributed between and under tall (3+m) dense tamarisk and mature black willow (7+ m). Sandbar willow was a common component in the more mesic areas. By the 2008 survey season, feral cattle and rerouting of the Virgin River after the 2005 floods had resulted in significant changes in the marsh. Cattail were no longer extant to any appreciable level and there was no appreciable water inflow to the marsh. Overall, the marsh is now dry and no longer suitable for YCRA. The black willow and tamarisk have faired better than the marsh habitat. Excepting a 2 ha patch, which was declining for many years now, the vast majority of black willow remain robust and healthy, as does the tamarisk. Habitat at Long Marsh, and beyond, is still good to excellent for YBCU.

A suitability survey was for YCRA was done at Long Marsh at the beginning of the 2008 survey season, but no protocol surveys were conducted due to lack of habitat. Long Marsh, in conjunction with Big Marsh and extended areas (see Figure 4), were surveyed for YBCU in 2008.

East Marsh

East Marsh was a small circular patch of marsh habitat on the east side of the Virgin River, roughly east of Long Marsh (Figure 4). East Marsh has been dry and devoid of live vegetation since the 2005 floods. Conditions remained unchanged in 2008 and no surveys were conducted due to lack of habitat.

Virgin River Landing and *Fisherman's Cove*

In previous years Virgin River Landing and Fisherman's Cove (Figure 5) were inundated by Lake Mead. Reduced lake levels exposed these sites in 2002, which quickly became populated with emergent vegetation. Floods in 2005 scoured both survey sites of vegetation and entrenched the Virgin River channel. The river channel remains entrenched at Virgin River Landing, up to 6 meters deep in some places, and range cattle have grazed off any emergent vegetation. Incipient rail habitat at Fisherman's Cove was grazed off and never developed further. The Virgin River Delta, which was proximal to both sites in 2005, has moved many kilometers south coincident with the continuing drop in water level of Lake Mead. There were no suitable YCRA or YBCU habitats at Virgin River Landing and Fisherman's Cove in 2008.

Muddy River Sites

The survey areas on the Muddy River begin upstream in the Moapa Valley west of

Glendale and terminate near Lake Mead (Figures 1, 6, 7, 8, 9, and 10). The channel and perennial flows are heavily modified and re-directed east of Glendale by a complex series of flood control structures, agricultural channels, agricultural drains, canals, and waterfowl management diversions. Habitats at the Muddy River sites vary greatly in the degree of openness, vegetation composition and vegetative structure. Thus, habitat conditions for YCRA and YBCU vary by site. In general, the habitats consist of cattail, bullrush, and common reed (*Phragmites australis*) with intermixed components of Goodding black willow, sandbar willow, tamarisk, Fremont cottonwood, and honey mesquite. Survey site coordinates are listed in Table 1. Survey site descriptions and habitat suitability for YCRA and YBCU in the 2008 survey season are reported below. YCRA and YBCU habitat suitability and site occupancy along the Muddy River, particularly at the OWMA, has change dramatically over the years. Readers are strongly encouraged to consult previous reports for a comprehensive perspective of habitat dynamics and suitability for both species.

Warm Springs Natural Area (WSNA)

The Warm Springs Natural Area (WSNA) was designated as Warm Springs Ranch in previous reports. Warm Springs Ranch was purchased by SNWA in 2008, which enabled greater access and established the primacy of habitat conservation for the site. The WSNA is located in the Moapa Valley in southern Nevada, approximately nine miles west of Glendale and one mile south of Highway 168 (Figure 6). The site is adjacent to but not on the Muddy River. Surface flows on the site mostly originate from Warm Springs, located approximately 1 k south of the Muddy River. Water from the springs flow through the area in a complex series of canals. Incipient springs can be found in several areas previously used as pastures. Water from the site drains to the Muddy River north of the site. Habitats on the approximately 1,400 acres are complex. Fremont cottonwood, black willow, velvet ash (*Fraxinus velutina*), tamarisk, and fan palms (*Washingtonia filifera)* are associated with many of the canals and drains. Pasture lands, in various stages of succession, occur between the canal and drain networks. Mesquite trees are a major component of the drier areas, either singly or in the form of large mesquite bosques. In general, there is a sub-surface moisture gradient running from the south to north. Trees and perennial shrubs roughly follow this gradient. Where present, tree canopies range from a few meters to 15+ meters. Significant marsh habitats are present, mostly in the south central portion of the site, and consist of cattail, sedges, and other varieties of wetland plants.

High quality YCRA and YBCU habitats occur in large proportions at the site, especially in the southern third. The site has been surveyed for YBCU in previous years by SBCM cooperatively with Bob Furtek of the Nevada Division of Wildlife. Prior to these surveys, WSNA was surveyed for YBCU by an independent group. To our knowledge, the site has never been surveyed for YCRA. Both YCRA and YBCU surveys were conducted in 2008.

Bowman Canal

Bowman Canal is a site along an inflow canal for Bowman Reservoir in the town of Logandale (Figure 7). The canal site is approximately ten meters wide and 250 meters long with three small ponds at the reservoir's intake. In its undisturbed state the vegetation consists of dense cattail lined by willow and cottonwood groves. The canal was cleared of vegetation before the 2006 survey season and the clearing now appears to be an annual event. There was no

suitable rail or cuckoo habitat during the 2008, and no surveys were conducted. Left undisturbed the habitat at this site has the potential to return to suitable YCRA habitat. There is no YBCU habitat at the site.

Grant Bowler Park

The Grant Bowler Park site is located east to northeast of Grant Bowler Park in the town of Logandale (Figure 8). Vegetation at this site are composed of cattails, sedges, tamarisk, willow and cottonwood. The site is deeply entrenched with steep banks. The site has also burned. Habitat at this site was not suitable for rail or cuckoo since 2006 and has remained unchanged. No surveys were performed in 2008. Left undisturbed and with modifications to the banks, the habitat at this site has the potential to return to suitable YCRA habitat. There is no YBCU habitat at the site.

Maverick Ditch

The Maverick Ditch site is located in the town of Overton near the intersection of Cooper Street and Jones Street (Figure 9). The site was named after the Maverick convenience store south of the site. The channel appears to function for irrigation drainage. The site is not on the active flow portion of the Muddy River. The surveyed area is approximately 400 meters long and 50 meters across at its widest point. A majority of the site has been burned annually beginning in 2004, but habitat recovery is rapid. The site is dominated by cattail, bulrush, common reed, tamarisk and yerba mansa averaging one to two meters tall, depending on the time since burning. A tamarisk removal/eradication project appears to be in progress since 2007. The surveyed area is bordered by homes and businesses in a rural setting. Maverick Ditch was surveyed for YCRA in 2008. The habitat is not suitable for YBCU.

Overton Wildlife Management Area (OWMA)

The Overton Wildlife Management area (OWMA), operated by the Nevada Division of Wildlife (NDOW), encompasses multiple survey areas for YCRA and YBCU. Suitable habitats vary in size and quality, depending on the site. Site descriptions are as follows:

Honeybee Pond

Honeybee Pond is located on the northernmost portion of the OWMA near Overton, Nevada (Figure 10). The site was subdivided during past surveys into Eastern and Western sites, but sites were combined in 2004 when the western site was drained. Honeybee Pond is actively managed for waterfowl, thus the habitat is composed of large expanses of cattail and reeds interspersed with open water. The site is bordered on the south by the Muddy River, which is contained by dikes. Habitats along the Muddy River canal are predominately composed of tamarisk. The thalweg of the canal is dredged irregularly among years. Rail habitat at Honeybee Pond is composed of dense monotypic patches of cattail varying in height from 3 to 4 meters tall. Proportions of vegetated versus open water habitat vary among years due to management practices. In 2008, the cattail had expanded considerably, and covered approximately half the surface area of Honeybee Pond by the end of the 2008 survey season. The habitat is excellent for YCRA, other rails and Least Bittern (LEBI). YCRA surveys were conducted in 2008.

Two patches of YBCU habitat occur east and southeast of Honeybee Pond (Figure 10).

Perennial habitat on the eastern patch is composed of palms, willows and cottonwoods, with large intervening areas of cattail and low profile tamarisk. Habitat to the southeast is composed of a dense, mature, linear and compact grove of tamarisk and Goodding's black willow surrounded by cattail marshes and a complex series of dikes with black willow and tamarisk boarders. The extent of perennial habitat at both locations are confined to well defined patches with open and park-like intervening areas of lower profile annual and perennial vegetation dominated by tamarisk. Both patches were surveyed for YBCU in 2008.

Refuge Housing Area

The Refuge Housing Area site (Figure 10) is located, as the name suggests, adjacent to the OWMA housing and OWMA headquarters, mostly south of Wildlife Road. The habitat is park-like, composed of mature cottonwood and locust trees up to 15 meters tall embedded in an open park-like areas. The areas of grass are maintained regularly. The YBCU habitats are within easy "flying distance" of the "Maintenance Shed Site" (see below) for YBCU. Birds using this site likely also to use the Maintenance Shed site. Habitat at the Refuge Housing Area is excellent for YBCU and was surveyed accordingly in 2008. There is no suitable YCRA habitat at this site.

Maintenance Shed

The Maintenance Shed site is located south-southeast of the OWMA housing area (Figure 10). The site was named for the maintenance sheds and "bone" yard used for service operations on the OWMA. Habitat at this site is classically park-like. Access roads are lined by cottonwoods and other areas are composed of grass. A network of narrow canals move water to a series of adjacent ponds on the north and east that are managed for waterfowl or upland game, depending on the prescription. The cuckoo habitat at the site is excellent, but limited. In pervious years, YBCU likely moved freely between the Maintenance Shed site, the Refuge Housing site, the Willow Strip site and possibly beyond. YBCU and surveys were conducted at the Maintenance Shed site in 2008. There was no YCRA habitat at or adjacent to this site in 2008.

Southwestern Willow Flycatcher

The Southwestern Willow Flycatcher site was established in 2005 and surveyed for YBCU through 2007 (Figure 10). The habitat consists of a 300 meter strip of dense, mature Goodding black willow with a sandbar willow and very dense tamarisk understory. The site is on the Muddy River, which is confined by an artificial channel. The site was named after Southwestern Willow Flycatchers that were incidentally found at the site in 2005 by SBCM biologists. Access to the site in 2008 had been compromised by channelization work on the OWMA. However, the site is proximal to the Willow Strip site (see below) and within easy flying distance by YBCU. Due to access problems and its close association with the Willow Strip site, the Southwestern Willow Flycatcher site was not surveyed for YBCU in 2008. There is no suitable YCRA habitat at the site.

Pintail Pond

The Pintail Pond site (Figure 10) is composed of a series of interconnected ponds

managed for waterfowl. The ponds are filled intermittently among years from a network of canals and diversions originating from the Muddy River. Some years the site is bordered by cattails around the margins of the pond. The center of the pond is open shallow water when flooded. The size and extent of rail habitat varies from year to year, depending on the waterfowl management prescriptions being applied. The pond have been dry and devoid of YCRA habitat since 2007. No rail surveys were warranted in 2008 due to lack of habitat.

Willow Strip

The Willow Strip site (Figure 10) is located east of Pintail Pond site. The access dike road is lined with linear strips of mature Goodding's black willow from 3 to 7m tall. Coverages range from continuous to patchy. Habitats bordering the eastern side of the access road, beyond the black willows, are composed of dense tamarisk and mesquite up to 4 meters tall. The Pintail Pond site (see above) lies to the west, the Southwestern Willow Flycatcher site (see above) is approximately 500 m to the north, and Blind 30 (see below) to the south. The habitat at the Willow Strip site in past years has been excellent for YBCU. However, due to the lack of water in the adjacent ponds, the habitat has become increasingly distressed, though still above average for YBCU. The site was surveyed accordingly in 2008. There was no suitable YCRA habitat at the site in 2008.

Blind 30

The Blind 30 site (Figure 10) was established in 2007 for YBCU. The site consists of a large, approximately 20 hectare, water impoundment managed for waterfowl. Goodding's black willow, sandbar willow and tamarisk line the dikes that encompass the impoundment. Perennial heights range from 1 to 7m. The distribution of perennial vegetation around the dike is patchy to continuous, consisting of a few trees to 100+ m stretches of continuous perennial cover, and is most dense along the northern, eastern and southern boarders. YCRA habitat at Blind 30 did not exist in 2007, but significant amounts of rail habitat have since emerged. Suitable to excellent YCRA habitat now exists around the margins of the site. Additional YCRA habitat is also present approximately 100 m to the east and southeast of the site. Habitat at the site is still excellent for YBCU. Blind 30 was surveyed for both YBCU and YCRA in 2008.

Mike's Site

Mike's Site (Figure 10) was first surveyed for YBCU in 2007. The site has two areas. The sites are roughly located along the access road leading to South Marsh (Figure 11). YBCU habitat at the sites consists of small isolated mature cottonwood patches embedded in a vast expanse of tamarisk associated with the OWMA water impoundments and canals. The small patches are within flying distance and YBCU were observed in 2007 flying between the patches. Mike's Site is also within flying distance of the South Marsh (see below) and Blind 30 (see above) sites, and possibly beyond. Fremont cottonwood at the two patches comprising Mike's Site are mature, up to 15 meters tall. The surrounding habitat is mature tamarisk, up to 4 meters tall, dense and continuous. The habitat at Mike's Site is suitable for YBCU, but not YCRA. The site was surveyed for YBCU in 2008.

South Marsh

The South Marsh site (Figure 10) is the southeastern most survey site on the OWMA. The site is composed of two large water impoundments bordered by access roads that surround and bisect the site. Collectively, these impoundments cover several hundred hectares. The habitat is composed of monotypic cattail patches up to 400 meters wide and nearly 1 kilometer long. The access roads on the dikes are irregularly and infrequently lined with Goodding's black willow, cottonwood, sandbar willow and tamarisk. The South Marsh site comprises the best and most extensive YCRA habitat on the OWMA. The site is managed for waterfowl. South Marsh was inundated at the beginning of the 2008 YCRA survey season, but drained shortly afterwards. The site was surveyed for YCRA in 2008 until the habitat was no longer suitable.

Small patches of YBCU habitat, consisting of willows and cottonwoods occur along the western dike road that bisects the two large water impoundments. The small habitat patches are not, in themselves, big enough to support YBCU, however the patches are within reasonable flying distances from Mike's Site. Mike's site (see above), which had YBCU in 2007 (Braden et al. 2008), is proximal to the YBCU habitat at South Marsh. South Marsh was surveyed for YBCU in conjunction with Mike's Site in 2008.

RESULTS

Yuma Clapper Rail

YCRA survey results for 2008 are presented in Table 2 and plotted in Figures 11 and 12. UTM coordinates are tabulated in Table 4. A total of 12 YCRA were detected, with birds occurring at Honeybee Pond, Blind 30 and South Marsh.

At Honeybee Pond (Figures 10 and 11) YCRA were detected on five of seven surveys, with a maximum number of 7 birds detected on 25 June. Dueting pairs were detected on 14 April, 28 May and 10 June. A family group of six were detected on 25 June. And, there were multiple single detections across the survey season (Table 4). Detections were distributed throughout Honeybee Pond.

At Blind 30 (Figures 10 and 12), YCRA were detected on four of six surveys, with the maximum of 4 birds detected on 14 May. One pair was detected on 14 May with the remaining detections being single bird (Table 4). Birds were detected both inside and outside the dike road that encompasses the site. Detections occurred on the east and southeast perimeter of the site with the majority of detections being in the southeastern portion of the surveyed area.

At South Marsh (Figures 10 and 12), one YCRA was detected on a single survey. South Marsh was being drained when the survey season began. By 30 April, the habitat was marginal at best, and there were no further YCRA detections.

Yellow-billed Cuckoo

YBCU survey results are presented in Table 3 and plotted in Figure 13. UTM coordinates are tabulated in Table 4. A total of 3 YBCU were detected. All detections occurred at the Warm Springs Natural Area (Figures 6 and 13). A pair of YBCU were detected on 26 June and were under observation for over one hour. Neither bird could be relocated on subsequent visits. A single YBCU was observed on 8 July. The bird responded behaviorally to

the tape, but not vocally. The bird could not be relocated on subsequent visits.

YCRA and YBCU longterm trends - Results of YCRA and YBCU surveys since 2000 are summarized by year and survey sites in Tables 5 and 6 respectively. The 2008 season had the fourth highest number of YCRA detections since surveys began in 2000. Of the Muddy River sites, the OWMA sites continue to be the most consistently occupied YCRA habitats since 2005. Of the Virgin River sites, the Mesquite Bridge has been the most consistently occupied site over the years.

Longterm YCRA detections and site occurrences continue to suggest cyclical occupancy patterns. The cyclic pattern is coincident with natural and anthropogenic changes in available YCRA habitat. Parsimony suggests fluctuations in available YCRA habitat is the primary factor affecting YCRA occurrences along the Virgin/Muddy River complex.

YBCU detections dropped in 2008 to the third lowest number since surveys began in 2000. In particular, YBCU detections at the OWMA, the most consistent detection sites since 2005, were negative in 2008. As with YCRA, longterm YBCU data also suggest cyclical occupancy, but the ultimate factors responsible for the cyclicity are not well understood.

Other Rails, Bitterns and Moorhens

Detections of other rails, bitterns and Common Moorhen are tabulated in Table 2. A minimum of 72 Virginia Rail (VIRA) were known to present in the 2008 survey season. VIRA were detected at every survey site with suitable rail habitat except Littlefield South. VIRA were the most abundant rail detected, and were most abundant at South Marsh (18 birds on 21 March) until the ponds were drained, after which their numbers declined precipitously. VIRA were likewise the most abundant rail at the Warm Springs Natural Area (17 birds on 16 April), and were consistently abundant throughout the 2008 survey season.

A minimum of 21 Sora were known to be present during the 2008 surveys. This a threefold increase over the 2007 survey season when a total of 7 birds were known to be present. Sora were detected at all survey sites with suitable habitat except the Maverick Ditch. Sora detections and distribution increased significantly from the 2007 survey season.

A minimum of 10 Least Bittern (LEBI) were known to be present during the 2008 surveys. LEBI were detected at the Mesquite Bridge, Mesquite Bridge 3, Warm Springs Natural Area, Honeybee Pond and Blind 30. LEBI were most abundant at Honeybee Pond.

A total of 9 Common Moorhen (COMO) were know to be present during the 2008 surveys. COMO were detected at Mesquite Bridge, Honeybee Pond, Blind 30 and South Marsh. COMO were most abundant at Honeybee Pond.

American Bittern and Black Rail were not detected in the 2008 survey season.

Southwestern Willow Flycatcher

Incidental Southwestern Willow Flycatcher (WIFL) detections were limited to the WSNA. Locations are plotted in (Figure 13), UTM coordinates are tabulated in Table 7. There were 9 detections of WIFL, either as single birds, pairs or combinations of pairs. Based on the date and behavior of the birds, the evidence suggests there were at least 5 WIFL pairs, including a possible polygamous group, breeding on the WSNA in 2008. One abandoned WIFL nest was found 22 July. The nest was apparently unsuccessful as there was no evidence that nestlings had

been present.

It is important to note that WIFL detections/observations did not follow WIFL survey protocol. And, there is a high likelihood WIFL were present at other locations on the WSNA in 2008. Regardless, incidental observations confirm that WIFL were present and breeding at the WSNA in 2008.

Incidental Bird Species Detections

Incidental bird species detected during 2008 YCRA and YBCU surveys are tabulated in Table 8. A total of 146 bird species were incidentally observed. The number is up from 139 birds species detected in 2007. A significant portion of the increase is likely due to greater access to WSNA. Among the more interesting species observed were Southwestern Willow Flycatcher, Solitary Sandpiper and Vermillion Flycatcher. Southwestern Willow Flycatcher have been previously mentioned. The Solitary Sandpiper is a long distance migrant which breeds on the tundra, yet a single individual lingered at the same location (photos available on request) for approximately one month beginning in mid-March. Vermillion Flycatcher were already know to be abundant and breeding on the WSNA, and incidental observations indicate this is still the case in 2008. At least 40 Vermillion Flycatchers were observed at the WSNA in the 2008 survey season.

It is important to note that incidental bird species detections were incidental to YCRA and YBCU surveys. Incidental bird detections should not be over-interpreted, since they are not based on rigorous bird census methodologies. Incidental bird species observations indicate presence, but not absence of a bird species from a site.

DISCUSSION

Yuma Clapper Rail

Twelve YCRA were detected in the 2008 season, down from the 19 YCRA observed in the 2007 season. Part or most of the change can be attributed to changes in the available YCRA habitat at Honeybee Pond, Blind 30, South Marsh and Mesquite Bridge from 2007 to 2008. On the plus side, YCRA habitat at Honeybee Pond nearly doubled in size as a result of cattail and bulrush infiltrations from the margins of the pond into the open water. Proportional cover on Honeybee Pond was about 50% cattail/bulrush and 50% open water at the end of the 2008 survey season, at least double the size of the YCRA habitat in 2007. YCRA occupancy increased accordingly from 3 birds in 2007 to 7 birds (including a family group) in 2008. Also on the plus side, YCRA habitat was not suitable at Blind 30 in 2007, yet in one year, the rail habitat matured, expanded and was occupied by 4 YCRA in 2008.

On the minus side, YCRA habitat at South Marsh, where 14 YCRA occupied the site in 2007, had only 1 detection in 2008. The YCRA habitat at South Marsh degraded rapidly at the start of the 2008 survey season when the marsh was drained. It is unlikely the YCRA detected in 2008 was paired or bred at South Marsh in 2008, since subsequent surveys (from 30 April on) were negative and the habitat in general was no longer suitable (for any rail species) due to lack of water. To some degree, but not all, the new habitat at Blind 30 compensated for habitat lost at

South Marsh in 2008. Also on the minus side, available YCRA habitat at the Mesquite Bridge site had been substantially reduced by suburban encroachment. More specifically, the habitat were a pair of YCRA was detected in 2007 had been replaced by golf greens and houses by 2008. There were no YCRA found at the Mesquite Bridge site in 2008.

WSNA is a promising site for YCRA habitat development. Significant areas of YCRA habitat are already present, and pasturage which had been grazed by the previous tenants was already going through rapid successional recovery by the end of the 2008 survey season. No actions are recommended at this time to facilitate YCRA habitat recovery, other than letting the habitat recover naturally, without further disturbance.

WSNA rail habitat also has potential for Black Rail. No Black Rail were detected in the 2008 surveys, but rail survey times were oriented to YCRA. Black Rail are most active and responsive between 2:00 A.M. to 4:00 A.M. The current data are not adequate to establish either the presence or absence of Black Rail at the WSNA. Presence/absence cannot be determined with confidence until surveys are done at the appropriate time.

Annual changes in YCRA habitat along the Virgin/Muddy River complex are not unusual. The 2005 flood had the greatest single season impact on YCRA habitats on the Virgin/Muddy River complex since YCRA surveys began in 2000. The 2005 survey season was the only year, out of eight years of monitoring, where no YCRA were detected at any site. The 2005 natural flood event affected virtually every survey site (Miller et al 2006). Nevertheless, rail habitat and YCRA had reestablished by 2006 and 2007 (Braden et al 2007, 2008). Habitat disruptions from natural disturbances can be widespread and unavoidable. But survey results confirm the disruptions from natural events are temporary.

In contrast, habitat disturbances from anthropogenic disturbances are more vexing. YCRA habitat is being both created and destroyed by human activities. For example, channelization activities on the Virgin River coincident with the 2005 floods both destroyed and created YCRA habitat. The habitat created below the Mesquite Bridge site has been steadily replaced over the years by golf greens, houses and dike modifications. YCRA, and now WIFL, habitats at the bridge will likely be impacted by upcoming bridge modifications. On the plus side, YCRA habitat upstream of the bridge at the Mesquite Bridge 3 site was intact and flourishing at the end of the 2008 survey season. Anthropogenic activities at the Mesquite sites clearly have great potential to either impact or enhance YCRA habitat.

Another example fo anthropogenic activities both positively and negatively affecting YCRA habitat is at the OWMA. The OWMA is clearly an asset to YCRA in southern Nevada. The OWMA provides thousands of acres of YCRA habitat incidental to water fowl management. And, the OWMA has had the most consistent occurrences and relatively high numbers of YCRA over the last three years. On the other hand, waterfowl management activities on the OWMA have also destroyed many acres of YCRA habitat. For example, Honeybee Pond was drained and cleared of excessive cattails in 2004, and YCRA did not return to the site until 2007. South Marsh had the highest YCRA count of all the sites in 2007 (14 birds), but was drained for maintenance early in the 2008 YCRA season. The conflict between creation and destruction of YCRA habitat on the OWMA might be mitigated by scheduling pond maintenance outside of the YCRA nesting/breeding season. Again, the OWMA is clearly an asset to YCRA, but the beneficial aspects can be significantly enhanced by careful scheduling of waterfowl enhancement

operations.

A third example of anthropogenic activities affecting YCRA is at the Maverick Ditch site. The Maverick Ditch site has burned every year starting in 2004. The burning appears to be preventive fire control as several houses and business are nearby. More recently, the burning may be part of a tamarisk control program, since the tamarisk at the site are being cut and piled. No YCRA have been detected at this site since the annual burning treatments began. Pre-emptive fuel reduction is one means to prevent loss of life and property from uncontrolled fire, which is certainly a priority, but it is not the only treatment option. YCRA and YCRA habitat at the site would be enhanced by using other wildfire control options, such as a fuel buffer zone around the site, or possibly biannual (or tri-annual?) controlled burns in conjunction with buffer zones.

A fourth example of anthropogenic activities affecting YCRA is at the Bowman Canal. The Bowman Canal is an inflow channel from the Muddy River to Bowman Reservoir. Bowman Reservoir is an irrigation reservoir and recreation site in the Moapa Valley. Bowman Canal is mechanically scoured of all vegetation every winter, presumably to facilitate water intake to the reservoir. YCRA habitat would be significantly enhanced by scheduling vegetation removal after the YCRA breeding/nesting season. Another possible option to consider is to scour the thalweg of the canal, leaving the margins to develop into YCRA habitat. There are many other sites and opportunities to enhance YCRA and YCRA habitats on the Virgin and Muddy Rivers complex coincident with anthropogenic activities.

A fifth and final example of anthropogenic effects on bird species on both the Virgin and Muddy Rivers is cattle grazing. Range and feral cattle continue to degrade YCRA habitat on the Virgin and Muddy Rivers. A large group (40+) of apparently feral cattle (no brands or ear tags) continue to degrade YCRA habitats at the Mormon Mesa sites. Further downstream, cattle continue to graze emergent rail habitats at Fisherman's Cove and Virgin River Landing. Cattle have become a pest on the OWMA over the past years, coincident with water elevation decline in Lake Mead. The OWMA has erected an exclusion fence, a proactive move on their part, but the fencing does not include Blind 30, South Marsh and areas to the east. Cattle are also present at Littlefield North and Littlefield South. Clearly, there is a great potential to enhance YCRA and YCRA habitats by controlling/confining range and feral cattle.

Yellow-billed Cuckoo

YBCU detections and observations declined dramatically from 12 in 2007 to 3 in 2008. Detections in 2008 were confined to the WSNA, where one pair and one individual were observed relatively early in the season. Subsequent surveys were negative and there was no further evidence to suggest YBCU nested at any of the survey sites, including the OWMA and Mormon Mesa sites.

The spatial and temporal shifts of cuckoo detections since SBCM surveys began in 2000 remain difficult to interpret. YBCU were relatively abundant on the OWMA in 2007 (8 of 12 detections) but absent in 2008. There were 4 YBCU at Mormon Mesa in 2007, but none in 2008. The conventional wisdom reports a large (7+ pair) YBCU breeding population at WSNA early in this decade, but SBCM and NDOW surveys have never found more then 3 in any one year since

surveys began in 2003, the 3 birds having been detected this survey season.

Putative factors affecting YBCU spatial and temporal breeding season distributions in southern Nevada are many, but there are few answers. Habitat loss and degradation can obviously affect YBCU breeding season occurrences, but YBCU habitats on the Virgin/Muddy River complex, with a few minor exceptions, appear to be stable and predictable since surveys began in 2000. The size of available habitat (patch size) might also affect occupancy. But available habitat for YBCU appears to be extensive, particularly at WSNA, Mormon Mesa, OWMA and Littlefield North. Food resource availability could reasonably affect occupancy. But, there are no data to assess the effects of changes in food availability, if any. The irruptive nature of YBCU in the American Southwest in general has yet to be investigated in a rigorous scientific venue. At this point in time, the mechanism affecting the occurrence of YBCU in southern Nevada are simply not known. The survey data indicate occupancy is cyclic and potentially uncoupled from habitat, but that is all we know. Given this lack of understanding, management for YBCU on the Virgin Muddy River complex is limited to preserving and enhancing existing habitat.

WSNA: Southwestern Willow Flycatcher

WIFL detections at WSNA were incidental, and did not adhere to FWS survey protocol. Nevertheless, detections and observations conclusively establish that WIFL were present and breeding on the WSNA in 2008. The WSNA has great potential for this species, including areas that were not visited, incidentally or otherwise, during our 2008 YCRA and YBCU surveys. Focused WIFL surveys at WSNA should be considered to determine the number of birds, their use areas, avoid impacts and to identify enhancement opportunities for this species.

SUMMARY

Yuma Clapper Rail

1) Twelve (12) YCRA were detected during the 2008 surveys. Detections were confined to the OWMA. YCRA were detected at South Marsh (1), Honeybee Pond (7) and Blind 30 (4). YCRA pairs were detected at Honeybee Pond and Blind 30. One family group was detected at Honeybee Pond.

2) YCRA habitats increased in 2008 at Honeybee Pond, Blind 30 and Littlefield South. YCRA habitat increases appeared to be a result of natural processes and waterfowl management practices.

3) YCRA habitats decreased in 2008 at South Marsh, Long Marsh and Mesquite Bridge. Decreases in YCRA habitat appeared to be a result of natural processes, urban and recreational developments, and waterfowl management practices.

4) Range and feral cattle continue to be a significant hindrance to YCRA habitat recovery, establishment and development.

Yellow-billed Cuckoo

1) Three (3) YBCU were detected during the 2008 surveys. All YBCU detections occurred at the WSNA. Detections consisted of 1 pair and a single individual. There was no convincing evidence that YBCU nested or bred at WSNA or anywhere else in the study area in 2008.

2) YBCU habitats appeared to be stable throughout the study area in 2008.

Southwestern Willow Flycatcher

1) WIFL detections were confined to WSNA. There were 9 incidental WIFL detections composed of at least 5 WIFL pairs, including a possible polygamous group, and one abandoned nest.

RECOMMENDATIONS

1) Continue YCRA and YBCU surveys. Surveys for both species have been conducted since 2000. These surveys are the most comprehensive and continuous surveys of YCRA and YBCU in southern Nevada. Data from these surveys provide fundamental, longterm, baseline information regarding the distribution and abundance of both species on the Virgin and Muddy River complex. This information is fundamental to integrating YCRA and YBCU conservation with water management policies.

2) Encourage and support credible efforts to enhance YCRA habitats throughout the Virgin/Muddy River complex. Specifically; 1) Engage NDOW in regards to the seasonal timing and frequency of waterfowl management prescriptions on the OWMA. 2) Engage the City of Overton in regards to fire prevention prescriptions at the Maverick Ditch site. 3) Engage local, state, federal and/or special interest jurisdictions in regards to maintaining and enhance YCRA in the City of Mesquite.

3) Initiate focused WIFL surveys/studies at the WSNA to determine occupancy, distribution and nesting success.

4) Initiate focused Black Rail surveys on the WSNA to determine presence/absence.

5) Encourage and support credible efforts to maintain and promote YBCU habitats on the Virgin/Muddy River complex. Encourage and promote credible scientific studies of factors affecting YBCU distribution and occurrence.

6) Encourage, support or initiate efforts to remove/contain range and feral cattle on the Virgin/Muddy River complex.

ACKNOWLEDGMENTS

We are thankful for SNWA for funding eight years of YBCU and YCRA surveys and commend them for their proactive determination to integrate species conservation with water policy in southern Nevada. Within SNWA, we especially want to thank Zane Marshall for his determination and foresight in initiating and advocating this project, and David Syzdek for continuing and promoting the effort. No less important has been the help of Bob Furteck at NDOW in orienting our biologists at the WSNA and participating in YBCU surveys. All have been essential. Without their help, this study would not have been possible.

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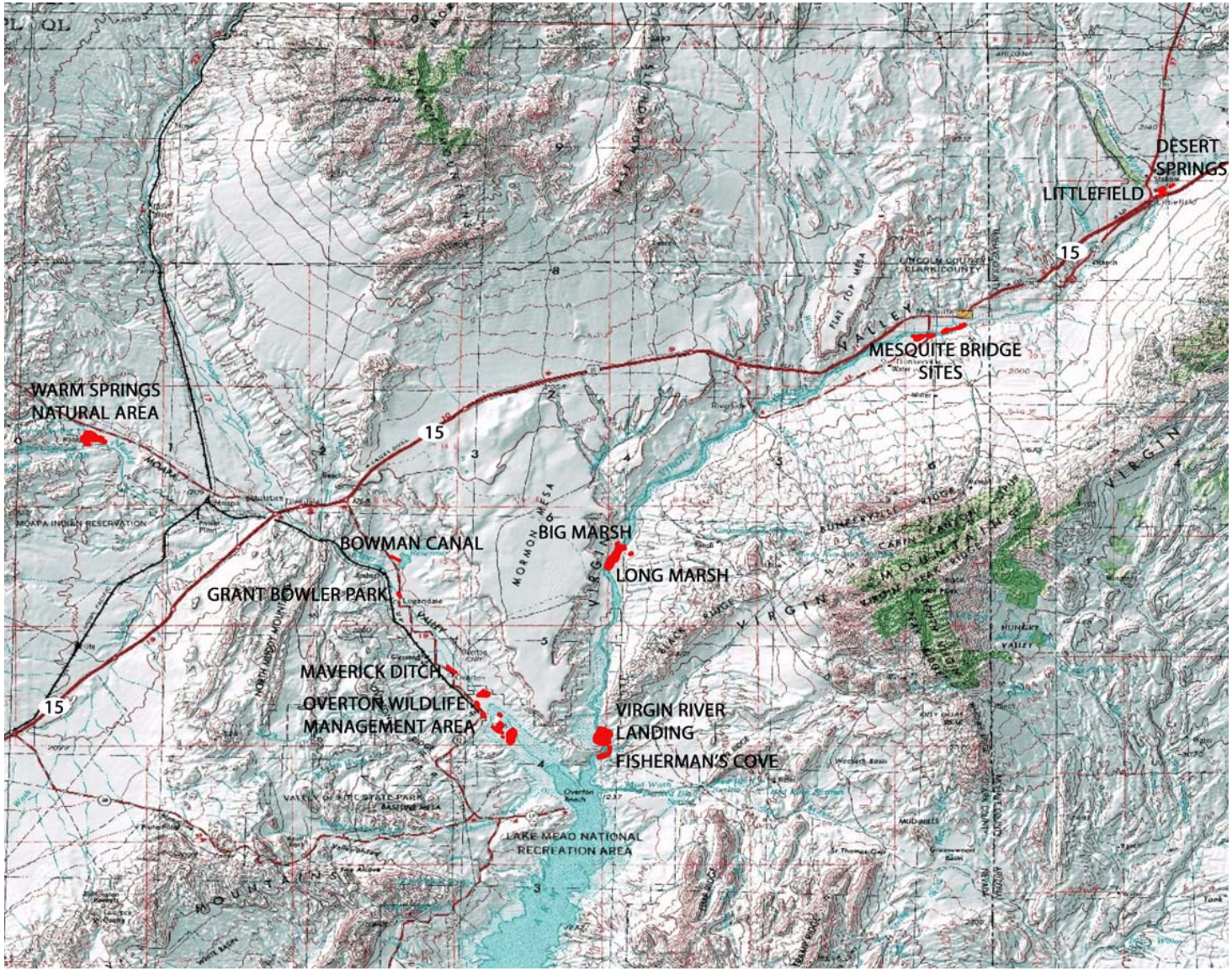

Figure 1. Regional overview of survey sites for Yuma Clapper Rail and Yellow-billed Cuckoo along the Virgin and Muddy Rivers.



Figure 2. Littlefield, Arizona survey sites for Yuma Clapper Rail and Yellow-billed Cuckoo.



Figure 3. Mesquite, Nevada survey sites for Yuma Clapper Rail and Yellow-billed Cuckoo.



Figure 4. Mormon Mesa survey sites for Yuma Clapper Rail and Yellow-billed Cuckoo.

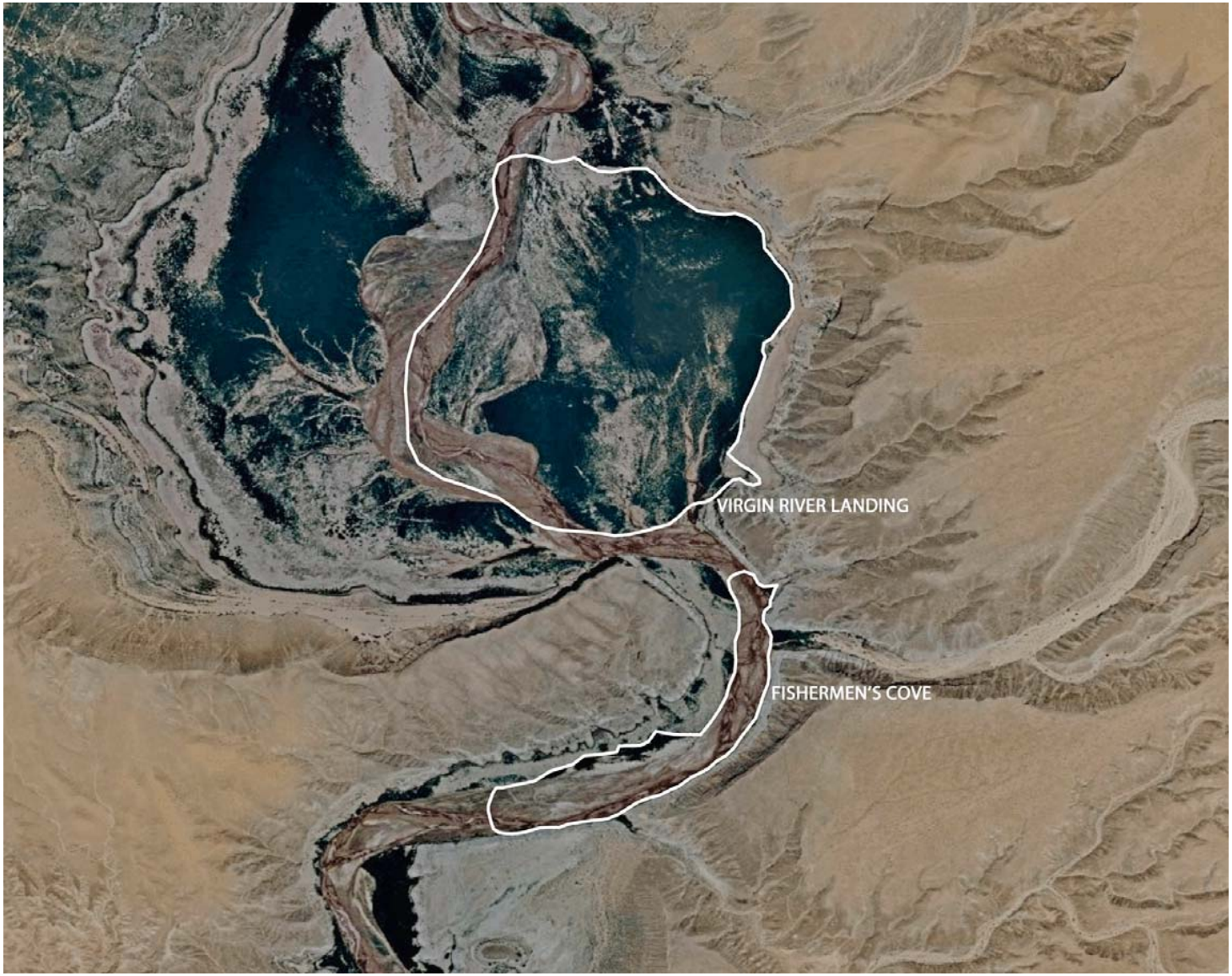

Figure 5. Virgin Delta survey sites for Yuma Clapper Rail and Yellow-billed Cuckoo.

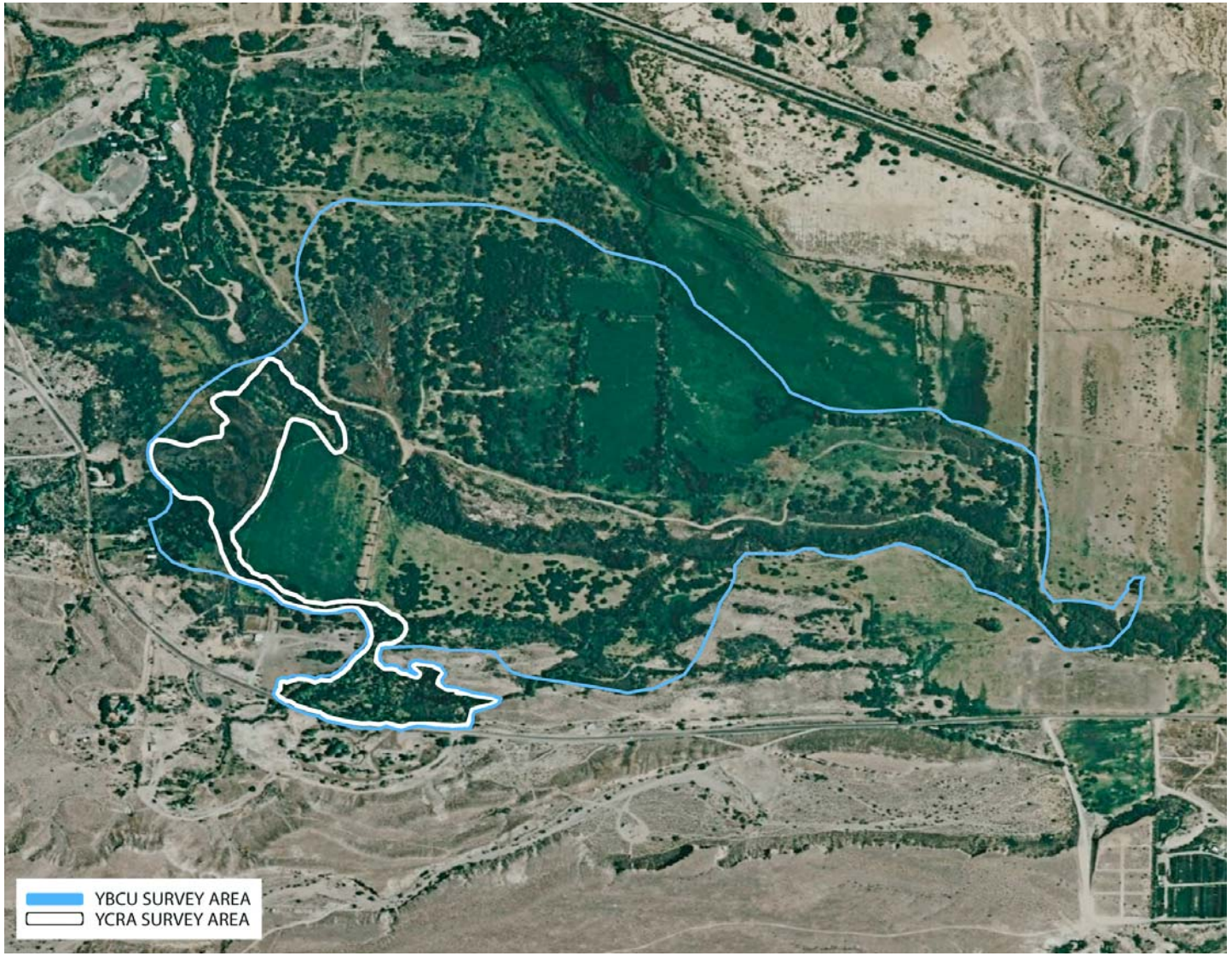

Figure 6. Warm Springs Natural Area survey sites for Yuma Clapper Rail and Yellow-billed Cuckoo.



Figure 7. Bowman Canal survey site for Yuma Clapper Rail.



Figure 8. Grant Bowler Park survey site for Yuma Clapper Rail.



Figure 9. Maverick Ditch survey site for Yuma Clapper Rail.



Figure 10. Overton Wildlife Management Area survey sites for Yuma Clapper Rail and Yellow-billed Cuckoo.



Figure 11. Yuma Clapper Rail detections at Honeybee Pond on the OWMA.



Figure 12. Yuma Clapper Rail detections at Blind 30 and South Marsh on the OWMA.



Figure 13. Yellow-billed Cuckoo and Southwestern Willow Flycatcher detections at the Warm Springs Natural Area.

Table 1: Locations, site names, and geographic coordinates for Yuma Clapper Rail and Yellow-billed Cuckoo survey sites on and along the Virgin and Muddy Rivers in southern Nevada. UTM coordinates are center points, see figures for site/survey polygons.

SITE NAME	LOCATION	UTM (NAD27)
Yuma Clapper Rail		
Big Marsh	Virgin River near Mormon Mesa	11 739484 E 4057710 N
Bowman Canal	Muddy River in Overton, Nevada	11 724864 E 4056419 N
East Marsh	Virgin River near Mormon Mesa	11 740398 E 4057198 N
Fisherman's Cove	Virgin River Delta	11 739236 E 4040878 N
Grant Bowler Park	Muddy River in Overton, Nevada	11 725253 E 4053374 N
Honeybee Pond	Overton Wildlife Management Area	11 731067 E 4045632 N
Littlefield South	Virgin River in Littlefield, Arizona	12 239484 E 4086707 N
Long Marsh	Virgin River near Mormon Mesa	11 739503 E 4057005 N
Maverick Ditch	Muddy River in Overton, Nevada	11 728886 E 4047419 N
Mesquite Bridge	Virgin River in Mesquite, Nevada	11 759109 E 4075353 N
Mesquite Bridge 3	Virgin River in Mesquite, Nevada	11 760997 E 4075951 N
Pintail Pond	Overton Wildlife Management Area	11 731502 E 4043761 N

Table 1 continued: Locations, site names, and geographic coordinates for Yuma Clapper Rail and Yellow-billed Cuckoo survey sites on and along the Virgin and Muddy Rivers in southern Nevada for 2008. UTM coordinates are center points, see figures for site/survey polygons.

SITE NAME	LOCATION	UTM (NAD27)
South Marsh	Overton Wildlife Management Area	11 732913 E 4042176 N
Virgin River Landing	Virgin River Delta	11 739006 E 4042326 N
Warm Springs Natural Area	Muddy River near Glendale, Nevada	11 704207 E 4065398 N
Yellow-billed Cuckoo		
Blind 30	Overton Wildlife Management Area	11 732085 E 4042897 N
Desert Springs	Virgin River near Littlefield, Arizona	12 240324 E 4087636 N
Honeybee Pond	Overton Wildlife Management Area	11 731002 E 4045628 N
Littlefield North	Virgin River in Littlefield, Arizona	12 239710 E 4087177 N
Long Marsh to Big Marsh	Virgin River near Mormon Mesa	11 739265 E 4057004 N
Maintenance Sheds	Overton Wildlife Management Area	11 731028 E 4043840 N
Mesquite Bridge 2	Virgin River in Mesquite, Nevada	11 758742 E 4075114 N
Mike's Site	Overton Wildlife Management Area	11 732310 E 4042176 N
Refuge Housing	Overton Wildlife Management Area	11 730624 E 4044736 N

Table 1 continued: Locations, site names, and geographic coordinates for Yuma Clapper Rail and Yellow-billed Cuckoo survey sites on and along the Virgin and Muddy Rivers in southern Nevada for 2008. UTM coordinates are center points, see figures for site/survey polygons.

SITE NAME	LOCATION	UTM (NAD27)
Southwestern Willow Flycatcher Habitat	Overton Wildlife Management Area	11 732111 E 4043940 N
Warm Springs Natural Area	Muddy River near Glendale, Nevada	11 704674 E 4065648 N
Willow Strip	Overton Wildlife Management Area	11 731933 E 4043495 N

Table 2: Results of Yuma Clapper Rail surveys by the San Bernardino County Museum in 2008 for sites in and along the Virgin and Muddy Rivers in southern Nevada. YCRA = Yuma Clapper Rail. VIRA = Virginia Rail. SORA = Sora, BLRA = Black Rail, LEBI = Least Bittern, AMBI = American Bittern, COMO = Common Moorhen. "s" = single individual, "p"= pair, "f" = family group. Survey times are A.M.

SITE	DATE	SURVEY TIMES	YCRA	VIRA	SORA	BLRA	LEBI	AMBI	COMO
Virgin River Sites									
Big Marsh	21 March	11:00 - 11:45	0	2s	0	0	0	0	0
	15 April	7:00 - 8:45	0	6s	0	0	0	0	0
	29 April	6:30 - 8:30	0	1s	2s	0	0	0	0
	13 May	6:30 - 8:30	0	0	0	0	0	0	0
	27 May	6:00 - 8:00	0	0	0	0	0	0	0
	10 June	6:45 - 8:45	0	0	0	0	0	0	0
Total survey time:		**11 hrs 30 min**							
Long Marsh [a]	21 March	Assessment [1]							
Fisherman's Cove [a]	22 March	Assessment [1]							
	11 June	Assessment [1]							
Virgin River Landing [a]	22 March	Assessment [1]							
	11 June	Assessment [1]							
Littlefield South	23 March	6:45 - 8:00	0	0	0	0	0	0	0
	15 April	9:20 - 9:50	0	0	0	0	0	0	0
	29 April	6:10 - 6:40	0	0	0	0	0	0	0
	13 May	6:10 - 6:40	0	0	1s	0	0	0	0
	27 May	6:20 - 6:40	0	0	0	0	0	0	0
	10 June	6:20 - 7:15	0	0	0	0	0	0	0
Total survey time:		**7 hrs 25 min**							
Littlefield North [a]	23 March	Assessment [1]							
	10 June	Assessment [1]							

Table 2 continued: Results of Yuma Clapper Rail surveys by the San Bernardino County Museum in 2008 for sites in and along the Virgin and Muddy Rivers in southern Nevada. YCRA = Yuma Clapper Rail. VIRA = Virginia Rail. SORA = Sora, BLRA = Black Rail, LEBI = Least Bittern, AMBI = American Bittern, COMO = Common Moorhen. "s" = single individual, "p"= pair, "f" = family group. Survey times are A.M.

SITE	DATE	SURVEY TIMES	YCRA	VIRA	SORA	BLRA	LEBI	AMBI	COMO
Mesquite Bridge	22 March	5:35 - 8:30	0	2s	1s	0	0	0	0
	15 April	6:20 - 8:05	0	6s	0	0	0	0	0
	29 April	7:15 - 9:55	0	7s	3s	0	1s	0	0
	13 May	7:20 - 9:50	0	6s	1s	0	0	0	0
	27 May	7:13 - 10:00	0	4s +2p	1s	0	1s +1p	0	1p
	11 June	6:00 - 8:30	0	2s	0	0	0	0	0
Total survey time:		**20 hrs 49 min**							
Mesquite Bridge 3	22 March	8:30 - 10:20	0	2s +2p	1s	0	0	0	0
	15 April	6:20 - 8:05	0	4s +1p	3s +1p	0	0	0	0
	29 April	7:15 - 9:55	0	4s +3p	1s	0	2s	0	0
	13 May	7:20 - 9:50	0	2s +1p	0	0	0	0	0
	27 May	7:13 - 10:00	0	3s +1p	1s	0	0	0	0
	11 June	6:00 - 8:30	0	4s	1s	0	0	0	0
Total survey time:		**14 hrs 52 min**							
Muddy River Sites									
Warm Springs Natural	22 March	Assessment [1]							
Area	23 March	7:00 - 8:30	0	15s	0	0	0	0	0
	16 April	6:00 - 7:30	0	5s + 6p	0	0	0	0	0
	1 May	5:45 - 7:15	0	7s	3s	0	0	0	0
	15 May	6:00 - 7:30	0	10s	3s	0	0	0	0
	29 May	6:00 - 7:30	0	6s	0	0	0	0	0
	12 June	5:45 - 7:30	0	11s	2s	0	0	0	0

Table 2 continued: Results of Yuma Clapper Rail surveys by the San Bernardino County Museum in 2008 for sites in and along the Virgin and Muddy Rivers in southern Nevada. YCRA = Yuma Clapper Rail. VIRA = Virginia Rail. SORA = Sora, BLRA = Black Rail, LEBI = Least Bittern, AMBI = American Bittern, COMO = Common Moorhen. "s" = single individual, "p"= pair, "f" = family group. Survey times are A.M.

SITE	DATE	SURVEY TIMES	YCRA	VIRA	SORA	BLRA	LEBI	AMBI	COMO
Total survey time:		**18 hrs 30 min**							
Bowman Canal [a]	21 March	Assessment [1]							
	14 April	Assessment [1]							
	14 May	Assessment [1]							
Grant Bowler Park [a]	21 March	Assessment [1]							
	14 April	Assessment [1]							
	14 May	Assessment [1]							
Maverick Ditch	21 March	10:50 - 11:20	0	0	0	0	0	0	0
	29 April	9:30 - 10:30	0	2p	0	0	0	0	0
	27 May	9:00 - 10:00	0	1s +1p	0	0	0	0	0
	10 June	9:45 - 10:45	0	5f	0	0	0	0	0
Total survey time:		**4 hrs**							
Honeybee Pond	21 March	6:50 - 8:30	0	3s	0	0	0	0	0
	14 April	6:00 - 8:03	1p	4s	0	0	0	0	1s
	30 April	6:10 - 7:34	3s	1s	0	0	0	0	4s
	14 May	6:00 - 7:30	0	0	0	0	2s	0	3s
	28 May	8:30 - 10:00	2p	2s	0	0	2s	0	2s
	10 June	5:30 - 7:30	1s + 2p	3s	0	0	3s	0	0
	25 June	8:15 - 9:00	1s + 6f	1s	1s	0	2s	0	0
Total survey time:		**19 hrs 44 min**							
Pintail Pond [a]		Assessment [1]							

Table 2 continued: Results of Yuma Clapper Rail surveys by the San Bernardino County Museum in 2008 for sites in and along the Virgin and Muddy Rivers in southern Nevada. YCRA = Yuma Clapper Rail. VIRA = Virginia Rail. SORA = Sora, BLRA = Black Rail, LEBI = Least Bittern, AMBI = American Bittern, COMO = Common Moorhen. "s" = single individual, "p"= pair, "f" = family group. Survey times are A.M.

SITE	DATE	SURVEY TIMES	YCRA	VIRA	SORA	BLRA	LEBI	AMBI	COMO
Blind 30	14 April	9:00 - 10:00	0	2s +1p	3s	0	2s	0	0
	30 April	8:00 - 9:37	3s	2s	2s	0	1s	0	0
	14 May	7:45 - 9:10	2s +1p	2s	0	0	0	0	0
	28 May	6:00 - 7:45	1s	1s +1p	0	0	1s	0	1s
	10 June	7:45 - 9:30	0	2s	0	0	0	0	0
	25 June	6:35 - 7:35	1s	0	1s	0	0	0	1s
Total survey time:		**16 hrs 45 min**							
South Marsh	21 March	7:30 - 9:00	0	18s	3s	0	0	0	2s
	14 April	6:30 - 8:30	1s	2s + 3p	1s	0	0	0	0
	30 April	6:15 - 8:15	0	0	0	0	0	0	0
	28 May	7:30 - 8:15	0	0	0	0	0	0	0
Total survey time:		**9 hrs 45 min**							
TOTAL BIRDS [2]			**12**	**72**	**21**	**0**	**10**	**0**	**9**
TOTAL SURVEY HOURS		**123 hrs 33min**							

1 – No survey. Dates are field visits for habitat suitability assessment/reassessments.
2 - Sum of the maximum number of birds detected per site. Maximum number of birds = the largest number of birds detected on a single survey event.
a – Habitat unsuitable for Yuma Clapper Rail. Not surveyed in 2008.
p - # of pairs detected, does not include # of single bird detections.
s - # of single birds detected. Does not include the # of pairs detected.
f - Assumed to be a family group when >2 birds were either seen together or vocalizing simultaneously within 5 m of each other.

Table 3: Results of 2008 Yellow-billed Cuckoo surveys by the San Bernardino County Museum for sites in and along the Virgin and Muddy Rivers in southern Nevada. Times are A.M. Numbers in parentheses are number of surveyors.

SITE	DATE	TIME	# YBCU DETECTED
Virgin River Sites			
Desert Springs	25 June	Assessment [1]	
Big Marsh Area	25 June	6:50 - 9:00 (1)	0
	9 July	6:30 - 8:30 (1)	0
	23 July	6:00 - 9:00 (2)	0
	5 August	6:00 - 9:30 (1)	0
Total survey time:		**10 hrs 40 min**	
Long Marsh Area	25 June	9:15 - 11:30 (1)	0
	9 July	6:30 - 9:00 (1)	0
	23 July	6:00 - 9:00 (2)	0
	5 August	5:55 - 7:35 (1)	0
Total survey time:		**9 hrs 25 min**	
Littlefield North	27 June	6:45 - 7:45 (1)	0
	10 July	7:00 - 8:30 (1)	0
	24 July	6:15 - 8:15 (2)	0
	6 August	6:20 - 7:20 (2)	0
Total survey time:		**5 hrs 30 min**	
Littlefield South	27 June	5:45 - 6:30 (1)	0
	10 July	5:30 - 6:15 (1)	0
	5 August	5:30 - 6:00 (1)	0
Total survey time:		**2 hrs 0 min**	
Mesquite Bridge 2	27 June	9:00 - 10:00 (1)	0
	10 July	9:00 - 10:30 (1)	0
	6 August	7:45 - 8:45 (2)	0
Total survey time:		**3 hr 30 min**	

Table 3 continued: Results of 2008 Yellow-billed Cuckoo surveys by the San Bernardino County Museum for sites in and along the Virgin and Muddy Rivers in southern Nevada. Times are A.M. Numbers in parentheses are number of surveyors.

SITE	DATE	TIME	# YBCU DETECTED
Muddy River Sites			
Refuge Housing	25 June	9:05 - 9:15 (2)	0
	9 July	6:05 - 6:30 (2)	0
	23 July	9:15 - 9:30 (2)	0
	5 August	6:00 - 6:20 (1)	0
Total survey time:		**1 hr 10 min**	
Maintenance Sheds	25 June	9:45 - 10:10 (2)	0
	9 July	6:35 - 7:10 (2)	0
	23 July	8:45 - 9:10 (2)	0
	5 August	6:25 - 6:55 (1)	0
Total survey time:		**1 hrs 55 min**	
Willow Strip	25 June	10:15 - 11:00 (2)	0
	9 July	7:15 - 8:15 (2)	0
	23 July	8:00 - 8:35 (2)	0
	5 August	7:00 - 8:00 (1)	0
Total survey time:		**3 hrs 20 min**	
Blind 30	25 June	6:25 - 7:40 (2)	0
	9 July	8:25 - 9:25 (2)	0
	23 July	6:25 - 7:00 (2)	0
	5 August	8:10 - 9:10 (1)	0
Total survey time:		**3 hrs 50 min**	
Mike's Site	25 June	8:00 - 8:45 (2)	0
	9 July	9:35 - 10:10 (2)	0
	23 July	7:45 - 7:55 (2)	0
	5 August	9:20 - 10:05 (1)	0
Total survey time:		**2 hr 15 min**	

Table 3 continued: Results of 2008 Yellow-billed Cuckoo surveys by the San Bernardino County Museum for sites in and along the Virgin and Muddy Rivers in southern Nevada. Times are A.M. Numbers in parentheses are number of surveyors.

SITE	DATE	TIME	# YBCU DETECTED
Honeybee Pond	25 June	8:15 - 9:00 (2)	0
	9 July	10:20 - 10:55 (2)	0
	23 July	9:40 - 10:45 (2)	0
	5 August	8:55 - 9:30 (1)	0
Total survey time:		**3 hrs 0 min**	
Warm Springs Natural Area	26 June	6:20 - 10:55 (4)	2 (paired)
	8 July	5:45 - 9:00 (4)	1[a]
	22 July	6:20 - 11:30 (2)	0
	7 August	5:30 - 8:30 (3)	0
Total survey time:		**16 hrs 0 min**	
TOTAL BIRDS			**3**
TOTAL SURVEY HOURS		**46 hrs 58 min**	

1 – No survey. Dates are field visits for habitat suitability assessment/reassessments.
a - Different location than 26 June sighting of YBCU pair.

Table 4: Yuma Clapper Rail and Yellow-billed Cuckoo detection locations for the 2008 survey season. Coordinates are NAD27.

SPECIES	SITE	DATE	UTM	COMMENTS
Yuma Clapper Rail				
	South Marsh	14 April	11 0733136 E 4042578 N	Unresponsive to tape. Clatter call as the observer was leaving.
	Blind 30	30 April	11 0732145 E 4042713 N	Extended kek calls in response to tape.
	Blind 30	30 April	11 0732223 E 4043158 N	One bird. Clatter call. Southeast of dike road.
	Blind 30	30 April	11 0732214 E 4043020 N	One bird. Clatter call. Southeast of dike road.
	Blind 30	14 May	11 0732058 E 4042590 N	One bird responded to tape. Clatter call.
	Blind 30	14 May	11 0732141 E 4042719 N	Dueting pair.
	Blind 30	14 May	11 0732124 E 4042649 N	One bird. Response to tape. Clatter call.
	Blind 30	28 May	11 0732145 E 4042636 N	One bird. Clatter call in response to tape.
	Blind 30	25 June	11 0732168 E 4042581 N	One bird. Clatter call southeast of dike road in response to tape.
	Honeybee Pond	14 April	11 0730611 E 4045469 N	Dueting pair clatter calls in response to tape.
	Honeybee Pond	30 April	11 0730612 E 4045469 N	One bird responded to tape.
	Honeybee Pond	30 April	11 0730804E 4045574 N	One bird, keking. Visual as it crossed the road.
	Honeybee Pond	30 April	11 0731250 E 4045651 N	One bird responded to tape. Clatter call.

Table 4 continued: Yuma Clapper Rail and Yellow-billed Cuckoo detection locations for the 2008 survey season. Coordinates are NAD27.

SPECIES	SITE	DATE	UTM	COMMENTS
	Honeybee Pond	28 May		
	Honeybee Pond	10 June	11 0731074 E 4045621 N	Clatter call.
	Honeybee Pond	10 June	11 0730927 E 4045748 N	Clatter call.
	Honeybee Pond	25 June		Clatter call. Single bird in response to tape.
	Honeybee Pond	25 June	11 0730888 E 4045475 N	6 YCRA within 5 m of each other. Multiple clatter calls and keks. Very responsive to tape.
Yellow-billed Cuckoo				
	Warm Springs	26 June	11 0705125 E 4065678 N	1 pair. Under observation for over an hour. Initially responsive to tape.
	Warm Springs	8 July	11 0704712 E 4065895 N	Single bird flew over in response to tape. Not vocalizing.

Table 5: Summary of San Bernardino County Museum Yuma Clapper Rail surveys along the Virgin and Muddy Rivers in Southern Nevada from 2000 through 2008. Numbers are the maximum number of detections. (-ns- = not surveyed)

	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Virgin River Sites									
Littlefield North [a]	2	0	0	0	1	ns- [h]	ns- [h]	-ns- [i]	-ns- [i]
Littlefield Bridge	0	0	0	0	-ns- [b]				
Littlefield South	2	0	0	0	1	-ns- [h]	0	-ns- [i]	0
Mesquite Upstream	0	0	0	1	-ns- [c]				
Mesquite Bridge	2	0	2	1	1	-ns- [c, h]	0	2	0
Mesquite Downstream	0	0	0	0	-ns- [c]				
Mesquite Bridge 3	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	0	0
Mormon Mesa: Big Marsh [d]	7 [e]	8-12	3	0	1	0	0	0	0
Mormon Mesa: Long Marsh	6	1	0	0	0	0	0	0	-ns- [i]
Mormon Mesa: East Marsh	5	2	-ns-	-ns-	0	-ns- [h]	-ns- [i]	-ns- [i]	-ns- [i]
Virgin River Landing	-ns-	-ns-	-ns-	0	2	0	0	-ns- [i]	-ns- [i]
Fisherman's Cove	-ns-	-ns-	-ns-	0	0	-ns- [h]	0	-ns- [i]	-ns- [i]
Muddy River Sites									
Warm Springs Natural Area	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	0 [f]
Glendale	-ns-	-ns-	0	0	-ns- [i]	-ns- [i]	-ns- [i]	-ns- [i]	-ns- [i]
Bowman Canal	-ns-	-ns-	-ns-	-ns-	0	0	-ns- [i]	-ns- [i]	-ns- [i]
Grant Bowler Park	-ns-	-ns-	-ns-	0	0	0	-ns- [i]	-ns- [i]	-ns- [i]

Table 5 continued: Summary of San Bernardino County Museum Yuma Clapper Rail surveys along the Virgin and Muddy Rivers in Southern Nevada from 2000 through 2008. Numbers are the maximum number of detections. (-ns- = not surveyed)

	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Maverick Ditch	1	0	4	1	0	0	0	0	0
Honeybee Pond	1	0	0	2	0	0	0	3	7[m]
Pintail Pond	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	0 [j]	-ns- [i]	-ns- [i]
Blind 30	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	4[l]
South Marsh	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	2 [j]	14	1
Total Detections	**26**	**13**	**9**	**5**	**6**	**0**	**2**	**19**	**12**

a - Includes Beaver Dam Wash.
b - Site was split in half and surveyed since 2004 as additions to Little Field North and South.
c - Suitable habitat at Mesquite Upstream and Downstream sites has decreased through time. Sites were combined with Mesquite Bridge site and surveyed with same beginning in 2005.
d - Mormon Mesa sites have been referenced as "Overton" sites in past reports.
e - Includes observations of two fledglings.
f - Survey site new in 2008.
h- Habitat disturbed by floods or bulldozers during winter 2005 flood events.
i - No suitable habitat
j - Survey site new in 2006.
l- Site first established in 2008.
m-Includes 1 family group of 6.

Table 6: Summary of San Bernardino County Museum Yellow-billed Cuckoo surveys along the Virgin and Muddy Rivers in southern Nevada from 2000 through 2008. Numbers are number of detections. (-ns- = not surveyed)

	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Virgin River Sites									
Desert Springs	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	0	0	-ns-
Littlefield North	2	0	0	0	0	0	0	0	0
Littlefield South	-ns-[i]	-ns-[i]	-ns-[i]	-ns-[i]	-ns-[i]	-ns-[i]	-ns-[i]	-ns-[i]	0
Mesquite Bridge	1	0	0	1	0	-ns-[h, i]	-ns-[i]	-ns-[i]	-ns-[i]
Mesquite Bridge 2	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	0[j]	0	0
Mormon Mesa [k]	3-4	6-10	0	0	0	0	3	4	0
Virgin Delta West	-ns-	2[f]	0	-ns-	-ns-	-ns-[h, i]	-ns-[i]	-ns-[i]	-ns-[i]
Muddy River Sites									
Blind 30	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	2	0
Honeybee Pond	-ns-	-ns-	-ns-	0	0	1	0	0	0
Maintenance Sheds	-ns-	-ns-	-ns-	-ns-	-ns-	1	2	2	0
Mike's Site	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	1[l]	0
Refuge Housing	-ns-	-ns-	-ns-	-ns-	-ns-	0	0	0	0

Table 6 continued: Summary of San Bernardino County Museum Yellow-billed Cuckoo surveys along the Virgin and Muddy Rivers in southern Nevada from 2000 through 2008. Numbers are number of detections. (-ns- = not surveyed)

	2000	2001	2002	2003	2004	2005	2006	2007	2008
Southwestern Willow Flycatcher	-ns-	-ns-	-ns-	-ns-	-ns-	0	0	0	-ns-
Warm Springs Natural Area [g]	-ns-	-ns-	-ns-	1	1	1	1	0	3
Willow Strip	-ns-	-ns-	-ns-	-ns-	-ns-	0	0	3	0
Total Detections	**6**	**10**	**0**	**2**	**1**	**3**	**6**	**12**	**3**

a - Includes Beaver Dam Wash.
b - Site was split in half and surveyed since 2004 as additions to Little Field North and South.
c - Suitable habitat at Mesquite Upstream and Downstream sites has been decreased over the years, so both sites were combined with Mesquite Bridge site and surveyed with same since 2004.
d - Mormon Mesa sites have been referenced as “Overton” sites in past reports.
e - Includes observations of two fledglings.
f - Nest, two eggs and fledglings.
g - Warm Springs Natural Area has been surveyed prior to 2003 by individuals not associated with SBCM. Site name prior to 2008 was Warm Springs Ranch.
h- Habitat disturbed by floods or bulldozers during winter 2005 flood events.
i - No suitable habitat
j - Survey site new in 2006.
k- Long Marsh, Big Marsh, and adjacent suitable habitats.
l - Site established in 2007.

Table 7: Incidental Southwestern Willow Flycatcher observations at the Warm Springs Natural Area during the 2008 Yuma Clapper Rail and Yellow-billed Cuckoo survey season. Coordinates are NAD27.

Date	UTM	Comments
29 May	11 0704167 E 4065430 N	Multiple *phitz-bews/whits* for extended periods of time over a large area. Same general area as subsequent observations on 12 June.
12 June	11 0704157 E 4065459 N	Seems to be a pair. *Phitz-bews/whits/wheeos* within a confined territorial area. Interactions with adjacent WIFL pair (see next entry).
12 June	11 0704137 E 4065521 N	Also seems to be a pair. *Phitz-bews/whits* within a confined territorial area. Interactions with adjacent WIFL pair (see previous entry).
12 June	11 0704170 E 4065407 N	Likely two adjacent pairs. Independent of the other 12 June observations. Multiple birds, *phitz-bews*, *whits*, counter singing, squabbling at territory boundary.
26 June	11 0704875 E 4065558 N	Two pairs. *Phitz-bews* at territorial boundaries, changing to *whitts*, occasional *wheeos*. Then silence for long periods of time.
26 June	11 0705125 E 4065678 N	One bird *phitz-bewing* briefly. Habitat is marginal at best. Likely not a breeding territory.
22 July	11 0704717 E 4065871 N	*Phitz-bews/whitts* for ~1.5 minutes then quiet. Occasional *whits* thereafter. One bird? Behavior suggests nest was likely present.
22 July	11 0704170 E 4065407 N	Same location as multiple pair observations on 12 June. Occasional *whits*, but could not locate bird(s).
22 July	11 0704127 E 4065561 N	Current year's nest, abandoned, no evidence that young occupied or fledged from nest.

Table 8: Incidental bird species detected during San Bernardino County Museum Yuma Clapper Rail and Yellow-billed Cuckoo surveys in 2008 along the Virgin and Muddy Rivers in southern Nevada. Detections are incidental and indicate presence only. Absence should not be inferred. See text, table 1, and figures for site locations.

Species	Littlefield North	Littlefield South	Mesquite Bridge 3	Mesquite Bridge	Big Marsh	Long Marsh	Maverick Ditch	Honeybee Pond [1]	Blind 30[1]	OWMA [2]	Warm Springs	Grant Bowler
Canada Goose			X					X	X	X		
Gadwall												
Mallard		X	X	X	X			X	X	X	X	
Cinnamon Teal			X		X			X	X	X		
Northern Shoveler								X	X			
American Widgeon									X			
Northern Pintail								X	X			
Blue-winged Teal									X	X		
Green-winged teal								X	X			
Redhead			X					X	X	X		
Canvasback									X			
Ring-necked Duck								X	X			
Greater Scaup									X			
Lesser Scaup								X	X			
Bufflehead									X	X		
Ruddy Duck								X	X			
Barrow's Golden-eye									X			
Common Golden-eye									X	X		
Ring-necked Pheasant								X	X		X	

Table 8 continued: Incidental bird species detected during San Bernardino County Museum Yuma Clapper Rail and Yellow-billed Cuckoo surveys in 2008 along the Virgin and Muddy Rivers in southern Nevada. Detections are incidental and indicate presence only. Absence should not be inferred. See text, table 1, and figures for site locations.

Species	Littlefield North	Littlefield South	Mesquite Bridge 3	Mesquite Bridge	Big Marsh	Long Marsh	Maverick Ditch	Honeybee Pond [1]	Blind 30[1]	OWMA [2]	Warm Springs	Grant Bowler
Turkey								X	X	X		
Domestic Rooster										X		
Peacock										X		
Gambel's Quail	X	X	X	X			X	X	X	X	X	X
Pied-billed Grebe								X	X	X		
Horned Grebe									X			
Eared Grebe				X				X	X			
Clark's Grebe								X	X	X		
Western Grebe								X	X	X		
American White Pelican									X			
Double-crested Cormorant								X	X			
Least Bittern			X	X				X	X	X		
Great Blue Heron		X	X	X	X			X	X	X	X	
Great Egret			X	X	X			X	X	X	X	
Snowy Egret			X	X				X	X	X		
Cattle Egret				X					X	X		
White-faced Ibis		X						X	X	X	X	
Green Heron			X	X				X	X			
Black-crowned Night-Heron					X			X	X	X	X	

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Table 8 continued: Incidental bird species detected during San Bernardino County Museum Yuma Clapper Rail and Yellow-billed Cuckoo surveys in 2008 along the Virgin and Muddy Rivers in southern Nevada. Detections are incidental and indicate presence only. Absence should not be inferred. See text, table 1, and figures for site locations.

Species	Littlefield North	Littlefield South	Mesquite Bridge 3	Mesquite Bridge	Big Marsh	Long Marsh	Maverick Ditch	Honeybee Pond [1]	Blind 30[1]	OWMA [2]	Warm Springs	Grant Bowler
Turkey Vulture	X		X	X	X		X	X		X	X	
Osprey										X		
Northern Harrier			X		X			X	X	X	X	
Sharp-shinned Hawk									X		X	
Cooper's Hawk			X					X			X	
Common Black-Hawk	X	X										
Red-tailed Hawk		X	X					X		X	X	
American Kestrel					X				X	X	X	
Merlin									X	X		
Prairie Falcon										X		
Peregrine Falcon									X	X		
Clapper Rail								X	X			
Virginia Rail			X	X	X		X	X	X	X	X	
Sora		X	X	X					X		X	
Common Moorhen			X	X				X	X	X		
American Coot		X	X	X	X			X	X	X		
Killdeer		X	X	X				X	X	X	X	
Black-necked Stilt									X			
American Avocet								X	X	X		
Greater Yellowlegs									X	X		

Table 8 continued: Incidental bird species detected during San Bernardino County Museum Yuma Clapper Rail and Yellow-billed Cuckoo surveys in 2008 along the Virgin and Muddy Rivers in southern Nevada. Detections are incidental and indicate presence only. Absence should not be inferred. See text, table 1, and figures for site locations.

Species	Littlefield North	Littlefield South	Mesquite Bridge 3	Mesquite Bridge	Big Marsh	Long Marsh	Maverick Ditch	Honeybee Pond [1]	Blind 30[1]	OWMA [2]	Warm Springs	Grant Bowler
Solitary Sandpiper											X	
Spotted Sandpiper	X	X		X					X	X	X	
Western Sandpiper									X	X		
Long-billed Curlew								X				
Long-billed Dowitcher									X	X	X	
Wilson's Snipe			X		X						X	
Ring-billed Gull								X	X			
California Gull									X			
Bonaparte's Gull									X			
Forster's Tern									X			
Caspian Tern								X	X	X		
White-winged Dove	X							X	X	X	X	
Mourning Dove	X	X	X	X	X	X	X	X	X	X	X	
Inca Dove											X	
Eurasian Collared Dove	X	X	X	X	X		X	X	X	X	X	
Yellow-billed Cuckoo											X	
Greater Roadrunner	X			X	X				X	X	X	X
Barn Owl											X	
Great Horned Owl	X										X	

Table 8 continued: Incidental bird species detected during San Bernardino County Museum Yuma Clapper Rail and Yellow-billed Cuckoo surveys in 2008 along the Virgin and Muddy Rivers in southern Nevada. Detections are incidental and indicate presence only. Absence should not be inferred. See text, table 1, and figures for site locations.

Species	Littlefield North	Littlefield South	Mesquite Bridge 3	Mesquite Bridge	Big Marsh	Long Marsh	Maverick Ditch	Honeybee Pond [1]	Blind 30[1]	OWMA [2]	Warm Springs	Grant Bowler
Lesser Nighthawk					X	X					X	
White-throated Swift	X	X			X				X		X	
Black-chinned Hummingbird			X	X				X				
Anna's Hummingbird	X										X	
Costa's Hummingbird								X				
Belted Kingfisher					X				X			
Northern Flicker	X		X						X		X	
Ladder-backed Woodpecker	X				X						X	
Common Poorwill											X	
Western Wood-Pewee											X	
Willow Flycatcher											X	
Gray Flycatcher										X		
Cordilleran Flycatcher					X						X	
Black Phoebe			X					X		X	X	
Say's Phoebe			X	X		X	X	X		X	X	
Vermillion Flycatcher											X	
Ash-throated Flycatcher				X	X						X	
Brown-crested Flycatcher	X				X	X			X	X	X	

Table 8 continued: Incidental bird species detected during San Bernardino County Museum Yuma Clapper Rail and Yellow-billed Cuckoo surveys in 2008 along the Virgin and Muddy Rivers in southern Nevada. Detections are incidental and indicate presence only. Absence should not be inferred. See text, table 1, and figures for site locations.

Species	Littlefield North	Littlefield South	Mesquite Bridge 3	Mesquite Bridge	Big Marsh	Long Marsh	Maverick Ditch	Honeybee Pond [1]	Blind 30[1]	OWMA [2]	Warm Springs	Grant Bowler
Cassin's Kingbird					X					X	X	
Western Kingbird	X		X		X				X	X	X	
Loggerhead Shrike	X									X	X	
Arizona Bell's Vireo	X			X	X	X			X	X	X	
Warbling Vireo		X						X	X			
Common Raven	X	X	X	X	X					X	X	
Bushtit											X	
Tree Swallow	X	X			X				X		X	
Violet-green Swallow	X								X		X	
Cliff Swallow	X	X			X	X		X	X	X	X	
Northern Rough-winged Swallow	X	X	X	X	X	X		X	X	X	X	
Barn Swallow		X	X	X	X			X	X		X	
Verdin	X		X					X	X	X	X	X
Bewick's Wren	X		X	X	X	X					X	
Marsh Wren			X	X	X			X	X	X	X	
Ruby-crowned Kinglet									X	X		
Blue-gray Gnatcatcher											X	
Black-tailed Gnatcatcher	X		X		X			X	X	X	X	
American Robin		X									X	

Table 8 continued: Incidental bird species detected during San Bernardino County Museum Yuma Clapper Rail and Yellow-billed Cuckoo surveys in 2008 along the Virgin and Muddy Rivers in southern Nevada. Detections are incidental and indicate presence only. Absence should not be inferred. See text, table 1, and figures for site locations.

Species	Littlefield North	Littlefield South	Mesquite Bridge 3	Mesquite Bridge	Big Marsh	Long Marsh	Maverick Ditch	Honeybee Pond [1]	Blind 30[1]	OWMA [2]	Warm Springs	Grant Bowler
Northern Mockingbird								X	X	X	X	X
European Starling	X										X	
American Pipit					X	X					X	
Le Conte's Thrasher											X	
Crissal Thrasher										X	X	
Phainopepla									X		X	
Orange-crowned Warbler									X			
Lucy's Warbler					X	X					X	
Yellow-rumped Warbler	X				X			X	X			
Yellow Warbler [a]	X	X	X	X	X	X		X	X	X	X	X
Common Yellowthroat	X	X	X	X	X		X	X	X	X	X	
Wilson's Warbler								X			X	
Yellow-breasted Chat	X	X			X	X		X	X	X	X	
Summer Tanager	X										X	
Western Tanager	X	X	X		X					X	X	
Abert's Towhee	X	X	X		X	X	X	X	X	X	X	
Brewer's Sparrow							X					
Song Sparrow	X	X	X	X	X	X	X	X	X	X	X	X
Lincoln's Sparrow											X	

Table 8 continued: Incidental bird species detected during San Bernardino County Museum Yuma Clapper Rail and Yellow-billed Cuckoo surveys in 2008 along the Virgin and Muddy Rivers in southern Nevada. Detections are incidental and indicate presence only. Absence should not be inferred. See text, table 1, and figures for site locations.

Species	Littlefield North	Littlefield South	Mesquite Bridge 3	Mesquite Bridge	Big Marsh	Long Marsh	Maverick Ditch	Honeybee Pond [1]	Blind 30[1]	OWMA [2]	Warm Springs	Grant Bowler
White-crowned Sparrow				X	X			X		X	X	
Blue Grosbeak	X		X		X				X	X	X	
Brewer's Blackbird								X		X	X	
Red-winged Blackbird			X	X	X			X	X	X	X	X
Western Meadowlark								X			X	
Yellow-headed Blackbird			X	X				X	X	X	X	
Great-tailed Grackle			X	X				X	X	X	X	
Brown-headed Cowbird	X		X		X	X	X	X	X	X	X	
Hooded Oriole											X	
Bullock's Oriole	X				X				X	X	X	
Purple Finch	X	X										
House Finch	X	X		X	X			X	X	X	X	
Lesser Goldfinch	X	X							X		X	
House Sparrow								X		X		

a – Includes *marcomi* and *sonorana* races of the Yellow Warbler.
1 – Located on the OWMA.
2 – Combination of Refuge Housing, South Marsh, Willow Strip and Mike's Site.

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2321 W. Royal Palm Road, Suite 103
Phoenix Arizona, 85021-4951

15 December 2010

Dear Cooperator,

The following report is being submitted to fulfill the requirements of Federal Fish and Wildlife Permit number TE039466-1. This permit was issued to the Arizona Cooperative Fish and Wildlife Research Unit to conduct call-broadcast surveys for Yuma clapper rails in Arizona and California.

We conducted surveys at 74 routes in 2010. Each route received 3-12 point-count surveys between March and July. All detections of primary marsh bird species were recorded, including detections of Yuma clapper rail. In total we recorded 1607 detections of Yuma clapper rails. These numbers could include multiple detections of the same individuals. A summary of our results is included in the attached report.

Although it is suggested in the permit, copies of field datasheets were not included with this report due to the volume of data collected. Copies of the approximately 5000 datasheets may be obtained upon request.

Sincerely,

Christopher Nadeau
Wildlife Biologist
University of Arizona
325 Biological Sciences East
Tucson, Arizona 85721
(520) 626-8912

The Effects of Fire on the Yuma Clapper Rail (*Rallus longirostris yumanensis*)

2010 Annual Report

for

USFWS Endangered Species Permit # TE039466-1

Courtney J. Conway and Christopher P. Nadeau
USGS Arizona Cooperative Fish and Wildlife Research Unit
University of Arizona
325 Biological Sciences East, Tucson, Arizona 85721

Introduction:

The Yuma clapper rail (*Rallus longirostris yumanensis*) is a federally endangered species that occurs along the lower Colorado River, the Imperial Valley of California, the Colorado River delta, and along the west coast of Mexico. Ninety percent of the U.S. population exists in only 2 wetlands (Conway et al. 1993) and much existing wetland habitat remains unoccupied. Yuma clapper rails are ranked 6th out of 230 breeding bird species in Arizona based on their conservation need (Latta et al. 1999). To ensure long-term persistence of U.S. populations, we need to have effective management and mitigation activities that improve habitat quality and benefit Yuma clapper rail populations. One possible management activity that has been proposed to benefit Yuma clapper rail populations is prescribed burning in areas with decadent emergent vegetation (Conway et al. 1993). Historically, marsh habitats along the lower Colorado River were highly ephemeral with periodic flooding and natural fires eliminating decadent stands of emergent vegetation. These stochastic events resulted in areas of early successional emergent marsh habitat thought to be beneficial to rails (Conway 1990, Conway et al. 1993). Years of flood control and fire suppression has resulted in substantial areas of decadent emergent marsh habitat, but very little early successional emergent marsh along the lower Colorado River. Prescribed fire may be the best technique for creating early-successional emergent marsh habitat required to enhance populations of Yuma clapper rails. Indeed, prescribed fire has been repeatedly suggested as a promising conservation measure for restoring Yuma clapper rail populations (Conway et al. 1993, Conway 1995, Eddleman and Conway 1998, Conway and Eddleman 2000), but has yet to be evaluated. We conducted pre- and post-burn surveys in both burned and control marshes to examine the effects of fire on the abundance of rails and the quality of rail habitat.

Field Locations

Study Sites were located along the lower Colorado River in Arizona (Yuma and Mohave Counties) and California (Imperial County), and south of the Salton Sea in the Imperial Valley of California (Imperial County). We worked closely with Imperial National Wildlife Refuge, Havasu National Wildlife Refuge, and Sony Bono Salton Sea National Wildlife Refuge to conduct burns and marsh bird surveys at each refuge. Each burn occurred between 2003 and 2009. We also surveyed marshes on other state and federally owned lands. See the attached maps, which include all our study locations (Appendix 2).

Methods:

We conducted call-broadcast surveys for rails in 2 types of study sites: sites recently burned (n=20) and non-burned (control) sites near each burn site (n=64). In 2010 at each study site, we conducted 3-12 replicate surveys between March and July. We used survey protocols that we developed based on our previous studies of marsh bird survey methods (Conway et al. 1993, Conway and Gibbs 2001, Conway et al. 2001, Conway 2009) and on recommendations from a recent wetland bird monitoring workshop at the USGS Patuxent Wildlife Research Center (Ribic et al.1999). Surveys were conducted during mornings between one half-hour before sunrise until 10:00 am and in the evenings between 5:00 pm until dusk (one half-hour after sunset). All surveys were conducted on days without rain and when wind speeds did not exceed 10 mph.

Survey Results:

A summary of our survey results for 2010 are included in Appendix 1(including geographic coordinates for each survey route). The format of this summary was developed through extensive phone and email conversations with USFWS staff. Results summarized by point are available upon request. Maps are included in Appendix 2.

Preliminary analysis of survey data from 2003-2007 are promising. Numbers of Yuma clapper rails increased following fire and abundance was higher compared to control sites in the 2 years post-burn. We will continue to monitor burn and control sites in subsequent years to determine the long-term effects of fire on rails and the fire frequency needed to maintain optimal rail habitat.

Literature Cited:

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Appendix 1. Number of Yuma clapper rails counted during each survey at each route during the 2010 breeding season. Latitude and Longitude data were recorded in the North American Datum 1983 and represent the average Latitude and Longitude of the survey route.

Site	Date	Observer	Location		Total Number of CLRA Detected Per Survey (repeats excluded)
			Latitude	Longitude	
aasw	30-Mar-10	Glen McHargue	32.8711379	-114.478076	0
aasw	16-Mar-10	Meaghan Conway	32.8711379	-114.478076	0
aasw	11-Apr-10	Meaghan Conway	32.8711379	-114.478076	0
aasw	13-Apr-10	Ian Maunsell	32.8711379	-114.478076	0
aasw	07-May-10	Ian Maunsell	32.8711379	-114.478076	0
all american canal and southern lcr	02-Apr-10	Ian Maunsell	32.8029971	-114.538807	0
all american canal and southern lcr	15-Apr-10	Lauren Macfarland	32.8029971	-114.538807	0
all american canal and southern lcr	04-May-10	Meaghan Conway	32.8029971	-114.538807	0
all american canal and southern lcr	25-May-10	Glen McHargue	32.8029971	-114.538807	0
arizona channel c	01-Apr-10	Meaghan Conway	32.9413327	-114.472738	5
arizona channel c	14-Apr-10	Lauren Macfarland	32.9413327	-114.472738	2
arizona channel c	05-May-10	Ian Maunsell	32.9413327	-114.472738	3
arizona channel c	17-May-10	Lauren Macfarland	32.9413327	-114.472738	0
arizona channel c	19-May-10	Lauren Macfarland	32.9413327	-114.472738	0
arizona channel c	20-May-10	Meaghan Conway	32.9413327	-114.472738	1
beal lake	22-Apr-10	Glen McHargue	34.7685031	-114.533232	0
beal lake	14-May-10	Ian Maunsell	34.7685031	-114.533232	2
beal lake	17-Jun-10	Glen McHargue	34.7685031	-114.533232	4
beal lake	25-May-10	Lauren Macfarland	34.7685031	-114.533232	4
deer island	02-Apr-10	Meaghan Conway	32.9449227	-114.479919	1
deer island	12-Apr-10	Ian Maunsell	32.9449227	-114.479919	1
deer island	04-May-10	Lauren Macfarland	32.9449227	-114.479919	0
deer island	14-May-10	Meaghan Conway	32.9449227	-114.479919	2
east pond	19-Apr-10	Lauren Macfarland	32.8721825	-114.475696	3
east pond	24-Mar-10	Glen McHargue	32.8721825	-114.475696	0
east pond	02-Apr-10	Glen McHargue	32.8721825	-114.475696	0
east pond	10-May-10	Meaghan Conway	32.8721825	-114.475696	1
Ferguson Lake FG	04-Apr-10	Meaghan Conway	32.9746225	-114.500759	0
Ferguson Lake FG	14-Apr-10	Meaghan Conway	32.9746225	-114.500759	1
Ferguson Lake FG	07-May-10	Lauren Macfarland	32.9746225	-114.500759	0
Ferguson Lake FG	21-May-10	Lauren Macfarland	32.9746225	-114.500759	0
Gila River Dome Valley East	12-Apr-10	Meaghan Conway	32.6974973	-114.289635	0
Gila River Dome Valley East	03-May-10	Glen McHargue	32.6974973	-114.289635	2
Gila River Dome Valley East	18-May-10	Meaghan Conway	32.6974973	-114.289635	1
Gila River Dome Valley East	15-Apr-10	Ian Maunsell	32.6974973	-114.289635	1
Gila River Dome Valley West	30-Mar-10	Glen McHargue	32.7585833	-114.369858	2

Gila River Dome Valley West	31-Mar-10	Lauren Macfarland	32.7585833	-114.369858	1
Gila River Dome Valley West	08-Apr-10	Glen McHargue	32.7585833	-114.369858	1
Gila River Dome Valley West	28-Apr-10	Meaghan Conway	32.7585833	-114.369858	8
Gila River Dome Valley West	14-May-10	Glen McHargue	32.7585833	-114.369858	3
Gila River Dome Valley West	16-Apr-10	Meaghan Conway	32.7585833	-114.369858	4
Gila River EM	08-Apr-10	Meaghan Conway	32.730506	-113.93146	0
Gila River EM	16-Apr-10	Glen McHargue	32.730506	-113.93146	0
Gila River EM	13-May-10	Glen McHargue	32.730506	-113.93146	0
Gila River EM	26-May-10	Glen McHargue	32.730506	-113.93146	0
Gila River North Gila Valley	30-Mar-10	Lauren Macfarland	32.7379427	-114.451424	7
Gila River North Gila Valley	14-Apr-10	Ian Maunsell	32.7379427	-114.451424	6
Gila River North Gila Valley	12-May-10	Glen McHargue	32.7379427	-114.451424	12
Gila River North Gila Valley	26-May-10	Meaghan Conway	32.7379427	-114.451424	3
Gila River Tacna Valley	08-Apr-10	Meaghan Conway	32.718204	-113.982354	0
Gila River Tacna Valley	16-Apr-10	Glen McHargue	32.718204	-113.982354	0
Gila River Tacna Valley	13-May-10	Glen McHargue	32.718204	-113.982354	0
Gila River Tacna Valley	26-May-10	Glen McHargue	32.718204	-113.982354	0
Gila River Wellton Valley	25-Mar-10	Meaghan Conway	32.7109727	-114.106521	0
Gila River Wellton Valley	13-Apr-10	Glen McHargue	32.7109727	-114.106521	0
Gila River Wellton Valley	10-May-10	Ian Maunsell	32.7109727	-114.106521	1
Gila River Wellton Valley	27-May-10	Glen McHargue	32.7109727	-114.106521	0
hidden shores boat a	13-May-10	Meaghan Conway	32.8922187	-114.456941	2
hidden shores boat a	29-Mar-10	Meaghan Conway	32.8922187	-114.456941	0
hidden shores boat a	13-Apr-10	Lauren Macfarland	32.8922187	-114.456941	2
hidden shores boat a	29-Apr-10	Meaghan Conway	32.8922187	-114.456941	0
hidden shores boat a	30-Apr-10	Glen McHargue	32.8922187	-114.456941	0
hidden shores boat b	30-Mar-10	Ian Maunsell	32.8883822	-114.462217	7
hidden shores boat b	30-Mar-10	Meaghan Conway	32.8883822	-114.462217	6
hidden shores boat b	14-Apr-10	Glen McHargue	32.8883822	-114.462217	4
hidden shores boat b	03-May-10	Ian Maunsell	32.8883822	-114.462217	7
hidden shores boat b	12-May-10	Meaghan Conway	32.8883822	-114.462217	4
hiddne shores boat c	20-May-10	Ian Maunsell	32.8933196	-114.458329	17
hidden shores boat c	29-Mar-10	Meaghan Conway	32.8933196	-114.458329	15
hidden shores boat c	15-Apr-10	Meaghan Conway	32.8933196	-114.458329	3
hidden shores boat c	04-May-10	Lauren Macfarland	32.8933196	-114.458329	9
hidden shores boat d	06-May-10	Lauren Macfarland	32.8986276	-114.461541	3
hidden shores boat d	19-Mar-10	Meaghan Conway	32.8986276	-114.461541	5
hidden shores boat d	30-Mar-10	Meaghan Conway	32.8986276	-114.461541	2
hidden shores boat d	13-Apr-10	Ian Maunsell	32.8986276	-114.461541	3
hidden shores marsh	02-Apr-10	Glen McHargue	32.8735422	-114.45586	11
hidden shores marsh	22-Mar-10	Meaghan Conway	32.87372	-114.45584	9
hidden shores marsh	22-Mar-10	Ian Maunsell	32.87372	-114.45584	9
hidden shores marsh	18-May-10	Lauren Macfarland	32.87372	-114.45584	0

hidden shores marsh	20-May-10	Lauren Macfarland	32.87372	-114.45584	3
hidden shores marsh	27-Apr-10	Meaghan Conway	32.87372	-114.45584	8
hurricane ridge marsh	03-May-10	Meaghan Conway	32.90174	-114.484188	0
hurricane ridge marsh	17-May-10	Glen McHargue	32.90174	-114.48419	0
hurricane ridge marsh	14-Apr-10	Ian Maunsell	32.90174	-114.48419	0
hurricane ridge marsh	26-Mar-10	Lauren Macfarland	32.90174	-114.48419	0
imperial dam road marsh a	29-Mar-10	Ian Maunsell	32.86609	-114.482533	0
imperial dam road marsh a	13-Apr-10	Meaghan Conway	32.86609	-114.482533	0
imperial dam road marsh a	04-May-10	Ian Maunsell	32.86609	-114.482533	0
imperial dam road marsh a	17-May-10	Lauren Macfarland	32.86609	-114.482533	0
imperial dam road marsh b	29-Mar-10	Ian Maunsell	32.858525	-114.492796	0
imperial dam road marsh b	13-Apr-10	Meaghan Conway	32.858525	-114.492796	1
imperial dam road marsh b	04-May-10	Ian Maunsell	32.858525	-114.492796	4
imperial dam road marsh b	17-May-10	Lauren Macfarland	32.858525	-114.492796	0
imperial dam road marsh c	26-Mar-10	Ian Maunsell	32.8576944	-114.490717	0
imperial dam road marsh c	29-Mar-10	Ian Maunsell	32.8576944	-114.490717	0
imperial dam road marsh c	14-Apr-10	Lauren Macfarland	32.8576944	-114.490717	0
imperial dam road marsh c	03-May-10	Ian Maunsell	32.8576944	-114.490717	3
imperial dam road marsh c	15-May-10	Meaghan Conway	32.8576944	-114.490717	1
imperial dam road marsh d	26-Mar-10	Ian Maunsell	32.8551557	-114.492404	0
imperial dam road marsh d	29-Mar-10	Ian Maunsell	32.8551557	-114.492404	0
imperial dam road marsh d	14-Apr-10	Lauren Macfarland	32.8551557	-114.492404	0
imperial dam road marsh d	03-May-10	Ian Maunsell	32.8551557	-114.492404	0
imperial dam road marsh d	15-May-10	Meaghan Conway	32.8551557	-114.492404	0
inwr ag field 10-27	06-May-10	Meaghan Conway	32.9872325	-114.49193	1
inwr ag field 10-27	30-Mar-10	Lauren Macfarland	32.9872325	-114.49193	1
inwr ag field 10-27	16-Apr-10	Ian Maunsell	32.9872325	-114.49193	6
inwr ag field 10-27	20-May-10	Meaghan Conway	32.9872325	-114.49193	3
inwr ag field 10-27	16-Apr-10	Ian Maunsell	32.9872325	-114.49193	2
inwr ag field 11	5-Apr-10	Lauren Macfarland	32.985993	-114.49117	7
inwr ag field 11	16-Apr-10	Ian Maunsell	32.985993	-114.49117	5
inwr ag field 11	21-May-10	Lauren Macfarland	32.985993	-114.49117	1
inwr ag field 11	3-May-10	Meaghan Conway	32.985993	-114.49117	20
inwr ag field 11	28-May-10	Meaghan Conway	32.985993	-114.49117	8
inwr ag field 12	05-May-10	Meaghan Conway	32.983902	-114.492464	0
inwr ag field 12	21-May-10	Ian Maunsell	32.983902	-114.49246	5
inwr ag field 12	26-May-10	Glen McHargue	32.983902	-114.49246	12
inwr ag field 12	29-Mar-10	Lauren Macfarland	32.983902	-114.49246	1
inwr ag field 12	14-Apr-10	Glen McHargue	32.983902	-114.49246	1
inwr ag field 13	18-May-10	Lauren Macfarland	32.982856	-114.49079	7
inwr ag field 13	29-Mar-10	Glen McHargue	32.982856	-114.49079	3
inwr ag field 13	13-Apr-10	Meaghan Conway	32.982856	-114.49079	13
inwr ag field 13	15-Apr-10	Lauren Macfarland	32.982856	-114.49079	3

inwr ag field 14	06-May-10	Meaghan Conway	32.9846791	-114.488501	7
inwr ag field 14	30-Mar-10	Lauren Macfarland	32.9846791	-114.488501	1
inwr ag field 14	20-May-10	Meaghan Conway	32.9846791	-114.488501	9
inwr ag field 14	16-Apr-10	Ian Maunsell	32.9846791	-114.488501	11
inwr ag field 16	02-Mar-10	Meaghan Conway	32.9829573	-114.483396	22
inwr ag field 16	23-Mar-10	Meaghan Conway	32.9829573	-114.483396	1
inwr ag field 16	24-Mar-10	Meaghan Conway	32.9829573	-114.483396	23
inwr ag field 16	05-Apr-10	Lauren Macfarland	32.9829573	-114.483396	9
inwr ag field 16	16-Apr-10	Ian Maunsell	32.9829573	-114.483396	4
inwr ag field 16	03-May-10	Lauren Macfarland	32.9829573	-114.483396	21
inwr ag field 16	17-May-10	Meaghan Conway	32.9829573	-114.483396	16
inwr ag field 16	28-May-10	Meaghan Conway	32.9829573	-114.483396	17
inwr ag field 16	16-Jun-10	Lauren Macfarland	32.9829573	-114.483396	3
inwr ag field 16	12-Jul-10	Meaghan Conway	32.9829573	-114.483396	5
inwr ag field 16	27-Jul-10	Meaghan Conway	32.9829573	-114.483396	8
inwr ag field 16	21-May-10	Lauren Macfarland	32.9829573	-114.483396	3
inwr ag field 17	18-May-10	Lauren Macfarland	32.98472	-114.48286	10
inwr ag field 17	29-Mar-10	Glen McHargue	32.98472	-114.48286	15
inwr ag field 17	23-Apr-10	Meaghan Conway	32.98472	-114.48286	13
inwr ag field 17	15-Apr-10	Lauren Macfarland	32.98472	-114.48286	11
inwr ag field 18	12-Mar-10	Meaghan Conway	32.98548	-114.483267	9
inwr ag field 18	30-Mar-10	Glen McHargue	32.98548	-114.483267	11
inwr ag field 18	31-Mar-10	Ian Maunsell	32.98548	-114.483267	15
inwr ag field 18	15-Apr-10	Ian Maunsell	32.98548	-114.483267	16
inwr ag field 18	30-Apr-10	Meaghan Conway	32.98548	-114.483267	11
inwr ag field 18	14-May-10	Meaghan Conway	32.98548	-114.483267	4
inwr ag field 18	24-May-10	Ian Maunsell	32.98548	-114.483267	18
inwr ag field 18	08-Jun-10	Lauren Macfarland	32.98548	-114.483267	2
inwr ag field 18	28-Jun-10	Meaghan Conway	32.98548	-114.483267	7
inwr ag field 18	13-Jul-10	Meaghan Conway	32.98548	-114.483267	5
inwr ag field 18	26-Jul-10	Meaghan Conway	32.98548	-114.483267	4
inwr ag field 21	5-May-10	Meaghan Conway	32.98941	-114.48667	14
inwr ag field 21	21-May-10	Ian Maunsell	32.98941	-114.48667	9
inwr ag field 21	26-May-10	Glen McHargue	32.98941	-114.48667	2
inwr ag field 21	29-May-10	Lauren Macfarland	32.98941	-114.48667	27
inwr ag field 21	14-Apr-10	Glen McHargue	32.98941	-114.48667	14
inwr hq bunkhouse	13-May-10	Meaghan Conway	33.0012014	-114.485803	0
inwr hq bunkhouse	12-Apr-10	Lauren Macfarland	33.0012014	-114.485803	0
inwr hq bunkhouse	26-Mar-10	Glen McHargue	33.0012014	-114.485803	0
inwr hq bunkhouse	02-Apr-10	Ian Maunsell	33.0012014	-114.485803	0
inwr hq bunkhouse	22-Apr-10	Meaghan Conway	33.0012014	-114.485803	0
inwr hq bunkhouse	30-Apr-10	Lauren Macfarland	33.0012014	-114.485803	0
island lake	16-Jun-10	Lauren Macfarland	33.0321537	-114.586184	1

island lake	30-Jun-10	Meaghan Conway	33.0321537	-114.586184	0
island lake	12-Jul-10	Meaghan Conway	33.0321537	-114.586184	1
martinez lake a	26-Mar-10	Meaghan Conway	32.9770721	-114.479334	5
martinez lake a	07-Apr-10	Meaghan Conway	32.9770721	-114.479334	0
martinez lake a	09-Apr-10	Meaghan Conway	32.9770721	-114.479334	4
martinez lake a	28-Apr-10	Lauren Macfarland	32.9770721	-114.479334	4
martinez lake a	03-May-10	Lauren Macfarland	32.9770721	-114.479334	4
martinez lake a	12-May-10	Glen McHargue	32.9770721	-114.479334	1
martinez lake b	01-Apr-10	Meaghan Conway	32.9803629	-114.469903	1
martinez lake b	12-Apr-10	Glen McHargue	32.9803629	-114.469903	6
martinez lake b	22-Apr-10	Meaghan Conway	32.9803629	-114.469903	5
martinez lake b	10-May-10	Glen McHargue	32.9803629	-114.469903	4
meers point and south river channel B	9-Apr-10	Lauren Macfarland	32.956688	-114.47479	2
meers point and south river channel A	5-May-10	Meaghan Conway	32.956688	-114.47479	1
meers point and south river channel B	7-May-10	Meaghan Conway	32.956688	-114.47479	6
meers point and south river channel B	16-Apr-10	Lauren Macfarland	32.956688	-114.47479	3
meers point and south river channel B	25-May-10	Glen McHargue	32.956688	-114.47479	4
meers point and south river channel A	6-May-10	Meaghan Conway	32.956688	-114.47479	4
meers point and south river channel A	24-May-10	Meaghan Conway	32.956688	-114.47479	6
meers point and south river channel A	8-Apr-10	Lauren Macfarland	32.956688	-114.47479	2
meers point and south river channel A	15-Apr-10	Glen McHargue	32.956688	-114.47479	4
Meers Point and South River Channel A	06-Apr-10	Meaghan Conway	32.9669519	-114.470665	4
no name lake	21-Apr-10	Glen McHargue	34.7826105	-114.530282	11
no name lake	13-May-10	Ian Maunsell	34.7826105	-114.530282	15
no name lake	26-May-10	Lauren Macfarland	34.7826105	-114.530282	10
no name lake	16-Jun-10	Meaghan Conway	34.7826105	-114.530282	9
north california channel	16-Apr-10	Meaghan Conway	32.9562482	-114.474315	4
north california channel	8-Apr-10	Ian Maunsell	32.956248	-114.47432	3
north california channel	7-May-10	Ian Maunsell	32.956248	-114.47432	2
north california channel	20-May-10	Lauren Macfarland	32.956248	-114.47432	1
north inwr boat B	5-May-10	Lauren Macfarland	33.030014	-114.58491	0
north inwr boat B	11-May-10	Meaghan Conway	33.030014	-114.58491	0
north inwr boat A	18-May-10	Ian Maunsell	33.030014	-114.58491	0
north inwr boat B	16-Apr-10	Lauren Macfarland	33.030014	-114.58491	2
north inwr boat A	15-Apr	Glen McHargue	33.030014	-114.58491	0
north inwr boat B	19-May-10	Ian Maunsell	33.030014	-114.58491	1
north inwr boat B	6-May-10	Lauren Macfarland	33.030014	-114.58491	1
north inwr boat A	7-Apr-10	Meaghan Conway	33.030014	-114.58491	1
north inwr boat B	8-Apr-10	Meaghan Conway	33.030014	-114.58491	0
north mittry lake a	29-Mar-10	Lauren Macfarland	32.849731	-114.446212	7
north mittry lake a	13-Apr-10	Ian Maunsell	32.849731	-114.446212	12
north mittry lake a	29-Apr-10	Glen McHargue	32.849731	-114.446212	7
north mittry lake a	13-May-10	Glen McHargue	32.849731	-114.446212	5

north mittry lake b	29-Mar-10	Glen McHargue	32.8583937	-114.450634	11
north mittry lake b	13-Apr-10	Lauren Macfarland	32.8583937	-114.450634	7
north mittry lake b	04-May-10	Meaghan Conway	32.8583937	-114.450634	4
north mittry lake b	19-May-10	Lauren Macfarland	32.8583937	-114.450634	5
north mittry lake c	25-Mar-10	Lauren Macfarland	32.8670039	-114.453372	15
north mittry lake c	01-Apr-10	Glen McHargue	32.8670039	-114.453372	9
north mittry lake c	19-Apr-10	Meaghan Conway	32.8670039	-114.453372	8
north mittry lake c	05-May-10	Ian Maunsell	32.8670039	-114.453372	9
north mittry lake c	06-May-10	Ian Maunsell	32.8670039	-114.453372	9
painted desert trail	13-May-10	Meaghan Conway	33.0187833	-114.50146	0
painted desert trail	12-Apr-10	Lauren Macfarland	33.0187833	-114.50146	0
painted desert trail	26-Mar-10	Glen McHargue	33.0187833	-114.50146	0
painted desert trail	02-Apr-10	Ian Maunsell	33.0187833	-114.50146	0
painted desert trail	30-Apr-10	Lauren Macfarland	33.0187833	-114.50146	0
senator wash	17-May-10	Glen McHargue	32.911364	-114.47727	1
senator wash	3-May-10	Meaghan Conway	32.911364	-114.47727	0
senator wash	14-Apr-10	Ian Maunsell	32.911364	-114.47727	0
senator wash	26-Mar-10	Lauren Macfarland	32.911364	-114.47727	1
south mittry lake	01-Apr-10	Glen McHargue	32.833883	-114.44589	14
south mittry lake	17-May-10	Ian Maunsell	32.833883	-114.44589	1
south mittry lake	19-May-10	Ian Maunsell	32.833883	-114.44589	0
south mittry lake	4-May-10	Ian Maunsell	32.833883	-114.44589	6
south mittry lake	14-Apr-10	Meaghan Conway	32.833883	-114.44589	13
south of dredge ramp a	25-Mar-10	Glen McHargue	32.8249771	-114.451099	6
south of dredge ramp a	18-Apr-10	Ian Maunsell	32.8249771	-114.451099	1
south of dredge ramp a	10-May-10	Glen McHargue	32.8249771	-114.451099	0
south of dredge ramp a	1-Apr-10	Ian Maunsell	32.8249771	-114.451099	0
south of dredge ramp b	01-Apr-10	Lauren Macfarland	32.8190357	-114.456863	1
south of dredge ramp b	16-Apr-10	Ian Maunsell	32.8190357	-114.456863	2
south of dredge ramp b	10-May-10	Meaghan Conway	32.8190357	-114.456863	0
south of dredge ramp b	25-Mar-10	Ian Maunsell	32.81951	-114.45638	7
squaw lake and south of squaw lake	26-Apr-10	Ian Maunsell	32.8948991	-114.470157	3
squaw lake and south of squaw lake	13-Apr-10	Glen McHargue	32.8951617	-114.469918	0
squaw lake and south of squaw lake	22-Apr-10	Ian Maunsell	32.8951617	-114.469918	0
squaw lake and south of squaw lake	12-May-10	Meaghan Conway	32.894899	-114.47016	5
squaw lake and south of squaw lake	02-Apr-10	Meaghan Conway	32.894899	-114.47016	9
squaw lake shore	02-Apr-10	Lauren Macfarland	32.9029338	-114.469773	2
squaw lake shore	10-May-10	Lauren Macfarland	32.902934	-114.46977	0
squaw lake shore	24-Mar-10	Ian Maunsell	32.902934	-114.46977	2
squaw lake shore	19-Apr-10	Glen McHargue	32.902934	-114.46977	3
upper goose lake burn	25-Apr-10	Glen McHargue	34.8207367	-114.509173	4
upper goose lake burn	25-May-10	Meaghan Conway	34.8207367	-114.509173	7
upper goose lake burn	17-Jun-10	Meaghan Conway	34.8207367	-114.509173	2

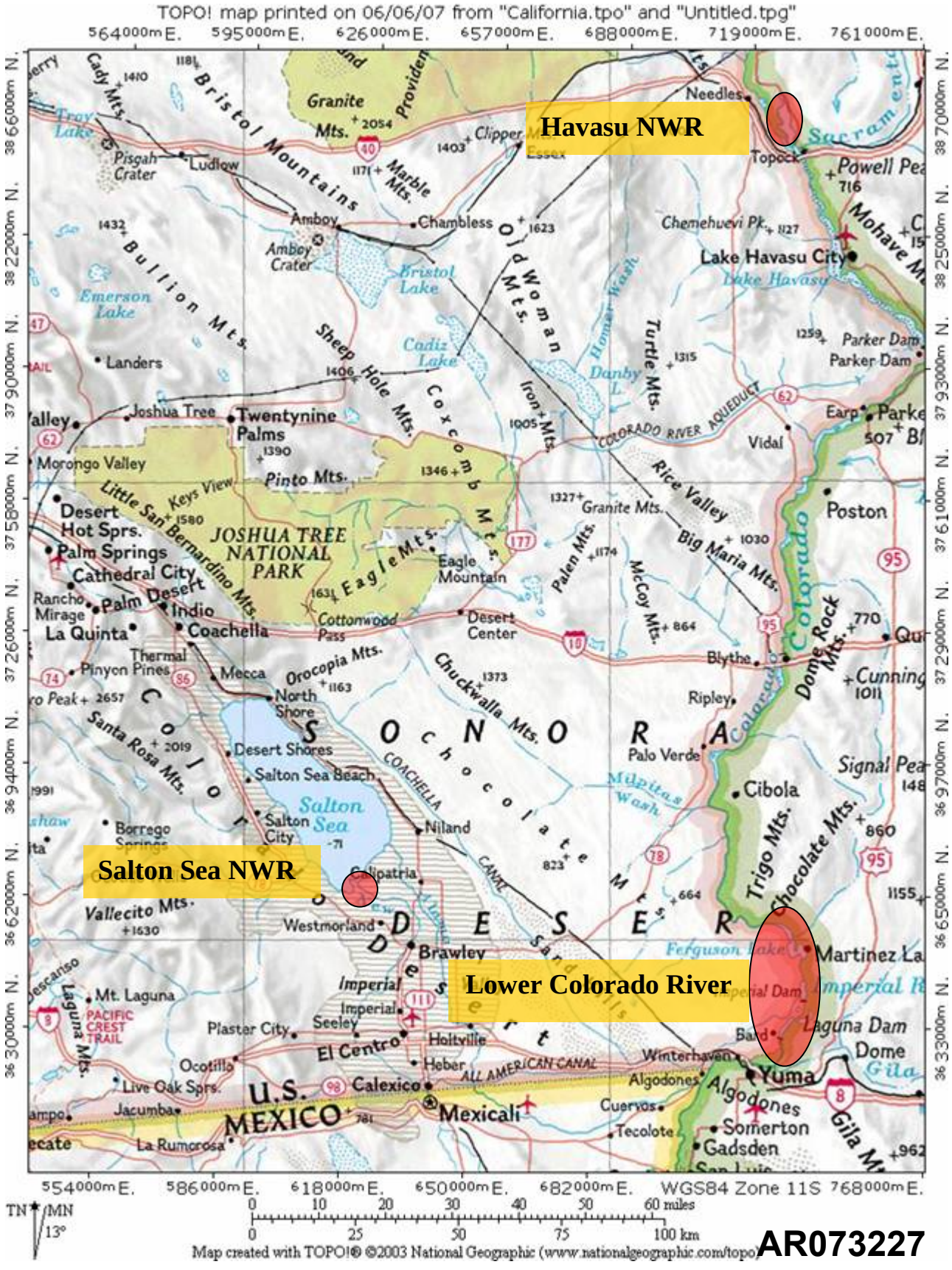
upper goose lake burn	11-May-10	Ian Maunsell	34.8207367	-114.509173	11
upper goose lake control	12-May-10	Ian Maunsell	34.7472125	-114.500039	6
upper goose lake control	28-May-10	Lauren Macfarland	34.7472125	-114.500039	8
upper goose lake control	26-Apr-10	Glen McHargue	34.7472125	-114.500039	4
upper goose lake control	17-Jun-10	Glen McHargue	34.7472125	-114.500039	2
water tower marsh	19-Apr-10	Lauren Macfarland	32.8696082	-114.478108	0
water tower marsh	24-Mar-10	Glen McHargue	32.8696082	-114.478108	0
water tower marsh	02-Apr-10	Glen McHargue	32.8696082	-114.478108	0
water tower marsh	10-May-10	Meaghan Conway	32.8696082	-114.478108	0
west pond a	17-May-10	Meaghan Conway	32.880216	-114.47814	0
west pond a	20-May-10	Ian Maunsell	32.880216	-114.47814	0
west pond a	30-Apr-10	Lauren Macfarland	32.880216	-114.47814	0
west pond a	2-Apr-10	Lauren Macfarland	32.880216	-114.47814	4
west pond a	26-Apr-10	Meaghan Conway	32.880216	-114.47814	0
west pond a	23-Mar-10	Glen McHargue	32.880216	-114.47814	2
west pond a	23-Mar-10	Ian Maunsell	32.880216	-114.47814	2
west pond b	19-May-10	Meaghan Conway	32.8793729	-114.48142	0
west pond b	18-May-10	Meaghan Conway	32.879373	-114.48142	0
west pond b	1-May-10	Lauren Macfarland	32.879373	-114.48142	0
west pond b	22-Mar-10	Lauren Macfarland	32.879373	-114.48142	3
west pond b	5-Apr-10	Ian Maunsell	32.879373	-114.48142	1
whiskey slough burn	30-May-10	Lauren Macfarland	34.803472	-114.51848	3
whiskey slough burn	15-May-10	Ian Maunsell	34.803472	-114.51848	1
whiskey slough burn	16-Jun-10	Glen McHargue	34.803472	-114.51848	0
whiskey slough burn	23-Apr-10	Glen McHargue	34.803472	-114.51848	4
whiskey slough burn	29-May-10	Lauren Macfarland	34.803472	-114.51848	0
whiskey slough control	30-May-10	Lauren Macfarland	34.804713	-114.52239	3
whiskey slough control	15-May-10	Ian Maunsell	34.804713	-114.52239	1
whiskey slough control	16-Jun-10	Glen McHargue	34.804713	-114.52239	1
whiskey slough control	23-Apr-10	Glen McHargue	34.804713	-114.52239	0
whiskey slough control	29-May-10	Lauren Macfarland	34.804713	-114.52239	0
willow lake burn	23-Apr-10	Glen McHargue	34.7853436	-114.517712	0
willow lake burn	13-May-10	Ian Maunsell	34.7853436	-114.517712	2
willow lake burn	31-May-10	Lauren Macfarland	34.7853436	-114.517712	3
willow lake burn	17-Jun-10	Meaghan Conway	34.7853436	-114.517712	0
willow lake burn	25-May-10	Lauren Macfarland	34.785344	-114.51771	0
willow lake control	28-May-10	Lauren Macfarland	34.793558	-114.52924	0
willow lake control	30-May-10	Lauren Macfarland	34.793558	-114.52924	2
willow lake control	1-Jun-10	Lauren Macfarland	34.793558	-114.52924	4
willow lake control	18-Jun-10	Glen McHargue	34.793558	-114.52924	3
willow lake control	24-Apr-10	Glen McHargue	34.793558	-114.52924	2
willow lake control	11-May-10	Ian Maunsell	34.793558	-114.52924	7
a-1 pond	20-Apr-10	Lauren Macfarland	33.0833211	-115.713418	30

a-1 pond	02-May-10	Nathan Rathbun	33.0833211	-115.713418	27
a-1 pond	13-May-10	Lauren Macfarland	33.0833211	-115.713418	24
a-1 pond	25-May-10	Nathan Rathbun	33.0833211	-115.713418	22
b-1 pond	27-Apr-10	Ian Maunsell	33.0834978	-115.704736	28
b-1 pond	07-May-10	Nathan Rathbun	33.0834978	-115.704736	21
b-1 pond	20-May-10	Glen McHargue	33.0834978	-115.704736	14
b-1 pond	29-May-10	Nathan Rathbun	33.0834978	-115.704736	16
bruchard bay	23-Apr-10	Lauren Macfarland	33.1054083	-115.684127	0
bruchard bay	05-May-10	Nathan Rathbun	33.1054083	-115.684127	2
bruchard bay	21-May-10	Glen McHargue	33.1054083	-115.684127	3
bruchard bay	31-May-10	Nathan Rathbun	33.1054083	-115.684127	4
hazard 10	22-Apr-10	Lauren Macfarland	33.1963783	-115.58284	5
hazard 10	07-May-10	Glen McHargue	33.1963783	-115.58284	3
hazard 10	25-May-10	Ian Maunsell	33.1963783	-115.58284	9
hazard 10	04-Jun-10	Nathan Rathbun	33.1963783	-115.58284	3
hazard 11	22-Apr-10	Lauren Macfarland	33.1977867	-115.577123	0
hazard 11	07-May-10	Glen McHargue	33.1977867	-115.577123	2
hazard 11	25-May-10	Ian Maunsell	33.1977867	-115.577123	7
hazard 11	04-Jun-10	Nathan Rathbun	33.1977867	-115.577123	3
hazard 6	20-Apr-10	Nathan Rathbun	33.1856663	-115.590121	4
hazard 6	14-May-10	Lauren Macfarland	33.1856663	-115.590121	8
hazard 6	21-May-10	Nathan Rathbun	33.1856663	-115.590121	6
hazard 6	28-May-10	Ian Maunsell	33.1856663	-115.590121	7
hazard 7	20-Apr-10	Nathan Rathbun	33.1860617	-115.587055	3
hazard 7	14-May-10	Lauren Macfarland	33.1860617	-115.587055	3
hazard 7	21-May-10	Nathan Rathbun	33.1860617	-115.587055	7
headquarters marsh	22-Apr-10	Nathan Rathbun	33.181615	-115.615995	4
headquarters marsh	05-May-10	Glen McHargue	33.181615	-115.615995	7
headquarters marsh	20-May-10	Nathan Rathbun	33.181615	-115.615995	3
headquarters marsh	27-May-10	Ian Maunsell	33.181615	-115.615995	1
headquarters marsh	04-Jun-10	Nathan Rathbun	33.181615	-115.615995	1
mckindry marsh	23-Apr-10	Lauren Macfarland	33.1699514	-115.631173	0
mckindry marsh	05-May-10	Nathan Rathbun	33.1699514	-115.631173	0
mckindry marsh	21-May-10	Glen McHargue	33.1699514	-115.631173	2
mckindry marsh	31-May-10	Nathan Rathbun	33.1699514	-115.631173	0
reidman 3	25-Apr-10	Nathan Rathbun	33.079425	-115.711813	29
reidman 3	04-May-10	Nathan Rathbun	33.079425	-115.711813	30
reidman 3	14-May-10	Nathan Rathbun	33.079425	-115.711813	17
reidman 3	26-May-10	Nathan Rathbun	33.079425	-115.711813	19
reidman 4	25-Apr-10	Nathan Rathbun	33.08197	-115.71163	19
reidman 4	04-May-10	Glen McHargue	33.08197	-115.71163	17
reidman 4	14-May-10	Nathan Rathbun	33.08197	-115.71163	14
reidman 4	26-May-10	Nathan Rathbun	33.08197	-115.71163	8

union pond	22-Apr-10	Nathan Rathbun	33.1754983	-115.625036	17
union pond	05-May-10	Glen McHargue	33.1754983	-115.625036	9
union pond	20-May-10	Nathan Rathbun	33.1754983	-115.625036	9
union pond	04-Jun-10	Nathan Rathbun	33.1754983	-115.625036	14
COE	27-Apr-10 and 30-apr-10	Nathan Rathbun. Ian Mausell	33.20786204	-115.576556	8
COE	5/4/2010 and 6-may-10	Nathan Rathbun, Glen McHargue	33.20786204	-115.576556	7
COE	12-may-10 and 5/13/2010	Nathan Rathbun, Lauren Macfarland	33.20786204	-115.576556	6

Appendix 2. Maps of survey sites.

General Survey Location Map



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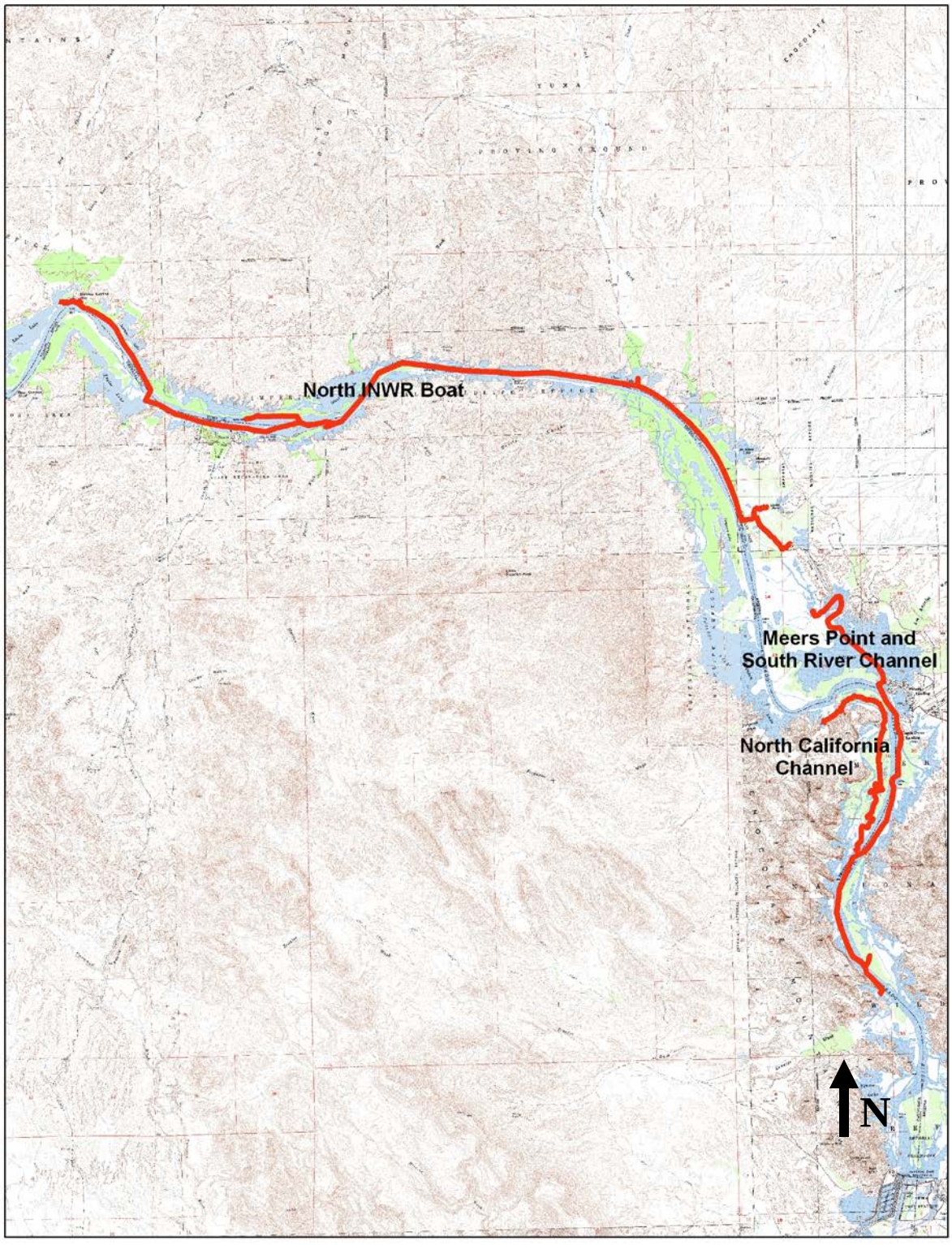
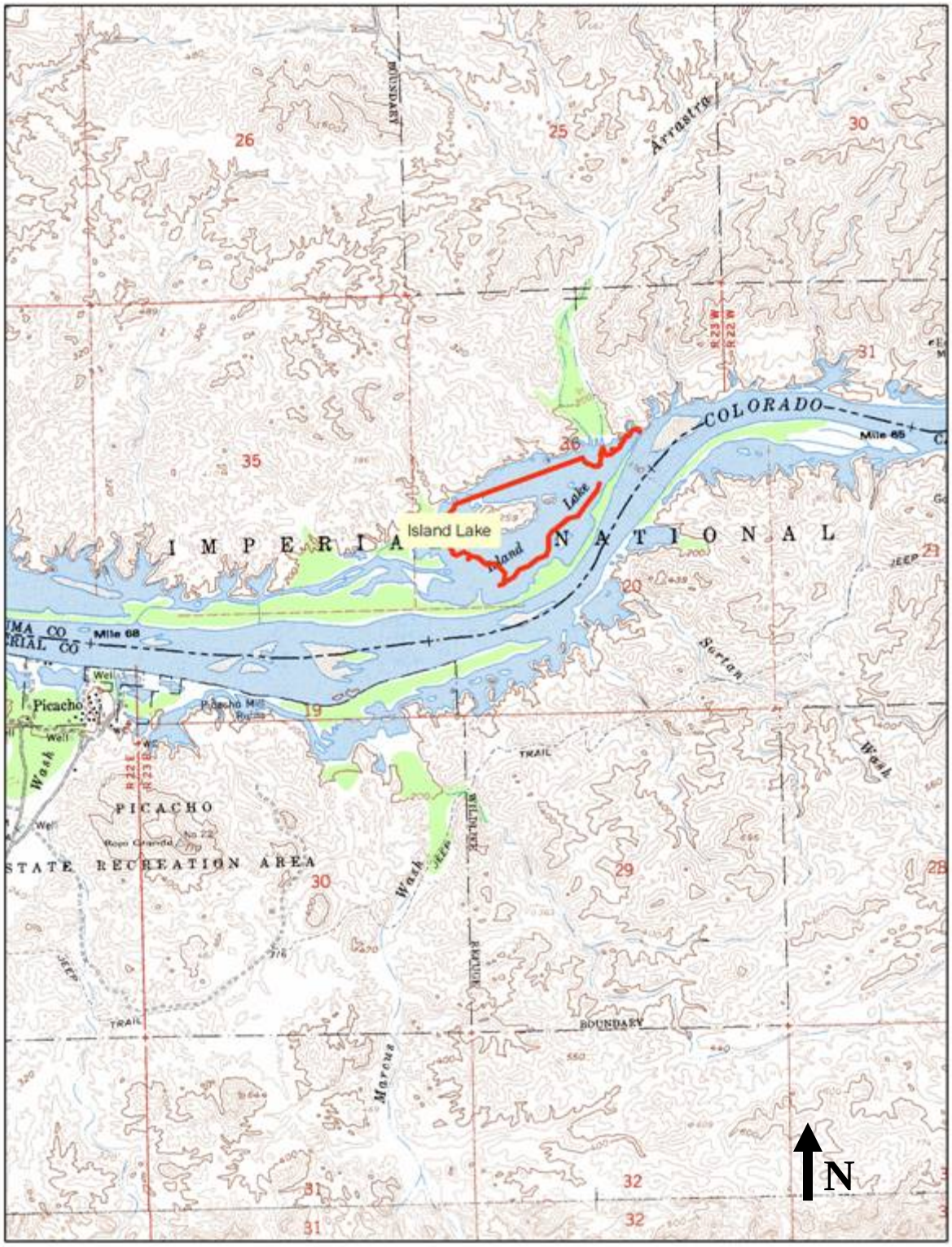
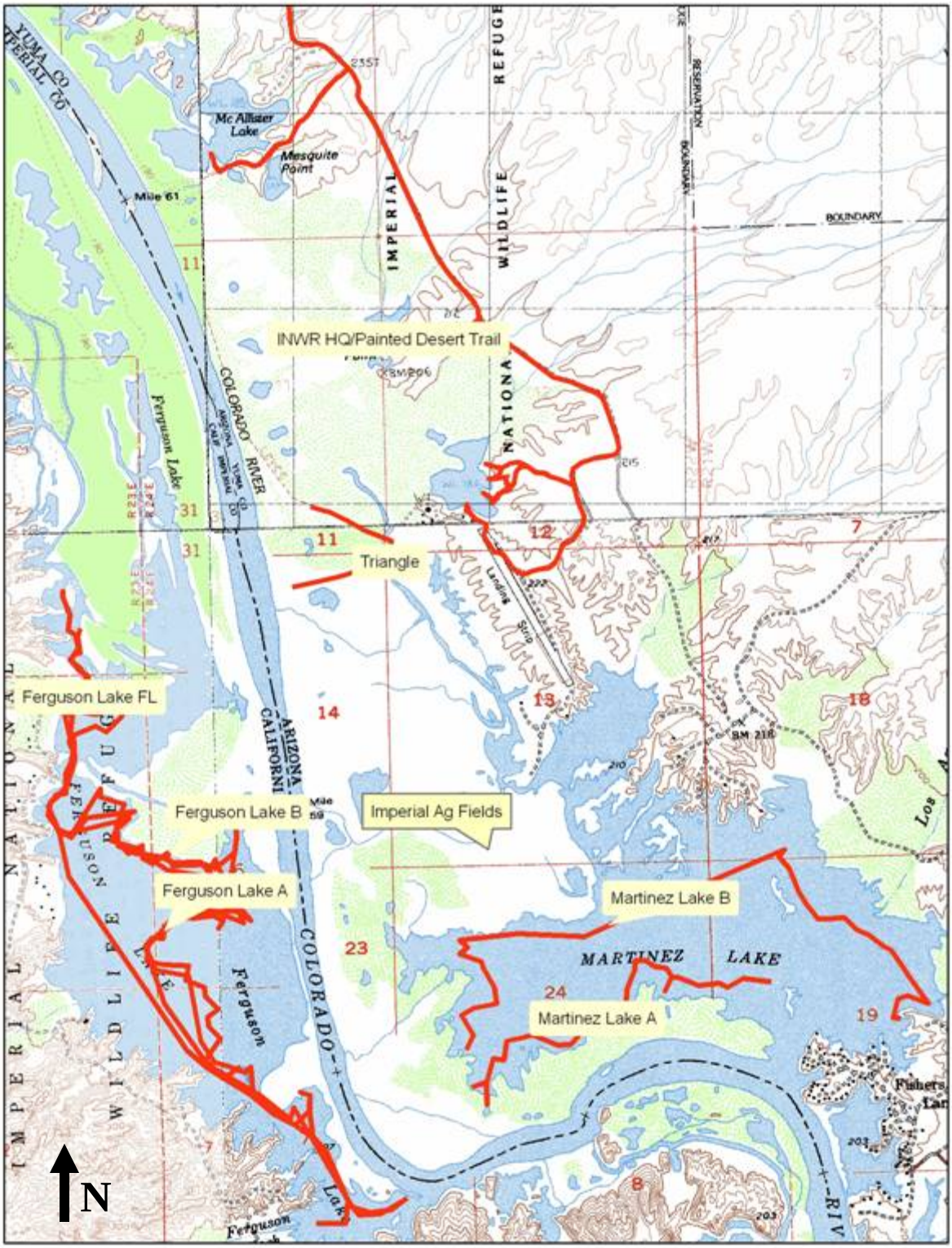
Lower Colorado River – North of Imperial NWR



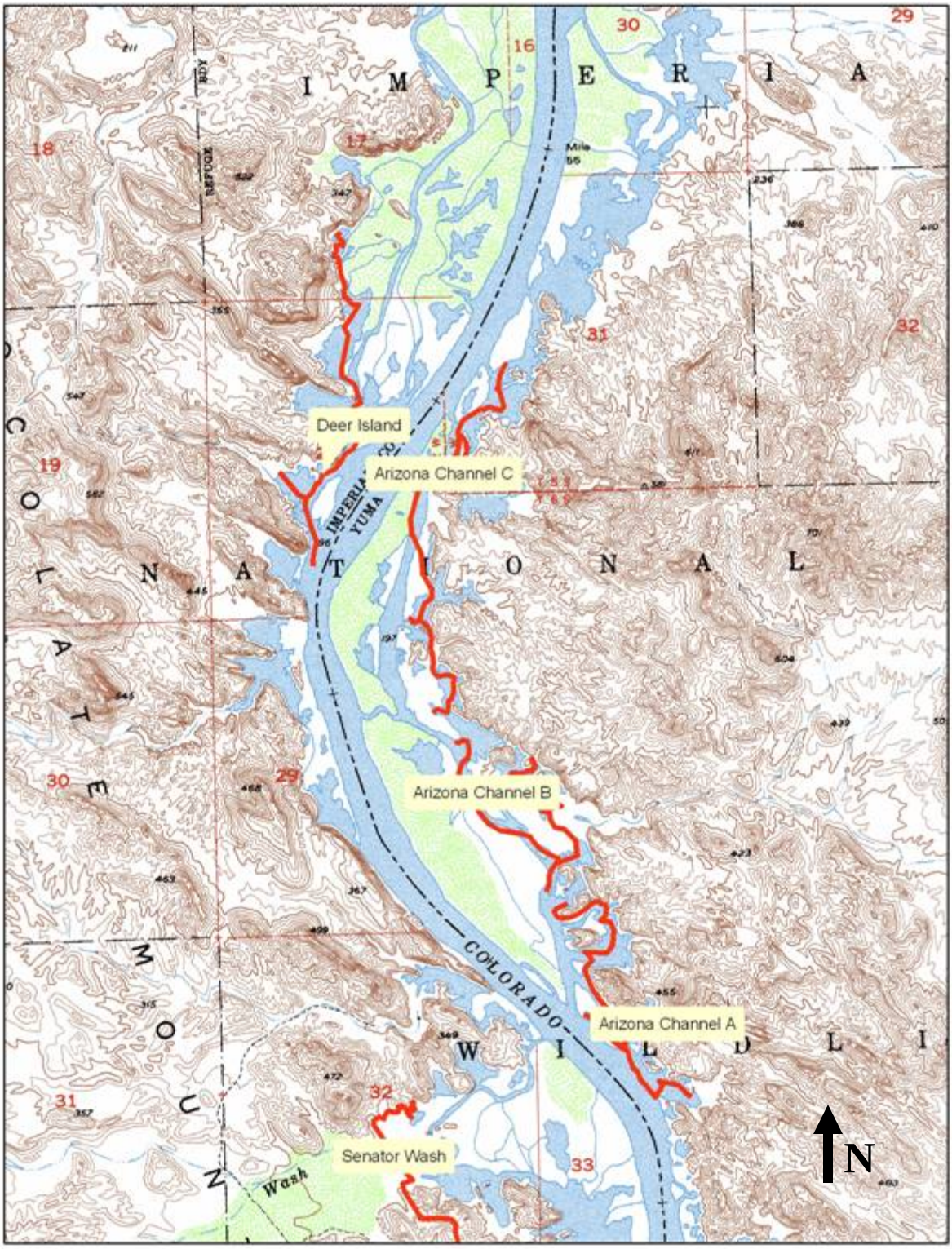
Lower Colorado River – Island Lake



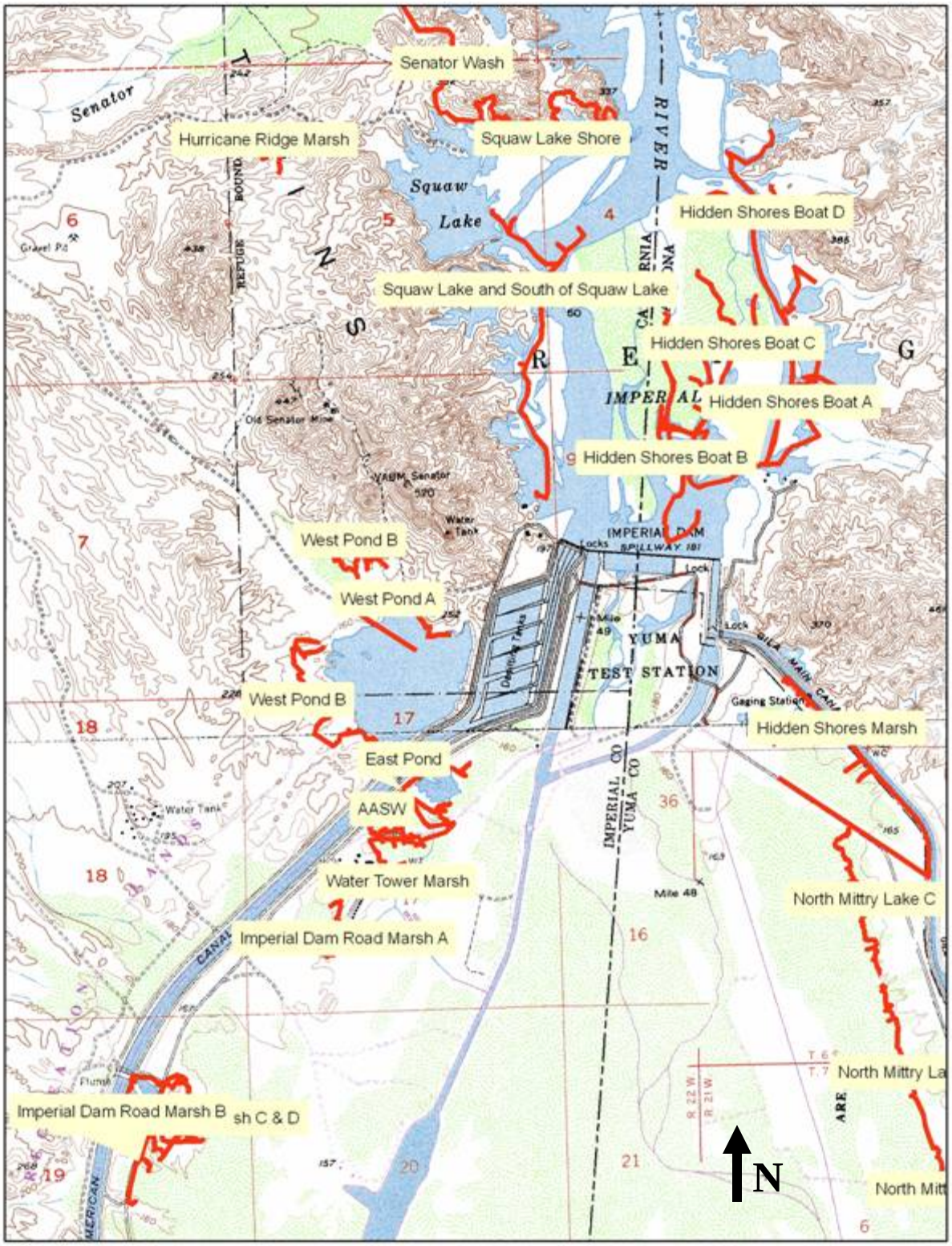
Lower Colorado River – Imperial National Wildlife Refuge



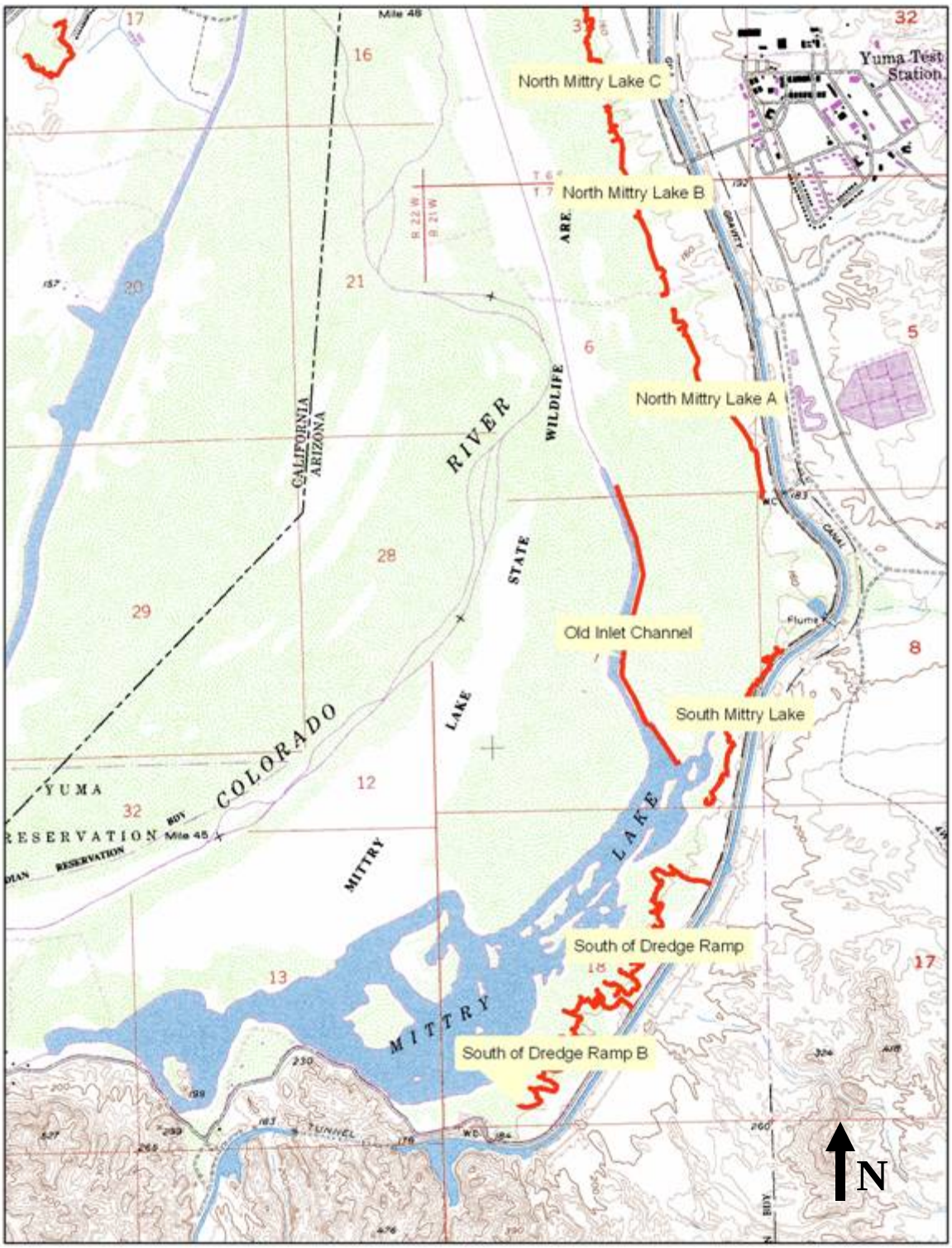
Lower Colorado River – Arizona Channel



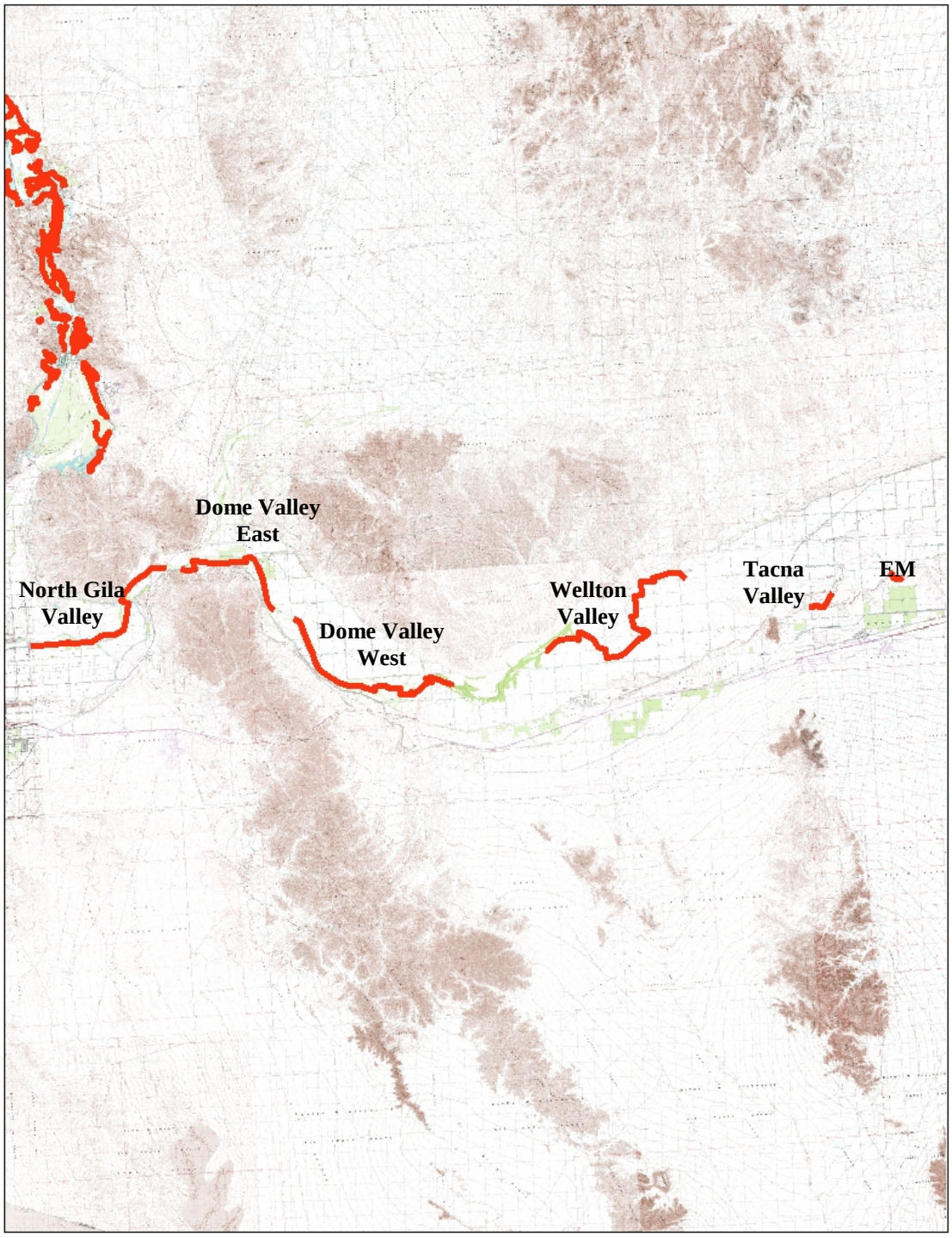
Lower Colorado River – Imperial Reservoir



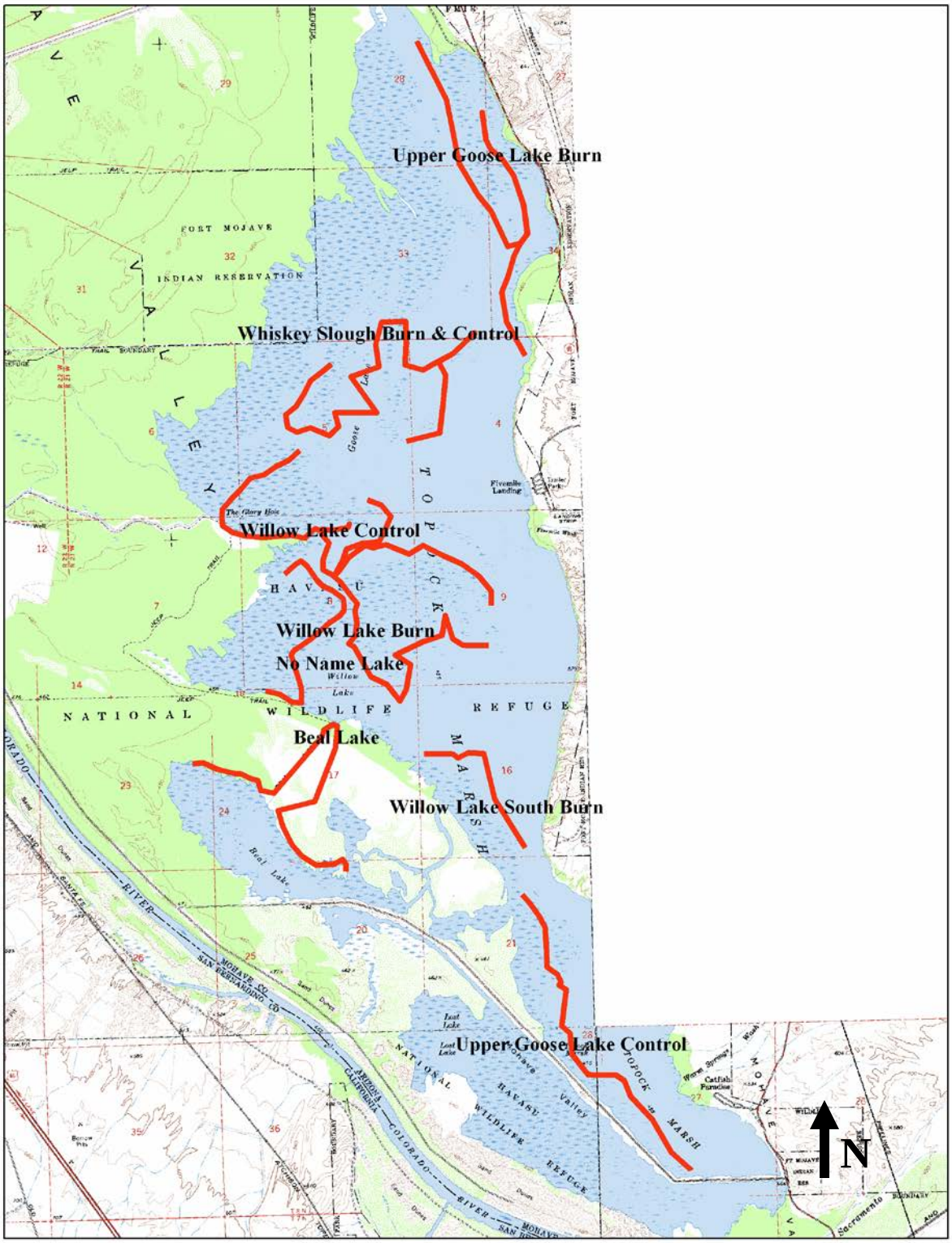
Lower Colorado River – North Mittry Lake



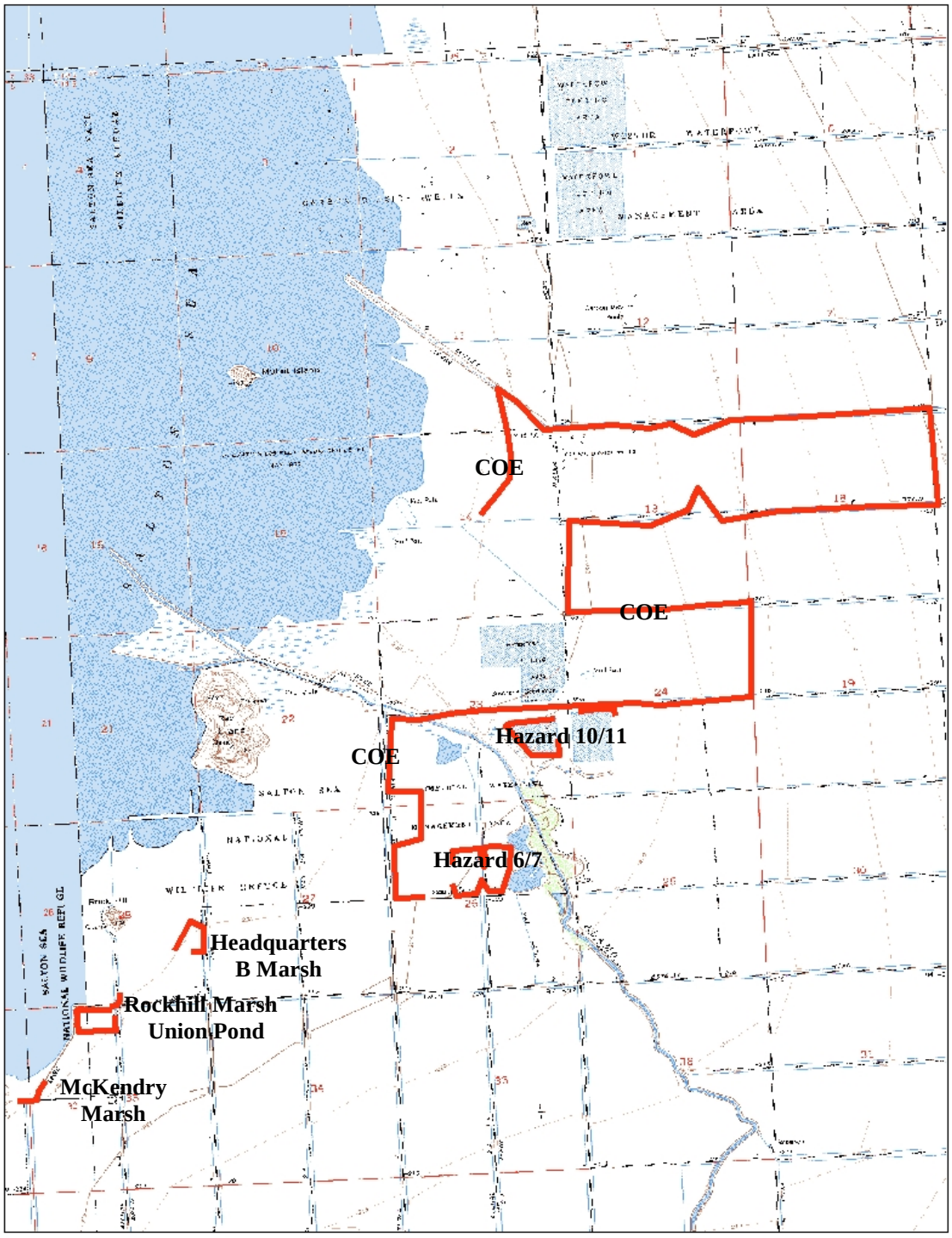
Lower Colorado River – Gila River



Havasu National Wildlife Refuge



Salton Sea National Wildlife Refute – Headquarters/Hazard Units



Salton Sea National Wildlife Refute – Unit 1



U.S. Fish & Wildlife Service

Avian Interactions with Utility-scale Solar Projects in Southern California

Thomas Dietsch
Migratory Bird Division
US Fish and Wildlife Service
AOU-COS-SCO Joint meeting
September, 2014



Climate Change and Birds

Many studies are now predicting that climate change may have negative consequences for many bird species.

- Audubon predicts there will be 314 bird species affected by climate change (2014).
- Point Blue and Sonoran Joint Venture modeled 67 bird species in Desert Southwest (2014). Website: http://data.prbo.org/apps/sjv

Audubon Climate Report



Department of Interior Renewable Goals



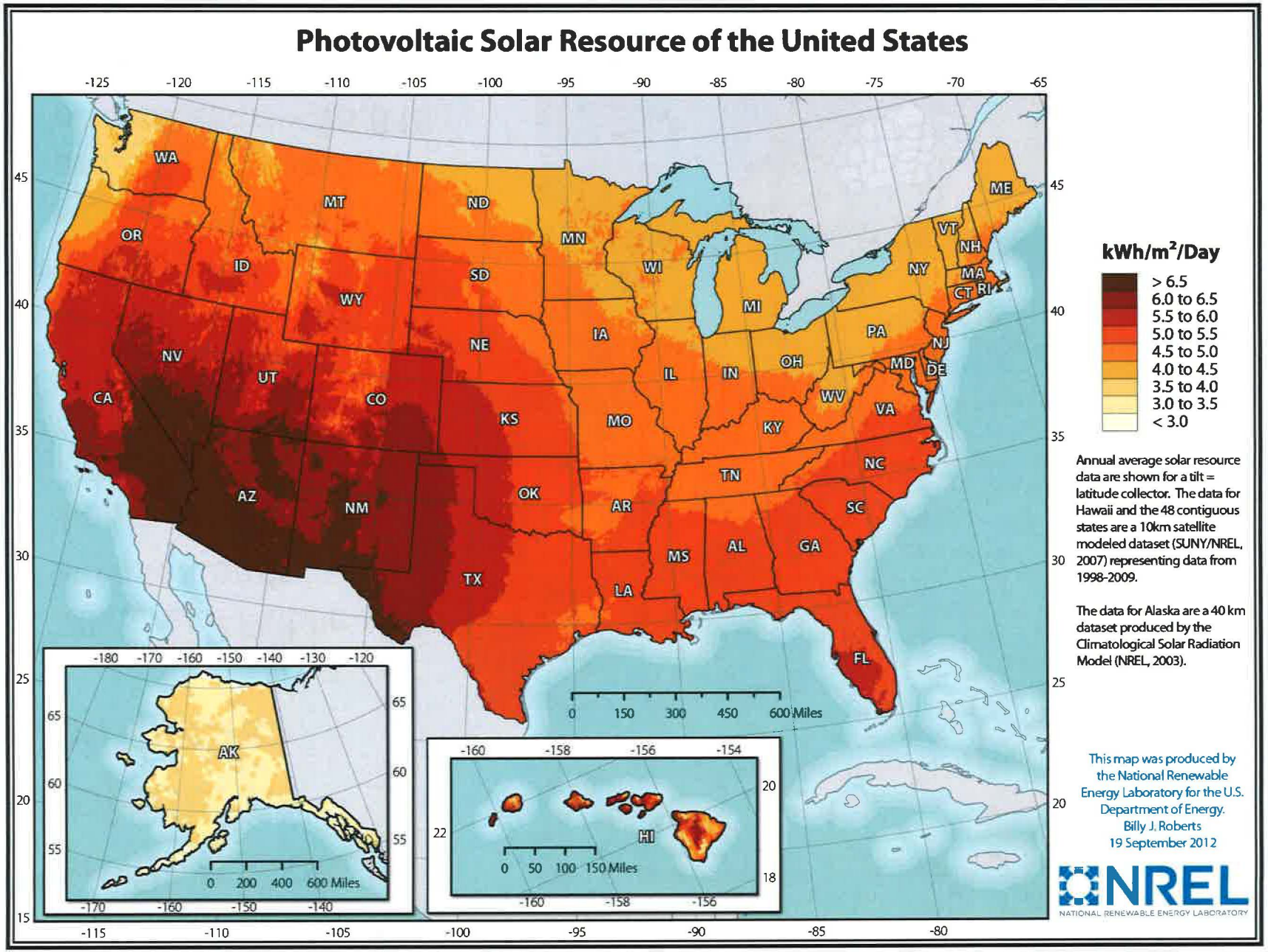


Projects on BLM land approved since 2009 will:

- Produce >10,000 MW of energy (wind and solar)
- Power about 3,500,000 homes
- Create about 13,000 jobs

Streamlined BLM Permitting

- Many solar projects permitted in under 18 months
- Standard practices would have taken 24 months or more

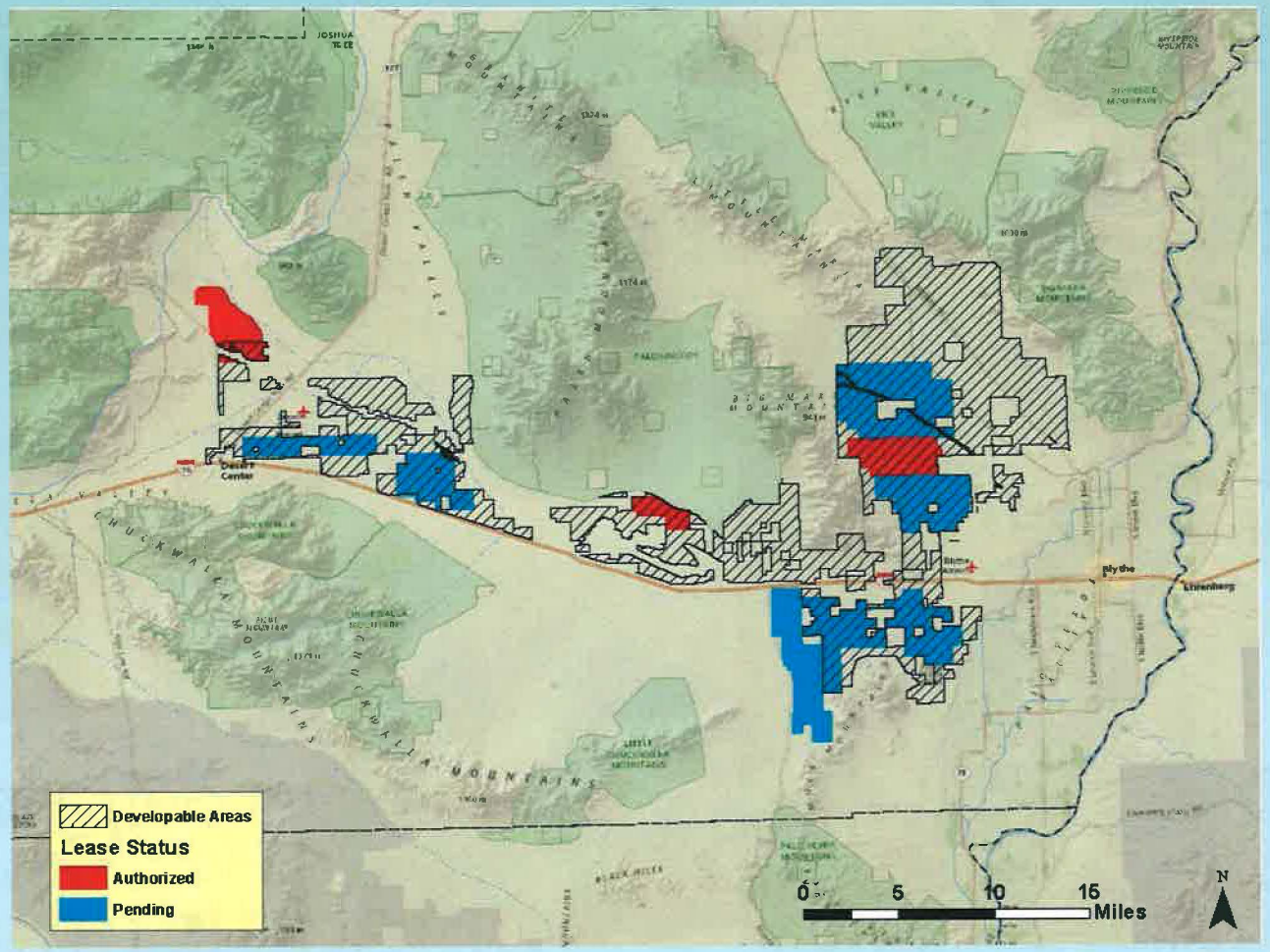

Photovoltaic Solar Resource of the United States
kWh/m²/Day
> 6.5
6.0 to 6.5
5.5 to 6.0
5.0 to 5.5
4.5 to 5.0
4.0 to 4.5
3.5 to 4.0
3.0 to 3.5
< 3.0
Annual average solar resource data are shown for a tilt = latitude collector. The data for Hawaii and the 48 contiguous states are a 10km satellite modeled dataset (SUNY/NREL, 2007) representing data from 1998-2009.
The data for Alaska are a 40 km dataset produced by the Climatological Solar Radiation Model (NREL, 2003).
This map was produced by the National Renewable Energy Laboratory for the U.S. Department of Energy.
Billy J. Roberts
19 September 2012
NREL
NATIONAL RENEWABLE ENERGY LABORATORY
0 150 300 450 600 Miles
0 200 400 600 Miles
0 50 100 150 Miles
WA
OR
CA
ID
NV
MT
WY
UT
AZ
CO
NM
ND
SD
NE
KS
OK
TX
MN
IA
MO
AR
LA
WI
IL
MS
MI
IN
KY
TN
AL
OH
WV
GA
FL
SC
NC
VA
PA
NY
MD
DE
NJ
CT
RI
MA
VT
NH
ME
AK
HI

Approved and Pending Solar Projects in California

- Mixture of Public and Private Lands
- Approved Solar Projects – 56,855 acres
- Pending Solar Projects – 94,108 acres
- Acreage of Solar projects in today's presentation – 15,016 acres



BLM has set aside Solar Energy Zones for future development (East Riverside SEZ)



Avian Impacts

Direct Effects: Collisions



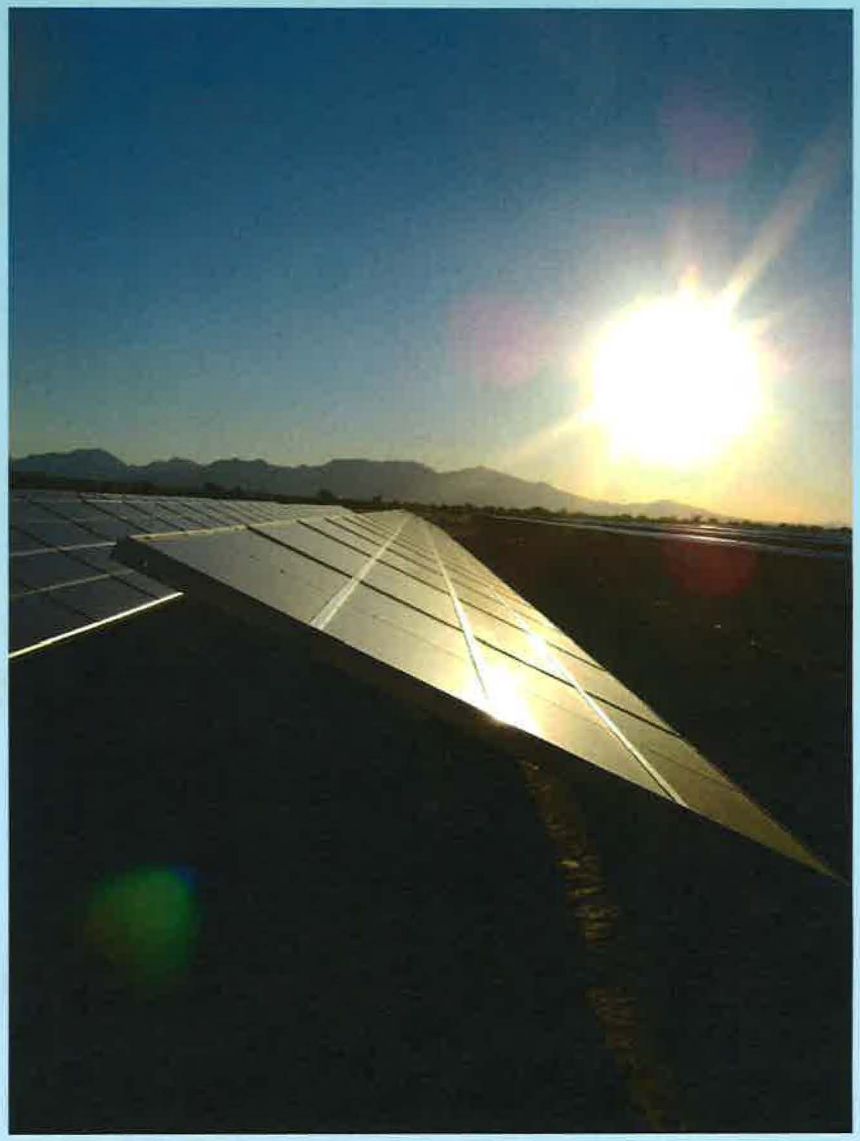






Collisions with panels are common





Concentrated Solar Technologies

Power Tower



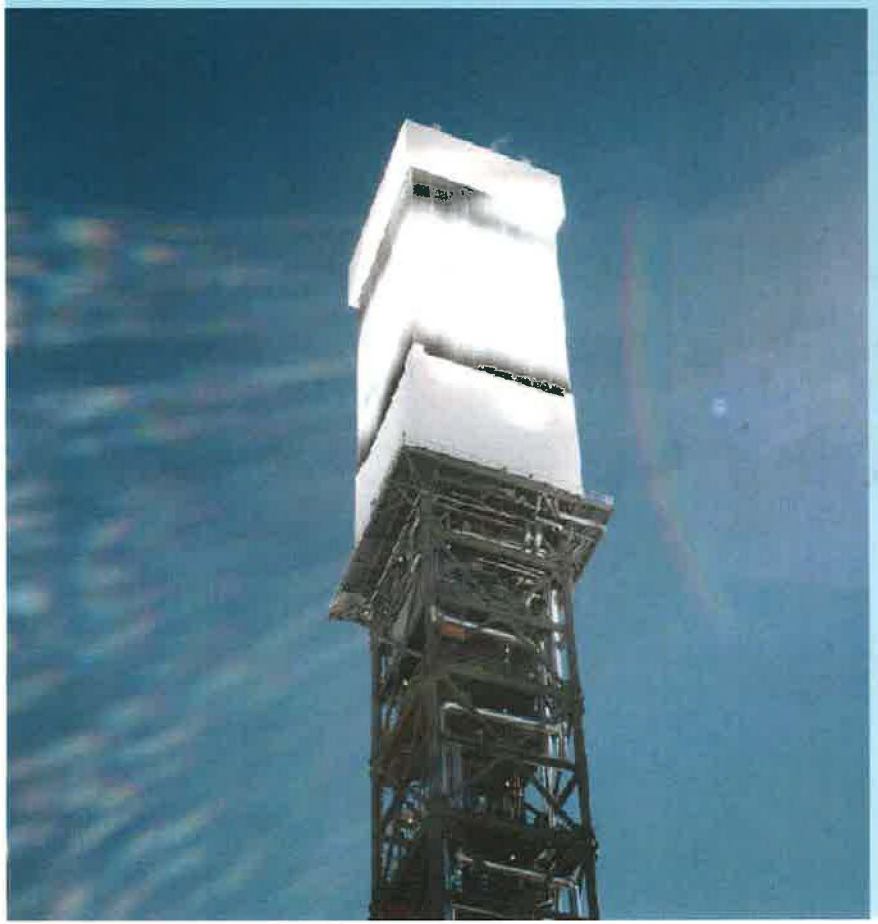
Solar Trough



Avian Impacts

Direct Effects

Solar Flux (power tower)









Objectives for Presentation

- Provide a summary of the initial data on avian interactions with solar projects in Southern California
- Discuss hypotheses for avian interactions
- Discuss actions being taken

Data for Today's Presentation

- Mortality reporting is required by lead agencies on many projects.
- Data from 6 projects in Southern California
  (3 Photovoltaic, 2 Solar Trough, 1 Power Tower)
- Data reported from 2012-August 2014.
- Each species was categorized by habitat, migratory group, and foraging guild.

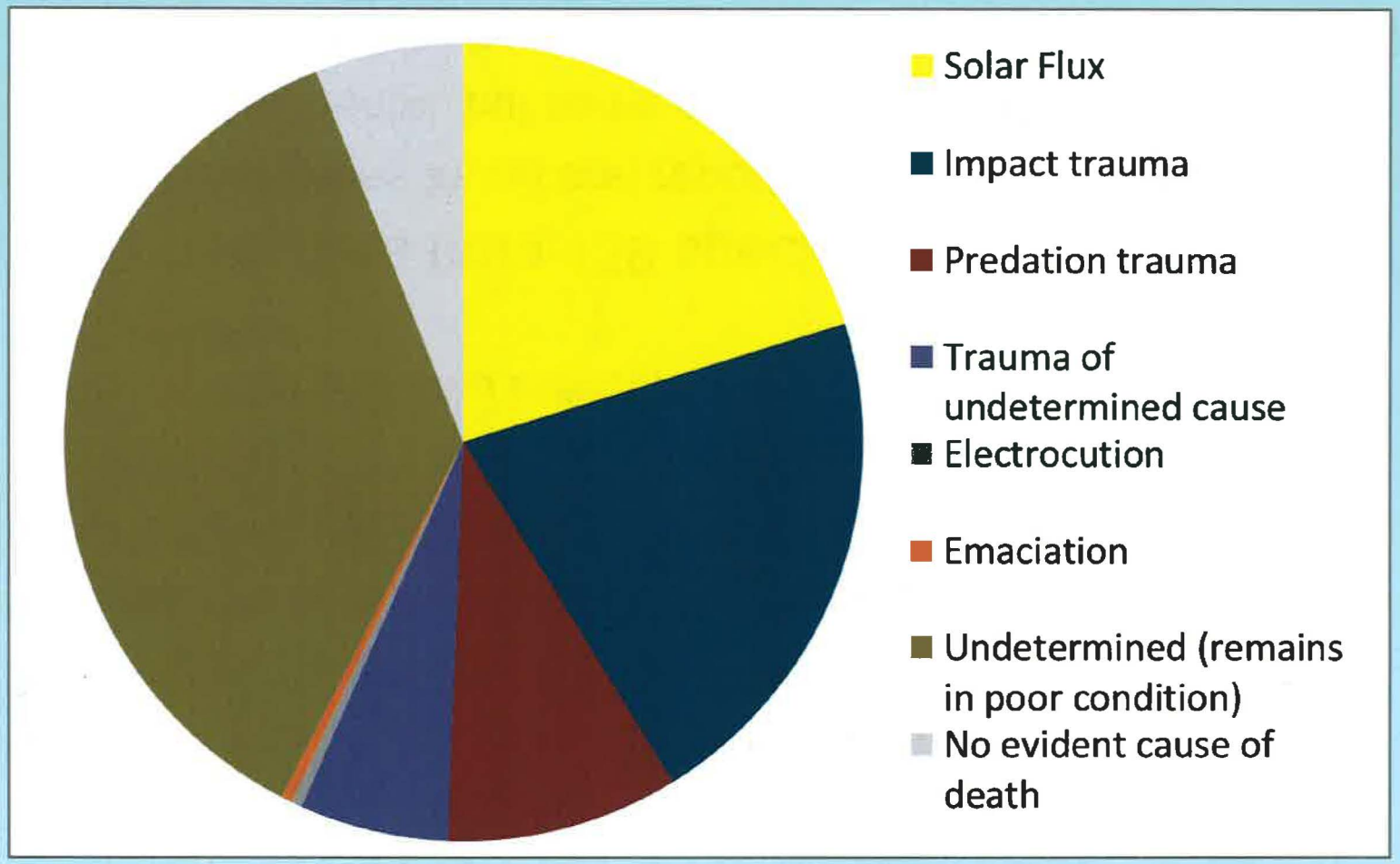
Caveats on Solar Avian Mortality data

- Data are primarily incidental, though some systematic surveys have commenced.
- Magnitude of mortalities cannot be estimated.
- Only projects in Southern California were included in this presentation.
- Data can provide information on which species may be at risk.
- Project features and types of injuries also indicated.

Initial Findings

- National Fish and Wildlife Forensics Lab Report (Feb 2014 using data from 2013)
  - From 3 solar projects, 233 carcasses from 71 species.
  - Collisions – Blunt force trauma
  - Solar Flux
  - "Significant Bat and Insect Mortality, including Monarch Butterflies".
- 1092 mortalities from 139 species (2012-Present)
  - Only mortalities found and reported included, no estimation.
  - Mostly Incidental, but some systematic surveys underway.
  - Many mortalities occur due to dehydration/heat stress after initial injury/stranding.
- Birds of Conservation Concern

Cause of Death from National Fish and Wildlife Forensics Lab Report (Kagan et al. 2014)



From 3 solar projects, 233 carcasses from 71 species.

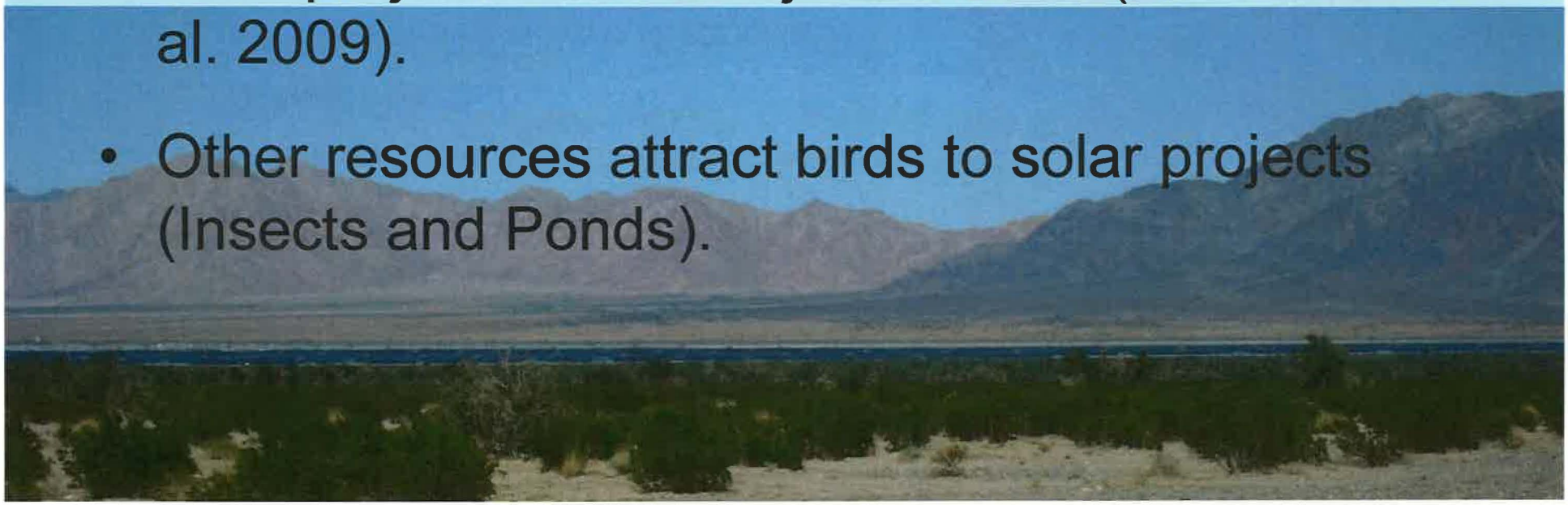
Species of Concern

- Federal Endangered/Threatened
  - Yuma Ridgeway's (Clapper) Rail
  - Willow Flycatcher
  - Yellow-billed Cuckoo (Proposed)
- State-listed/Fully Protected
  - Peregrine Falcon
  - Bank Swallow
- 19 Birds of Conservation Concern
  - Western Grebe
  - Horned and Eared Grebes
  - American White Pelican
  - Burrowing Owl
  - Calliope Hummingbird

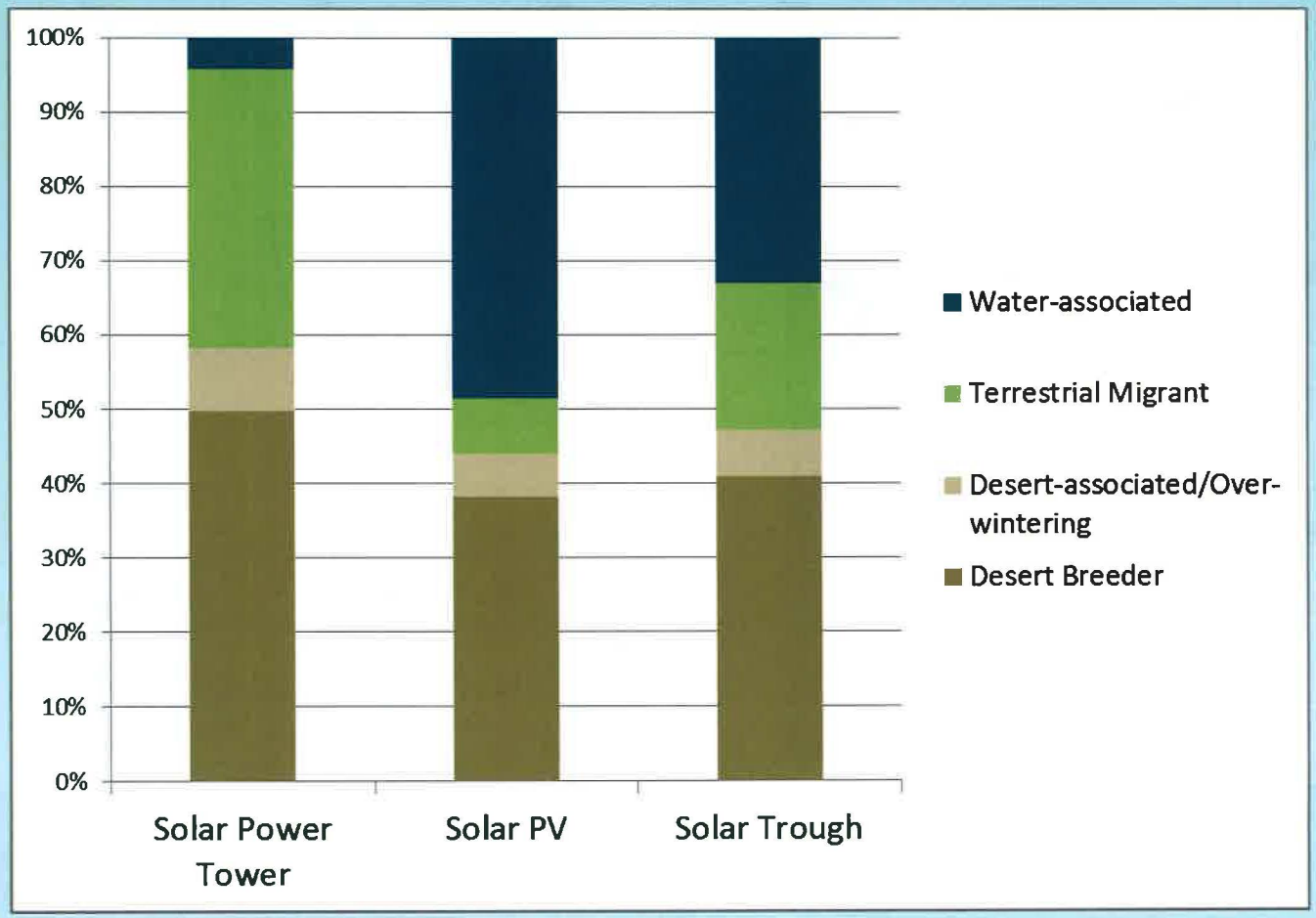


Hypotheses

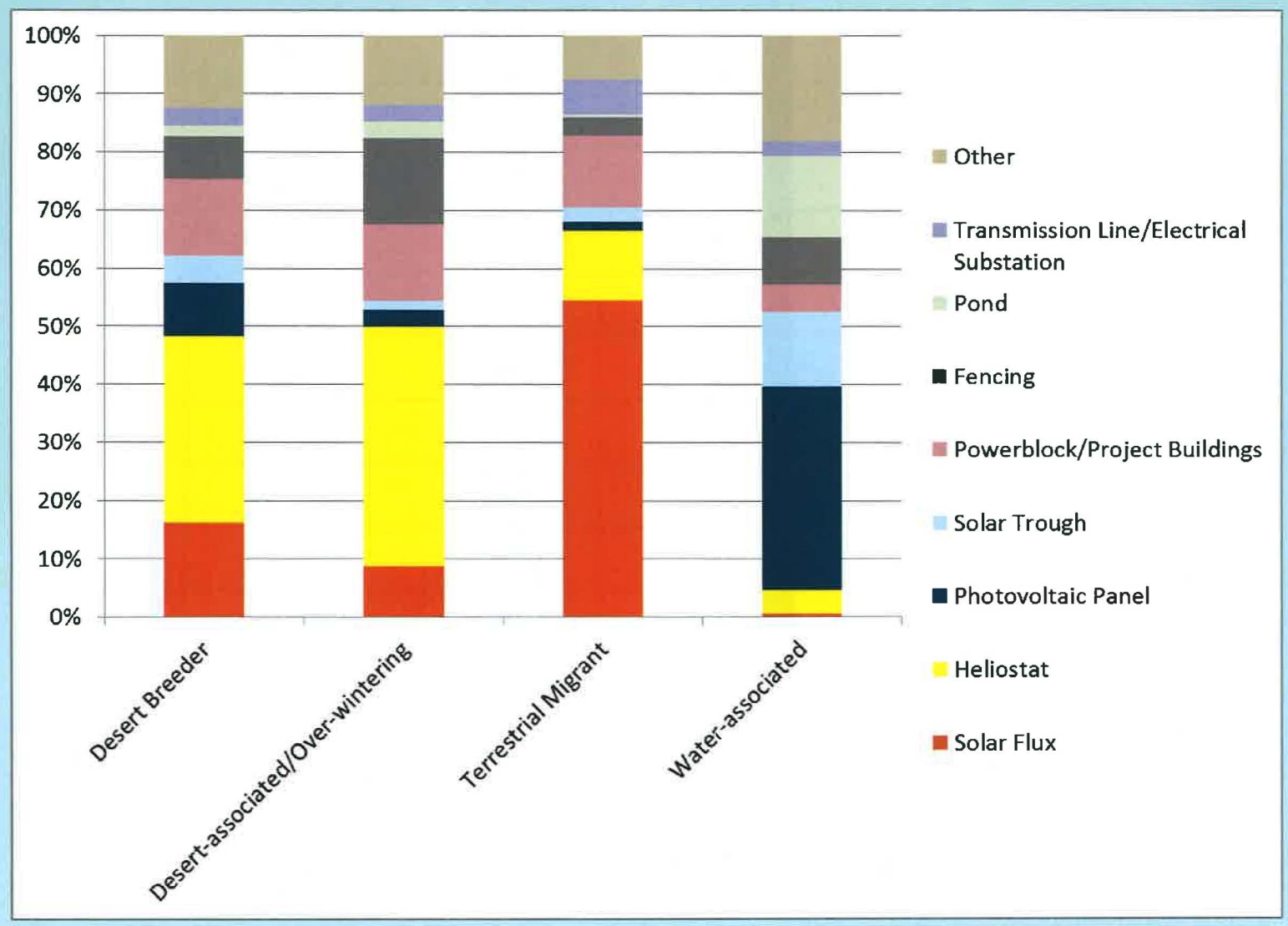
- Mortalities represent background mortality.
- Mortalities occur during normal bird movements (Anthropogenic, no landscape-scale attraction).
- Polarized light may attract birds and insects to solar projects in the Mojave Desert (Horvath et al. 2009).
- Other resources attract birds to solar projects (Insects and Ponds).



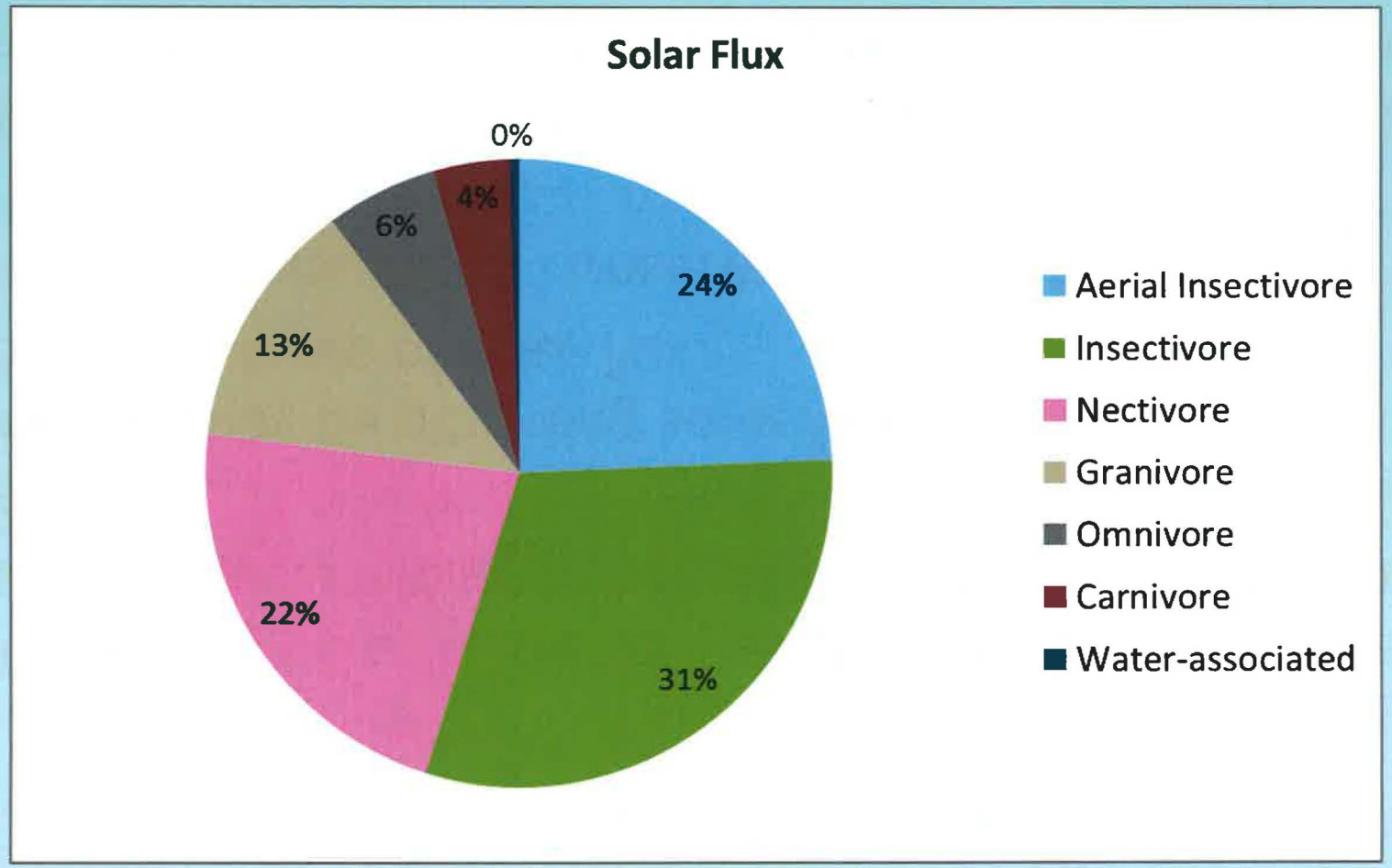
Habitat/Migratory Status of Birds found injured on Solar Projects



Solar Project Features Associated with Mortalities



Foraging Guilds of Birds with Solar Flux Injuries



Conclusions

- There may be a "lake effect" associated with utility-scale solar projects similar to that described by Horvath et al. 2009.
- Insects may be attracting some birds to areas with elevated levels of solar flux.
- Many bird species of conservation concern may be at risk.
- Many species affected are long-distance migrants, thus any population level effects may be difficult to determine.
- Initial findings suggest need for robust monitoring to better understand these phenomena and to support adaptive management.

Information Needs

- When – timing (day or night)
- Why – attractant and/or unidentified barrier
- Where – are there differences based on project location
- Are there differences in avian taxa affected and does it differ based on solar technology?
- Are there cumulative impacts?

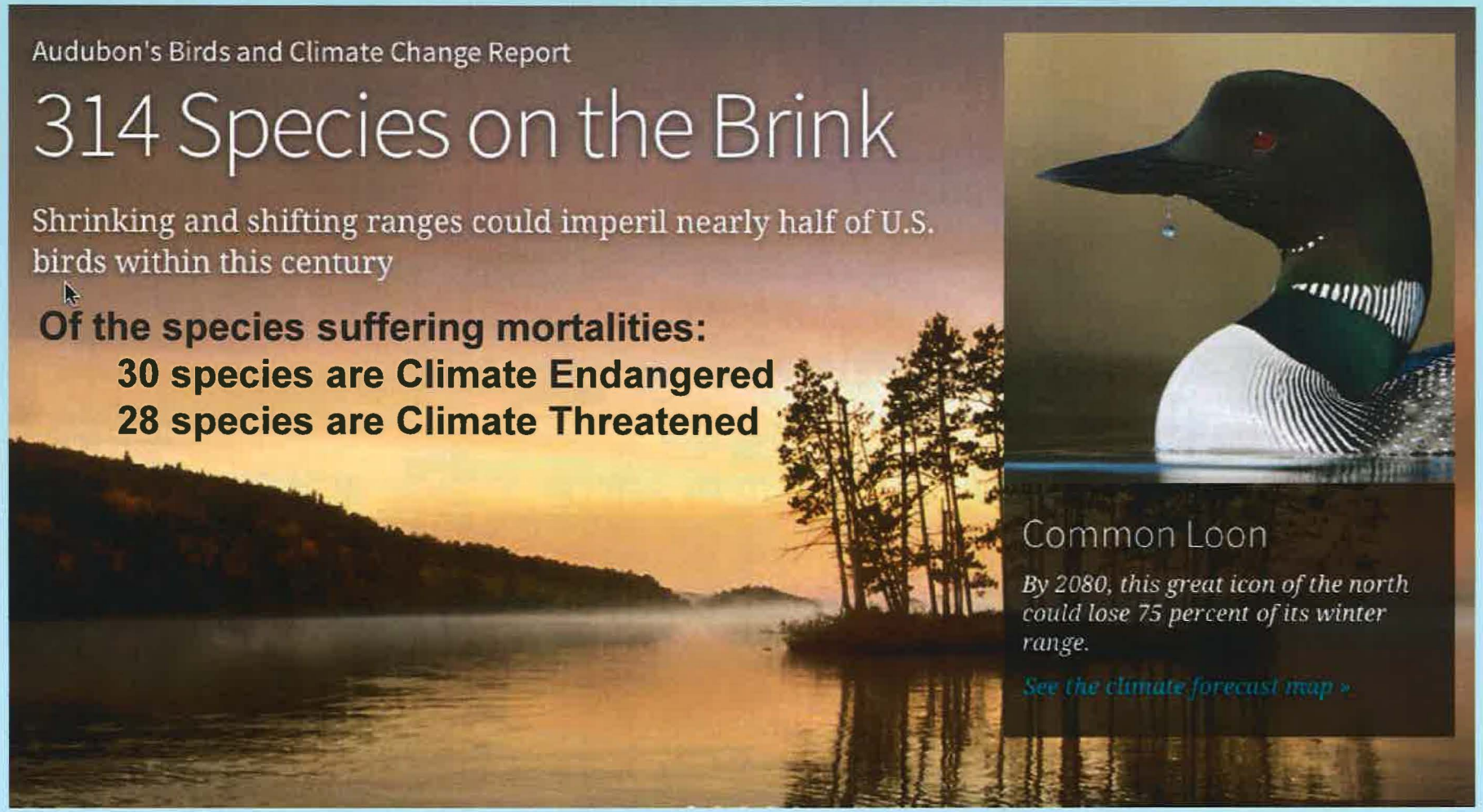
Research Needs

- Optical Ecology – Perception and Settling Response
- Mojave and Sonoran Desert Migratory Pathways
- Migratory Connectivity Research to identify populations affected
  - Populations affected may be distant from the source of mortalities
  - Stable Isotopes
  - Genotypes
  - Telemetry of appropriate-sized birds
- Identify Best Management Practices and Deterrent Methods

Actions being taken

- Coordinating with USFWS Office of Law Enforcement (Forensics Report).
- Working with solar industry to implement robust mortality monitoring.
  - Searcher Efficiency and Carcass Persistence Trials
  - Developing template for monitoring at each technology type.
- Coordinating with other agencies to find ways to avoid and minimize avian mortalities, including Department of Energy.
- USGS has initiated Avian Behavior Pilot Project at Power Tower Project
- Avian Solar Working Group (stakeholders and agencies)
- Collaborative funding of research and adaptive management

Final Thoughts



U.S. Fish & Wildlife Service

Questions?



USGS
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An Annual Report for Desert Tortoise Translocation Research at Fort Irwin

2011 Progress



Prepared for:
U.S. Army National Training Center
Natural Resource Program Manager

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY
WESTERN ECOLOGICAL RESEARCH CENTER

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U.S. GEOLOGICAL SURVEY
WESTERN ECOLOGICAL RESEARCH CENTER

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USGS Western Ecological Research Center
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Henderson, NV 89074

2011 Progress

Draft

Prepared for:

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Natural Resource Program Manager

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By K. Kristina Drake, Todd C. Esque, Kenneth E. Nussear, Christina M. Aiello, Patrick G. Emblidge, and Philip A. Medica

ABSTRACT

The threatened status of the Mojave population of the desert tortoise (*Gopherus agassizii*), in conjunction with the expansion of the Fort Irwin National Training Center (NTC), necessitated the development of a Translocation Plan to remove tortoises from military lands prior to training expansion (Esque *et al*. 2005; Esque *et al*. 2009). Since 2005, the Henderson office of USGS has conducted research designed to understand potential impacts of translocation on translocated, as well as resident and control desert tortoises. This research has expanded our knowledge of desert tortoise ecology and resulted in published information used by managers to enhance the survival of desert tortoise populations. In 2011, we submitted a new publication as a result of this work evaluating the acute and chronic physiological stress associated with translocation (Drake *et al.* In Review). Throughout the year, we continued to monitor tortoises remaining on Fort Irwin and acquired new animals in designated translocation areas to establish baseline metrics prior to translocation. We performed health evaluations and habitat characterizations on all sites in preparation for future translocation and research on the Fort Irwin desert tortoise population.

INTRODUCTION

The Agassiz's desert tortoise (*Gopherus agassizii*) was listed in 1990 as a threatened species under the Endangered Species Act (Fish and Wildlife Service 1990), and critical habitat within the Mojave desert was designated in 1994 (Fish and Wildlife Service 1994, Fish and Wildlife Service 2011a). In 2004, President George W. Bush signed the Fort Irwin Military Lands Withdrawal Act of 2001, authorizing the Fort Irwin National Training Center (NTC) to expand its training activities into 110,000 acres of military land that had been designated as critical habitat, some of which were previously used for military training prior to the listing of the desert tortoise. This expansion included three areas; two of which had sufficient numbers of tortoises to warrant translocation (the Southern Expansion Area [SEA] and the Western Expansion Area [WEA]), and thus were subject to specific conservation actions under the ESA. In order to fulfill the commitments made under the FWS Biological Opinion for the expansion, all tortoises residing in the expansion areas were to be monitored via radio telemetry, translocated to designated habitat outside of the Army training areas, and subsequently monitored following translocation (Esque *et al*. 2005; Esque *et al.* 2009).

Previous research focused on tortoises translocated from the SEA to adjacent Bureau of

Land Management (BLM) areas in 2008; hereafter, referred to as the Southern Expansion Translocation Area (SETA; Esque *et al.* 2005; Drake *et al.* 2009). In support of the SEA to SETA translocation, many field and laboratory experiments were designed to understand the potential acute and chronic impacts of translocation by researching aspects of tortoise ecology. To this end, the NTC supported research called for in the translocation plan (Esque *et al.* 2005) and evaluating the physiological stress associated with translocation, nesting success, incidence of disease, recruitment, behavior, social interaction, habitat characteristics, genetic variation and anthropogenic impacts of desert tortoise throughout this study site, much of which has resulted in published articles in peer reviewed journals (Drake *et al.* 2006-2011a, b; McIntyre *et al.* 2007; Heaton *et al.* 2008; Nussear *et al.* 2008; Esque *et al.* 2010; Latch *et al.* 2011; Drake *et al.* In Review). A subset of telemetered tortoises were not translocated with the initial effort, and remain in the SEA. These remaining tortoises are scheduled for translocation in the spring of 2012.

According to the amended translocation plan, tortoises in the WEA were scheduled for translocation in the upcoming years. In support of this anticipated activity, we identified additional translocation sites for WEA animals on adjacent BLM lands in an area designated as the Western Expansion Translocation Area (WETA; Esque *et al.* 2009). We monitored tortoises with radio telemetry in the WEA, and began attaching radios and monitoring animals in the recipient population in the WETA. In preparation for these upcoming translocations, we performed standard clinical health evaluations (Fish and Wildlife Service 2011b) to identify disease prevalence within the SEA, WEA, SETA, and WETA. We specifically tested for *Mycoplasma agassizii, M. testudineum* and chelonian herpesvirus, which are pathogens suspected to adversely affect tortoise survivorship (Jacobson et al. 1991; Jacobson 1994).

Many questions about "habitat quality" arose after elevated levels of tortoise mortality were observed following the 2008 translocation. Although this was largely due to subsidized predation related to a natural fluctuation of productivity (Esque et al. 2010), habitat quality, and the related concept of carrying capacity are frequently raised as management questions, and there is no definitive measure of either of these for desert tortoises. We initiated new research in 2011 aiming to quantify habitat quality by understanding the interactions of animal health relative to habitat and environmental conditions. The goal of this work was to provide a quantitative measure of "habitat quality" for desert tortoises by linking the survival and health of tortoise populations with measures of habitat attributes in an integrated way across the landscape. To accomplish this, we incorporated the use of gene expression to quantify the interactions of animal health in relation to habitat and environmental stressors by sampling habitat parameters across the landscape.

Gene expression quantifies many aspects of animal health by evaluating the up-regulation of specific ribonucleic acid (RNA) pathways that are activated by infectious agents, toxin exposures, and other influences that alter physiological status (Bowen *et al.* 2007; Bowen *et al.* 2011). Gene expression is the process by which information from the deoxyribonucleic acid (DNA) template of a particular gene is transcribed into messenger

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RNA (mRNA) and eventually translated into a functional protein. The amount of a particular gene that is expressed is physiologically dictated by a number of intrinsic and extrinsic factors, including stimuli such as infectious agents, toxin exposure, or trauma. The earliest detectable signs of health impairment are altered levels of gene transcripts, evident prior to clinical manifestation and subsequent detection by health evaluations (McLoughlin *et al*. 2006). As a result, analysis of mRNA can provide information not only about genetic potential but also about dynamic changes in the functional state of an organism. In fact, mRNA levels closely approximate functional protein levels, and specific changes in mRNA have been identified following heat shock, drug treatment, and changes in metabolic and disease states.

In addition to the parameters we have been measuring since 2005 (e.g. disease prevalence, movements, mortality, perennial plant cover and annual plant production), this year we analyzed habitat parameters such as diversity of annual plants, assemblages of perennial plants, soil chemical composition and potential toxicants as well as a variety of anthropogenic disturbances. Over time, tortoise health (from both health evaluations and results of gene expression analyses) will be analyzed in spatially explicit models evaluating the influence of these habitat parameters. This project differs fundamentally from previous research because it is aimed specifically at not only learning about tortoise health responses, but also *why* tortoises respond as they do.

MATERIALS AND METHODS

Study Area

The study area for the Fort Irwin research is comprised of four distinct, but adjacent areas centered around translocation actions that took place in 2008 and actions anticipated for 2012. These are the SEA, the SETA, the WEA, and the WETA. A great deal of this landscape is quantified as good to excellent potential as desert tortoise habitat (Nussear *et al.* 2009). The two expansion areas are designated to return to military training areas after translocation of the tortoises residing in them is complete. The SEA is a 94 km^2 area along the southern edge of the NTC. It is bounded by the 3890000 and 3887000 North and 523000 and 550000 East Universal Transverse Mercator (UTM) North American Datum 1983 lines (Figure 1). Two areas within the SEA property boundary are designated tortoise conservation areas and have been selected as possible translocation sites for the remaining SEA tortoises in 2012. The WEA is a 283 km^2 area situated in the southwest corner of the NTC. It is approximately bounded by the 3908200 and 3890200 North and 492500 and 516500 East UTM lines. A holding facility for juvenile tortoises referred to as the Western Expansion Juvenile Enclosures (WEJE) is located within the WEA at 508079 East UTM and 3899909 North UTM (Figure 1).

Both expansion areas (SETA and WETA) share a border with over 2,428 km^2 of mostly BLM lands containing critical desert tortoise habitat and designated for tortoise translocation activities (Figure 1). Tortoises monitored on the NTC are tentatively scheduled for translocation into the SETA and WETA in 2012. The SETA is located directly south of the SEA, and served as the translocation site for the animals that were

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translocated from the SEA in 2008. The SETA is ~ 1000 km^2 in area and is located within the Superior-Cronese Desert Wildlife Management Area (DWMA), Western Mojave Recovery Unit. It is bounded on the south by Interstate 15, on the north by the southernmost boundary of Fort Irwin, on the west by the 508000 East UTM line, and on the east by the 568000 East UTM line (Figure 1). Nine plots within the SETA were selected as possible translocation sites for the remaining SEA tortoises (shown as light green shaded areas in Figure 1). The WETA is south and west of the WEA, and covers 1,153.6 km^2 entirely within the Superior-Cronese Critical Habitat DWMA. It is bounded on the north by the Naval Air Weapons Station China Lake, to the south by the 3860980 North UTM line, and to the east and west by the 508340 and 465080 East UTM line.

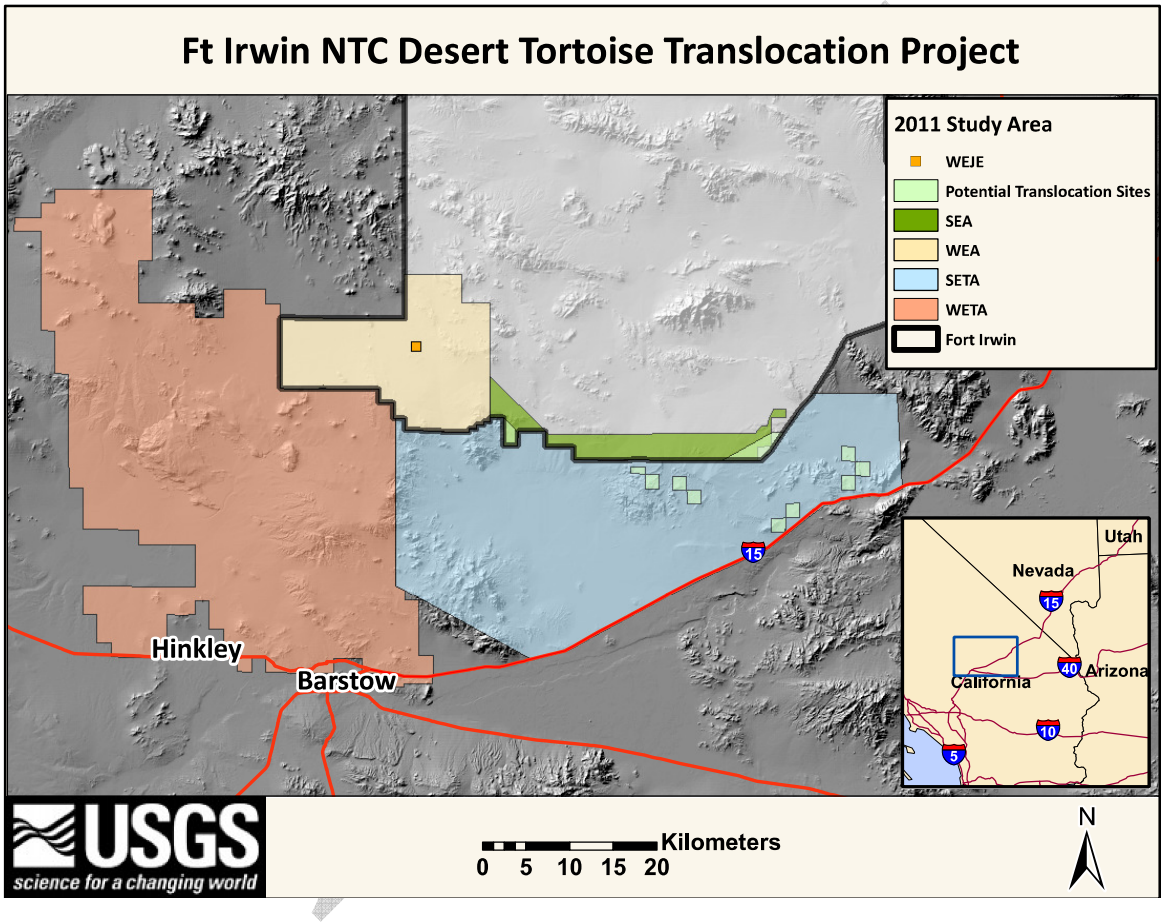

Figure 1. *Map of the Fort Irwin NTC desert tortoise monitoring areas and surrounding translocation areas.*

Study Animals

In 2011, we continued to monitor 73 (please note – the actual number of animals varies due to radio failure, mortality and new accessions as this work is ongoing – The Ft Irwin Translocation database maintains the most up-to-date information at any time) tortoises residing in the SETA that have been part of our research on the 2008 translocation of tortoises from the SEA. Beginning October 1, 2010, we also assumed responsibility for

monitoring tortoises awaiting translocation in the SEA and WEA, and by January 2011, we were monitoring 322 tortoises total, with 271 in the WEA and 51 in the SEA. We also conducted surveys throughout the WETA during spring and fall of 2011 to accession new adult tortoises to be used in upcoming translocation research and monitoring following the anticipated translocation in 2012. Transmittered tortoises were tracked monthly in 2011 with few exceptions due to lost or failure of radio transmitters. Repeated efforts were conducted to locate missing animals.

Animal Encounters

Data Collection and Measurements

On each encounter with a tortoise, we recorded date, time, observer, local weather, microhabitat, and geographic location (UTM). Additionally, animals were measured or had transmitter attachment/maintenance when necessary. For those encounters, we also recorded mass and shell dimensions of animals, and information associated with transmitter attachment (Appendix 1). Several microhabitat characteristics were recorded during each tortoise encounter. These included general characteristics of the tortoise's geomorphic location (e.g. hill, wash, flats), soils (e.g. cobble, sandy loam, sand), vegetation, specific microhabitat (e.g. sun, shade, burrow), and behavior (e.g. basking, eating; Appendix 1). When the microhabitat of the tortoise was associated with perennial vegetation, the species and dimensions of the vegetation were recorded. Data were recorded using Trimble Juno SB Handheld Computers running Pendragon Software (v 5.3) as well as paper datasheets.

Physical Measurements and Marking

Tortoises were measured using metal tree calipers during their initial capture, when radio transmitters were replaced, or during complete health assessments. Measurements (mm) included the midline carapace length (MCL) measured from the center tip of the nuchal and supracaudal scutes, plastron length measured between the notches of the gular and anal scutes, shell width measured between the fifth and sixth marginals, and maximum shell height. Tortoises were weighed to the nearest ~20 g using a field portable digital scale. A uniquely numbered ID tag based on location (4000's for the SEA, 5000's for the WEA, and 7000's for the WETA) was attached with epoxy to a depressed portion of a vertebral scute for identification. In previous years tortoises were notched using the Highly Modified Honegger System, which is a modification of a system developed by Froese and Burghardt (1975) and uses numbers 1, 2, 4 and 7 along the marginal scutes (Honegger 1979; Appendix 2). Our numbered ID tags matched this notching number for animals that were previously notched.

General Health Assessment

When first marked, and again upon each encounter, each tortoise was visually inspected for injuries, morphological anomalies, ticks, and obvious symptoms of cutaneous dyskeratosis, osteoporosis, and upper respiratory tract disease (URTD). This basic health

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assessment was recorded for general characterization only, and only when animals were visible. A more thorough health assessment was performed once on each tortoise during spring or fall as described in the Health Assessment section.

Transmitters

Transmitters were attached to all tortoises found in the SEA and WEA and to adult tortoises (MCL > 180 mm) in the WETA. The mass of the attached transmitter was variable (9.7 g, 13.8-15.0 g, 17.0 g, 19.5 g, or 25.5-27.5 g) depending on the size of the tortoise. The different transmitter sizes were due to various battery configurations, where larger and heavier batteries provide longer transmitter life. Any individuals from the SEA or WEA too small for radio attachment were relocated to the WEJE until translocation is conducted. Transmitters were attached to the first costal scute with putty epoxy, and only one segment of plastic tubing was used to attach the antenna to the second costal scute. The rest of the antenna was allowed to trail freely. A small dab of silicone sealant was placed between the head of the transmitter and the first tubing segment to reduce the risk of entanglement. When a transmitter was nearing its scheduled battery expiration date or was functioning improperly, it was replaced with a new transmitter.

Health Assessments

We implemented standardized health assessment and sample collection procedures to characterize disease prevalence based on the guidance provided in the FWS health assessment procedures handbook (Fish and Wildlife Service 2011b; Appendix 3). Each health assessment consisted of a visual assessment of the animal, oral swab, nasal lavage, blood collection, measurements, rehydration (if necessary), disinfection, lab processing, and tissue analysis. Prior to each assessment all equipment was cleaned of debris and disinfected with a 1:10 bleach solution wipe. We recorded the tortoise's mass to the nearest ~20g using a portable field scale before handling to document any mass loss due to voiding. Tortoises that voided urine or urates during health assessments were rehydrated by soaking in a shallow water bath (soaking) for 20 minutes or injection of 0.9% sterile saline using a 21 g needle and 60 mL syringe into the epicoelomic cavity (Appendix 4).

We made a thorough visual inspection of the tortoise: examining the general posture, respiration, face, skin, and shell for any clinical signs of disease, abnormalities, or damage. Notching, abnormalities, and any other identifying marks were recorded and photographed and additional photos were taken of the face, carapace, and plastron. The body condition of each tortoise was scored using a value ranging from 1 to 9 to provide a relative index of the muscle mass, size, mass, and attitude or behavior (Fish and Wildlife Service 2011b).

Oral swabs were collected by rolling two sterile, plastic, cotton-tipped swabs across the choana, tongue, and oral mucosa. The coloration of the oral cavity and presence of ulcers, lesions or oral plaques was recorded. Following the oral examination, a nasal lavage was taken using a 5 ml slip tip syringe of 0.9% sterile saline solution with a volume suitable for the tortoise's size (Appendix 4). Each nare was flushed with saline and the fluids from the flush were collected in a sterile 60 mL conical vial. The conical vial was swirled to

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ensure a thorough mixture and aliquoted into vials with three types of media: one containing 1 mL lavage fluid to 1 mL Lysogeny Broth (general culture medium), one with equal parts lavage fluid to SP4 (culture medium targeting *Mycoplasma sp*.), and a third with 1 mL lavage fluid to 200 µL RNAlater® (RNA stabilizing reagent). These vials were labeled and stored in a sealed plastic container on ice for no more than five hours until processed in the lab.

Blood samples were collected from the subcarapacial sinus using 23 or 25 gauge needles pre-coated with sodium heparin (Hernandez-Divers *et al*. 2002). Blood samples were stored for subsequent analysis on several media, including: filter papers, microtainers, and RNA Protect® Animal Blood Tubes (Qiagen, Valencia, CA). Blood samples were labeled, and stored on ice for no more than five hours until processed in the lab. Blood collected in lithium heparinized microtainers was centrifuged at 3400 rpm for 10 minutes to separate plasma from red blood cells. Ocular estimation of the percentage of packed red blood cells (hematocrit), plasma consistency and plasma color was used to categorize the amount of lymphatic fluid present: None (0%), low (1-15%), medium (16-30%), high (31%+), or undetermined. Plasma was extracted using a micropipette and placed into labeled cryogenic vials. Oral swabs, nasal lavage vials, red blood cells, RNAprotect® Animal Blood Tubes, and plasma aliquots were frozen and transferred on dry ice to Henderson, NV for ultracold storage (-80°C) prior to shipment for laboratory analysis.

Blood plasma and nasal samples in SP4 were shipped to Dr. Mary Brown at the University of Florida to determine the presence of antibodies to *Mycoplasma agassizii* or *Mycoplasma testudineum* in plasma using enzyme-linked immunoassay (ELISA) tests and to culture and identify *Mycoplasma* in lavage samples using polymerase chain reactions (PCR) (Brown *et al.* 1994; Wendland *et al*. 2007). ELISA results were categorized as negative (titer <32), suspect (titer 32-64), or positive (titer >64). Oral swab samples were sent to Dr. Elliot Jacobson at the University of Florida for PCR tests for herpesvirus.

Gene Transcription and RNA Extraction

Blood samples in vials containing RNA Protect® were shipped on dry ice to the University of California-Davis (U.C. Davis) for RNA transcript analysis. In the lab, the RNA was isolated to manufacturer's standard protocol specifications with one exception. We split each sample into two spin columns to account for the nucleated red blood cells found in reptiles. The manufacturer's standard protocol included a one-column DNase treatment to remove contaminating gDNA (using silica-based microspin technology). Afterwards, the extracted RNA was stored at -80°C for analysis. A standard cDNA synthesis was performed on 2 µg of RNA template from each animal. Reaction conditions included 4 units reverse transcriptase (Omniscript®, Qiagen, Valencia, CA), 1 µM random hexamers, 0.5 mM each dNTP, and 10 units RNase inhibitor, in RT buffer (Qiagen, Valencia, CA). Reactions were incubated for 60 minutes at 37°C, followed by an enzyme inactivation step of 5 minutes at 93°C, and then stored at –20°C until further analysis.

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Degenerate primers were designed based upon multi-species alignments (GenBank) as previously described (Bowen *et al.* 2007). Briefly, degenerate primer pairs were developed for the desert tortoise and were used on cDNA from three randomly selected tortoise samples. Degenerate primer pairs were designed to amplify 10 genes of interest and one ribosomal or "housekeeping" gene (Bowen *et al*. 2007). PCR amplifications using these primers were performed on 20 ng of each cDNA sample in 50 µl volumes containing 20–60 pmol of each primer, 40 mM Tris-KOH (pH 8.3), 15 mM KOAc, 3.5 mM Mg $(OAc)_2$, 3.75 µg/ml bovine serum albumin (BSA), 0.005% Tween-20, 0.005% Nonidet-P40, 200 µM each dNTP, and 5U of Advantage® 2 Taq polymerase (Clontech, Palo Alto, CA). The PCR was performed on an MJ Research PTC-200 thermal cycler (MJ Research, Watertown, MA) and consisted of 1 cycle at 94°C for 3 minutes, followed by 40 cycles at 94°C for 30 seconds, at 60°C for 30 seconds, and 72°C for 2 minutes, with a final extension step of 72°C for 10 minutes. The products of these reactions were electrophoresed on 1.5% agarose gels and resulting bands visualized by ethidium bromide staining. Definitive bands representing PCR products of a predicted base pair size of the targeted gene were excised from the gel, and extracted and purified using a commercially available nucleic acid-binding resin (Qiaex II Gel extraction kit, Qiagen, Valencia, CA). Nucleotide sequences of both strands were determined by dideoxy nucleotide methods using an automated sequencer (Model 373; Applied Biosystems, Foster City, CA). Nucleotide sequences of the PCR products were analyzed using Align™ and Contig™ sequence alignment software programs (Vector NTI™; Informax Inc, North Bethesda, MD) and compared to known sequences using the NCBI BLAST program (Altschul *et al.* 1990), and the IMGT/HLA database (Robinson *et al.* 2001). Primer pairs appropriate for real-time PCR were designed based on the elucidated desert tortoise sequences for each gene.

Real-time PCR for the individual, tortoise-specific housekeeping gene (S9) and genes of interest were run in separate wells. Briefly, 1 µl of cDNA was added to a mix containing 12.5µl of QuantiTect SYBR Green® Master Mix [5mM Mg^{2+}] (Qiagen, Valencia, CA), 0.5µl each of forward and reverse sequence specific primers, 0.5µl of Uracil-N-Glycosylase (Invitrogen, Carlsbad, CA), and 10.0µl of RNase-free water, making the total reaction mixture 25µl. The reaction mixture cDNA samples for each gene of interest and S9 were loaded into 96 well plates in duplicate and sealed with optical sealing tape (Applied Biosystems, Foster City, CA). Reaction mixtures containing water, but no cDNA, were used as negative controls; thus approximately three to four individual tortoise samples were run per plate.

Amplifications were conducted on a 7300 Real-time Thermal Cycler (Applied Biosystems, Foster City, CA). Reaction conditions were as follows: 50°C for 2 minutes, 95°C for 15 minutes, 40 cycles of 94°C for 30 seconds, 58°C for 30 seconds, 72°C for 31 seconds, an extended elongation phase at 72°C for 10 minutes. Reaction specificity was monitored by melting curve analysis using a final data acquisition phase of 60 cycles of 65°C for 30 seconds and verified by direct sequencing of randomly selected amplicons (Bowen *et al.* 2007). Cycle threshold crossing values (C_T) for the genes of interest were normalized to the S9 housekeeping gene.

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Habitat Characterization

We surveyed plots to characterize desert tortoise habitat by quantifying annual and perennial vegetation cover, species richness, annual productivity, and soil composition. Survey plots were 30 m by 30 m and were randomly located throughout all four study areas (Figure 2).

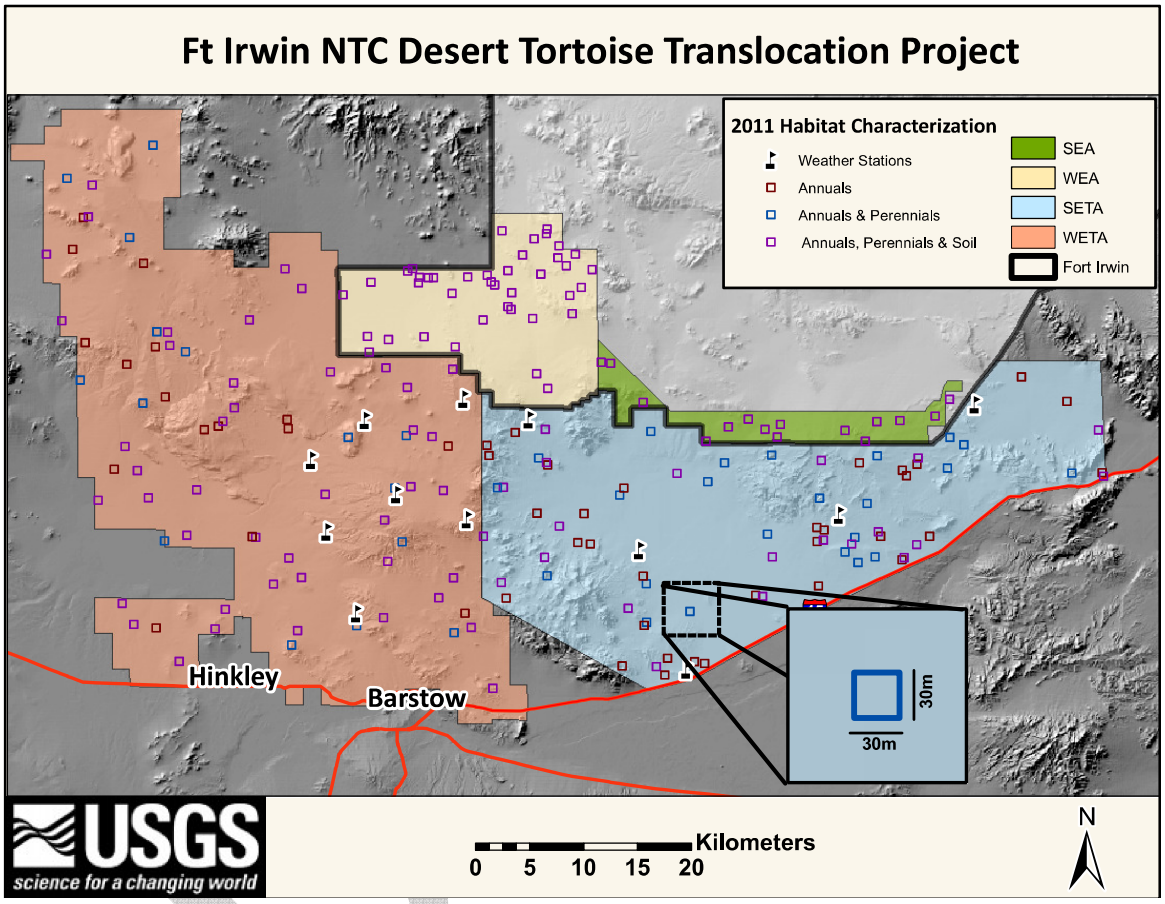

Figure 2. *Vegetation transects and soil collection sites sampled in 2011 with weather station locations on all sites.*

Annual Vegetation Sampling

We surveyed plots (n=206) to characterize annual plant productivity, live cover and species richness from March 23 thru May 20, 2011. Fifteen evenly spaced quadrats (1 m^2) were surveyed within each plot and a species list of annual vegetation was recorded for each quadrat (Appendix 5). Normalized Density Vegetation Index (NDVI) photos were taken of each 1 m^2 quadrat and NDVI calculated values (see Vegetation Photography section) were used as estimates of annual % cover. Above ground annual biomass was clipped and collected within a 0.1 m^2 sub-sample of each quadrat. Annual vegetation remaining from the previous year was excluded from the collection. All biomass was dried for three days to constant mass and weights (g) were recorded for each quadrat.

Annual biomass was compared between sites using a linear mixed-effects model and analysis of variance (ANOVA). Tukey multiple comparisons was used for cover and species richness analysis. We used linear regression to identify correlations between annual and perennial species richness, annual biomass, and elevation. All statistics were calculated using R (V 2.14.0, R Development Core Team 2011).

Vegetation Photography

Photos were taken of each 1 m^2 quadrat using NDVI and Enhanced NDVI (ENDVI) vegetation stress cameras from an overhead position. The photos were shot using automatic focus and automatic light settings. We used both 2-band Canon550® NDVI MK I and 3-band Canon550® NDVI MK II (Canon U.S.A. Inc., Lake Success, NY) vegetation stress cameras modified by maxmax.com. These vegetation cameras captured the light reflected by plants, Near Infrared (NIR) light wavelengths (670nm-750nm), visible green light, and the visible blue light absorbed by plants. Typically the visible light in a digital photo is separated into three channels: Red, Green, and Blue. These cameras separated the NIR light into the Red channel, and visible Green and Blue light into their respective channels (Llewellyn 2011).

The photos were edited in Adobe® Photoshop® (Adobe Systems Inc. San Jose, CA) and analyzed using R and Grass GIS (GRASS Developmental Team, 2011) to calculate the NDVI values for each photo. For the 2-band photos we used the NDVI calculation and for the 3-band photos we used the ENDVI calculation (Llewellyn 2011; Figure 3). To omit NDVI values generated by non-plant sources, we scaled the values using NDVI = 0.2 as the baseline so only NDVI values above this threshold were used in analysis. For the ENDVI calculation we scaled the values using NDVI = 0.11. Baseline values were determined by comparing the NDVI cover values of a test sample of photos against our ocular estimates of cover at those sample sites. We chose the baseline values with the lowest AIC (Burnham & Anderson 2002).

$$NDVI = \frac{(NIR - Blue)}{(NIR + Blue)}$$

$$ENDVI = \frac{(NIR + Green) - (2 \times Blue)}{(NIR + Green) + (2 \times Blue)}$$

Figure 3. *Normalized Density Vegetation Index (NDVI) and Enhanced Normalized Density Vegetation Index (ENDVI) calculation (Llewellyn 2011).*

Perennial Vegetation Surveys

We surveyed a series of nested plots to determine the plot size that represented the majority of perennial species in the study area (Scheiner 2003) to ensure that the 30 m by 30 m plots used to assess the annual vegetation were of adequate size. A subset (n=75) of the annual plots were surveyed for perennials from July 5 thru July 18, 2011. All perennial species were identified to determine species richness (Appendix 6). A survey of

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additional perennial plant species richness plots (n=120) was conducted across the study area from October 1-26, 2011. In addition to recording all species present, we recorded ocular estimates of perennial cover, listing species on a percentage scale. Cover values measured using line-intercept transects were conducted in previous years and the data from that work is still relevant.

Soil Sampling

The soil samples (n=120) were collected in conjunction with vegetation surveys. Approximately 250 mL of soil were collected from the four corners of each vegetation plot and combined for a total volume of 1 L. At each collection site the surface soil was scraped down approximately 50 mm and the exposed soil was collected. The sample was filtered through a 2 mm screen and funneled into a glass collection container. The small particle soil and the excluded large particles were individually weighed to determine soil bulk density. Collection tools were rinsed with de-ionized water and isolated after each use to prevent cross-contamination. The samples were kept cool (2-6°C) until ready for testing. Soil samples were tested for 52 analytes, including heavy metals, explosives, petroleum hydrocarbons, polynuclear aromatics, extractable organic halides, perchlorate and organic phosphorous by Summit Environmental Technologies, Inc, New Mexico.

Climate

We installed five HOBO® (Onset Computer Corporation, Bourne, MA) U30 Remote Monitoring System weather stations in the SETA in August 2010, two units in the WETA in December 2010, and five units in the WETA in 2011 (Table 1; Figure 2). Each station was placed in desert tortoise habitat choosing sites that represented the range of elevation and vegetation composition across the study area. All units were equipped with sensors to measure air temperature at 70, 30, and 1 cm above ground, temperature at 30 cm and 70 cm below ground, relative humidity, solar radiation (light intensity), rain, and wind speed. The WETA weather stations were also fitted with soil moisture sensors, which will be added to SETA stations in 2012.

Table 1. Location of active weather stations in the Fort Irwin NTC translocation sites WETA and SETA.

Site	UTM Easting (NAD 83 Zone 11S)	UTM Northing (NAD 83 Zone 11S)	Year Installed
WETA	494143	3871136	2011
WETA	497890	3882199	2011
WETA	504447	3879838	2011
WETA	504107	3891034	2011
WETA	489958	3885358	2011
WETA	495965	3889072	2010
WETA	491396	3878718	2010
SETA	510179	3889133	2010
SETA	520415	3877007	2010
SETA	524801	3865888	2010
SETA	538975	3880255	2010
SETA	551574	3890525	2010

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Movements

Home-ranges

We estimated active season (March 1, 2011 to October 31, 2011) home-range area (ha) for all tortoises with more than six observations during the season. We calculated the minimum convex polygon (MCP) for each individual using the R package adehabitatHR (Calenge 2006).

Winter Activity

Winter encounters (defined as November 20, 2010 – February 20, 2011) were analyzed to test assumptions of tortoise inactivity during the winter season (Nagy and Medica 1986; Rautenstrach 1998). Tortoises were classified as "active" if they were observed above ground or the calculated distance between encounters was greater than 15 m (the typical precision of our global positioning system [GPS] receivers). We calculated net distance moved for each individual by adding distances moved between each winter observation.

RESULTS

Animal Encounters

Tortoises were tracked at least once a month resulting in 7,283 encounters between January 1, 2011 and October 31, 2011. The number of tortoises encountered each month in 2011 is summarized in Appendix 7. At the end of October 2011, we were tracking 544 tortoises among all sites (Figure 4). We located 161 non-transmittered tortoises and incorporated them into the study and a total of 351 transmitters were routinely changed in anticipation of battery failure. A detailed list of transmitter serial numbers, frequencies, and associated tortoises is provided in Appendix 8a-c.

Survivorship

Eight tortoises were found dead in 2011 (Appendix 9) and one additional animal was euthanized due to very poor condition (see Health Assessments section below). Tortoise mortality rate for 2011 continued to decrease from previous years despite an increase in the number of tortoises being monitored (Table 2, Figure 4).

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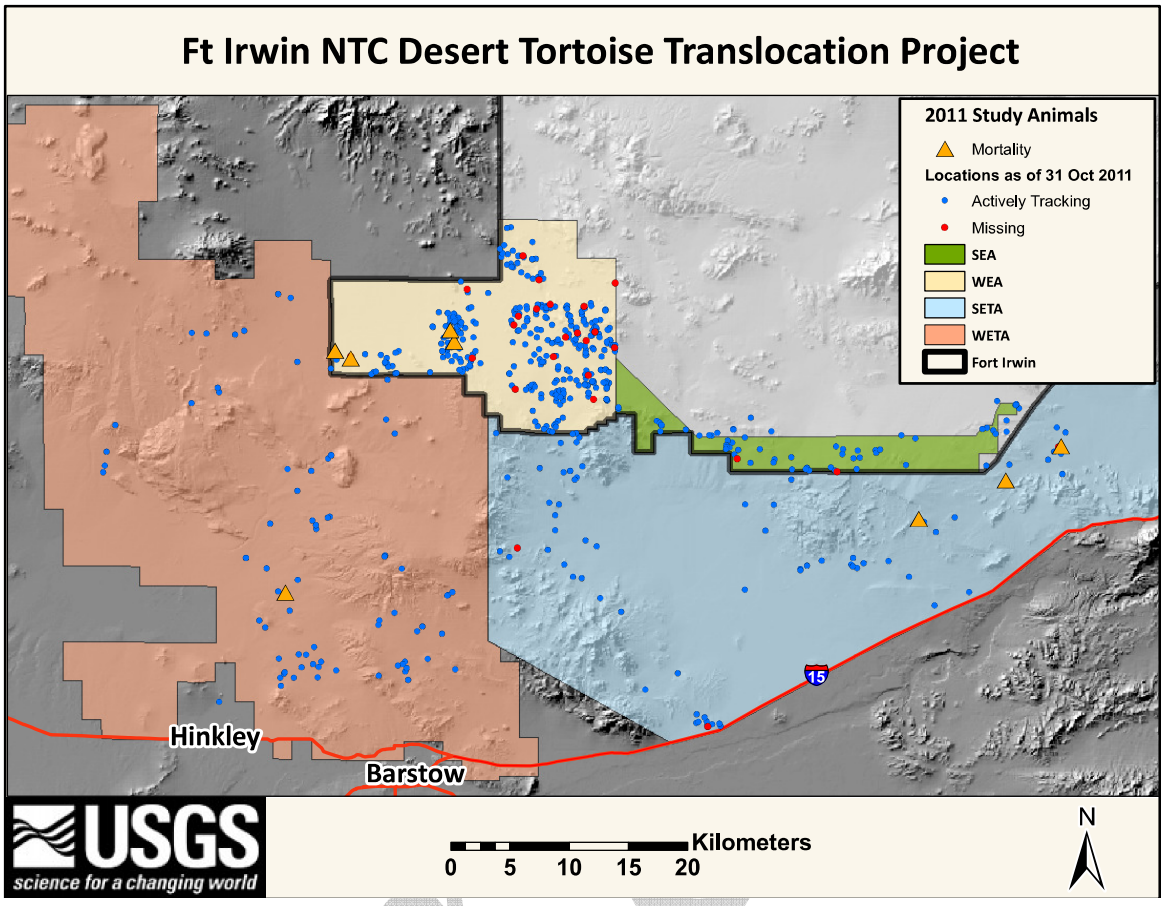

Figure 4. *Locations of desert tortoise mortality events throughout the study area as of 31 October 2011.*

Table 2. Desert tortoise mortality from 2008-2011 at the Ft. Irwin study site.

Year	# Dead	# Monitored	% Mortality
2008	39	121	32.2
2009	31	90	34.4
2010	11	82	13.4
2011	8	525	1.5

Health Assessments

We completed 507 total health assessments on tortoises, including 320 in the WEA, 69 in the, 57 in the SEA, and 61 in the SETA. There remain 15 tortoises in the WEA that still require a portion of the health assessment process in order to be eligible for translocation. Tissues collected are reported in Appendices 11through13.



Figure 5. *Atypical tortoise showing disfiguration and clinical signs vs. typical "healthy" tortoise on Fort Irwin.*

We observed few tortoises (n=16, 3% of all tortoises surveyed) with mild to moderate clinical signs of illness, including some symptoms characteristic of URTD and shell disease (Figure 5, Fish and Wildlife Service
2011b). Most tortoises visually inspected showed little or no sign of clinical infection or illness. Tortoise 5345 was found in such poor condition that a health assessment could not be completed. With authorization from FWS, and California Fish & Game (CADFG), we removed this tortoise from the WEA to receive veterinary care on Fort Irwin. When the condition was determined to be too poor to return to the WEA, we transferred the tortoise to CADFG to be sent to an appropriate lab for euthanasia and necropsy.

Results received for ELISA and PCR tests are reported in Appendices 11through13 with their corresponding tissue samples. Table 3 reports the number of tissue samples that were sent for each laboratory test and how many tortoises tested positive, negative, suspect, or are still pending. Of the plasma samples tested, 21 tortoises (5%) had positive ELISA titers: 9 tortoises, all from the WETA, were seropositive for *Mycoplasma agassizii* antibodies and 12 tortoises were seropositive for *Mycoplasma testudinuem* antibodies. An additional 8 tortoises are suspect for *M. agassizii* antibodies and 31 were suspect for antibodies to *M. testudineum* (Table 3). All other plasma samples have tested negative. All oral swab samples analyzed to date tested negative for presence of herpesvirus (Appendix 10), and all lavage cultures analyzed to date tested negative for presence of either *Mycoplasma* species (Figure 6, Appendix 11). The data for blood collection from all tortoises in 2011 can be found in Appendix 12.

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Table 3. Total number of desert tortoises at Fort Irwin NTC whose tissues were sent for analysis and results received in 2011.

Site	Sample Type	Test type	# Tortoise Samples Sent	# Positive	# Negative	# Suspect	# Pending
WEA	Oral swab	PCR Herpesvirus	321	0	168	0	153
	Nasal Lavage	PCR *Mycoplasma sp.*	314	0	92	0	222
	Plasma	ELISA *M. agassizii*	327	0	321	3	3
	Plasma	ELISA *M. testudineum*	327	5	305	15	2
SEA	Oral swab	PCR Herpesvirus	57	0	56	0	1
	Nasal Lavage	PCR *Mycoplasma sp.*	57	0	15	0	42
	Plasma	ELISA *M. agassizii*	57	0	55	0	2
	Plasma	ELISA *M. testudineum*	57	0	54	1	2
SETA	Oral swab	PCR Herpesvirus	63	0	1	0	62
	Nasal Lavage	PCR *Mycoplasma sp.*	59	--	--	--	59
	Plasma	ELISA *M. agassizii*	62	0	62	0	0
	Plasma	ELISA *M. testudineum*	62	1	53	8	0
WETA	Oral swab	PCR Herpesvirus	69	--	--	--	69
	Nasal Lavage	PCR *Mycoplasma sp.*	65	--	--	--	65
	Plasma	ELISA *M. agassizii*	69	9	55	5	0
	Plasma	ELISA *M. testudineum*	69	6	56	7	0

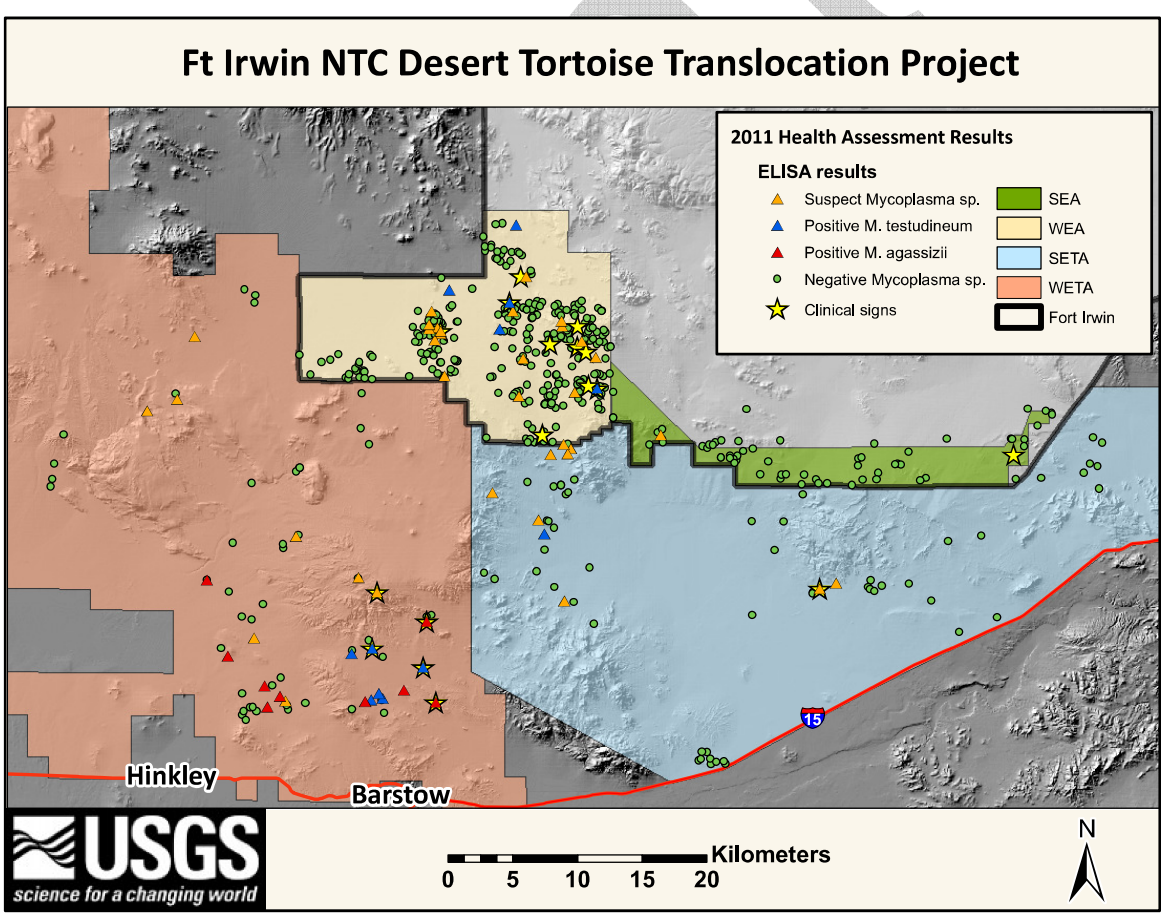

Figure 6. *Desert tortoise locations with ELISA results and clinical signs observed in 2011 on Fort Irwin sites.*

Gene Transcription and RNA Extraction

Genetic transcription of our samples at U.C. Davis is ongoing.

Table 4. Description of genes selected for use in transcription analysis.

	Gene	Gene function
1	Calmodulin	CaM mediates processes such as inflammation, metabolism, apoptosis, smooth muscle contraction, intracellular movement, short-term and long-term memory, nerve growth and the immune response. Shell as well
2	Aryl Hydrocarbon Receptor AHR	Responds to PAH and TCDD
3	Angiotensin 1 converting enzyme (ACE2)	**Angiotensin I converting enzyme 2** (ACE2) is an exopeptidase that catalyses the conversion of angiotensin I to the nonapeptide angiotensin[1-9].[1] ,or the conversion of angiotensin II to angiotensin 1-7. ACE 2 has direct effects on cardiac function, and is expressed predominantly in vascular endothelial cells of the heart and the kidneys.
4	Vitellogenin	Vitellogenin is an egg yolk precursor protein expressed in the females of nearly all oviparous species including fish, amphibians, reptiles, birds, most invertebrates, and the platypus. Vitellogenin is the precursor of the lipoproteins and phosphoproteins that make up most of the protein content of yolk. In the presence of estrogenic endocrine disruptive chemicals (EDCs), male fish can express the Vg gene in a dose dependent manner. Vg gene expression in male fish can be used as a molecular marker of exposure to estrogenic EDCs.
5	Tumor suscpt protein	Up-regulation in presence of carcinomas – downstream of RAS
6	Estrogen receptor alpha	**Estrogen receptor alpha** (**ER-α**), also known as **NR3A1** (nuclear receptor subfamily 3, group A, member 1), is a nuclear receptor which is activated by the sex hormone estrogen. In humans, ER-α is encoded by the gene *ESR1* (EStrogen Receptor 1).
7	Growth hormone rec.	Will likely change dependent on age
8	S9	housekeeping
9	Thyroid hormone receptor alpha	Thyroid hormone receptor can be used as a mechanistically based means of characterizing the thyroid-toxic potential of complex contaminant mixtures. Thus increases in THR expression may indicate exposure to organic compounds including PCBs and potential health effects such as developmental abnormalities and neurotoxicity (Tabuchi *et al.* 2006). Hormone-activated transcription factors bind DNA in the absence of hormone, usually leading to transcriptional repression (Tsai and O'Malley 1994).
10	Mx 1	Responds to viral infection. Vertebrates have an early strong innate immune response against viral infections, characterized by the induction and secretion of cytokines that mediate an antiviral state, leading to the up-regulation of the MX-1 gene (Kibenge *et al.* 2005).
11	HSP 70	Heat shock, chaperone, stress
12	MDF 88	Myeloid differentiation factor 88 - These results indicate that tMyD88 might possess an important role in defense against microbial infection in Chinese soft-shelled turtles similar to that in mammals.
13	CD9	Real-time PCR analysis further indicated that after Aeromonas hydrophila infection, the turtle CD9 mRNA was up-regulated in various tissues at 8h, and significantly up-regulated during 8h to 7d. These results indicated that turtle CD9 may be involved in anti-bacterial immune response
14	MnSOD	superoxide dismutase

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Specific primers and genetic information are being optimized for select genes targeted to assess health in tortoises in response to habitat parameters. A total of 14 genes have been identified for use in these analyses and are described in Table 4.

Habitat Characterization

Annual Vegetation Sampling

Annual biomass differed significantly between study areas ($F_{1,3}$=47.66, p<0.01). The WETA had the greatest mean (±SE) annual biomass (54.0 ± 4.0 g/m^2) while the SEA had the lowest (10.7 ± 2.5 g/m^2; Table 5). We found a significant difference in annual species richness between study areas ($F_{3,202}$=7.85, p<0.01; 5). We found that annual species richness in the WEA was significantly higher than in the SETA ($F_{3,202}$=7.85, p<0.01) and marginally in the SEA ($F_{3,202}$=7.85, p=0.05). Additionally, annual species richness in the WETA was significantly higher than in the SETA ($F_{3,202}$=7.85, p=0.02). We found a no correlation between annual species richness and elevation ($F_{1,203}$=79.56, p<0.01, R^2=0.278). We found no correlation between biomass of annual plants and species richness of annual plants ($F_{1,293}$=4.027, P=0.05, R^2=0.01). Annual plant cover (%) is preliminary and provided primarily for comparison. More work is required to understand relationships between annual plant cover, biomass, and NDVI or ENDVI photographs.

5. Mean (±SE) annual biomass, total plant cover (from NDVI) and mean annual species richness (±SE) by study area.

Site	n	Biomass (g/m2)	Cover (%)	Species Richness
SETA	73	16.7 ± 1.3	11.74 ± 0.31	15.58 ± 0.66
WETA	77	54.0 ± 4.0	25.04 ± 0.46	19.72 ± 0.92
WEA	40	44.3 ± 4.9	14.48 ± 0.59	22.30 ± 1.12
SEA	15	10.7 ± 2.5	9.77 ± 0.74	16.20 ± 1.32

Perennial Vegetation Surveys

Perennial species richness varied significantly between study areas ($F_{3,142}$=5.798, p<0.01; Table 6). We found the SETA had significantly lower species richness than both the WETA ($F_{3,142}$=5.798, p<0.01) and the WEA ($F_{3,142}$=5.798, p<0.01). The WETA and the WEA have higher mean (±SE) elevations (911 ± 20 m and 1010 ± 13 m respectively) than the SETA (662 ± 18 m) and we found a positive but weak correlation between perennial species richness and elevation ($F_{1,144}$=90.03, p<0.01, R^2=0.38).

Table 6. Mean (±SE) perennial species richness within a 30 m x 30 m plot.

Site	n	Perennial Species Richness
SETA	35	5.69 ± 0.58
WETA	56	8.96 ± 0.68
WEA	40	9.53 ± 0.67
SEA	15	7.93 ± 0.78

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Soil Sampling

No explosive compounds, petroleum hydrocarbons, perchlorates, or extractable organic halides were detected in any of the soil samples (Table 7). There were 9 heavy metals were detected in the soil of the SEA, 11 in the WEA, 10 in the SETA, and 11 in the WETA (Table 7). Future analyses will consider these data in the context of tortoise ecology and spatial patterns of distribution.

Table 7. Descriptive results of soil chemistry analyses for Ft. Irwin National Training Center. Total range of analytes provided in parentheses. Frequency of plots where analytes were detected are presented by study area. Practical Quantifiable Limit (PQL) of detection provided for each analyte.

Test Group	Analyte (Range in mg/kg)	SEA (n=20)	SETA (n=15)	WEA (n=40)	WETA (n=45)	PQL (mg/kg)	Dilution Factor
Heavy Metals	Aluminum (2800 - 33000)	12	13	27	23	2.5	1
Heavy Metals	Beryllium	0	0	0	0	2.5	1
Heavy Metals	Cadmium (0.52 - 11)	15	14	14	30	0.5	1
Heavy Metals	Chromium (2.6 - 35)	15	15	32	31	2.5	1
Heavy Metals	Cobalt (2.6 - 20)	13	15	28	33	2.5	1
Heavy Metals	Copper (3.2 - 91)	11	14	28	27	2.5	1
Heavy Metals	Hexavalent Chromium	0	0	0	0	1.25	1
Heavy Metals	Iron (6100 - 40000)	2	6	18	24	2.5	1
Heavy Metals	Lead (5.2 - 76)	0	3	1	7	5	1
Heavy Metals	Manganese (79 - 790)	8	15	30	31	2.5	1
Heavy Metals	Mercury	0	0	0	0	0.2	1
Heavy Metals	Molybdenum (4.9 - 5.2)	0	0	1	1	2.5	1
Heavy Metals	Nickel (2.6 - 34)	12	16	31	38	2.5	1
Heavy Metals	Zinc (20 - 98)	15	17	35	38	2.5	1
Explosives	HMX	0	0	0	0	1	1
Explosives	RDX	0	0	0	0	1	1
Explosives	1,3,5-TNB	0	0	0	0	1	1
Explosives	1,3-DNB	0	0	0	0	1	1
Explosives	Tetryl	0	0	0	0	1	1
Explosives	NB	0	0	0	0	1	1
Explosives	2,4,6-TNT	0	0	0	0	1	1
Explosives	4-Am-DNT	0	0	0	0	1	1
Explosives	2-Am-DNT	0	0	0	0	1	1
Explosives	2,6-DNT	0	0	0	0	1	1
Explosives	2,4-DNT	0	0	0	0	1	1
Explosives	2-NT	0	0	0	0	1	1

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Explosives	4-NT	0	0	0	0	1	1
Explosives	3-NT	0	0	0	0	1	1
Polynuclear Aromatics	Acenaphthylene	0	0	0	0	0.2	1
Polynuclear Aromatics	Acenaphthene	0	0	0	0	0.2	1
Polynuclear Aromatics	Anthracene	0	0	0	0	0.2	1
Polynuclear Aromatics	Benzo(a)anthracene	0	0	0	0	0.15	1
Polynuclear Aromatics	Benzo(a) pyrene	0	0	0	0	0.05	1
Polynuclear Aromatics	Benzo(b) fluoranthene	0	0	0	0	0.2	1
Polynuclear Aromatics	Benzo(ghi)perylene	0	0	0	0	0.2	1
Polynuclear Aromatics	Benzo(k) fluoranthene	0	0	0	0	0.2	1
Polynuclear Aromatics	Chrysene	0	0	0	0	0.2	1
Polynuclear Aromatics	Dibenzo(a,h) anthracene	0	0	0	0	0.05	1
Polynuclear Aromatics	Fluorene	0	0	0	0	0.2	1
Polynuclear Aromatics	Fluoranthene	0	0	0	0	0.2	1
Polynuclear Aromatics	Indeno(1,2,3-cd) pyrene	0	0	0	0	0.15	1
Polynuclear Aromatics	Naphthalene	0	0	0	0	0.2	1
Polynuclear Aromatics	Phenanthrene	0	0	0	0	0.2	1
Polynuclear Aromatics	Pyrene	0	0	0	0	0.2	1
Total Petroleum Hydrocarbons – Diesel Range Organics	TPH-DRO	0	0	0	0	50	1
Total Petroleum Hydrocarbons – Gasoline Range Organics	TPH-GRO	0	0	0	0	10	1
Extractable Organic Halides	EOX	0	0	0	0	50	1
Perchlorate	Perchlorate	0	0	0	0	0.5	1
Organic Phosphorus	Organic Phosphorus (13 - 300)	7	11	22	18	10	0.4

Movements

Home-ranges

Home range using minimum convex polygon 43.2 (68.8 sd) ha for males and 29.3 (153.5 sd) for females.

Winter Activity

During the winter, 9.8% (37 of 377) of tortoises displayed some activity, and 11 were active on more than one occasion. The mean over-winter distance moved by active tortoises was 181 ± 46 m, with a range of 2.2 m to 1,625 m. Activity events occurred equally between December and January encounters (n=25), and January and February encounters (n=24), typically the coldest months of the year.

DISCUSSION

One of the original and major goals of this research project has been to quantify physiological stress in response to translocation. In 2011, we completed analyses related to stress physiology of desert tortoises and submitted a manuscript to a peer-reviewed journal. The manuscript, was submitted to Ft Irwin as a courtesy copy, and fully describes the stress physiology research. Therefore, we will not reiterate that work here, but describe results of field work in 2011. The following paragraph is excerpted from the abstract of the manuscript (Drake et al. In Review).

Wildlife translocation is increasingly used to mitigate human development activities by moving animals out of harm's way. However, little is known about the extent to which translocating tortoises influences the health, physiology, and behavior of translocatees or the residents that inhabit areas where translocatees are moved. To understand the relationship between physiological stress and translocation, we conducted a multi-year study on desert tortoises at Fort Irwin, California. Blood samples were collected from adult tortoises in three treatment groups (resident, translocated, and control) for one year prior to and two years after translocation. Samples were analyzed by radioimmunoassay for plasma total corticosterone (CORT), a glucocorticoid hormone commonly associated with stress responses in reptiles. CORT values were analyzed in relation to potential covariates (e.g. animal sex, date, activity, treatment, handling time, air temperature, movement, precipitation, and annual plant production) among seasons and years. CORT values in males were higher than in females, and values for both varied monthly throughout the activity season and among years. Year and sex were the strongest predictors of CORT, and translocation explained little in terms of CORT. Based on these results, we concluded that translocation does not elicit a physiological stress response in desert tortoises that can be detected with this method (Drake *et al*. In Review).

To improve our understanding of the interactions among animal health, habitat, and anthropogenic activities in relation to translocation, we collected information to evaluate animal health and behavior with habitat conditions such as annual plant production, perennial vegetation cover, and soil chemical composition. We also targeted specific tortoise genes that are physiologically activated by infectious agents, toxin exposures,

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trauma, etc, and began laboratory analysis to quantify the expression of these genes. Habitat parameters such as production and diversity of annual plants, cover and assemblages of perennial plants, soil chemical composition and potential toxicants as well as a variety of anthropogenic disturbances were evaluated in order to be considered in spatially explicit models based on tortoise distributions in relation to their survival and health.

We evaluated tortoises across the study area for clinical and physiological indicators of disease. Based on the clinical condition of tortoises and available laboratory results for selected pathogens, we observed a low prevalence of disease across the study site. Only 3% (16/515) of assessed tortoises in 2011 displayed clinical signs of illness. Laboratory results indicated that less than 5% of tortoises had antibodies for known pathogens *Mycoplasma agassizii* and *Mycoplasma testudineum.* However, presence of antibodies only shows that an animal has been exposed to the bacteria and does not indicate that the animal is currently infected. Other laboratory diagnostics can be used to identify *Mycoplasma spp.* or *Herpesvirus* organisms in tortoises. PCR of nasal lavage samples for *Mycoplasma spp*. and oral swabs for *Herpesvirus* organisms have not detected the presence of these pathogens in our study site, but a majority of culture results (~70%) are pending. When the 2012 activity season resumes, we will continue to conduct health assessments on tortoises that still require testing. With health data collected and analyzed from tortoises across our sites, we hope to gain a better understanding of the prevalence and spatial distribution of disease within the sample tortoise population on a landscape scale.

In addition to health and disease, we continued to evaluate the potential effects of translocation on animal movement, behavior and survivorship. In previous years, we reported animal home-range sizes using 95% kernel utilization distributions (Drake *et al.* 2008-2011 a, b). This year, our frequency of radio tracking tortoises was reduced due to the large number of animals requiring monitoring. With fewer locations per tortoise, kernel-based home-range calculations severely biased home-range sizes when compared to MCP home-ranges, limiting our ability to make comparisons between years.

An examination of encounters during the winter months suggests that tortoises may exhibit higher levels of activity than previously reported during the coldest period of the year (Nagy and Medica 1986, Rautenstrauch et al. 1998). Wilson et al. (1999) monitored winter behavior of penned juveniles from the SEA on Fort Irwin and categorized 18% of their juveniles as “active” (tortoise was outside of a burrow) at some point during November 27, 1996 to January 23, 1997, suggesting that factors such as burrow depth, and body size may influence increased winter activity levels. Pending climate, disease, and habitat data may help identify the causative factors behind higher frequency of winter activity in the SETA. These results are still pending.

During 4 years of study at Ft. Irwin we observed highly variable mortality rates ranging from 34% in 2009 down to 1.5% in 2011 and the majority of that was attributed indirectly to predation. Previous life history studies observed similarly variable mortality rates in consecutive (i.e. 4.4% and 18.4%, Turner et al. 1984). Turner et al. (1984) also

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reported unpublished materials from K.H. Berry indicating that a site in the west Mojave had <5% mortality during 5 previous years (estimated from carcass remains), followed by a year when she observed 27% mortality among 48 marked tortoises over 12.5 km^2. Periods of drought may directly influence tortoise survivorship leading to regional population declines (Longshore et al. 2003). Drought can also indirectly increase mortality through increased predation on adult tortoises as the result of a functional response (prey switching) of predators to a decrease in prey availability (Woodbury and Hardy, 1948; Peterson, 1994, Esque *et al.* 2010). It would seem that many years of low mortality such as we observed in 2011 at Ft Irwin would be required to facilitate positive population growth in these areas where as much as 80% of the adult population were lost in 3 years. In addition to low mortality, high reproductive rates and juvenile survivorship would be required, however, this has not been demonstrated in desert tortoise populations.

In 2012, we will complete laboratory analysis for health and disease diagnostic screening and genetic expression, and investigate the potential influences of translocation on desert tortoise populations. We will continue habitat characterization (i.e., primary production, annual vegetation structure, etc.) so that differences in habitat among the translocation and recipient sites are well documented.

ACKNOWLEDGEMENTS

This research would not have been possible without the help of the U.S. Geological Survey, U.S. Department of the Army-Ft. Irwin, U.S. Fish and Wildlife Service, California Department of Fish and Game and the Bureau of Land Management. Our thanks are extended to Clarence Everly, Mickey Quillman, Roy Averill-Murray, Kat Darst, Becky Jones, and Charles Sullivan for providing project guidance and expertise to the research design and data collection. We thank USGS staff including Andrew Berger, Zach Cava, Felicia Chen, Santino Lauricella, Jose Lopez, Andrew Modlin, Claire Phillips, Bryant Reynolds, Marianne Richter, Robert Saulino, Julie Swanton, John Uzzardo, and Vanessa Van Zerr for their hard work and assistance throughout this project. In addition, we would like to thank the following Student Conservation Association volunteers: Lexie Albe, Ashton Bunce, Jesse Hill, John Jozkowski, Sydney Kelly, Max Markley, Carolyn Moore, Becca Moreci, Daniel Oquendo, Natalie Rathjen-Gonzales, Karis Ritenour, Elise Rodriguez, Sara Rosenberg, Annamarie Saenger, Chris Samoray, Mariel Sorlien, Stewart Smith, Megan Stump, Catherine Wangen, Morgan Webb, and Jo Werba for their field assistance in vegetation and tortoise monitoring. Any use of trade, product or firm names in this publication is for descriptive purposes only and does not imply endorsement by the US government.

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APPENDICES

Appendix 1. Sample of data sheet completed for each desert tortoise encounter on all study sites in 2011

Appendix 2. Highly Modified Honegger System notching diagram

Appendix 3. Sample of data sheet completed for each desert tortoise health assessment on all study sites in 2011

Appendix 4. Table of appropriate tissue collection volumes by tortoise size

Appendix 5. Annual vegetation species key of plant species located on study sites in 2011 (Attached Separately)

Appendix 6. Perennial vegetation species key of plant species located on study sites in 2011. (Attached Separately)

Appendix 7. Summary of monthly tortoise encounters on all sites in 2011 (Attached Separately)

Appendix 8a. List of active radio transmitters in 2011 (Attached Separately)

Appendix 8b. List of removed transmitters in 2011 (Attached Separately)

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Appendix 8c. List of lost radios and tortoises in 2011 (Attached Separately)

Appendix 9. List of tortoise mortalities in 2011 (Attached Separately)

Appendix 10. List of oral swab samples collected from tortoises in 2011 with *Herpesvirus* PCR results received (Attached Separately)

Appendix 11. List of nasal lavage samples collected from tortoises in 2011 with *Mycoplasma spp*. PCR results received (Attached Separately)

Appendix 12. List of blood samples collected from tortoises in 2011 with ELISA results received (Attached Separately)

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Annual Monitoring of Lane Mountain Milkvetch (*Astragalus jaegerianus*) at Fort Irwin, CA: April – May 2011

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Abstract
This report describes the results of the 2011 annual census of the federally endangered Lane Mountain milkvetch (*Astragalus jaegerianus*) on Fort Irwin, a U.S. Army installation in California. The goal of the annual census, conducted since 2005, is to determine the effects of military activity on the growth and viability of the Lane Mountain milkvetch. Military activity is expected to begin near two of the populations in 2012, making 2011 the final year of baseline measurement. Results from this year's census indicate that Lane Mountain milkvetch population numbers have decreased overall since 2001, but have increased since 2007. Annual mortality was slight, and was more than compensated for by annual recruitment. The average number of fruits per plant were the highest seen since the census began; however, seed production appeared to be less than in previous years. A few additional studies not conducted in previous censuses were included this year to better understand the milkvetch's natural history.

Introduction

The Lane Mountain milkvetch (*Astragalus jaegerianus*) is a rare perennial herb that grows within the boundary of Fort Irwin, CA. While there are over 250 other species of milkvetch in North America, the Lane Mountain milkvetch (hereafter "milkvetch") is unique in requiring a small host shrub to support its vine-like stems. The species is cryptic, with stems hidden in the host canopy. Each summer the leaves and stems of a milkvetch die, leaving a perennial rootstock. Annual growth begins as early as October (Huggins, personal communication), the plant begins to flower around the beginning of April, and fruits form around the middle of April (Rundel et al. 2010). During flowering and fruiting, the plant becomes more conspicuous. The fruits begin to dehisce (pods split open, releasing seeds) in late May, followed by senescence. The Lane Mountain milkvetch may remain dormant for one to several years, presumably to survive drought (Rundel et al. 2010). The number of plants entering dormancy and resprouting is small, but important for maintaining population viability (U.S. Army: Fort Irwin 2010).

The Lane Mountain milkvetch gained protection under the United States Endangered Species Act when the U.S. Fish and Wildlife Service listed it as endangered in 1998 (USFWS 1998). There are four known populations of milkvetch, three of which are located within the boundary of Ft. Irwin and one that is located on Coolgardie Mesa, approximately 14 km southwest of the western boundary of Ft. Irwin. In spring, 2011, the FWS classified all known Lane Mountain milkvetch habitat not administered by the Army as critical habitat (USFWS 2011). However, it is not clear if critical habitat designation will increase the negligible protection from ORVs that milkvetch habitat now receives.

Annual monitoring of *A. jaegerianus* is required by the Fort Irwin Integrated Natural Resource Management Plan (INRMP, NTC 2006) to ensure that populations are stable and to determine any impact that nearby military training may have on the species. The monitoring plan for *A. jaegerianus* is described in detail in the Lane Mountain Milkvetch Long-term Monitoring Plan (DPW-Env 2005) and published in the Fort Irwin INRMP (NTC 2006). The census has been conducted annually since the spring of 2005 to monitor the viability of the species. As a cryptic species, an accurate census requires trained observers, established study plots, and tagged plants. An annual report has summarized the results of the census since 2006. The main objective of long-term monitoring is to determine the effects of military training on milkvetch.

No military training or construction projects directly threatened milkvetch populations BW (Brinkman Wash) and EP (East Paradise) during 2011, largely because the Army has not yet started to train in the Western Expansion Area where these populations are located. Military training adjacent to populations BW and EP could begin in 2012. Thus, 2011 may be the last year of baseline data collection before the potential impact of military training. Population NG (NTC-Gemini) is within the traditional boundaries of Fort Irwin. Potential impacts to NG have remained consistently low from year to year. Population CM (Coolgardie Mesa) is on Bureau of Land Management (BLM) land and serves as a scientific control population for comparison to NG, BW, and EP, which are all on military land.

Threats to each population vary but could include effects of military activities, off-road vehicle (ORV) use, drought, herbivory, and long-term climate change. Population NG (NTC-Gemini) borders actively used military training areas to the south (Training Area B1) and east (Training Area B2), although the conservation area is fenced, signed, and off-limits to military activities. B1 and B2 are used for squad exercises rather than brigade-level mechanized training, and there are no simulated villages near NG. Consequently, indirect disturbance to NG, such as dust and trash, are presumably less than those generated in most Fort Irwin training areas. The core area of populations BW and EP, with the greatest milkvetch densities, have been incorporated into conservation areas (Figure 1). These areas have been partially fenced with barbed wire and signed. In 2010, gates leading into the Western Expansion Area, where EP and BW are located, from public land to the south were locked to prevent entry. The locked gates and Range Control oversight has decreased traffic in EP, although ORV tracks continue to be found in study plots and host plant transects in EP, and BW. Based on casual observations, Natural Resource Section staff members believe that ORV activity is increasing, despite off-limits signage that has been erected along the remote, rough border of BW and EP.

This report presents the results of the 2011 annual census, compares 2011 growth with that of previous years, and discusses the continued viability of the milkvetch. This year's census was modified from previous years to differentiate new milkvetch recruits from resprouts to better understand the role of dormancy in milkvetch populations. The census was also modified to examine the timing of flower development, so that total seed production throughout the growing season can eventually be estimated. In past censuses, flower and fruit counts have provided only a 1-day snapshot of the entire one- to two-month long reproductive output. Finally, this year, the field crew quantified herbivory in the four populations. While herbivory has been anecdotally noted in previous censuses, it has not been adequately examined. A more systematic study of

herbivory was included in this year's census as it can have a significant impact (positive and negative) on population dynamics and growth (Begon and Mortimer, 1986, McNaughton, 1986). Understanding these aspects of the milkvetch's natural history can lead to a better conservation plan for this endangered species.

Methods

Population density, survival, mortality, and recruitment. Census methods followed previous censuses (U.S. Army: Fort Irwin 2005), except where noted below. Each of the four populations, CM, EP, BW, and NG, contain ten plots. All forty plots, established in 2005, were censused once in 2011. The corners of most plots are permanently marked with rebar and can be located with GPS. The Lane Mountain Milkvetch Long-term Monitoring Plan (U.S. Army: Fort Irwin 2005) describes how annual monitoring can be used to detect impacts from Army training, using CM as a control.

To survey a plot, the perimeter was cordoned off with two 100-meter measuring tapes, and then divided into five belts 10 meters wide using four 50-meter measuring tapes. Two biologists walked side-by-side within each belt searching each shrub for milkvetch. A surveyor's wire flag was placed in each shrub or area searched. All plants with tags from previous censuses were tallied and recorded as being dead or alive. New milkvetch were numbered and tagged. This year, biologists found many tiny seedlings in host plants that previously held full grown milkvetch but have been dead for one or more years. In these cases, the tagged plant was marked as dead, but was noted as having a seedling. Occasionally, plants that had previously been observed and tagged could not be relocated the next year because tags were removed by packrats or because of GPS or record keeping errors. A plant that could not be relocated was recorded as "CNF" (could not find) and was assumed dead, based on the low probability of both a plant and its aluminum tag going undetected at a known UTM (Universal Transverse Mercator) location.

After the first two weeks of the survey, the size of the plant was recorded as being a seedling (single stem below or just entering host canopy), small (stems within host canopy), small to medium, medium (stems on top of host canopy with several branches and less than 50 fruits or flowers), medium to large, or large (many stems, fruits, and flowers). The date a plot is censused – early in the season vs. late in the season – can influence measurements of reproductive effort. If bias in census date is not addressed, population NG will be the first population visited in the spring because it is closest to the Fort Irwin DPW-Environmental office. Population BW, on the other hand, has the most remote plot locations and may not be censused until fruits begin dehiscing. To avoid a bias in sampling dates, the field crew rotated the populations visited to ensure two to five plots in each population were surveyed each week.

Cumulative mortality is the number of milkvetch dying after 1 year, after two years, and so forth, up to six years. Considering the seven years of censuses, there are four time periods where 1-year mortality can be measured: 2005-2006, 2008-2009, 2009-2010, and 2010-2011. Time periods beginning or ending with 2007 (2006-2007, 2007-2008) cannot be analyzed, because all plants were dormant in 2007. Note that the sample size for 1-year mortality – 4 – is small considering the substantial variation in climate among time periods (drought to wet, early spring to late spring, etc.). If this analysis is continued in the future, yearly variation in mortality should

attain equilibrium and an accurate estimate of 1-year mortality can be made. Using the same method of inspecting individual time periods, there are three periods of 2-year mortality (2006-2008, 2008-2010, 2009-2011); three periods of 3-year mortality (2005-2008, 2006-2009, 2008-2011); two periods of 4-year mortality (2005-2009, 2006 - 2010); two periods of 5-year mortality (2005-2010, 2006-2011); and one period of 6-year mortality (2005-2011). Dormancy can be confused with mortality, but the longer a plant is not present, the more likely plants are truly dead and not dormant. Therefore, cumulative mortality over longer periods of time gives a mortality estimate that is less biased by dormancy.

Age determination. Beginning in the 2010 census, a few newly found milkvetch plants were inspected at the base of the stem to determine if the plant had sprouted from a seed that season or if it had emerged from a dormant plant established during previous years. In the 2011 census, this attempt to determine the age of recruits was expanded. All recruit and adult milkvetch plants were inspected to determine the woodiness of the basal stem. Plants were recorded as being not woody, rigid, woody, and very woody. These categories were subjective and evolved during the census. Examples of each designation are depicted in Figure 2. The intermediate class "rigid" refers to well developed stems on larger plants that had superficially woody characters - medium diameter, shaggy bark, inflexible - but lacked characters indicative of secondary growth – nodes formed by previous year's growth and indeterminate expansion of the stem radius. Woody stems appeared to have entered secondary growth, based on stem thickness, but nodes were not observed. Very woody stems had entered secondary growth and had nodes from a previous year's growth. If the base could not be accessed due to a very thick host plant, the base was labeled as unknown and eliminated from any analyses using the base woodiness data. The distance of the stem from the tag and the location of the stem in relation to the tag were recorded in centimeters and degrees, respectively. This information will serve in future years to determine if a plant found is the same plant as in previous years or if it is a new plant growing in the same host (but presumably sprouting at a different location under the host). Finally, a picture of each plant was taken. This data was compiled and stored in a database located on the Ft. Irwin DPW-Environmental SharePoint website (http://irwig3c2itamweb/Units/DPW-ENV), in an area created for flora, containing Lane Mountain milkvetch annual surveys.

Reproduction. Fruits and flowers on each new and previously found milkvetch were counted to measure reproductive effort. Counts were not precise, but are probably within 5% of actual numbers. About 50 maturing fruits were covered with mesh bags to trap seeds after fruit dehiscence (Figure 2).

Phenology. Reproductive output – flower and fruit counts – is a 1-day snapshot of a process that normally proceeds for one or two months. This year, observations were made to quantify the speed of flower and fruit development, and the number of seeds per fruit. Flower and fruit development were observed weekly on 104 flowers on 10 plants at plots CM-5 and CM-6, beginning on 18 April or 01 May, respectively. A flower or fruit was chosen, marked with a jeweler's tag, the stage of development was recorded (Table 1, Figure 3), and the time spent in transition between stages was determined. Weekly visits terminated on May 23. When a flower transitioned between three stages over the course of a week (e.g. flr3 – frt2) the duration of both transition (flr3 - frt1, frt1 - frt2) was set at 3.5 days. In a few cases where a flower transitioned

between four stages, the duration of each of the three transitions lasted 2.33 days. Flowers in all stages were tagged to ensure adequate observation of each transition. Five maturing fruits on each plant that were not used to study phenology were enclosed in a fine mesh bag (Figure 3). It was anticipated that seeds would collect in the bag after fruits dehisced, and that the number of seeds/fruit could be counted. All seeds were returned to the ground under the host's canopy.

In addition, a second protocol was used to study the developmental timing of reproductive output. As time permitted, fruits and flowers on 73 plants were counted during a second visit, and the number of fruits and flowers during the first visit was compared with number of fruits and flowers later in the season. Additionally, data were analyzed using a linear regression to predict the final number of fruit based on flower and fruit production during the first visit and elapsed time between visits.

Herbivory. Presence or absence of herbivory by non-insect animals was recorded in 22 of the 40 plots. Herbivory was confirmed by observing milkvetch stems that were eaten (Figure 4). Data were analyzed using log likelihood ratio (similar to a chi-square test) comparing presence of herbivory against location of the population, size of the plant, woodiness of the base, amount of flowers present on each plant, and amount of fruits present on each plant. To compare flower and fruits on each plant against herbivory, data were compiled into three biologically meaningful categories. If zero fruits or flowers were present, the plant was placed in the "no fruits" and "no flowers" category. If one to twenty fruits or flowers were present on a plant, it was placed in the "few fruits" and "few flowers" category. If there were more than twenty fruit or flowers on a plant, it was placed in the "many fruits" and "many flowers" category.

Host plant cover. Between 2005 and 2008, 44 vegetation transects were established to monitor the percent cover of milkvetch host plants within each population. Use of the same transect each year (vs. randomization) minimizes variation due to transect location, creating a more powerful experimental design (Green 1989) Each vegetation transect consists of two parallel, 100-meter lines approximately 8 meters apart. In 2011, only 16 transects (four from each population) were measured. The time saved was used to conduct phenology, reproduction, and herbivory studies. The beginning, midpoint, and end of the 16 transects are marked with rebar. To measure the vegetation cover under each transect line, a 100-meter measuring tape was extended from one end of each transect line to the other end and straightened. Tape placement is usually within 2 or 3 cm of the true center line, but can vary by as much as 15 cm if strong winds are blowing. Any living part of a perennial plant which crossed the transect line was identified to species and the part of the plant under the line was measured. Dead plants and dead branches of living plants were not measured. A branch is a stem that originates near the base of a plant and supports many smaller branches. Shoots and small stems that had been created during the previous year, but were inactive in 2011, were measured.

Off road vehicle impact. Of the four populations, CM is the only one not adjacent to proposed or active military training. The experimental design for long-term monitoring relies on using the CM population as an experimental control for comparison with populations likely to be impacted by military training. CM is receiving substantial human impacts from illegal ORV riding that affect its use as a scientific control for military training.

Off Road Vehicle (ORV) impacts to study plots on CM were recorded visually and with pictures on weekends and during 4 week days in late May. Observations were centered on the area of heaviest disturbance, and do not represent the entire CM population. Biologists visited 32 locations where milkvetch had been recorded during the 2001 census (Charis 2002), and rated the amount of disturbance on a scale of 1-5, where 1 indicates no sign of ORV presence, 2 and 3 indicate moderate ORV damage, and 4 and 5 indicate severe disturbance (Table 2). The 32 locations had been similarly categorized in 2006 (U.S. Army: Fort Irwin 2006) and 2010 (U.S. Army: Fort Irwin 2010). An additional 26 locations from the 2001 census, which were observed in 2010 but not in 2006, were visited and observed.

Precipitation and Dust. Regional precipitation for each water year (October 1 through September 30) was monitored by obtaining measurements for Barstow, CA (WRCC 2011). Precipitation in or adjacent to each milkvetch population was measured using 11 columnar rain gauges. Precipitation measurements before the 2005-2006 water year are based on fewer precipitation gauges.

Passive dust accumulation was measured during a 4-day period ending on 07 April and during the 7-day period ending on 07 June, 2011. There are 16 passive dust traps (four per population), similar to traps used by Reheis (1995). Traps are made from 12 by 7.5 inch ammo boxes covered with a screen basket that holds 2 layers of glass marbles. Traps are placed on pickets at a height of about 2 m above the ground. Dust was removed from traps by spraying the marbles and the ammo box with soapy water and collecting the water in plastic bottles. The water from each dust trap was poured into a pre-weighed foam bowl and then allowed to evaporate. The weight of the dust was calculated by subtracting the tare weight of the bowl from the final weight of the bowl and dehydrated dust.

Statistical analyses. Individual plants were not tagged in 2001, so the 2001 survey could not be included in the analyses. Very little precipitation fell in 2007, resulting in no ecologically significant plant growth. The milkvetch, and most other desert perennials, remained dormant. There is no way to visually distinguish a dormant milkvetch from a dead milkvetch, and all plants were assumed to be dormant in 2007 (rather than dead). Therefore, data from 2007 are not analyzed in this report. Differences among populations – for population densities, host plant cover, reproductive output, and dust accumulation – were tested for statistical significance using a one-way analysis of variance (ANOVA), without post hoc tests. Differences among years were not tested, because these comparisons would require a multi-way ANOVA best left to a separate report. For all tests, the test statistic, the degrees of freedom (df), and the probability of the test outcome (p-value) are reported. An alpha value of 0.05 or less indicates statistical significance. Wilcoxon sign tests – a non-parametric analog of the t-test that does not require normally distributed data - and correlation coefficients are used to test the significance of differences or association between measured variables. Linear regression was used to analyze the dependence of final fruit production on elapsed time between visits, and fruit and flower production during earlier visits. MS Excel, MYSTAT, and R were used to compute statistics.

Results

Population Density. The total number of living Lane Mountain milkvetch plants growing on study plots in 2011 was 198, a 31.1 % increase from the 151 plants found in 2010 (U.S. Army: Fort Irwin 2010). Of the 151 plants counted in 2010, 145 survived, and 6 died or entered dormancy. CM (particularly the eastern half) supports higher milkvetch density than BW, EP, and NG (Figure 5). All 2011 plot data are listed in Appendix I. Each life-history parameter is described in more detail below, and the interaction among life-history forces appears in the Discussion.

During the last decade, population density declined from a high point in 2001 to a low point in 2007 and 2008 (Figure 6). Density has increased during the period 2009 – 2011, but is still far below 2001 values. The long-term decrease appears to be correlated with decadal climate fluctuations that brought wet weather during the 1990's and dry weather during the 2000's (McAuliffe and Hamerlynck 2010; Huggins, et al 2010). Milkvetch numbers stabilized during 2008 - 2009, years that received slightly less than the yearly average precipitation, and increased in 2010 and 2011, years that received greater than average precipitation during the milkvetch growing season. It remains to be seen if milkvetch density will return to high 2001 levels or equilibrate at lower 2008 – 2009 densities.

Survival and Mortality. Between 2010 and 2011, 6 plants (4.0% of 2010 plants) died, became dormant, or could not be accounted for, and 145 plants (96.0% of 2010 plants) survived. During the previous census period, 2009 to 2010, 8 plants (6.3% of 2009 plants) died. Mortality is indistinguishable from dormancy in the field, slightly inflating mortality measurements (see Discussion).

Although the mortality of milkvetch is not great from year to year, some plants die every year, resulting in moderate cumulative mortality over the span of several years (Figure 7). Of the 215 plants observed in 2005, only 87 (40.3%), remained alive in 2011. The expected survival of Lane Mountain milkvetch from year to year is 89%; declines to 74% over a three-year period; to 55% over a four-year period; and stabilizes at 40% (+/- 1%) for time periods between 5 and 7 years (Figure 7).

The average life expectancy of the Lane Mountain milkvetch appears to be bimodal (U.S. Army: Fort Irwin 2010). Mortality of new adults is greater than adults that are several years old. An extreme example of short life span is provided by new plants in 2006. After the harsh conditions of 2006 (a relatively dry year followed by an extreme drought), 63.6% of new plants died within two years. On the other hand, 40% of the plants tagged in 2005 are still alive after 7 years. During measurements of ORV damage on CM, 9 living milkvetch from the 2001 census were found, and 47 plants that had been alive in 2001 could not be found. Two milkvetch were found that had recently died, with no signs of human impact. These before and after observations of a 10-year time span support the findings in the U.S. Army: Fort Irwin (2010) report that most milkvetch die within a few years, but that some milkvetch can live for more than 10 years.

Recruitment. Of the 198 plants counted in 2011, 44 were recruits (Appendix 2), and 9 were resprouts. All previously unrecorded plants were considered recruits, even if they appeared to be

more than one year old. Recruitment has increased in the past three years: 13 new plants in 2009, 26 new plants in 2010, and 44 new plants this year. However, the number of recruits was 11 plants fewer than the number found in 2006. Five of the new plants were recently germinated seedlings and are not expected to survive, based on research by Rundel et al. (2005). An additional 53 seedlings were observed growing under tagged plants that are now dead. All of these seedlings were small, had not successfully entered the host canopy, and are expected to die. This year is the first year that seedlings have been spotted during the census. Sharifi et al. (2004) showed that seedlings are present in small numbers, but it has never been the objective of long-term monitoring to find them. Seedlings were detected in the current census during studies of stem bases and herbivory.

Observations of plant bases as a method of determining the age of recruits met with mixed success. The base was almost always difficult to trace to ground level and observe, in large part because most milkvetch hosts are low to the ground and multistemmed. A typical host, such as *Thamnosma montana* (turpentine broom) or *Ericameria cooperi* (Cooper's goldenbush) consists of 20-30 stems at ground level, with the milkvetch stem entering the ground among the host stems (and not off to the side). Tracing a milkvetch stem to ground level always endangers the weak milkvetch stems, and can damage host stems and small plants growing in the host's canopy. Bases did not fit discrete categories, even though the categories reported in Table 3 were refined throughout spring monitoring. Many rigid bases were probably misclassified as woody. No clear threshold or break point between young and old stems could be determined.

Most recruits were seedling or small in size (n = 33, Table 3), and had bases that were not woody (n = 28, Table 3). Small recruits with herbaceous bases could have grown from seed during the current growing year, October 2010 through April 2011. However, recruits with intermediate woodiness (rigid or woody, n = 10) and intermediate size (medium or medium-large, n = 8) were also common. These intermediate sized recruits could have grown from seed in 2010-2011, but it is more likely that they began growth early in 2010. Surprisingly, three medium sized "recruits" had very woody bases or woody bases with remnants of previous growth. These large, woody individuals were at least one year old and could have been several years old.

Frequently, recruits had a combination of young and old characters. For example, two medium-to large-sized plants had non-woody bases but had 48 and 175 fruits; one medium-sized, non-woody recruit had 221 fruits; one recruit had a very thick base showing remnants of last year's growth, but was only medium in size and had only 30 fruits; and one medium-sized, rigid plant had remnants of last year's growth.

Dormancy and Resprouting. In 2011, 8 "dead" plants resprouted, and one plant that could not be found in 2010 but was found in 2011 is probably a resprout. Considering the four censuses from which it is possible to discern resprouting (after 2007), 29 plants have resprouted after one to five consecutive years of dormancy (Table 4). Due to the specter of dormant plants resprouting, it is difficult to conclude with certitude that a milkvetch is dead.

Reproduction. Of the 196 living plants that were larger than seedlings, 177 attempted to reproduce, producing flowers or fruits. At least 167 plants matured at least one fruit, and the mean fruit production for plants of all sizes was 85.1. Flower production ranged from 0-515

(average = 64.3), and fruit production ranged from 0-440. Two exceptional plants were outside this range, one producing 1195 flowers, and the second producing 1115 fruits. Reproductive effort, in terms of number of fruits per plant, was lowest in CM population, and greatest in EP population (Table 5, Figure 8). Differences among populations were significant ($p = 0.013$, $df = 3$, Kruskal-Wallis rank sum test). In 2008 and 2009, CM population had the greatest number of fruits per plant, and it was assumed that the same unknown factor that created high milkvetch density in the CM population also created greater reproductive effort. However, results from 2011 show that reproductive effort can be low even when density is high. The low reproductive effort on CM is consistent with phenology observations that reproduction on CM started later in the growing season than at other populations.

Ten fruits that had been bagged (Figure 3) either dehisced, dropping their seeds into bags, or were so close to dehiscing that the walls of the fruit could be separated and the seeds counted. The number of seeds per fruit ranged from 2 to 8, with a mean of 4.9. Many aborted ovules were present, but an accurate count could not be made in field conditions. Although flower and fruit production was higher this year than in any preceding year (Figure 9), the great number of aborted flowers, fruits, and ovules indicates that actual seed production may have been less than fruit and flower counts suggest.

Phenology. Flowers developed rapidly, frequently progressing two developmental stages in a week, and occasionally progressing three stages. For example, one flower on plant 756 (plot CM-5) was in the first flower stage (flr1) on April 18, and had developed to the first fruit stage (frt1) on April 25; and a second flower progressed from a spent flower (flr3) to a mature fruit (frt3) during the same period. Pollination is primarily by a small Megachilid bee, *Anthidium dammersi* (Charis 2003). It is not known if milkvetch reproduction is limited by the number of bees.

Of the 104 tagged flowers on 10 plants in CM-5 and CM-6, 24 progressed through at least one stage, and usually several stages, before aborting or becoming damaged by the wind. On average, each developmental stage lasted 4.4 days. However, early flower stages develop a little more rapidly than later fruiting stages (Table 6, Figure 10), a trend that is statistically significant ($r = 0.463$, $p = 0.001$, $n = 51$ transitions). No single flower was observed progressing from bud stage through flowering, and ending in mature fruit. But based on the development time for each individual stage, bud to frt3 development averaged 26.6 days, with a minimum development time of 16.2 days.

Upon reaching full size (frt3), fruits remained on plants until the end of May before either dehiscing, falling from the plant without dehiscing, or aborting. On plot CM-5, where four plants were visited for six consecutive weeks, mature fruits (frt3) remained on plants for an average of 32.6 days. Several healthy, mature fruits remained on parents for the full 6-week duration of observations. Only two mature fruits were observed to begin dehiscence. However, few dehisced milkvetch fruits were observed on any plant, in any plot, in 2011.

Most tagged flowers and fruits disappeared before developing into mature fruits. It was not possible to determine if the loss of flowers and fruits was caused by abortion, herbivory, wind damage, investigator damage, or some other cause of failure. On plot CM-5, 51.4% of the 42

flowers disappeared before reaching frt2; and on CM-6, 61.6% of the 62 flowers disappeared before reaching the frt2 stage. Observations on CM-6 began four weeks after those on CM-5, during drier conditions, explaining why flower failure was higher on CM-6.

A second, repeat visit was made to 71 living plants (35% of living plants in 2011). The average time between the first visit and the second was 26 days, ranging from 16 to 39 days. The number of plants that increased fruit production between visits was not significantly different than the number of plants that decreased fruit production (Figure 11; $Z = -1.374$, $n=66$, $p=0.17$); however, flower production decreased significantly (Figure 12; $Z= -6.461$, $n=64$, $p<0.001$). Seven and ten percent of plants showed no difference in fruit or flower number between visits. Population BW was the only population in which no plants increased in fruit production from the first visit to the second; in contrast, 73.9% of plants in CM increased in fruit production (Figure 13). CM was also the only population to have any plants (17.39%) that increased in flower number from the first visit to the second (Figure 14). Multiple regression indicates that the number of fruit present at the second count is dependent upon the time that elapsed between visits and the number of flowers and fruit present at the first count (Adjusted $R^2=0.545$, $F=28.95$, $df=3$ and 67, $p<0.0001$). As elapsed time between visits increased, the number of fruits present during the second visit decreased (Table 7) – a sign that the reproductive season was coming to a close. However, the number of fruits and flowers at the first visit were positively correlated with number of fruits at the second visit (Table 7) – a sign that reproduction was not limited by anatomy or structure of the inflorescence.

Herbivory. In some cases grazed stems had been trimmed to the base of the plant, and in every case had been trimmed below the flower and fruit line so that no flowers and fruits were found on trimmed stems. Of the 107 plants that were surveyed for herbivory, 40.2% had been grazed. Presence of herbivory was independent of the population, plant size, and number of flowers on a plant (Table 8, Figures 15-17). The absence of any association between herbivory and population indicates that any difference in density or reproductive effort among the four populations cannot be attributed to grazing. Plants with few fruits were grazed significantly more frequently (63.6%) than plants with no fruits (41.6%) and plants with many fruits (37.1%, Table 8, Figure 18). Herbivory was also significantly affected by the woodiness of a plant's base (Table 8, Figure 19). Rigid-based plants had a high occurrence of herbivory (63.6%) compared to non-woody (18.9%), woody (32%) and very woody (33.3%) plants.

Host plant cover. Host plant cover averaged 19.2% over all four populations in 2011, indistinguishable from the 19.8% cover recorded in 2010 for the same 16 transects. Canopy cover was statistically indistinguishable among populations in 2011(Figure 20, $p > 0.2$, $df = 12$, Kruskal-Wallis non-parametric analog to the one-way ANOVA).

Canopy cover during the last six years (Figures 21 and 22) has been relatively homogeneous with only one noteworthy trend. Cover on Coolgardie Mesa increased by 6% to 8% during 2008 and 2009, but then decreased to baseline levels (18%-21%) in 2010 and 2011 (Figure 21). Long-term trends discussed in this report are based on the same 16 transects used this year, not the full sample of 44 transects.

Off Road Vehicle Impact. Coolgardie Mesa was used for illegal ORV riding (Figure 23c) during each of 8 weekend visits during October 2010 through May 2011. Users are camping (with impunity – Figure 23b) in groups of about 5 to 25 recreational vehicles (Figure 23d) each supporting 1-4 ORVs. ORV tracks were also seen on study plots and vegetation transects in BW and EP populations (Figure 23a). Observer ratings of disturbance in 2011 were slightly greater than, 2010 (Table 9). Disturbance level from 58 locations rose 0.2 units, out of a possible 4 units ($Z = 1.912$, $df = 57$, $p = 0.056$). The increase in disturbance approaches statistical significance. Apparently, disturbance increased at new locations (farther from the rendezvous area), but not at old locations (closer to and within the rendezvous area). Thus, pair-wise comparisons of 32 old locations, between 2010 and 2011, were not statistically significant (Table 9), but pair-wise comparison of 26 new locations was statistically significant (Table 9). Disturbance level actually decreased at 10 locations, but never more than one unit (e.g. from level 3 to level 2). Decreasing disturbance level is expected at a number of the locations which are now protected by BLM fencing. Disturbance level increased at 19 locations, and increased two units at 3 of the 19 locations. Thus, disturbance was occasionally rapid, but recovery was always gradual.

Precipitation. During the presumed growth period of the Lane Mountain milkvetch, October 2010 through April 2011, the Barstow/Daggett weather station received 3.93 inches of precipitation, 48% greater than the same time period in average water years (Figure 24, WRCC 2011). Although the total precipitation during the milkvetch growth period was above average, most of the precipitation fell during one week in December 2010. The 2.52 inches of precipitation that fell in December 2010 was 425% greater than average. January through April of 2011 was extremely dry relative to past years. Thus, although 2010-2011 was a wet winter, much of the precipitation may have been unavailable for plants because it was received in a short time period.

Precipitation gauges in the WEA, erected and monitored by DPW Natural Resources Section, corroborate above-average precipitation in the winter and early spring of 2011 (Figure 25). Growing year precipitation averaged 5.70 inches among the 12 WEA rain gauges, almost 2 inches greater than the 3.93 inches received at Barstow/Daggett. Average December precipitation among the 11 WEA gauges was 4.38 inches, about two inches greater than Barstow/Daggett.

Dust. Passive dust accumulation 2 m above the ground averaged 0.100 grams/month between June 2010 and March, 2011 (Figure 26). Dust accumulated at 0.145 grams/month during spring (April - early June), far greater than the 0.056 grams/month measured during summer – winter. The pattern of increased dust accumulation during spring was also seen during 2009 – 2010. Potential differences between populations were analyzed using ANOVA (Analysis of Variance). Season (June-March vs. April-May) was also a factor in the ANOVA. Differences between seasons were significant (2-way ANOVA, $df = 1, 24$, $p < 0.001$), but populations did not differ significantly (2-way ANOVA, $df = 3, 24$, $p = 0.4477$).

There are two possible explanations for the increase in dust deposition during spring. Strong winds are typical of the Mojave Desert in spring, and increase atmospheric dust during this period. A second possible explanation is methodological. A dilute detergent solution was used to wash dust from marbles, and may have dislodged dust particles from previous years. The

purpose of the detergent was to dissolve traces of Tanglefoot, a viscous bird repellent applied around the edges of traps. Mild detergent will continue to be used in the future.

Plant Locations. A picture database was created for Lane Mountain Milkvetch using Microsoft Office Access 2007. Pictures show the location of individual LMMV plants, the stem bases, and new seedlings found this year. The database is organized by plot location, tag number, and key words. The key words used are location, stem, and seedling. The database also has pictures of ORV damage, including tracks and illegal trails located on Coolgardie Mesa. There are also pictures of LMMV plants that were first found and recorded in 2001. The picture database can be found in SharePoint under Annual LMMV Census, titled "LMMV Plant Picture Database" (http://irwig3c2itamweb/Units/DPW-ENV/Flora).

Discussion

Herbivory. Some ecological factors – population, flower number, and plant size – had no effect on herbivory whereas other factors – fruit production and base woodiness – significantly affected herbivory. With the exception of population, all of the ecological factors investigated are divided into classes that are extreme values (maximum and minimum), and classes that are median and between the maximum and minimum classes. For example, in the case of fruit production, "few fruits" is the median condition whereas "no fruits" and "many fruits" are the extreme conditions. Similarly, "rigid" and "woody" bases are median conditions whereas "non-woody" and "very woody" bases are extremes. In cases where ecological factors significantly influenced grazing, the median condition had greater herbivory than the extreme condition. The same pattern of more herbivory in median classes was seen for fruit counts and plant size, although classes were not significantly different.

We think that extreme classes avoid herbivory as an unintended consequence of whatever puts them into an extreme class. For example, woodier plants, by virtue of their greater resource storage, can grow earlier in the season when rodent density is lower and rodents are less active. Earlier growing plants not only avoid herbivory, but produce the greatest number of flowers. Smaller, non-woody plants with few fruits avoid herbivory because small plants are undetected, and because they have been present for a shorter period of time.

Herbivory may be beneficial if the grazer is also the plant's primary seed disperser. No field studies have been conducted to determine what animals feed on the milkvetch, but likely candidates include ground squirrels, jackrabbits, packrats, and possibly the federally threatened desert tortoise (*Gopherus agassizii*). Additionally, no studies have been conducted to determine the primary means of seed dispersal in milkvetch. Consequently, whether the herbivory on the milkvetch is beneficial or detrimental to the overall health of the populations is uncertain.

Several anecdotal observations have some bearing on the role of herbivory in Lane Mountain milkvetch populations. First, herbivory was considerably greater in 2011 than in previous years. In fact, herbivory was not previously measured because it did not appear to be a significant ecological force. Second, a few milkvetch individuals were encountered with aphids and mites, but this source of herbivory was not measured. Insect herbivory creates a different pattern of tissue damage than that observed and recorded in this study, and should be incorporated into

future studies of herbivory. Third, if herbivory is associated with a specific rodent, such as packrats, then there should be an association between herbivory and habitat. Habitat parameters such as slope, aspect, elevation, and rock cover can be gleaned from GIS coverages, particularly those containing Digital Elevation Models, and satellite imagery.

Herbivory is an important feature of milkvetch natural history that could cause differences in viability among populations, independent of military impacts. Therefore, future milkvetch surveys should include measurement of herbivory.

Reproductive Phenology. Two different lines of observation were used to investigate the total reproductive output of plants – repeat visits and tags on flowers. When plants were visited a second time, it was found that plants with more fruits and flowers during the first visit tended to produce more mature fruits at the time of the second visit (Table 7). This result demonstrates that reproductive effort is not determinate, that is, limited by time, anatomy, or stored resources. Rather, reproductive effort is indeterminate, and increases with size and resources. As elapsed time increased from 16 to 39 days, fruit production declined. This indicates that the season for milkvetch reproduction ended during the study.

The regression model predicting the number of fruits during the second visit, based on the number of fruits and flowers present during the first visit and the elapsed time, was highly significant but only explained 55% of the total observed variation in final fruit numbers. Thus, attempts to estimate cumulative fruit production from data collected during a single visit would be inaccurate. The unpredictability of cumulative fruit production can be explained by differences in the period of growth among plants, rather than variation in flower and fruit development. Lane Mountain milkvetch begin growing from a woody caudex sometime in the fall or winter, and continue upward growth through the host canopy as resources permit. Plants begin to flower when stems emerge on the top of the host canopy. However, the date of emergence on top of the canopy can differ greatly among plants. Variation in phenology explains why most plants had fewer fruits at the second visit, while a few plants had more fruits, a result seen previously in 2006 (U.S. Army: Fort Irwin 2006). Variation in reproductive phenology was also seen among populations. For example, CM began reproductive activity later than other populations, and was the only population to show an increase in flower number during the second visit.

Phenology observations showed that, on average, buds developed into fruits in 26.6 days and then remained on plants for an additional 29.8 days (at CM 5). The minimum time for a bud to become a fruit is 16.2 days. Because fruits develop so rapidly, some of the fruits counted during the second visit were probably new, and had not been present as fruits, flowers, or buds during the first visit. But, given the long time period that most fruits remained on stems (average = 28 days), some of the fruits counted during repeat visits were probably present during the first visit. Thus, the fruits seen during the second visit were probably a mix of old and new fruits.

Rundel, et al. (2010) also observed the phenology of flower and fruit development. Their observations are similar to ours, with two minor exceptions. They observed a two-week gap between bud formation and flower blooming, whereas we observed that buds could form flowers within a week. However, they made their observations at the beginning of March, when the

weather is cooler than late April, when we made our measurements. Also, they may have looked at smaller buds needing a longer development time. They observed many fruits dehiscing, and used dehiscence as an end point for floral phenology. The fruits in our study usually dropped from stems before dehiscing, and we saw few dehisced fruits during repeat visits. The difference between their 2009-2010 observations and our 2010-2011 observations can be explained by different patterns of precipitation between years. Precipitation was prolonged through winter and early spring in 2009-2010, but was confined to a single pulse during December 2010, followed by drought. The pulse stimulated growth and reproduction, but the drought prolonged fruit maturation, and increased flower, fruit, and ovule abortion.

Dormancy and Recruitment. Despite having conducted seven consecutive years of monitoring, we are unable to explain the role of dormancy and resprouting in milkvetch populations, and to distinguish among dormancy and mortality, or resprouting and recruitment. When a tagged plant is absent, there is no method to determine if it died or simply became inactive. When a previously untagged plant is found, there is no method to distinguish between the resprouting of a long-dormant milkvetch versus recruitment from seed. Inability to recognize dormancy is not a moot point. Last year's annual survey report (U.S. Army: Fort Irwin 2010) makes the case that dormancy is uncommon but ecologically significant because about nine percent of plants appearing to be dead are actually alive, but dormant. A nine percent increase or decrease in mortality can make the difference between viability and extinction.

Below, we present evidence that both resprouting and recruitment are present in milkvetch populations. Some of that evidence relies on basal stem observations that were made for the first time in 2011. Unfortunately, biologists found it difficult, and often impossible, to observe the milkvetch base at the point of ground entry, within the basal area of a profusely multistemmed host. However, there was clearly a difference between basal stems that were herbaceous (non-woody) or very woody (Figure 2).

The case for dormancy and its importance in milkvetch populations begins with qualitative evidence that plants do indeed enter and return from dormancy. One of three plants resprouting after one year of dormancy had a very woody stem and was clearly a resprout. This plant was small, produced only 28 fruits and no flowers, and would have looked like a new recruit if the stem had not been checked. Two other one-year resprouts were similarly small and produced relatively few fruits and flowers, but had non-woody stems. Based on their non-woody stems these one-year resprouts were more likely to have been recruits than resprouts. Six resprouts had been dormant for four years and were small, non-woody, and with relatively few fruits and flower. It is more likely that they were seedlings than resprouts. Thus, out of 9 resprouts in 2011, only one plant was likely to have been a resprout, based on its very woody stem.

Some quantitative evidence supports the presence of dormancy. Table 4 shows that dormancy most frequently lasted for two years, and that periods of dormancy for three or more years are rare. If resprouting after dormancy were actually caused by seed germination and growth, resprouting would remain constant in all time intervals. An exception to the pattern of less resprouting over longer time intervals was seen this year when six plants, described in the preceding paragraph, appeared to resprout after a four year dormancy. We think that the original six plants are truly dead, and that six recruits have taken their place.

The case for recruitment is, like dormancy, primarily indirect. Five of the 44 recruits were seedlings. One seedling was inspected by Connie Rutherford, FWS, and determined to be a recruit (vs. a resprout) based on the lack of a perennial root. The UCLA research team has similarly determined that milkvetch recruits do exist by locating milkvetch seedlings with cotyledons attached (Rundel et al. 2005). However, no seedling has permanently established itself (Rundel, et al. 2005) unless it has received supplemental water (Rundel, et al. 2010). Thus, although seedlings certainly do exist, there are no convincing observations that first year seedlings are the source of recruitment into populations.

The 39 recruits that were larger than seedlings had a confusing combination of seedling, juvenile, and adult characteristics. Juveniles are plants larger than seedlings that have usually entered the host canopy, but have not developed adult characters such as large size, fruits and flowers, and woody bases. Each of the 39 recruits could have originated in each of three ways:

1. The resprouting of a long-dormant plant.
2. A one- or two-year-old adult that remained undetected while it was a juvenile.
3. A first-year juvenile (germinated during the last year).

There are three hypotheses for development of seedlings and juveniles into adults:

1. The slow hypothesis states that development of milkvetch into adults is slow, and requires several, possibly many, years.
2. The rapid hypothesis states that development is rapid, and adult characters may develop within the first year.
3. The intermediate hypothesis is a compromise between slow and rapid. This hypothesis states that development takes place within about 2 years, and that adult characters may appear during the first year.

If the slow hypothesis is true, then each of the 39 recruits can be assigned to one of the three possible origins: the 3 woodiest recruits are resprouts; the 29 recruits with one or more adult characters are several years old and have avoided detection while hidden by the host canopy; and 7 recruits without any adult characters are first-year juveniles. This analysis is repeated for all three hypotheses in Table 10, which also lists the primary assumptions of each hypothesis.

Hypothesis 1 is unlikely, because it is unlikely that 3 plants (Table 10) are returning from dormancy after a 7-year hiatus, and because it is unlikely that 30 juvenile plants escaped detection during the 2010 census, and possibly the 2009 census. Hypothesis 2 is somewhat unlikely, because it is unlikely that first-year plants could vary so greatly in the development of adult characters. Hypothesis 3 – relatively short development time with some adult character development during the first year – is the most likely hypothesis.

To summarize, quantitative and qualitative evidence proving dormancy truly occurs is strong, but the amount of resprouting is unclear. Similarly, while seedling germination is fairly common, the number of juveniles that successfully establish and the number of years needed for establishment are unclear. While most of the recruitment this year was from first-year plants, some of the recruitment could have come from juveniles that have been hiding in host canopies for a year.

Host Plant Cover. The 2010 report for Lane Mountain milkvetch monitoring (US Army – Fort Irwin 2010) viewed the amount of cover in 2010 as puzzlingly low, given increases in precipitation that year. This dilemma continues in 2011, another year with higher than average precipitation during the growing season, but only baseline canopy growth. The ITAM RTLA vegetation monitoring program also reports declines in plant cover during 2010 and 2011 (Dr. David Housman, personal communication). Several recent papers describe a decade-long decline in perennial vegetation in the Mojave Desert (Hammerlynck and McAullife 2010). It is possible that all cover measurements collected in the last six years reflect a decline from long-term averages.

The sampling design for host cover was changed in 2011, reducing the number of transects from 44 to 16. In 2015, and at future 4- or 5-year intervals, all 44 transects will be measured. The reduction in sample size from 44 to 16 greatly reduces confidence in detecting impacts to the plant community. The long-term monitoring plan for the Lane Mountain milkvetch (US Army: Fort Irwin 2005) states that a 20% decline in host cover on Fort Irwin conservation areas will trigger interagency adaptive management. To ensure that a 20% decline is not caused by normal yearly variation and measuring error, the 16 transects should be homogeneous enough – both among years and among transects – that a 20% decline (e.g. from 20% cover to 16% cover) will be statistically significant. This report does not determine the power of monitoring data to reveal declines in host plants. Hopefully, the subject can be investigated in the future.

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Tables

Table 1. Developmental stages used to classify flower and fruit development. Stages were based on observer intuition - no standard botanical nomenclature is available for developmental stage.

Stage	Stage Name	Description
1	Bud	Sepals cover developing flower
2	Flr1	Petals are expanding
3	Flr2	Receptive to pollinators; petals turn a deeper hue of red
4	Flr3	Spent flower. Petals are relaxed, crinkled, and often pale white or yellow-tinged.
5	Frt1	Fruit is developing.
6	Frt2	Fruit approaches full size.
7	Frt3	Full size. Due to variation in fruit size, small mature fruits cannot be distinguished from immature large fruits.

Table 2. Disturbance scale used to classify ORV damage in Coolgardie Mesa.

Scale	**Description**	**Notes**
1	No sign of ORV presence	1. Search for LMMV within circumference 20 meters from point. 2. Disturbance must be 15 or fewer meters from point.
2	1-4 ORV tracks present within 15m radius of location	3. Age of track is not important. If there is no new ORV usage, the number of tracks will decline over the years.
3	5+ ORV tracks present; no vegetation loss or breakage	4. You must be reasonably sure it is an ORV track. Rodents make trails that look like ORV tracks. Erosion may look like a track. But: rodents and draining water will follow an ORV track because it is the line of least resistance.
4	"Digging" ORV; plant limbs broken, removed, or plant density/cover decreased	5. "Digging" means the ORV dug a small furrow, rather than just crushing plants on the surface.
5	Probable loss of shrubs and presence of cleared areas	

Table 3. Characteristics of recruits (plants observed for the first time in 2011). Plants sizes were: vs – very small; s – small; s-m – small to medium; m – medium; m-l – medium to large; and l – large. Base is the central stem of the milkvetch at the point it enters the ground.

Base	Number of plants		Size	Number of plants		Fruits	Number of plants
Seedling	5		Seedling	5		0	13
Not Woody	23		vs and s	26		1-10	7
Rigid	7		s-m	2		11-25	8
Woody	3		m	6		26-100	11
Very Woody	2		m-l	2		101-221	5
Unknown	4		l	2			
			Unknown	1			

Table 4. Reappearance of dormant plants. A 3-yr dormancy, for example, means that a milkvetch was recorded as DEAD or CNF for 3 years consecutive years (2005-2009 or 2006-2010) before resprouting. Percent of Plants is the number of resprouts divided by the number of living plants in the year the resprout appeared. Highlighting designates the questionable return of long dormant plants. Some of these plants are probably new recruits.

	1-year dormancy	2-year dormancy	3-year dormancy	4-year dormancy	5-year dormancy
Number of Time periods	2	3	2	2	1
Number of Plants	5	15	3	6	0
Percent of Plants (average)	1.5%	4.0%	1.1%	1.6%	0%

Table 5. Reproduction in 2011 summarized by population.

Plot	Total Number of Fruits	Total living plants	Average number of Fruits per plant	Maximum number of fruits on a plant
BW	3685	41	90	305
CM	4176	86	49	410
EP	6391	46	139	1115
NG	3433	30	114	440
Total	17685	203	87	

Table 6. Mean number of days required for each stage of flower and fruit development. * Too few observations.

Transition Stage	Stage Description	N (number of transitions)	Days (Mean)	Standard Deviation
1	bud-flr1	1	2.3	*
2	flr1-flr2	3	2.3	*
3	flr2-flr3	13	4.8	2.13
4	flr3-frt1	11	4.2	1.83
5	frt1-frt2	12	5.5	1.80
6	frt2-frt3	11	7.3	3.65

Table 7. Correlation coefficient, R, between three factors and final fruit production (mature and dehisced fruits on the second visit).

Variable	
	Final fruit production
Elapsed time between visits	-0.3880
Number of flowers at first visit	0.5073
Number of fruits at first visit	0.4886

Table 8. The association between the presence of herbivory and ecological factors.

Factor	Number of classes	Name of classes	Df	Test statistic, G	p
Population	4	BW, CM, EP, NG	3	3.567	0.312
Plant size	5	small, small-med., medium, med-large, large	4	5.134	0.274
Number of flowers	3	None, <20, >20	2	1.230	0.541
Base	4	Not woody, rigid, woody, very woody	3	12.195	0.007
Fruit production	3	None, <20, >20	4	6.581	0.037

Table 9. Comparisons of ORV damage between the 2010 and 2011 census. Statistical comparisons were made using a two-tailed Wilcoxon signed rank test, a nonparametric test suitable for paired, ordinal data (Zar 1999).

Comparison	Mean 2010	Mean 2011	df	Z (test statistic)	p
All locations	1.93	2.10	57	1.912	0.056
Farther from rendezvous (new locations)	1.42	1.77	25	2.236	0.025
Close to rendezvous (old locations)	2.34	2.38	31	0.025	0.799

Table 10. Comparison of three hypotheses that explain the origin of milkvetch recruits in 2011. Columns Hyp1 (Slow seedling development), Hyp 2 (Rapid development), and Hyp 3 (Intermediate) show the number of 2011 recruits assigned to each type of origin (row), for each hypothesis.

Origin of recruits	**Hyp 1: Slow**	**Criteria**	**Assumptions**
A long-dormant plant resprouts.	3	Very woody basal stem, or indication of past growth.	Very Woody basal stems take many years to develop, and are most likely adult resprouts.
A one- or two-year-old recruit eventually grows large enough to reach the top of the host canopy and be seen.	39	At least one adult characters is present - large size, flower and fruit production, or woody basal stems.	Lower detection rate. Juveniles frequently remain hidden in host canopy.
A first-year recruit that germinated during the last year.	7	Adult characters are absent.	First-year recruits lack adult characters.
Origin of recruits	**Hyp 2: Rapid**	**Criteria**	**Assumptions**

A long-dormant plant resprouts.	0	Basal stem is undergoing secondary growth and has many old lateral stems.	(1) Woody bases can develop in first year. (2) Extremely unlikely for a plant to remain dormant for more than 7 years.
A one- or two-year-old recruit eventually grows large enough to reach the top of the host canopy and be seen.	6	Plants in this class have all three adult characters: medium to large size, fruits, flowers, and woodiness.	Very high detection rate. Unlikely that a juvenile can remain hidden during first year.
A first-year recruit that germinated during the last year.	43	Plants have 0-2 adult characters, but not all three.	First-year recruits frequently develop adult characters.
Origin of recruits	**Hyp 3: Inter-mediate**	**Criteria**	**Assumptions**
A long-dormant plant resprouts.	0	Basal stem is undergoing secondary growth and has many old lateral stems.	(1) Woody bases can develop in the first two years. (2) Extremely unlikely for a plant to remain dormant for more than 7 years.
A one- or two-year-old recruit eventually grows large enough to reach the top of the host canopy and be seen.	17	Plants have 2-3 adult characters.	High detection rate. Juveniles may remain hidden in host canopy during their first year.
A first-year recruit that germinated during the last year.	22	Plants have 0-1 adult characters.	First-year recruits begin developing adult characters and often have a combination of adult and juvenile characters.

Figures

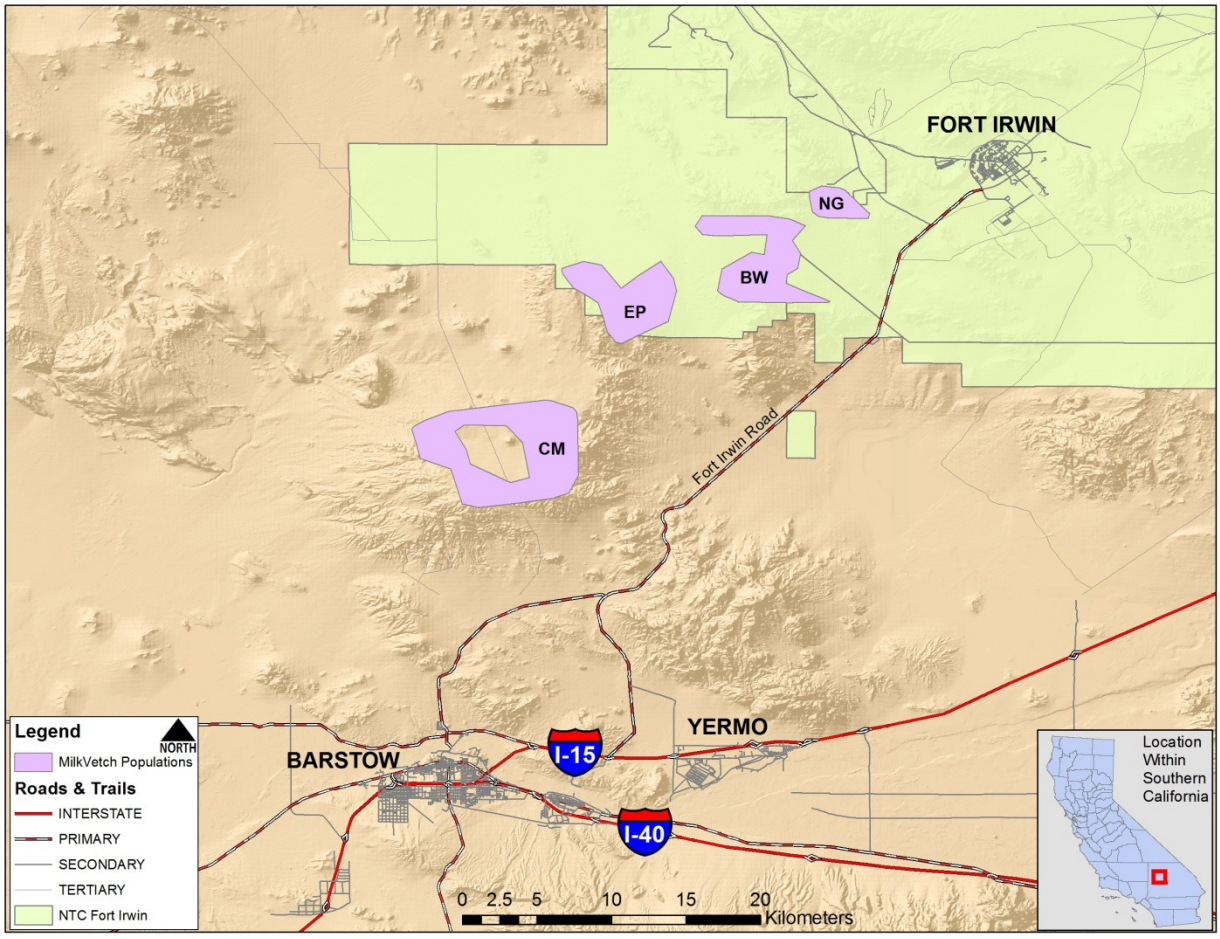


Figure 1. Location of all known populations of the Lane Mountain milkvetch near Barstow and Fort Irwin, California.

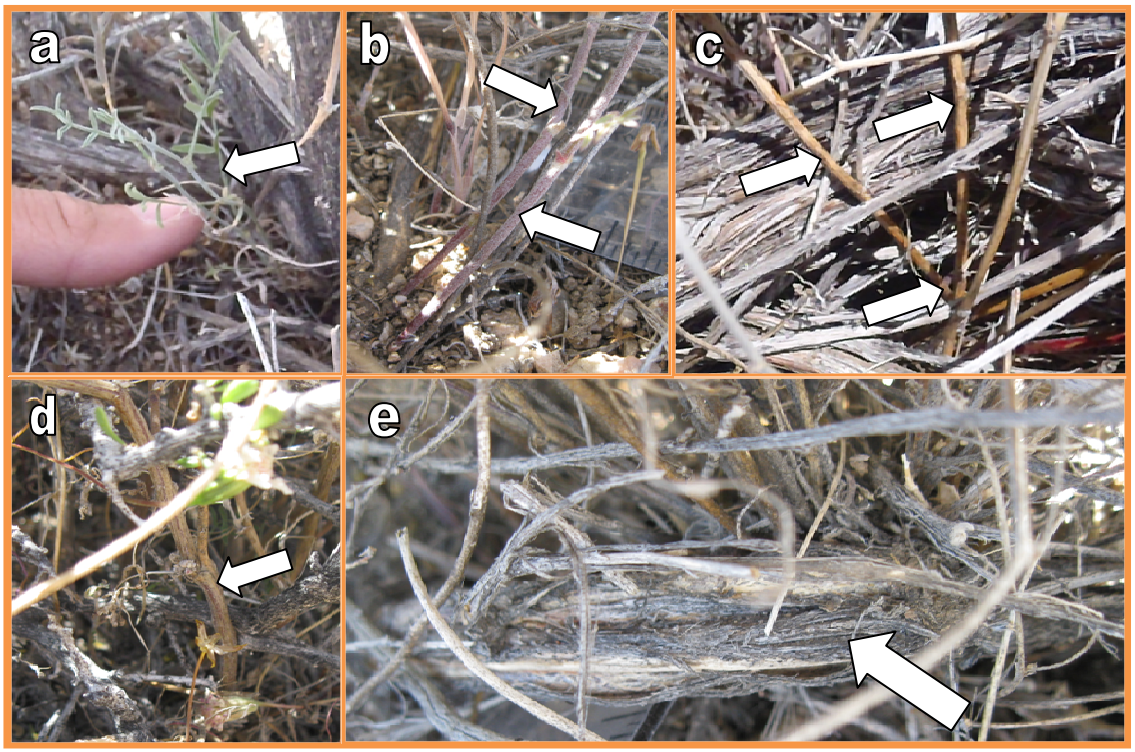


Figure 2. Stem descriptions based on level of secondary growth: a) seedling; b) not woody; c) rigid; d) woody; e) very woody

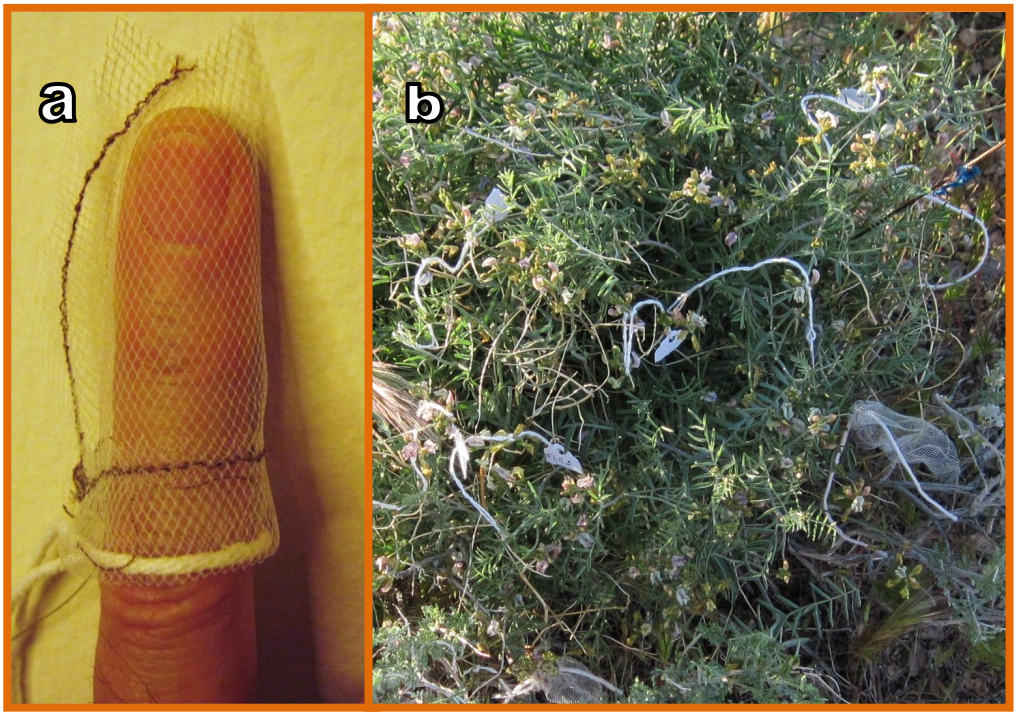


Figure 3. a. Bag constructed to collect seeds at fruit dehiscence. **b.** Bag and jeweler's tag placement on milkvetch, with host in background.



Figure 4. Herbivory on a milkvetch. Arrows point to stems that have been grazed.

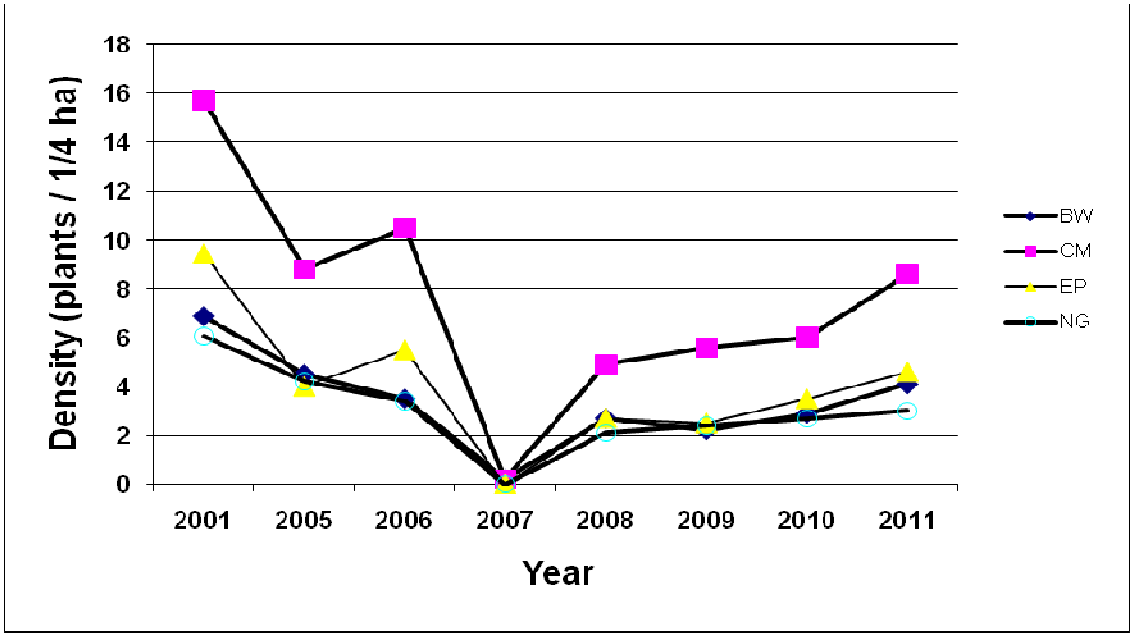


Figure 5. Variation in milkvetch density among study plots in eight annual censuses. Each point on the graph is the average of ten plots within each of the four populations.

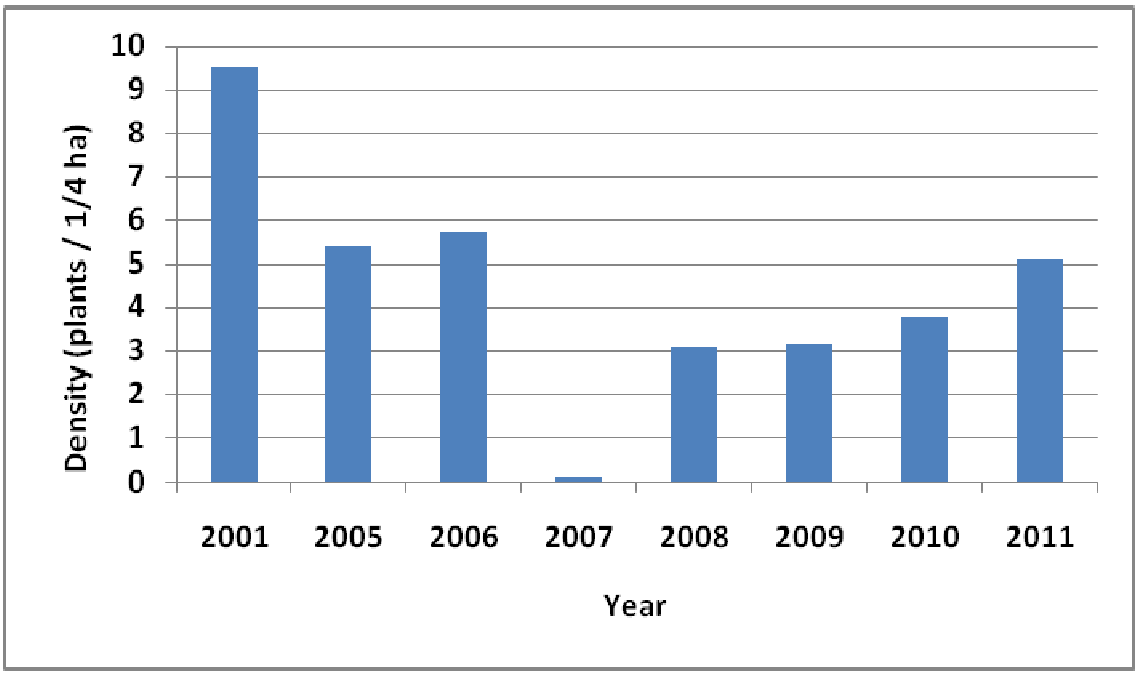


Figure 6. Average density on 40 study plots during the last decade. Density is the number of Lane Mountain milkvetch per ¼ hectare of land.

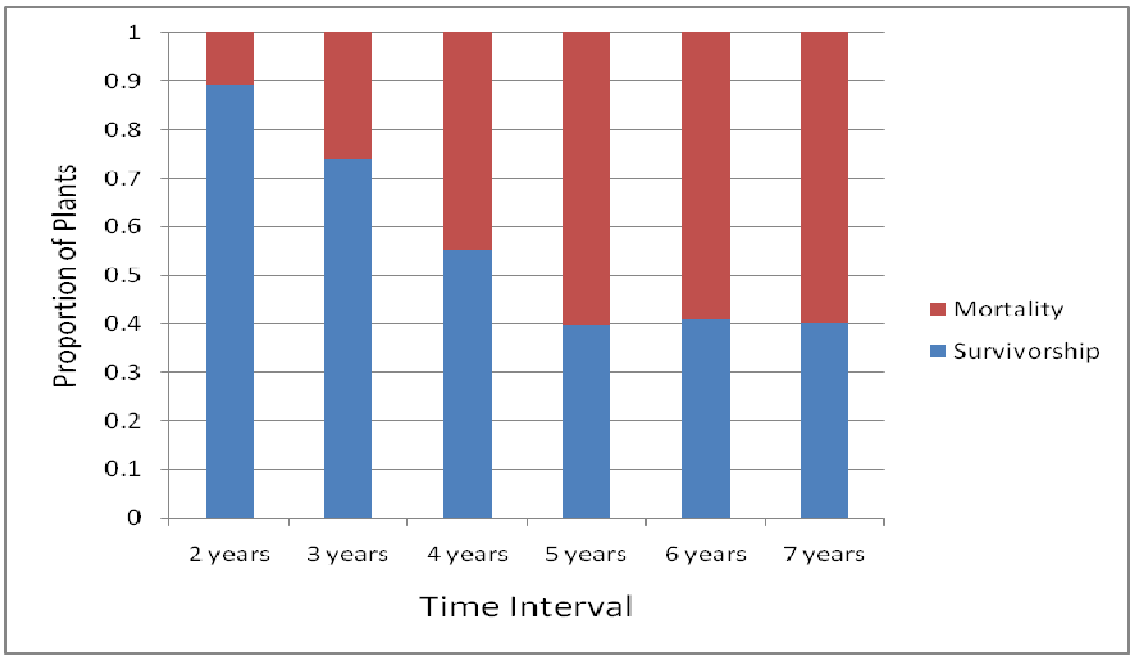


Figure 7. Cumulative survivorship and mortality over time periods ranging from 2 years to 7 years. Each time period is the average of 2-4 time periods, except the 7-year time period, for which there is only one estimate (2005 – 2011). Proportion surviving (or dying) is the number of individuals present (or absent) during the final year of the time interval, divided by the number present during first year of the interval.

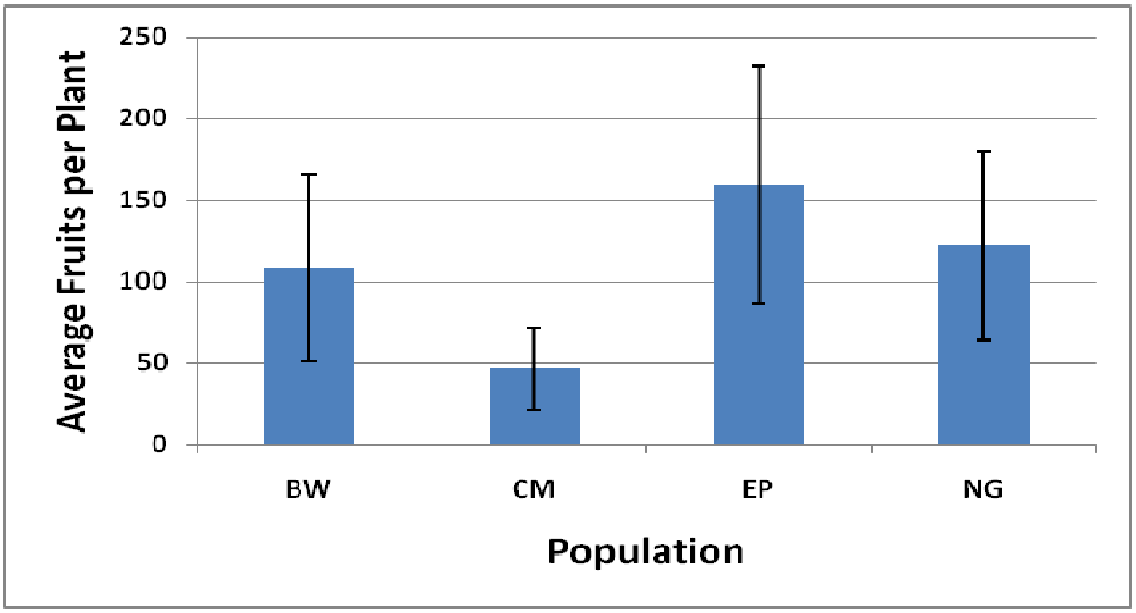


Figure 8. Differences in reproductive effort (fruits per plant) among milkvetch populations in 2011. Data are from 203 plants, averaged over 40 study plots in 4 populations. Error bars represent 95% confidence intervals.

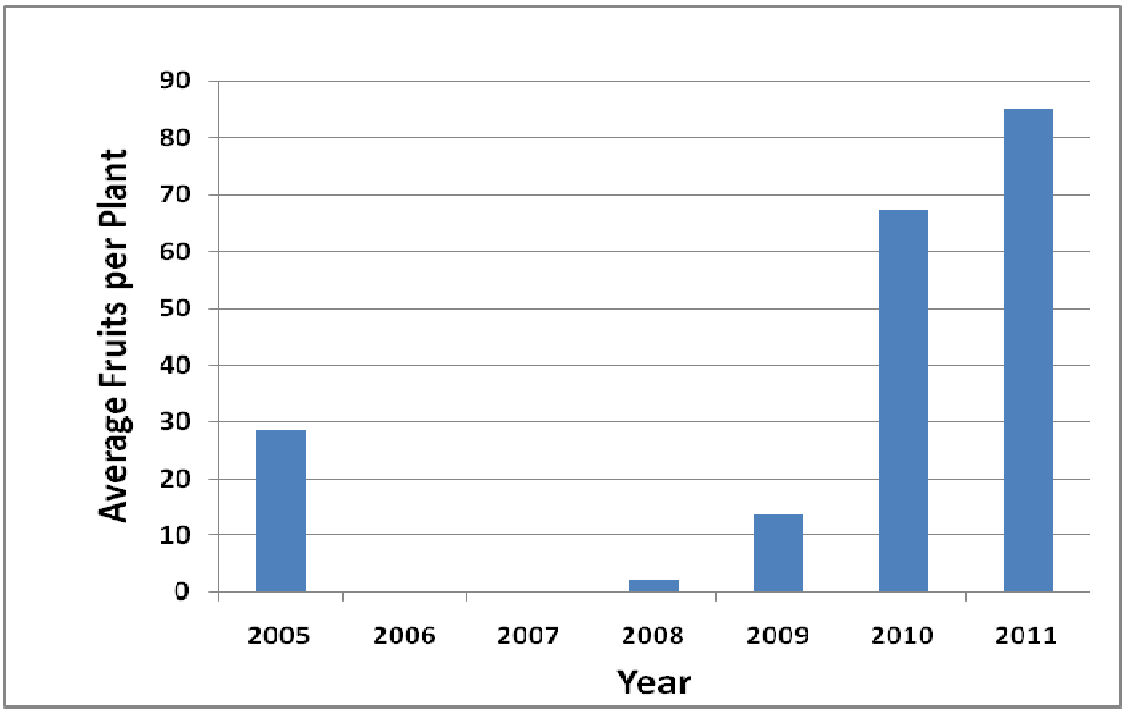


Figure 9. Reproductive effort (fruits per plant) over time. Data are from all living plants in each census, irrespective of plot or population.

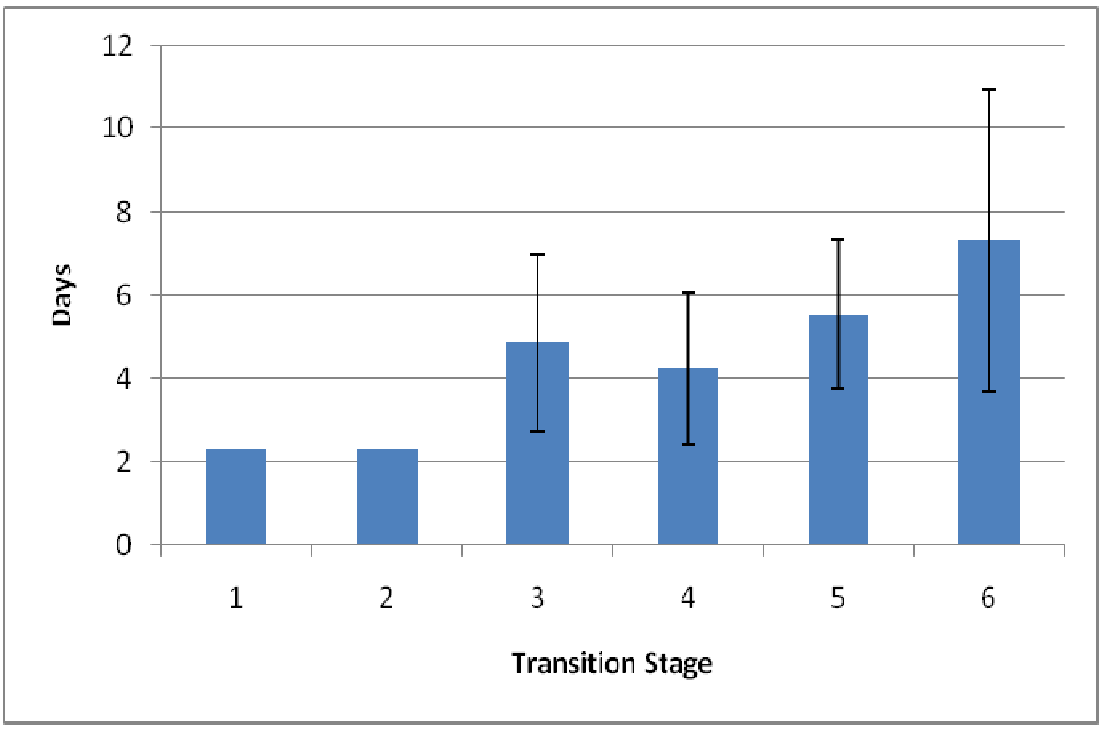


Figure 10. Developmental time of flowers and fruits. A transition stage is the time taken for the transition between one stage and the next. Stages are described in Methods.

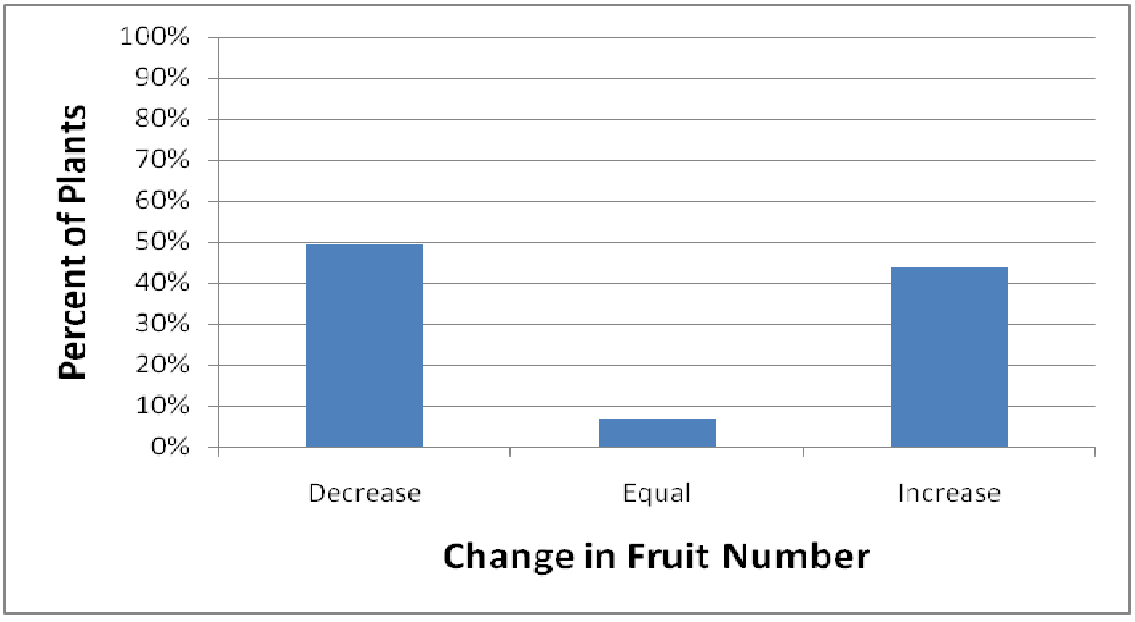


Figure 11. Overall change in number of fruit present between the first and second visits in the Lane Mountain milkvetch in 2011. The average time elapsed between the two visits was 26 days. The overall number of plants that showed an increase in fruit number is not different from the number of plants that showed a decrease in fruit number from the first visit to the second (Z=-1.374, n=66, p=0.17).

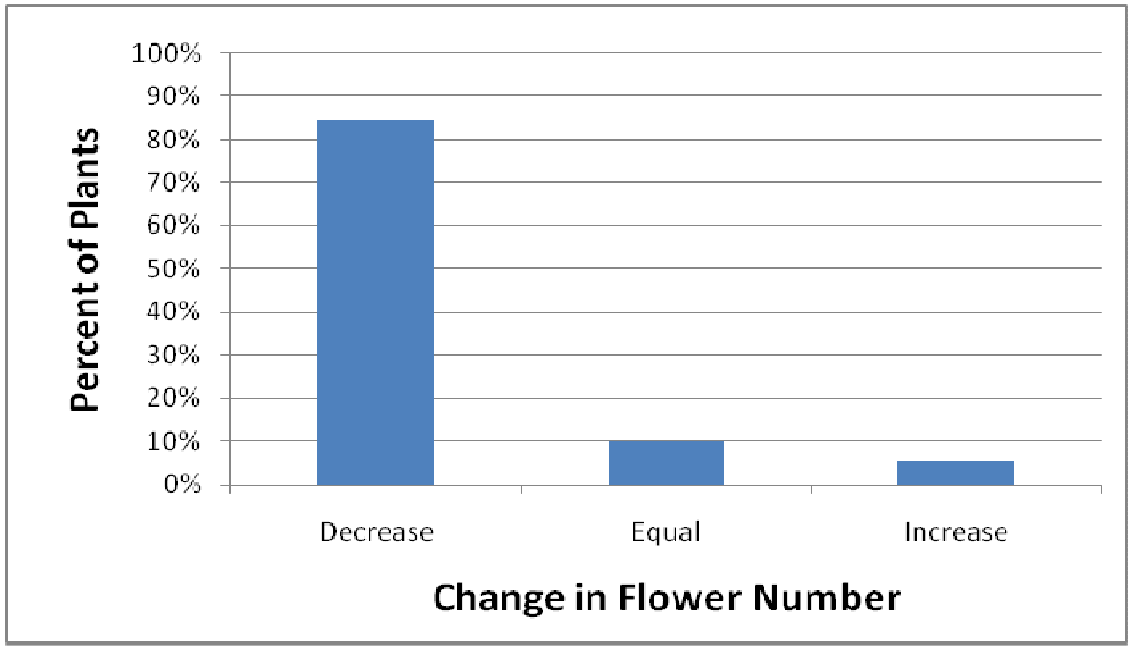


Figure 12. Overall change in number of flowers present between the first and second visits in the Lane Mountain milkvetch in 2011. The average time elapsed between the two visits was 26 days.

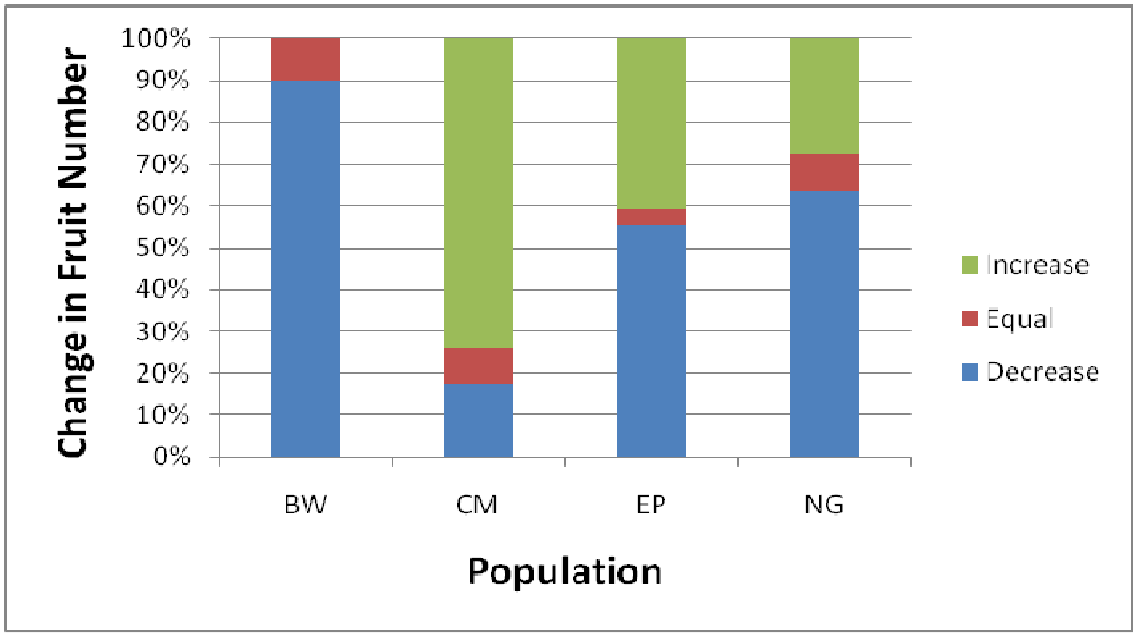


Figure 13. Percent change in number of fruit present between the first and second visits in the four Lane Mountain milkvetch populations in 2011. The average time elapsed between the two visits was 26 days.

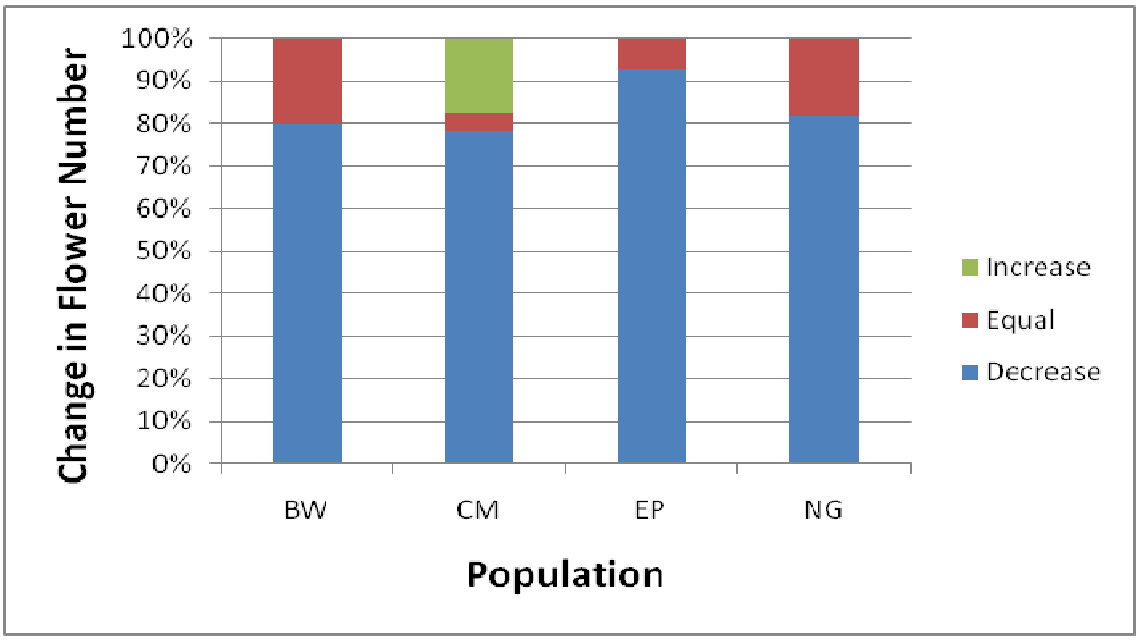


Figure 14. Percent change in number of flowers present between the first and second visits in the four Lane Mountain milkvetch populations in 2011. The average time elapsed between the two visits was 26 days.

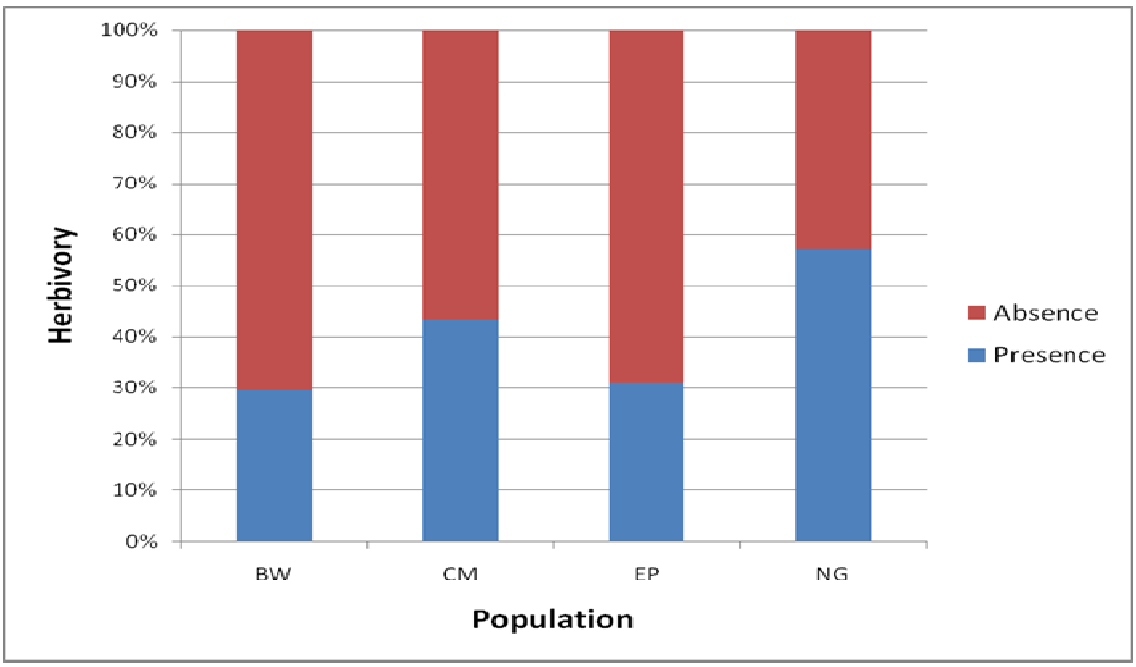


Figure 15. Presence and absence of herbivory by non-insect animals in each of the Lane Mountain milkvetch populations. Herbivory is independent of population ($G = 3.567$, $df = 3$, $p = 0.312$).

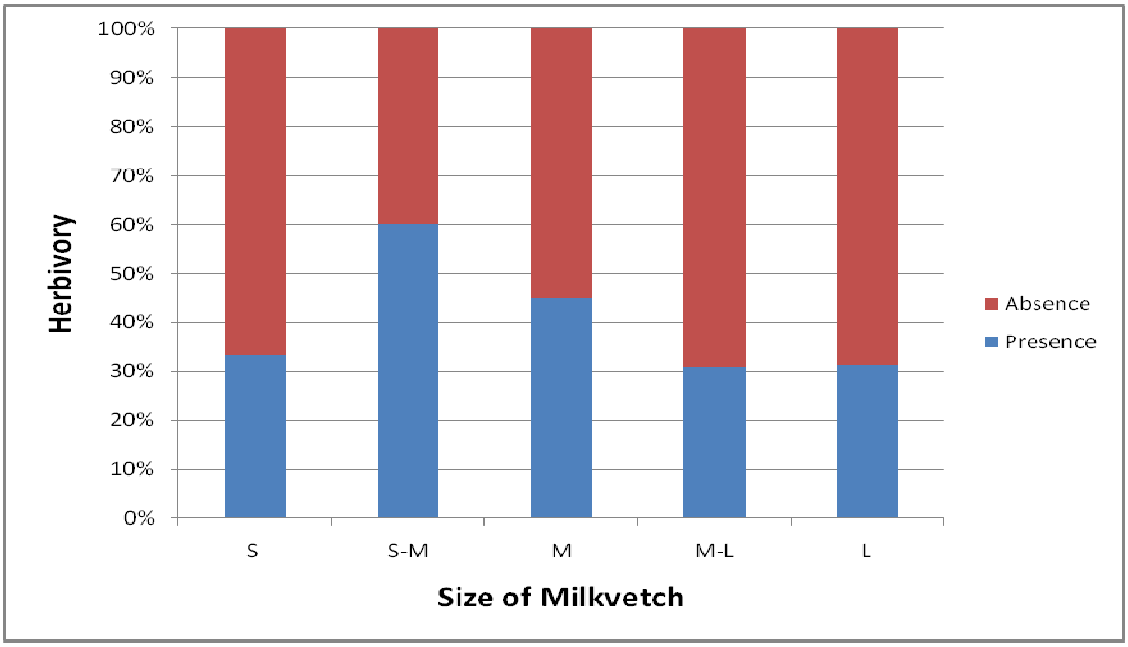


Figure 16. Presence and absence of herbivory in each size category of Lane Mountain milkvetch. S=small plants, S-M=small to medium plants, M=medium plants, M-L=medium to large plants, L=large plants. Herbivory is independent of the size of the milkvetch (G = 5.134, df = 4, p = 0.274).

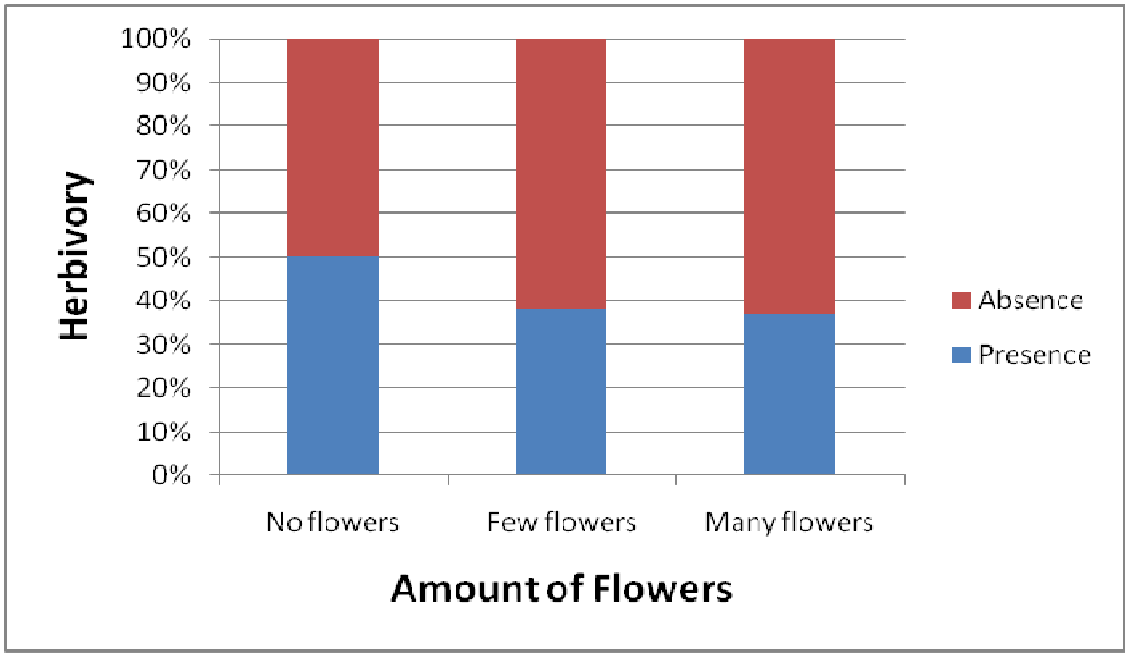


Figure 17. Presence and absence of herbivory based on number flowers present per plant. Herbivory is independent of the amount of flowers present on each plant (G = 1.230, df = 2, p = 0.541).

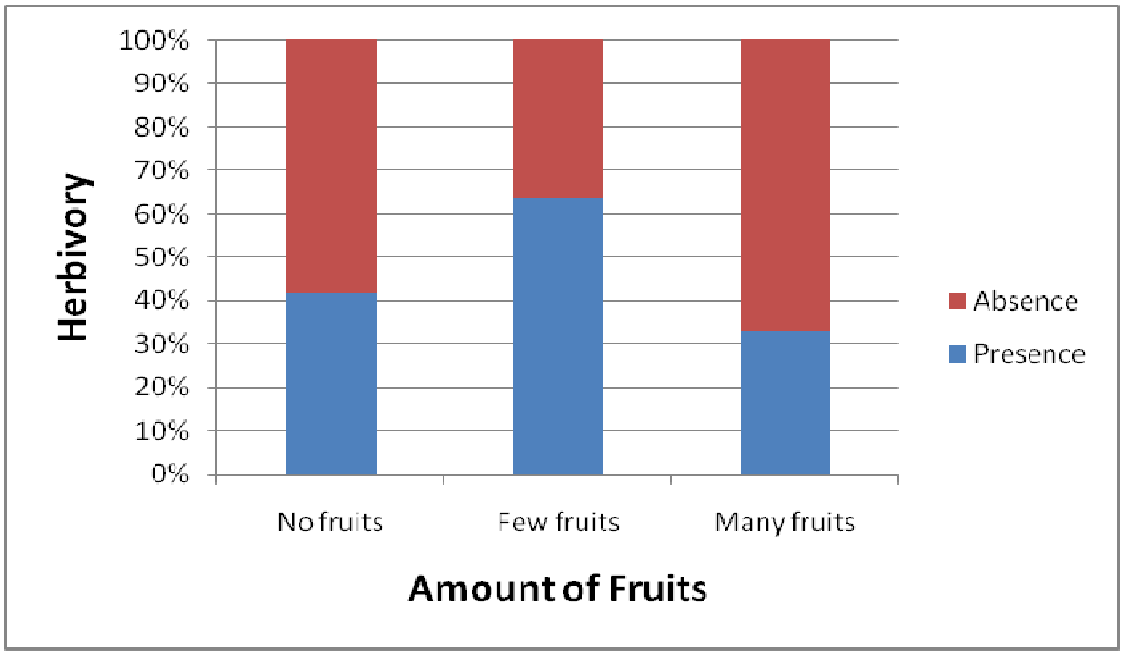


Figure 18. Presence and absence of herbivory based on number fruits present per plant. Herbivory is not independent of the amount of fruits present on each plant (G = 6.581, df = 2, p = 0.037).

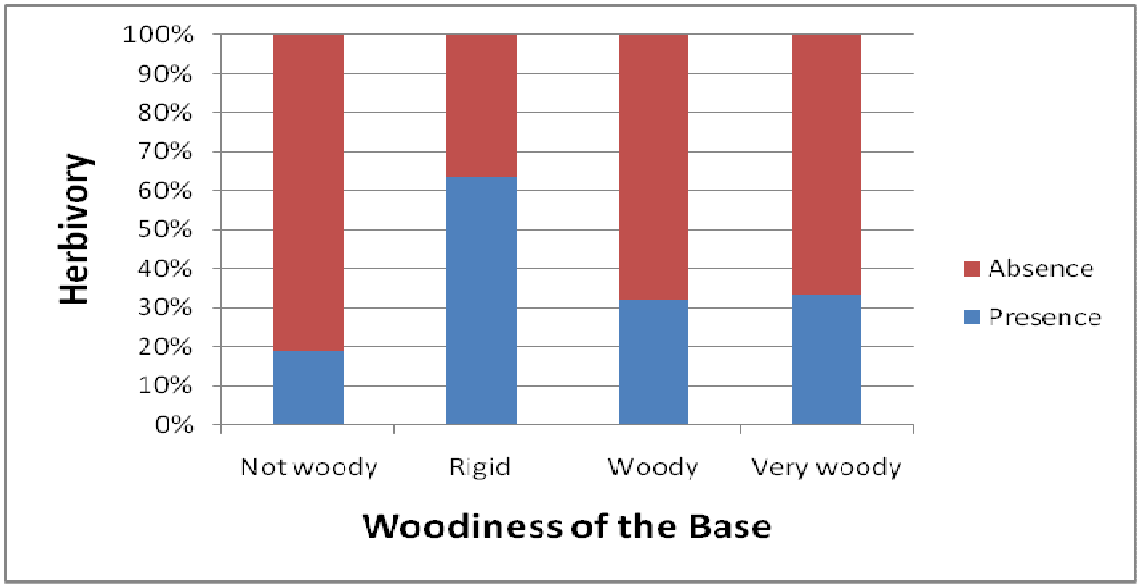
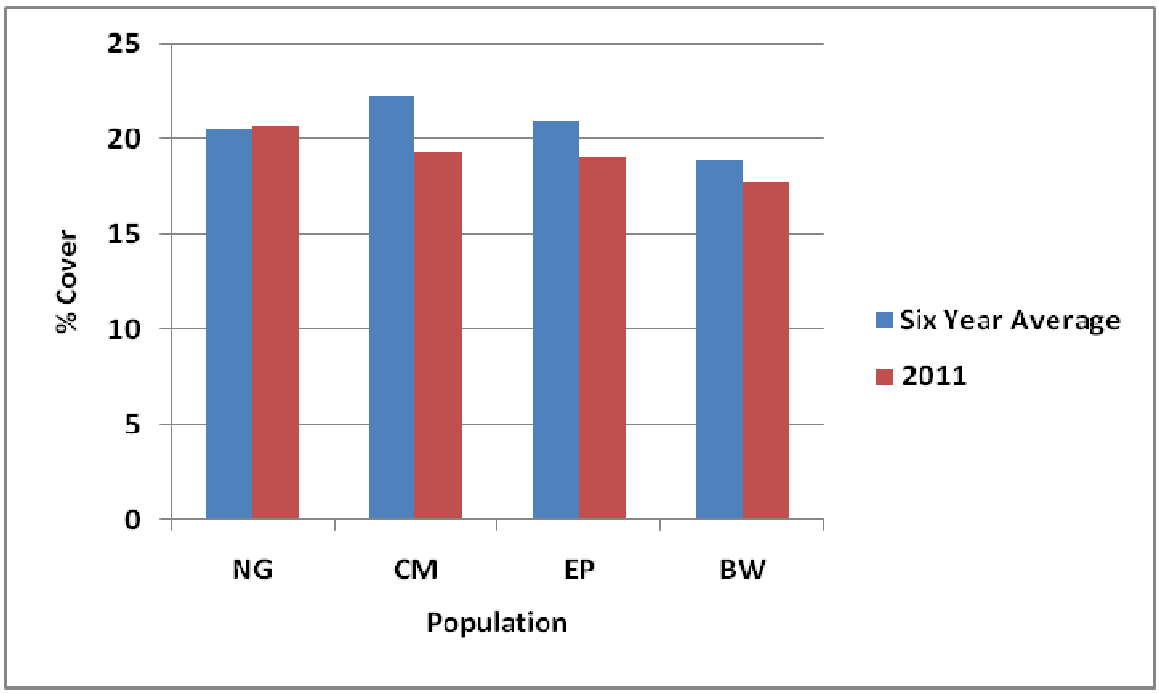


Figure 19. Presence and absence of herbivory in each woodiness category of Lane Mountain milkvetch. Herbivory is not independent of how woody the base is (G = 12.195, df = 3, p = 0.007).



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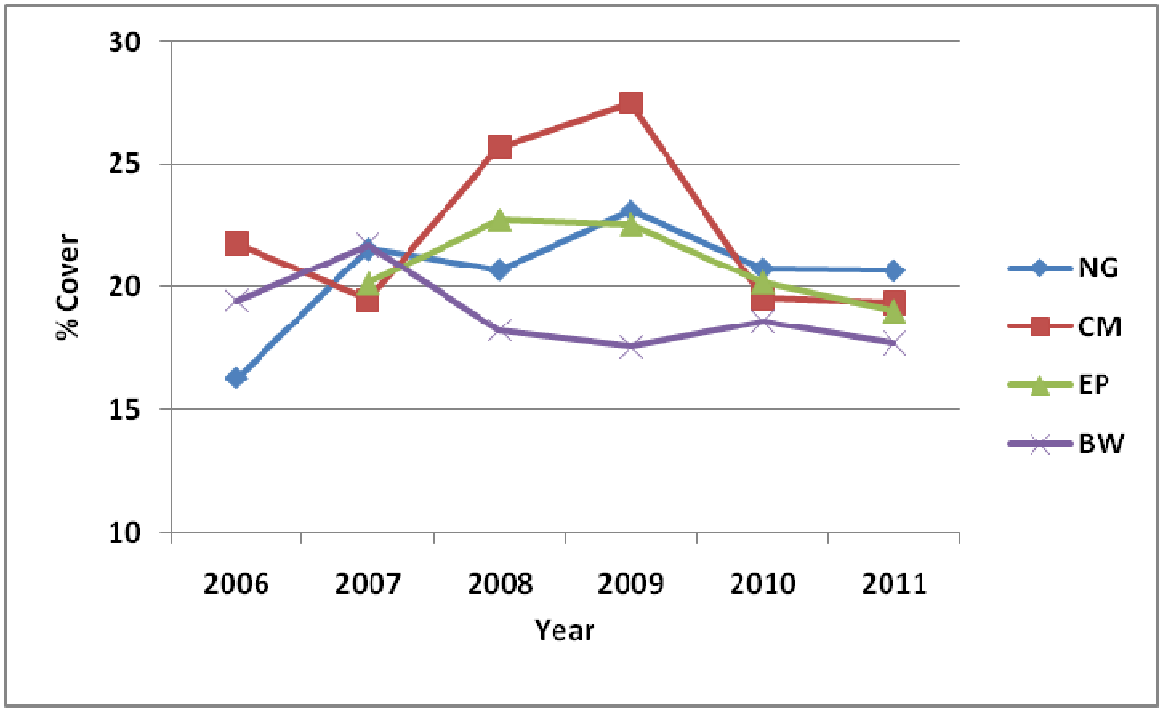

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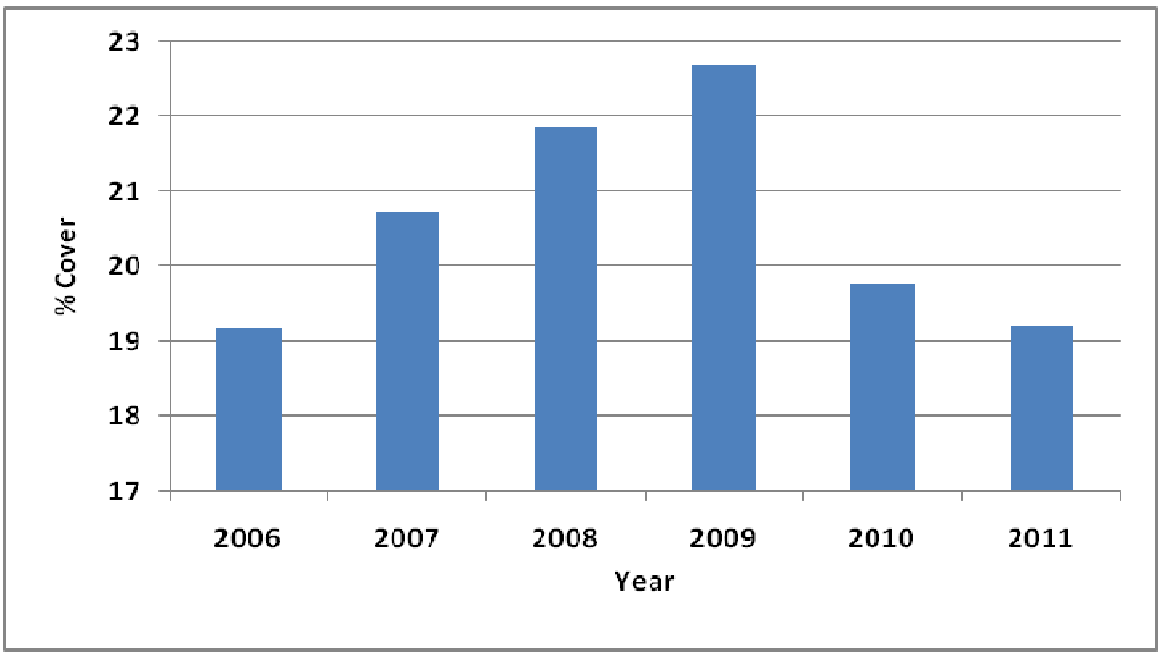

Figure 22. Variation in canopy cover of host plants from year to year. Data is restricted to the same four transects within each population that were measured in 2011.

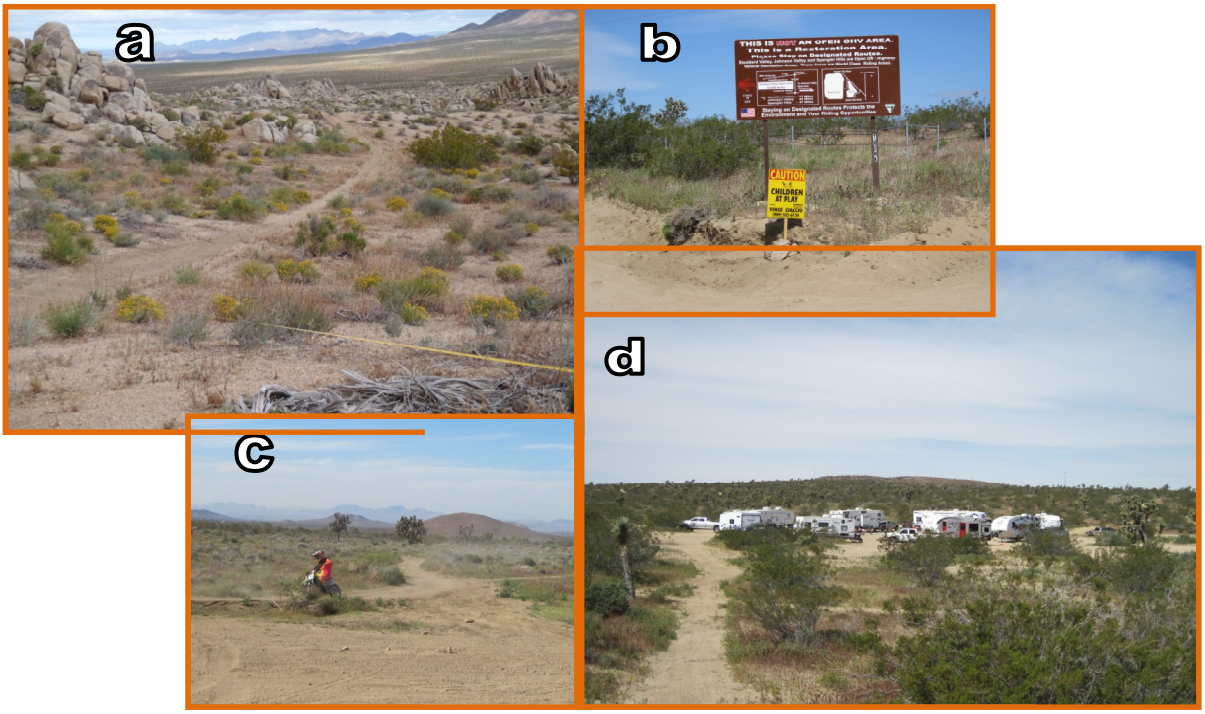

Figure 23. ORV use in Lane Mountain milkvetch populations. a: ORV trail in BW population cuts across a canopy transect. b: ORVers have erected a sign just below a BLM sign forbidding off-roading. c: Motorcycle rider. Barren area in foreground was caused by ORV use. d. A typical encampment of about 10 recreational vehicles that could easily support 40 ORVs.

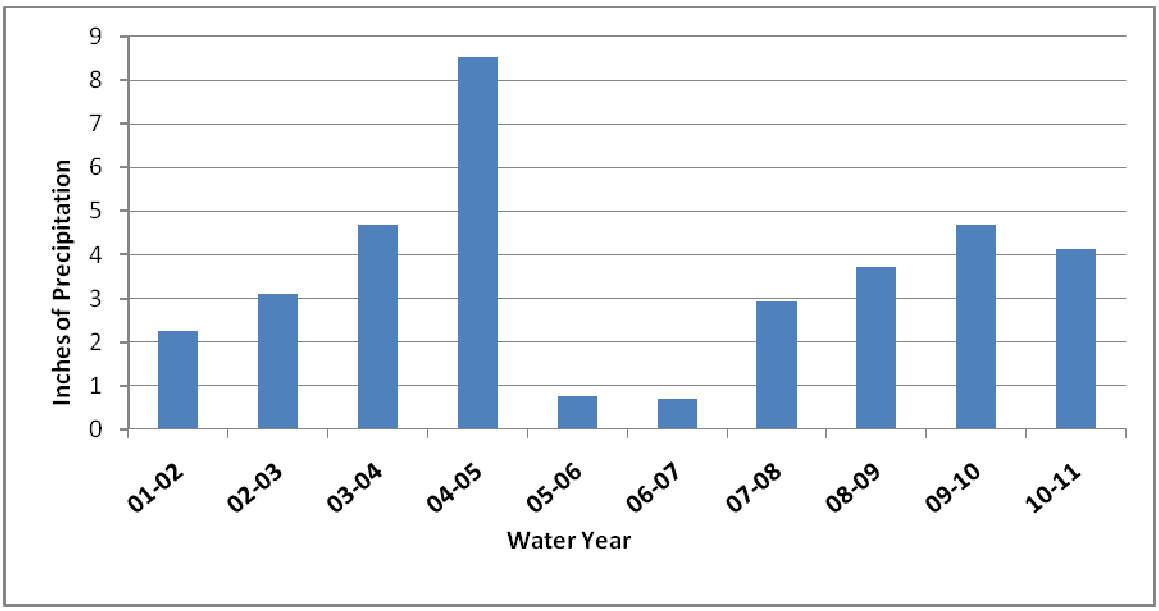

Figure 24. Water year annual precipitation recorded at the Barstow, California, Daggett Airfield over the last decade. Water year 10-11 shows values through July, 2011.

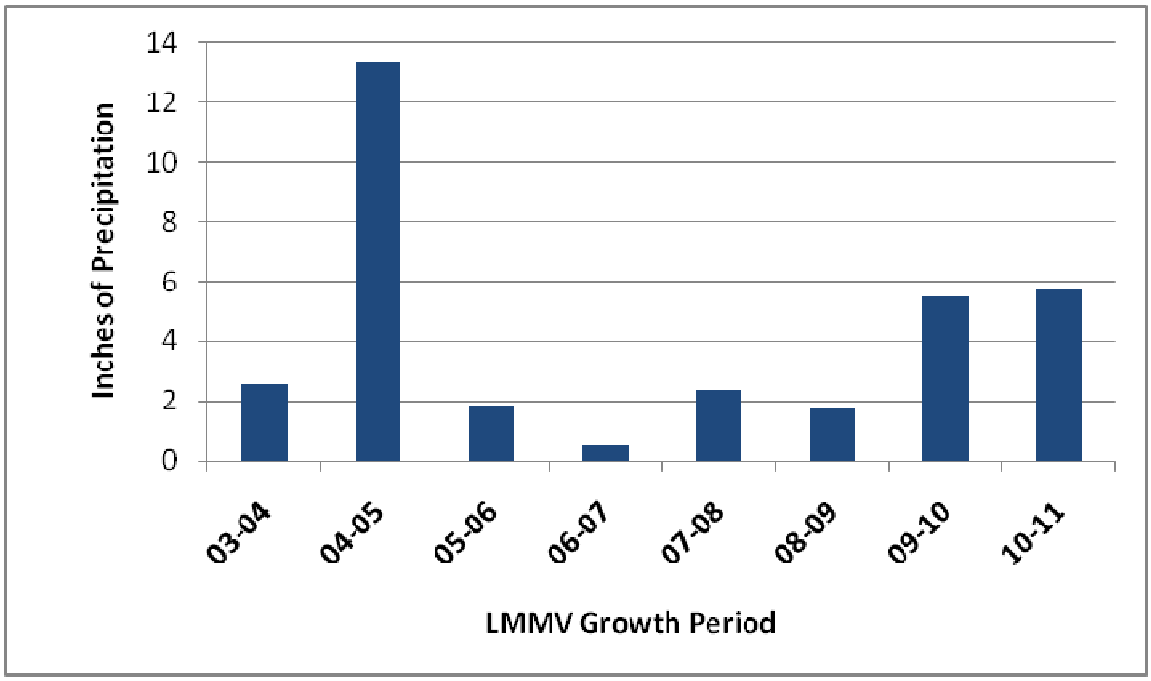

Figure 25. October through April precipitation, the presumed growth period of the Lane Mountain milkvetch, recorded from rain gauges within or near populations NG, BW, and EP. Precipitation from 2003 to 2005 was averaged from four gauges. Precipitation from 2005 to the present was averaged from 10 (2005-2006) or 11 gauges.

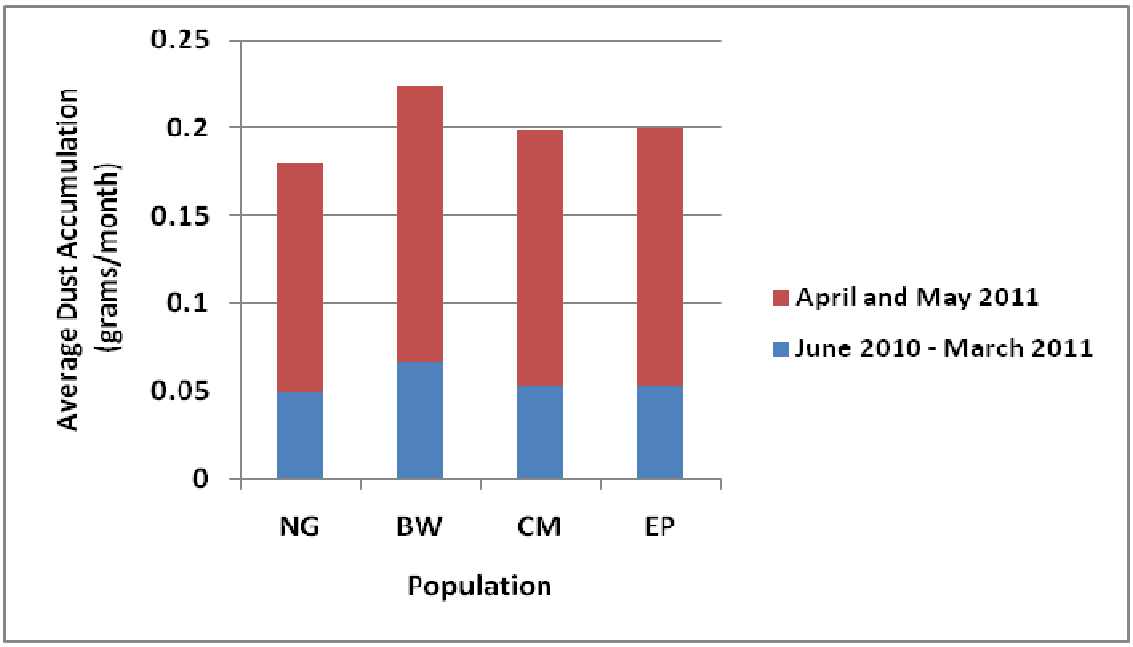

Figure 26. Dust accumulation in the four Lane Mountain milkvetch populations. Accumulation is measured from 4 dust collectors per population, twice per year.

Appendix I. Plot Data from 2011. The Deg and Dist columns represent the approximate number of degrees and centimeters the plant's root is located away from the tag. In cases where more than one stem was seen entering the soil, degrees and distance are given for each. Fruits 2011 and Flowers 2011 columns represent the number of fruits and flowers present at each plant at the first count only. Tag # -99 indicates a plant that is close to, but outside, the study plot.

Pop	Plot	Tag #	2011	Deg	Dist	Base	Fruits 2011	Flowers 2011
BW	1	181	DEAD					
BW	1	182	DEAD	20/20	51/54	seedling	0	0
BW	1	183	DEAD					
BW	1	184	DEAD					
BW	1	185	ALIVE	155	27	rigid	21	5
BW	1	186	ALIVE	100	18	woody	13	0
BW	1	187	NEW	200	25	woody	2	0
BW	1	188	NEW	170	20	not woody	32	0
BW	2	190	DEAD			seedling	0	0
BW	2	191	ALIVE	45	38	woody	93	67
BW	2	192	ALIVE	0	40	woody	166	125
BW	2	193	ALIVE	110	21	rigid	192	80
BW	2	194	DEAD					
BW	2	195	ALIVE	15	47	not woody	305	70
BW	2	196	NEW	290	27	rigid	107	3
BW	2	199	ALIVE	250	30	not woody	60	5
BW	2	201	DEAD					
BW	2	202	ALIVE	60	28	rigid	28	38
BW	3	-99	NEW			unknown	141	0
BW	3	103	ALIVE	85	45	unknown	305	52
BW	3	104	DEAD	320	20	seedling	0	0
BW	3	105	CNF					
BW	3	106	DEAD					
BW	3	107	DEAD					
BW	3	108	DEAD	270	18	seedling	0	0
BW	4	98	NEW			seedling	0	0
BW	4	99	NEW	220	19	woody	20	0
BW	4	100	NEW	0	30	not woody	30	0
BW	4	101	ALIVE	10	29	not woody	6	0
BW	4	102	DEAD					
BW	5	211	ALIVE	230	23	very woody	235	330
BW	5	212	ALIVE	65	27	woody	266	0

BW	6	109	DEAD					
BW	6	110	DEAD					
BW	6	111	DEAD					
BW	6	112	DEAD					
BW	6	113	DEAD	10	40	seedling	0	0
BW	6	114	DEAD					
BW	6	115	NEW	290	15	seedling	0	0
BW	6	116	DEAD					
BW	6	117	DEAD					
BW	6	118	ALIVE	17	25	unknown	166	0
BW	6	119	ALIVE	295	25	unknown	74	12
BW	6	120	NEW	285	45	woody	149	2
BW	7	161	DEAD					
BW	7	162	ALIVE	325	50	woody	7	0
BW	7	163	ALIVE	320	20	not woody	49	0
BW	7	164	ALIVE	5	21	woody	133	0
BW	7	165	NEW	100	23	not woody	38	0
BW	8	151	ALIVE	140	46	woody	249	0
BW	8	152	DEAD					
BW	8	153	DEAD			seedling	0	0
BW	8	154	ALIVE	125	25	not woody	103	10
BW	8	155	DEAD			seedling	0	0
BW	8	156	ALIVE	30	3	woody	9	0
BW	8	157	ALIVE	200	2	rigid	4	0
BW	9	251	ALIVE	330	60	very woody	209	0
BW	9	252	DEAD			seedling	0	0
BW	9	253	ALIVE	270	47	not woody	109	0
BW	9	255	ALIVE	60	20	rigid	33	7
BW	10	230	ALIVE	300	38	woody	1	0
BW	10	232	ALIVE	360	41	very woody	56	0
BW	10	233	DEAD					
BW	10	234	DEAD	210	28	seedling	0	0
BW	10	235	ALIVE	120	18	rigid	65	0
BW	10	236	ALIVE	220	16	rigid	63	0
BW	10	237	ALIVE	170	27	rigid	62	0
BW	10	238	NEW	265	20	rigid	7	0
BW	10	239	NEW	190	24	very woody	77	1
CM	1	693	ALIVE	115	18	not woody	16	2
CM	1	694	ALIVE	230	36	not woody	0	8
CM	1	695	ALIVE	20	36	not woody	17	6
CM	1	696	DEAD					

CM	1	697	DEAD					
CM	1	698	DEAD					
CM	1	699	DEAD			seedling	0	0
CM	1	700	DEAD					
CM	1	701	ALIVE	345	45	woody	305	195
CM	1	702	ALIVE	50	22	woody	13	19
CM	1	703	ALIVE	120	30	unknown	2	40
CM	1	704	DEAD					
CM	2	692	NEW	350	30	not woody	48	1
CM	2	770	ALIVE	350	29	woody	168	47
CM	2	771	ALIVE	300	52	woody	410	258
CM	2	772	DEAD					
CM	2	773	DEAD					
CM	2	774	DEAD			seedling	0	0
CM	2	775	ALIVE	310	56	woody	226	64
CM	2	776	ALIVE	60	32	rigid	20	53
CM	2	777	DEAD					
CM	2	778	ALIVE	270	31	very woody	126	73
CM	2	779	DEAD			seedling	0	0
CM	2	780	ALIVE	260	50	not woody	16	76
CM	2	781	ALIVE	0	36	rigid	70	109
CM	2	782	DEAD	310	30	seedling	0	0
CM	2	783	NEW	230	24	not woody	40	29
CM	2	784	NEW	275	17	not woody	11	35
CM	2	785	NEW	135	11	not woody	0	0
CM	2	786	NEW			seedling	0	0
CM	2	787	NEW	150	19	not woody	4	0
CM	3	684	NEW	75	27	rigid	5	14
CM	3	685	NEW	210	16	not woody	1	2
CM	3	686	NEW	80	20	seedling	0	0
CM	3	705	DEAD					
CM	3	706	DEAD			seedling	0	0
CM	3	707	ALIVE	235	10	not woody	3	1
CM	3	708	DEAD	40/60	60/65	seedling	0	0
CM	3	709	DEAD	295	43	seedling	0	0
CM	3	710	DEAD	235	8	seedling	0	0
CM	3	711	DEAD					
CM	3	712	DEAD	245/310	28/18	seedling	0	0
CM	3	713	ALIVE	225/115	30/42	not woody	0	3
CM	3	714	ALIVE	80	29	rigid	3	16
CM	3	715	DEAD			seedling	0	0

CM	3	716	ALIVE	210	22	not woody	0	1
CM	3	717	DEAD	305	20	not woody	0	0
CM	3	718	DEAD	330	25	seedling	0	0
CM	3	719	ALIVE	120	18	unknown	9	13
CM	3	720	DEAD			seedling	0	0
CM	3	721	DEAD	290	25	not woody	0	0
CM	3	722	ALIVE	300	25	woody	91	145
CM	3	723	DEAD					
CM	3	724	DEAD					
CM	3	725	ALIVE	270/270	1/26	unknown	35	135
CM	3	727	DEAD	20/0	30/30	seedling	0	0
CM	3	728	DEAD	305	14	seedling	0	0
CM	3	729	ALIVE	100	30	not woody	52	34
CM	3	730	DEAD					
CM	3	732	DEAD					
CM	3	734	DEAD					
CM	3	735	DEAD					
CM	3	736	DEAD					
CM	3	737	DEAD			seedling	0	0
CM	3	738	DEAD	110/105	45/45	seedling	0	0
CM	3	739	DEAD	150	20	seedling	0	0
CM	3	740	ALIVE			woody	33	386
CM	3	793	NEW	330	30	not woody	221	139
CM	3	794	NEW	150	16	not woody	0	0
CM	3	795	NEW	310	26	rigid	16	66
CM	3	796	NEW	240	25	not woody	4	6
CM	3	797	NEW	170	20	rigid	17	20
CM	4	639	ALIVE	140	27	not woody	0	36
CM	4	640	ALIVE	220	45	unknown	1	0
CM	4	641	DEAD			seedling	0	0
CM	4	740	DEAD			seedling	0	0
CM	4	741	ALIVE	280/240	28/16	rigid	1	2
CM	4	742	DEAD	10	25	not woody	0	0
CM	4	744	DEAD					
CM	4	745	DEAD	310	18	not woody	0	0
CM	4	746	DEAD					
CM	4	747	DEAD					
CM	4	748	ALIVE	200	40	unknown	2	33
CM	4	749	ALIVE	210	21	rigid	0	0
CM	4	750	DEAD			seedling	0	0
CM	4	751	DEAD			seedling	0	0

CM	4	752	ALIVE	160	16	woody	0	247
CM	4	753	ALIVE	155	29	woody	0	0
CM	5	-99	NEW			unknown	49	124
CM	5	753.1	DEAD					
CM	5	754	DEAD					
CM	5	755	ALIVE	170	25	not woody	32	105
CM	5	756	ALIVE	20	36	rigid	95	420
CM	5	757	ALIVE	5	30	not woody	258	260
CM	5	758	ALIVE	90	50	very woody	30	74
CM	5	759	ALIVE	310	33	woody	35	88
CM	5	760	ALIVE	145	28	rigid	23	260
CM	5	761	DEAD					
CM	5	762	DEAD					
CM	5	763	DEAD					
CM	5	764	ALIVE	40	20	woody	66	87
CM	5	765	DEAD					
CM	5	766	ALIVE	155	32	not woody	3	12
CM	5	767	ALIVE	135	27	rigid	51	185
CM	5	768	ALIVE	0	24	rigid	156	140
CM	5	769	ALIVE	175	15	rigid	37	55
CM	5	864	NEW	350	39	not woody	24	99
CM	5	865	NEW	290	37	not woody	18	105
CM	5	866	NEW	90	39	not woody	4	43
CM	5	867	NEW	290/280	11/30	not woody	175	515
CM	6	871	ALIVE	100	20	unknown	13	88
CM	6	872	ALIVE	220	25	unknown	0	47
CM	6	873	DEAD	320	35	seedling	0	0
CM	6	874	ALIVE	340	15	unknown	1	8
CM	6	875	ALIVE	190	20	unknown	297	320
CM	6	876	ALIVE	190	50	very woody	142	102
CM	6	877	ALIVE	210	25	unknown	5	9
CM	6	878	DEAD	210	20	unknown	0	0
CM	6	879	ALIVE	100	15	unknown	5	28
CM	6	880	DEAD	170	30	seedling	0	0
CM	6	881	DEAD	200	15	seedling	0	0
CM	6	882	DEAD					
CM	6	883	DEAD					
CM	6	884	ALIVE	15	30	unknown	23	92
CM	6	885	ALIVE	330	40	unkown	0	65
CM	6	886	NEW	215	15	unknown	0	3
CM	7	831	ALIVE	275	29	unknown	49	21

CM	7	832	ALIVE	300	40	woody	27	185
CM	7	833	ALIVE	350	46	rigid	2	60
CM	7	834	DEAD					
CM	7	835	DEAD	305	20	seedling	0	0
CM	7	836	ALIVE	115	45	rigid	297	9
CM	7	837	ALIVE	315	25	unknown	14	1
CM	8	801	DEAD					
CM	8	802	DEAD					
CM	8	803	DEAD					
CM	8	804	ALIVE	20	18	not woody	0	0
CM	8	805	NEW	115	20	not woody	0	0
CM	9	811	DEAD					
CM	9	812	DEAD			seedling	0	0
CM	9	813	DEAD			seedling	0	0
CM	9	814	DEAD			seedling	0	0
CM	9	815	ALIVE	0	20	rigid	46	0
CM	9	817	DEAD					
CM	9	818	ALIVE	110	20	rigid	120	0
CM	10	847	ALIVE	360	35	unknown	38	96
CM	10	848	ALIVE	10	320	unknown	0	12
CM	10	849	ALIVE	210	15	unknown	2	9
CM	10	850	CNF					
CM	10	851	DEAD	40	15	seedling	0	0
CM	10	852	ALIVE	340	10	unknown	4	83
CM	10	853	ALIVE	30	20	unknown	20	32
CM	10	854	ALIVE	80	20	unknown	0	0
CM	10	886	NEW	275	45	unknown	29	127
CM	10	887	NEW	30	22	unknown	0	0
EP	1	489	ALIVE	165	28	not woody	156	115
EP	1	495	DEAD					
EP	1	496	DEAD					
EP	1	497	DEAD			seedling	0	0
EP	1	498	DEAD					
EP	1	499	DEAD					
EP	1	500	DEAD					
EP	1	501	ALIVE	195	25	rigid	14	125
EP	1	502	ALIVE	185	48	woody	186	325
EP	1	503	DEAD			seedling	0	0
EP	1	504	CNF					
EP	1	505	ALIVE	350	30	not woody	170	98
EP	1	506	ALIVE	0	28	not woody	115	21

EP	1	507	ALIVE	15	40	woody	124	89
EP	1	508	DEAD					
EP	1	509	DEAD					
EP	1	510	DEAD					
EP	1	511	DEAD			seedling	0	0
EP	1	512	CNF					
EP	1	513	ALIVE	265	38	woody	160	146
EP	2	514	DEAD			seedling	0	0
EP	2	515	ALIVE	185	47	unknown	110	230
EP	2	516	DEAD					
EP	2	517	ALIVE	10	34	not woody	185	86
EP	2	518	ALIVE	195	17	not woody	43	13
EP	2	519	DEAD					
EP	2	520	ALIVE	0	60	not woody	147	102
EP	2	521	ALIVE	355	16	not woody	120	11
EP	3	855	DEAD	15	20	seedling	0	0
EP	3	856	DEAD					
EP	3	857	DEAD					
EP	3	858	DEAD			seedling	0	0
EP	3	859	DEAD			seedling	0	0
EP	3	860	ALIVE	110	30	unknown	1115	34
EP	3	861	DEAD					
EP	3	862	DEAD					
EP	3	863	NEW	230	25	rigid	13	0
EP	3	864	NEW	115	23	unknown	12	3
EP	4	522	DEAD					
EP	4	523	DEAD					
EP	4	524	ALIVE	220	8	not woody	315	0
EP	4	525	ALIVE	175	8	unknown	90	1
EP	4	526	NEW	325	25	not woody	173	2
EP	4	527	ALIVE	270	18	woody	192	0
EP	4	528	NEW	305	35	not woody	0	0
EP	4	529	NEW	45	25	not woody	74	0
EP	5	630	ALIVE	170	28	rigid	105	0
EP	5	631	ALIVE	280	45	woody	9	0
EP	6	568	ALIVE	245	17	very woody	16	0
EP	6	569	ALIVE	220	14	woody	104	133
EP	6	570	ALIVE	110	27	woody	0	0
EP	6	571	ALIVE	160	60	woody	114	19
EP	6	572	ALIVE	130	62	very woody	380	220
EP	6	573	ALIVE	185	30	not woody	410	194

EP	6	574	ALIVE			not woody	0	0
EP	6	575	DEAD					
EP	6	576	DEAD					
EP	6	577	ALIVE	335	27	very woody	12	280
EP	6	578	ALIVE	110	23	not woody	236	16
EP	7	540	DEAD					
EP	8	559	ALIVE	0	19	very woody	275	94
EP	8	560	ALIVE	300	38	very woody	254	105
EP	8	561	ALIVE	355	19	rigid	81	102
EP	8	562	DEAD			seedling	0	0
EP	8	563	DEAD			seedling	0	0
EP	8	564	DEAD					
EP	9	-99	NEW			unknown	0	0
EP	9	-99	NEW			unknown	0	0
EP	9	401	DEAD					
EP	9	402	DEAD			seedling	0	0
EP	9	404	DEAD					
EP	9	405	ALIVE	20	24	not woody	88	55
EP	9	406	ALIVE	190	47	unknown	137	112
EP	9	407	DEAD			seedling	0	0
EP	9	408	ALIVE	100	30	unknown	47	0
EP	9	409	DEAD					
EP	9	410	ALIVE	40	39	very woody	211	43
EP	9	411	ALIVE	330	34	not woody	26	3
EP	9	412	NEW	270	25	not woody	0	0
EP	9	413	NEW	320	16	not woody	0	0
EP	10	621	ALIVE	340	30	unknown	206	0
EP	10	622	ALIVE	280	36	unknown	166	0
EP	10	623	DEAD			seedling	0	0
EP	10	624	DEAD					
NG	2	430	ALIVE	0	21	rigid	54	3
NG	2	431	ALIVE	275	30	rigid	220	28
NG	2	432	DEAD					
NG	2	433	ALIVE	300	21	not woody	41	0
NG	2	434	ALIVE	340/330	17/18	woody	440	50
NG	2	435	ALIVE	0	27	rigid	230	19
NG	3	300	ALIVE	220	21	unknown	98	4
NG	3	301	DEAD					
NG	3	302	DEAD					
NG	3	303	ALIVE	30	37	woody	340	1
NG	3	304	DEAD					

NG	4	421	DEAD					
NG	5	374	ALIVE	40	22	rigid	87	0
NG	5	375	DEAD					
NG	5	376	DEAD					
NG	5	377	ALIVE	150	17	woody	224	1
NG	6	441	DEAD					
NG	6	442	DEAD					
NG	6	443	ALIVE	230	18	not woody	36	9
NG	6	444	ALIVE	270	49	woody	89	4
NG	6	445	ALIVE	170	21	very woody	28	0
NG	7	360	ALIVE	250	15	woody	31	1
NG	7	361	DEAD					
NG	7	362	DEAD	0	0	seedling	0	0
NG	7	363	DEAD				0	0
NG	7	364	ALIVE	220	68	very woody	174	0
NG	7	365	DEAD					
NG	7	366	DEAD					
NG	7	367	DEAD			seedling	0	0
NG	7	368	DEAD					
NG	7	369	DEAD	0	20	seedling	0	0
NG	7	370	DEAD					
NG	7	371	NEW	280	20	very woody	30	0
NG	7	372	NEW	350	15	rigid	52	3
NG	8	-99	NEW			unknown	300	450
NG	8	305	ALIVE	315	28	not woody	63	138
NG	8	306	DEAD					
NG	8	307	DEAD					
NG	8	308	ALIVE	325	39	woody	76	175
NG	8	309	DEAD					
NG	8	310	DEAD					
NG	8	311	ALIVE	80	28	rigid	170	140
NG	8	312	DEAD					
NG	8	313	DEAD					
NG	8	314	DEAD			seedling	0	0
NG	8	315	DEAD					
NG	8	316	ALIVE	350/20	18/18	woody	47	165
NG	8	317	DEAD					
NG	8	318	DEAD					
NG	8	319	NEW			seedling	0	5
NG	8	372	DEAD					
NG	9	321	DEAD					

NG	9	322	DEAD					
NG	9	323	DEAD					
NG	9	324	DEAD					
NG	9	325	ALIVE	205	60	unknown	65	80
NG	9	326	ALIVE	40	23	rigid	10	85
NG	9	327	ALIVE	100	17	woody	8	50
NG	9	328	ALIVE	160	13	not woody	20	105
NG	9	329	DEAD					
NG	9	330	DEAD					
NG	10	340	ALIVE	180	25	unknown	110	400
NG	10	341	DEAD					
NG	10	342	DEAD					
NG	10	343	DEAD			seedling	0	0
NG	10	344	ALIVE	230	15	woody	315	1195
NG	10	345	ALIVE	100	30	not woody	24	158
NG	10	346	NEW	280	26	not woody	51	51

Appendix II. New plants found during the 2011 census. Tag # -99 indicates a plant that is close to, but outside, the study plot.

Pop	Plot	Tag #	Easting	Northing
BW	1	187	515849	3893711
BW	1	188	515860	3893718
BW	2	196	516405	3893147
BW	3	-99	514554	3893950
BW	4	98	514185	3894359
BW	4	99	514199	3894349
BW	4	100	514213	3894354
BW	6	115	514826	3893956
BW	6	120	514815	3893982
BW	7	165	515431	3895118
BW	10	238	515685	3894238
BW	10	239	515690	3894242
CM	2	692	503457	3884188
CM	2	783	503485	3884192
CM	2	784	503483	3884170
CM	2	785	503493	3884194
CM	2	786	503487	3884197
CM	2	787	503484	3884190
CM	3	684	502673	3883478
CM	3	685	502663	3883499

CM	3	686	502678	3883481
CM	3	793	502686	3883503
CM	3	794	502686	3883499
CM	3	795	502696	3883502
CM	3	796	502664	3883493
CM	3	797	502655	3883485
CM	5	-99	504129	3884544
CM	5	864	504136	3884528
CM	5	865	504134	3884549
CM	5	866	504143	3884545
CM	5	867	504145	3884508
CM	6	886	496993	3882752
CM	8	805	497407	3883411
CM	10	886	497322	3882655
CM	10	887	497297	3882652
EP	3	863	508348	3892995
EP	3	864	508334	3893012
EP	4	526	507822	3893537
EP	4	528	507829	3893498
EP	4	529	507857	3893502
EP	9	-99	506206	3893068
EP	9	-99	506208	3893112
EP	9	412	506181	3893077
EP	9	413	506201	3893074
NG	7	371	518343	3899339
NG	7	372	518343	3899339
NG	8	-99	519177	3788612
NG	8	319	519196	3899581
NG	10	346	519640	3899775

BIOLOGICAL ASSESSMENT OF THE EFFECTS OF SOLAR ENERGY DEVELOPMENT ON THE U.S. BUREAU OF LAND MANAGEMENT'S PROPOSED SOLAR ENERGY ZONES

MAY 2012

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NOTATION

The following is a list of acronyms, abbreviations, and units of measure used in this document. Some acronyms used only in tables may be defined only in those tables.

GENERAL ACRONYMS AND ABBREVIATIONS

AVWS	audio visual warning system
AZGFD	Arizona Game and Fish Department
BA	Biological Assessment
BLM	Bureau of Land Management
BO	Biological Opinion
CDFG	California Department of Fish and Game
CFR	*Code of Federal Regulations*
CNDDB	California Natural Diversity Database
DOE	U.S. Department of Energy
DOI	U.S. Department of the Interior
DWMA	Desert Wildlife Management Area
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act of 1973
FAA	Federal Aviation Administration
FR	*Federal Register*
GAP	Gap Analysis Project
GHG	greenhouse gas
HTF	heat transfer fluid
NEPA	National Environmental Policy Act of 1969
NISC	National Invasive Species Council
NMDGF	New Mexico Department of Game and Fish
NP	National Park
NSTC	National Science and Technology Council
NWR	National Wildlife Refuge
PEIS	programmatic environmental impact statement
PV	photovoltaic
ROD	Record of Decision
ROW	right-of-way

SEZ	solar energy zone
SWReGAP	Southwest Regional Gap Analysis Project
UDWR	Utah Division of Wildlife Resources
U.S.	United States
USFWS	U.S. Fish and Wildlife Service
USGCRP	U.S. Global Change Research Program
USGS	U.S. Geological Survey

UNITS OF MEASURE

ac-ft	acre-foot (feet)
°C	degree(s) Celsius
cm	centimeter(s)
°F	degree(s) Fahrenheit
ft	foot(ft)
in.	inch(es)
km	kilometer(s)
km^2	square kilometer(s)
m	meter(s)
m^3	cubic meter(s)
mi	mile(s)
MW	megawatt(s)
yr	year(s)

1 INTRODUCTION

1.1 BACKGROUND

Section 7(a)(2) of the Endangered Species Act (as amended) (ESA) requires every federal agency, in consultation with and with the assistance of the Secretary of the Interior, to ensure that any action it authorizes, funds, or carries out in the United States or on the high seas is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. Section 7(b) of the ESA requires the Secretary, after conclusion of early or formal consultation, to issue a written statement (Biological Opinion [BO]) setting forth the Secretary's opinion detailing how the agency action affects listed species or critical habitat. Biological Assessments (BAs) are required under Section 7(c) of the Act if listed species or critical habitat may be present in the area affected by any major construction activity as defined in Title 50, Part 402.02 of the *Code of Federal Regulations* (50 CFR 402.02). This BA was prepared to meet the above requirements for initiating consultation and to facilitate the issuance of a BO.

1.2 PURPOSE AND FRAMEWORK OF THIS BIOLOGICAL ASSESSMENT

The purpose of this Draft BA is to assess the effects of solar energy development within designated areas on U.S. Department of the Interior (DOI) Bureau of Land Management (BLM)-administered lands in six southwestern states on federally listed and proposed species and any designated or proposed critical habitat. The six states are Arizona, California, Colorado, Nevada, New Mexico, and Utah. The areas identified to be evaluated for solar energy development in this BA are proposed solar energy zones (SEZs). Solar energy development on these proposed SEZs is considered to be part of the BLM's Proposed Solar Energy Program. A detailed description of the Proposed Solar Energy Program and associated environmental impacts is provided in the *Draft Programmatic Environmental Impact Statement for Solar Energy Development in Six Southwestern States* (hereafter referred to as "Draft PEIS") (BLM and DOE 2010) and in the *Supplement to the Draft Programmatic Environmental Impact Statement for Solar Energy Development in Six Southwestern States* (hereafter referred to as the "Supplement") (BLM and DOE 2011). The proposed action is summarized in Section 2 of this BA.

The SEZs considered for solar energy development may contain, or be in close proximity to, known populations, critical habitats, or potentially suitable habitats for listed species. This BA examines the potential effects of development in the proposed SEZs under the Solar Energy Program in order to facilitate U.S. Fish and Wildlife Service (USFWS; hereafter referred to as the "Service") analysis of jeopardy for ESA-listed species.

This BA, where appropriate, incorporates by reference information from the Draft PEIS and the Supplement. Information specific to the effects determination for listed or proposed species or designated critical habitat is included in this document.

1.3 DOCUMENT ORGANIZATION

This BA consists of four main parts: (1) a description of the proposed action, including required project design features and other minimization measures that will be followed to ensure compliance with the ESA; (2) a description of the process by which species were identified for inclusion in this BA, which was based on the location and characteristics of the action area and known common impacts of solar energy development on ecological resources; (3) a discussion of all species that could occur in the affected area that are federally listed as threatened or endangered or that are proposed for federal listing under the ESA (including species descriptions and potential effects of the proposed action); and (4) cumulative effects.

Section 2 of this BA provides a description of the proposed action for the purposes of this BA and a listing of the required project design features to address potential ecological impacts. Under the proposed action, the BLM would establish a Solar Energy Program that would improve the efficiency of land use decisions for utility-scale solar energy rights-of-way (ROWs) on the designated SEZs. Based upon analyses and information presented in the Supplement, approximately 285,000 acres (1,153 km^2) of BLM-administered lands have been identified as proposed SEZs in the six-state region.

The proposed action also includes required project design features to avoid or reduce impacts on environmental resources. Design features are mitigation measures that the BLM would require of any utility-scale solar energy development on the proposed SEZs.

Section 3 describes the process for identifying species for formal consultation in this BA.

Section 4 describes the geographic scope of the action area and provides a summary of common utility-scale solar energy development.

Section 5 discusses the impacts of utility-scale solar energy development and BLM's proposed action on ecological resources and ESA-listed species. Section 5.1 discusses general and technology-specific impacts on ecological resources, and Section 5.2 discusses anticipated effects on species that could occur in the proposed SEZ affected areas.

Section 6 presents a discussion of cumulative effects. Under the ESA, cumulative effects are considered the effects of future state, Tribal, local, or private actions that are reasonably certain to occur in the action area considered in this BA, in addition to the potential solar development assessed in this BA. Future federal actions unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA.

2 PROPOSED ACTION

2.1 DESCRIPTION OF THE PROPOSED ACTION

The BLM proposes to establish a new Solar Energy Program of administration and authorization policies and required design features to replace certain elements of its existing Solar Energy Policies (BLM 2007a; 2010a,b). The proposed program would be established for BLM-administered lands in six southwestern states—Arizona, California, Colorado, Nevada, New Mexico, and Utah. Not all BLM-administered lands are appropriate for solar energy development. Under the proposed action, the BLM would identify a number of SEZs within the lands available for ROW application where the BLM would prioritize solar energy and associated transmission infrastructure development. The proposed SEZs are shown in Figures 2-1 through 2-6 and listed by state with acreage, BLM field office, and county in Table 2-1. Approximately 285,000 acres (1,153 km^2) have been identified as proposed SEZs.

The process of identifying SEZs was undertaken by the BLM state and field offices. Characteristics of SEZs that made them more suitable for solar energy development include proximity to existing transmission or designated corridors and roads, slopes of 1 to 2% or less, and a minimum of 2,500 acres (10.1 km^2) in size. The exclusion areas listed in Table 2-2 were used to determine lands available for ROW application, as well as the proposed SEZs.[1] Additional filters were also applied by the field office staff based on local conditions, institutional knowledge, and coordination efforts.

Through the Record of Decision (ROD) for the Final PEIS, the BLM may decide to carry forward some or all of the proposed SEZs as part of the agency's Solar Energy Program. Further, the Secretary of the Interior may decide to withdraw the public lands encompassed in the SEZs from potentially conflicting uses through the issuance of a Public Land Order.

The proposed Solar Energy Program would also establish comprehensive program administration and authorization policies and design features to be applied to all utility-scale solar energy projects on BLM-administered lands in the six-state action area. The BLM would establish additional SEZ-specific design features to address SEZ-specific resource conflicts. Collectively, these design features represent the most widely accepted methods to avoid and/or minimize potential impacts from the types of activities associated with solar energy development and to successfully administer solar energy development on public lands.

Under the proposed Solar Energy Program, individual ROW applications would continue to be evaluated on a project-by-project basis; however, the BLM proposes that these evaluations would tier to the programmatic analyses presented in the Final PEIS and the decisions implemented in the resultant ROD and land use plan amendments to the extent appropriate.

[1] Data for several exclusion categories could not be mapped because of the lack of data. Exclusion areas that could not be mapped would be identified during pre-application consultations with local BLM staff or site-specific evaluation of individual ROW applications.

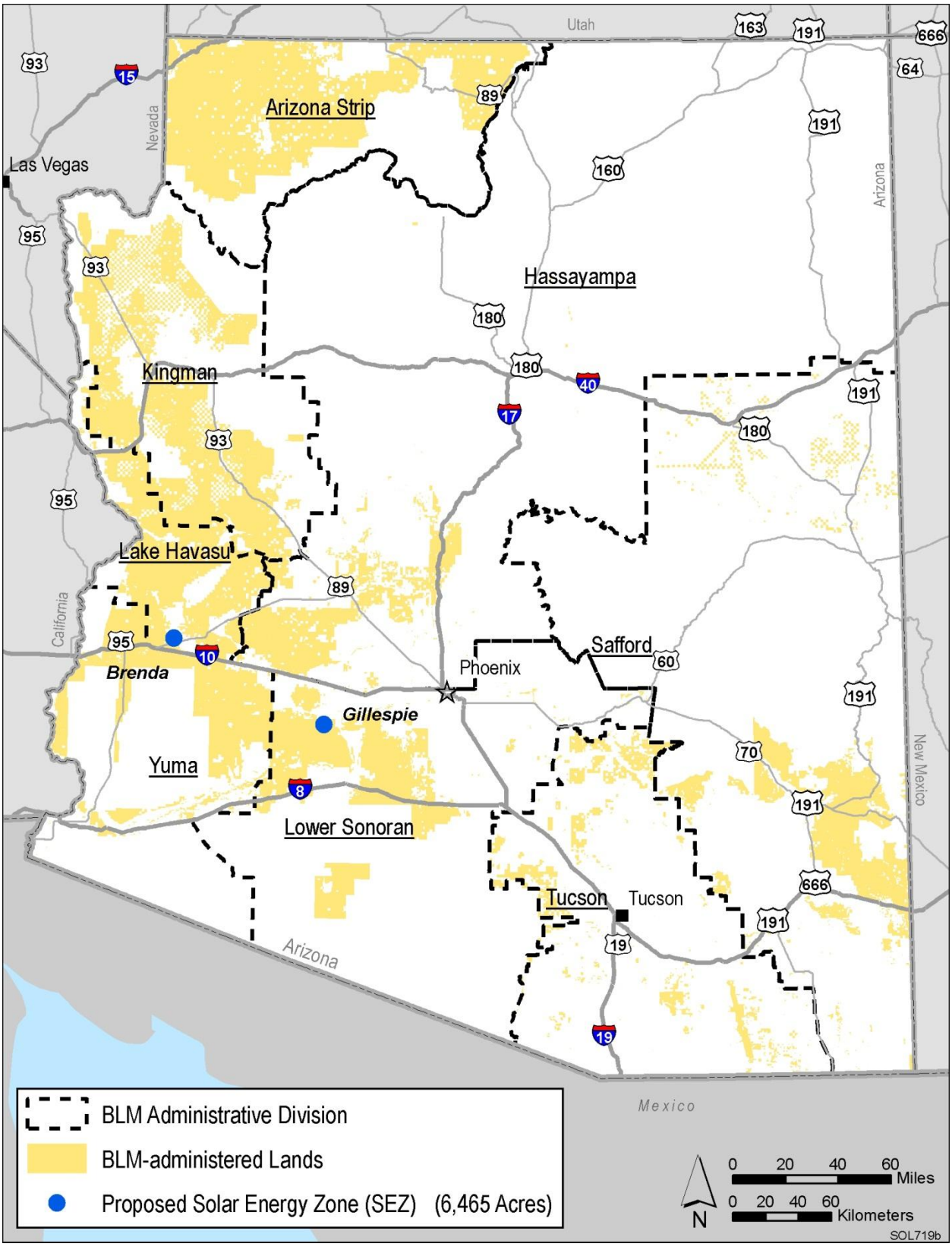

FIGURE 2-1 BLM-Administered Lands and Proposed SEZs in Arizona

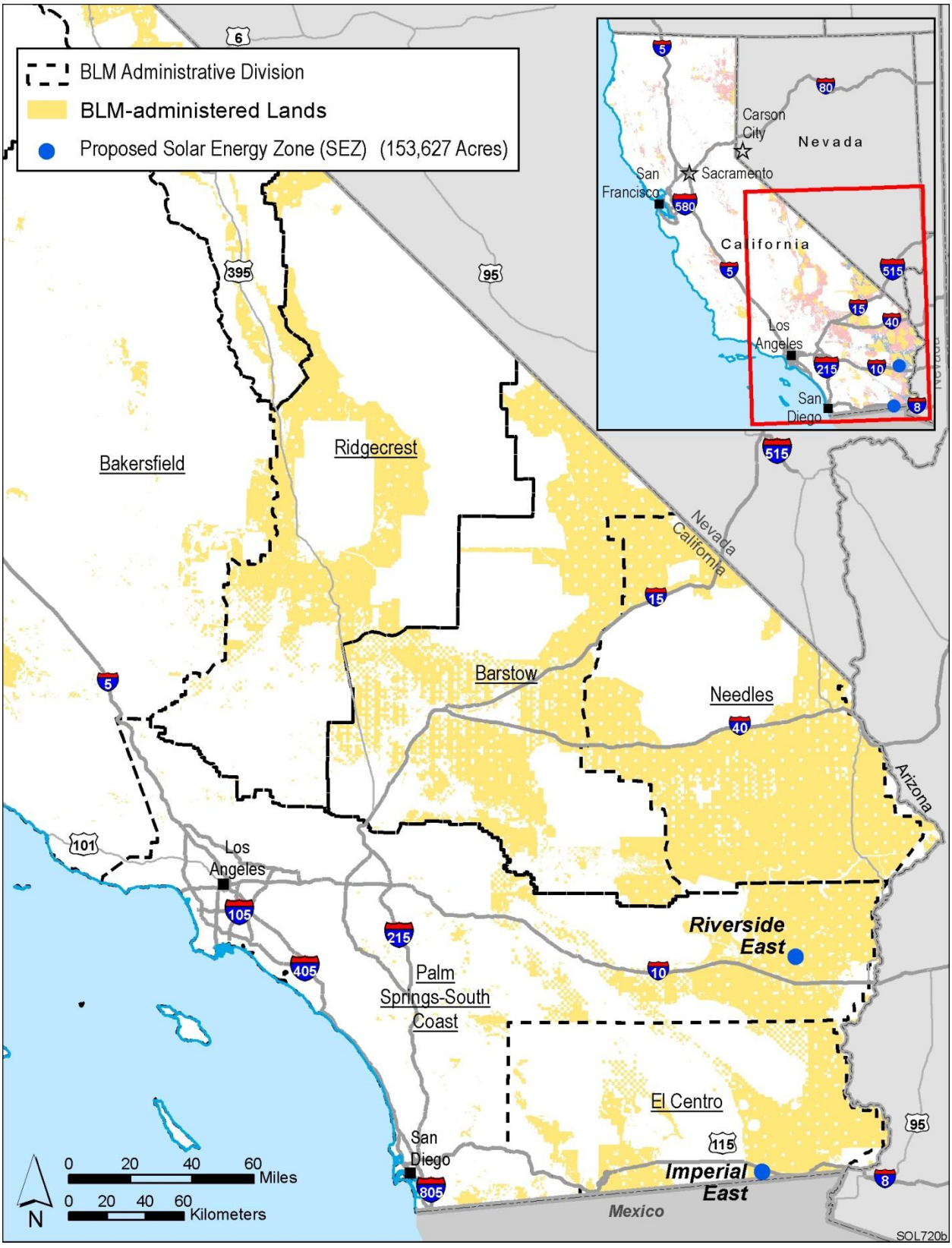

FIGURE 2-2 BLM-Administered Lands and Proposed SEZs in California

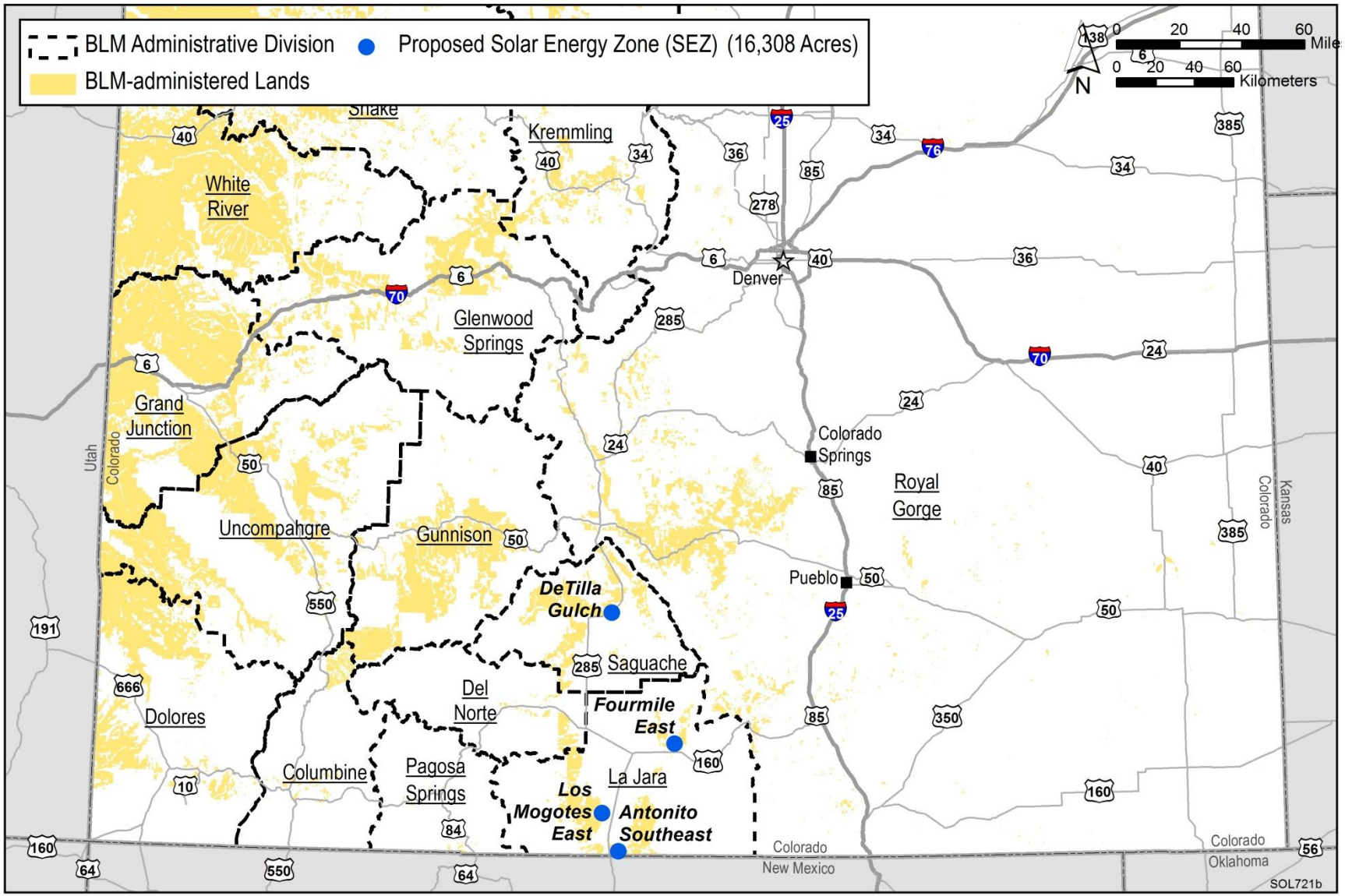

FIGURE 2-3 BLM-Administered Lands and Proposed SEZs in Colorado

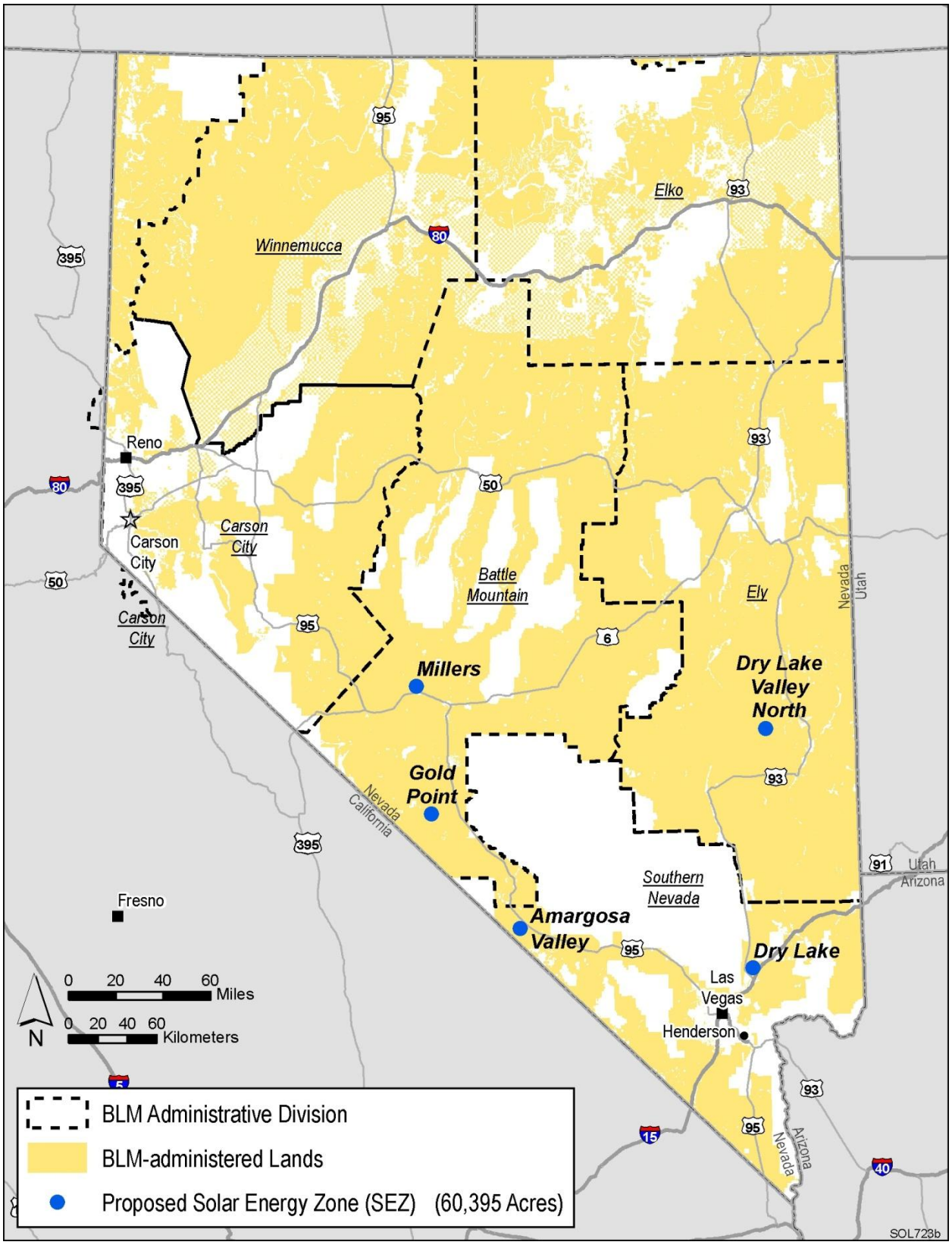

FIGURE 2-4 BLM-Administered Lands and Proposed SEZs in Nevada

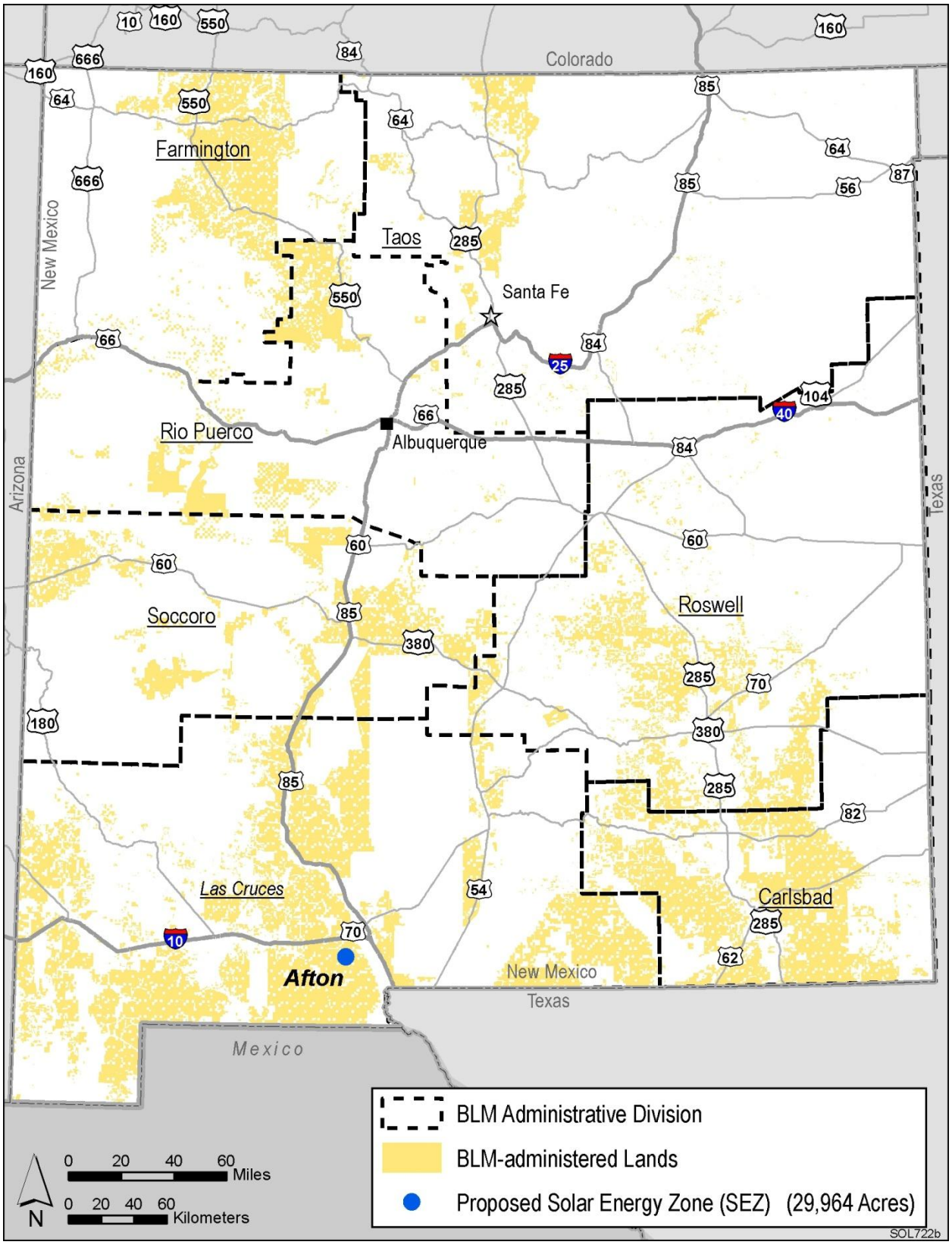

FIGURE 2-5 BLM-Administered Lands and Proposed SEZs in New Mexico

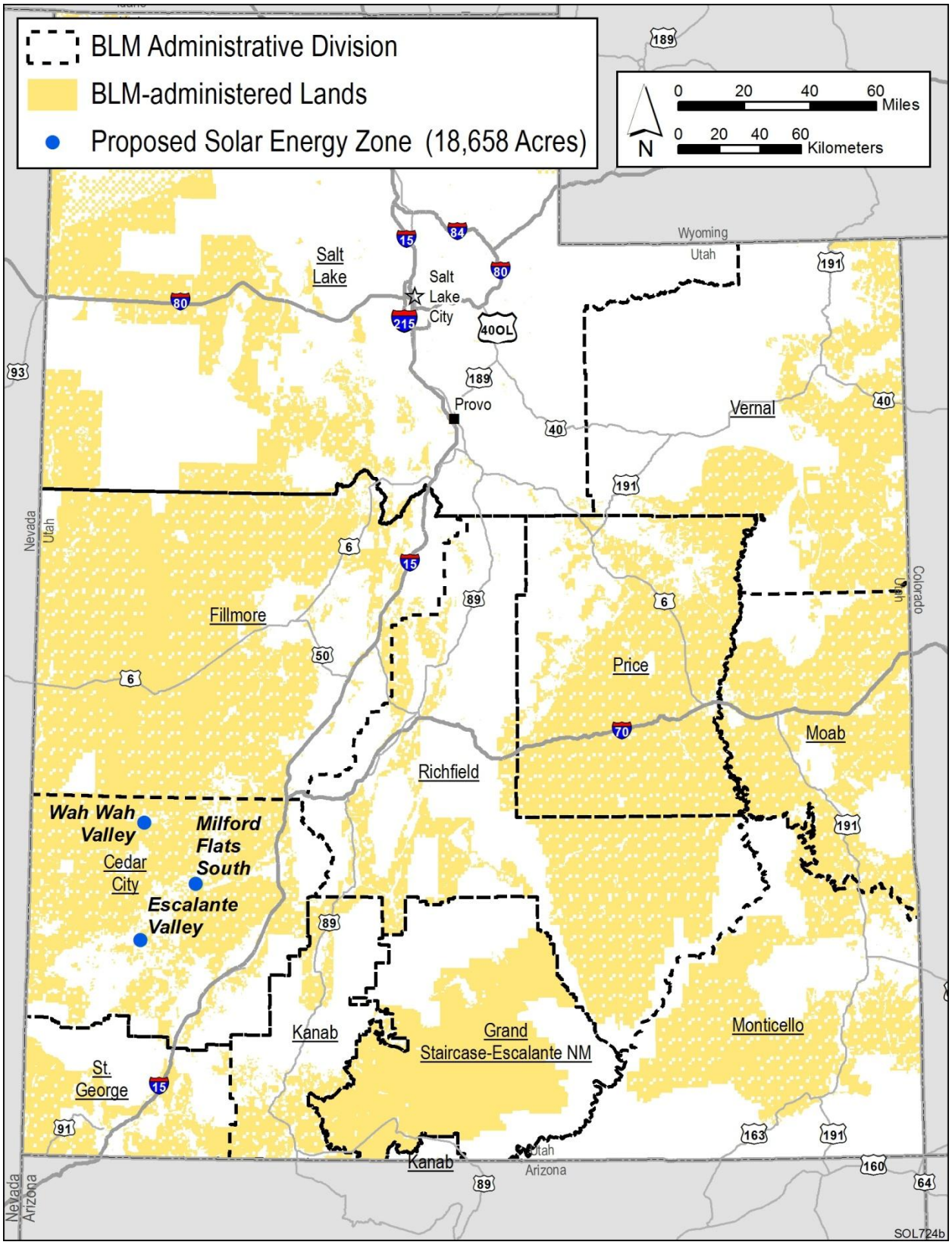

FIGURE 2-6 BLM-Administered Lands and Proposed SEZs in Utah

TABLE 2-1 Proposed SEZs and Approximate Acreage by State[a]

Proposed SEZ (BLM Office/County)	Total SEZ Approximate Acreage	Developable Area Approximate Acreage
Arizona		
Brenda (Lake Havasu/La Paz)	3,878	3,847
Gillespie (Lower Sonoran/Maricopa)	2,618	2,618
Total	6,496	6,465
California		
Imperial East (El Centro/Imperial)	5,722	5,717
Riverside East (Palm Springs–South Coast/Riverside)	159,457	147,910
Total	165,179	153,627
Colorado		
Antonito Southeast (La Jara/Conejos)	9,729	9,712
De Tilla Gulch (Saguache/Saguache)	1,064	1,064
Fourmile East (La Jara/Alamosa)	2,883	2,882
Los Mogotes East (La Jara/Conejos)	2,650	2,650
Total	16,326	16,308
Nevada		
Amargosa Valley (Southern Nevada/Nye)	9,737	8,479
Dry Lake (Southern Nevada/Clark)	6,186	5,717
Dry Lake Valley North (Ely/Lincoln)	28,726	25,069
Gold Point (Battle Mountain/Esmeralda)	4,810	4,596
Millers (Battle Mountain/Esmeralda)	16,787	16,534
Total	66,246	60,395
New Mexico		
Afton (Las Cruces/ Doña Ana)	30,706	29,964
Total	30,706	29,964
Utah		
Escalante Valley (Cedar City/Iron)	6,614	6,533
Milford Flats South (Cedar City/Beaver)	6,480	6,252
Wah Wah Valley (Cedar City/Beaver)	6,097	5,873
Total	19,191	18,658
Total	304,144	285,417

[a] To convert acres to km^2, multiply by 0.004047.

TABLE 2-2 Revised Areas for Exclusion under the BLM's Solar Energy Development Program

1. Lands with slopes greater than 5%.
2. Lands with solar insolation levels less than 6.5 kWh/m^2/day.
3. All Areas of Critical Environmental Concern (ACECs), including Desert Wildlife Management Areas (DWMAs) in the California Desert District.
4. All critical habitat areas (designated and proposed) for listed species under the Endangered Species Act of 1973 (as amended).
5. All areas where the applicable land use plan designates no surface occupancy (NSO).
6. All areas where there is an applicable land use plan decision to protect lands with wilderness characteristics.
7. Developed recreational facilities, special-use permit recreation sites (e.g., ski resorts and camps), and all Special Recreation Management Areas (SRMAs), except for those in the State of Nevada and a portion of the Yuma East SRMA in Arizona.[a]
8. All areas where solar energy development proposals are not demonstrated to be consistent with the land use management prescriptions for or where the BLM has made a commitment to take certain actions with respect to sensitive species habitat, including but not limited to sage grouse core areas, nesting habitat, and winter habitat; Mohave ground squirrel habitat; flat-tailed horned lizard habitat; and fringe-toed lizard habitat. Greater sage-grouse habitat as identified by the BLM is excluded in California, Nevada, and Utah, and Gunnison's sage-grouse habitat is excluded in Utah.[b]
9. All ROW exclusion areas identified in applicable plans other than those specific to utility-scale solar energy development.
10. All ROW avoidance areas identified in applicable plans other than those specific to utility-scale solar energy development.
11. All areas where the land use plan designates seasonal restrictions.
12. All Desert Tortoise translocation sites identified in applicable land use plans.
13. Big Game Migratory Corridors identified in applicable land use plans.
14. Big Game Winter Ranges identified in applicable land use plans.
15. Research Natural Areas.
16. Lands categorized as Visual Resource Management (VRM) Class I or II (and, in Utah, Class III[c]).
17. National Recreation Trails and National Back Country Byways.
18. National Historic and Scenic Trails, including a corridor of 0.25 mi (0.4 km) from the centerline of the trail, except where a corridor of a different width has been established.

TABLE 2-2 (Cont.)

19. National Historic and Natural Landmarks.

20. Within the boundary of properties listed in the *National Register of Historic Places* and additional lands outside the designated boundaries to the extent necessary to protect values where the setting and integrity is critical to their designation or eligibility.

21. Areas with important cultural and archaeological resources, such as traditional cultural properties and Native American sacred sites, as identified through consultation and recognized by the BLM.

22. Wild, Scenic, and Recreational Rivers, including a corridor of 0.25 mi (0.4 km) from the ordinary high-water mark on both sides of the river, except where a corridor of a different width has been established.

23. Segments of rivers determined to be eligible or suitable for Wild or Scenic River status, including a corridor of 0.25 mi (0.4 km) from the ordinary high-water mark on either side of the river.

24. Old Growth Forest.

25. Lands within a solar energy development application found to be inappropriate for solar energy development through an environmental review process that occurred prior to finalization of the Draft Solar PEIS.[d]

26. Lands previously proposed for inclusion in SEZs that were determined to be inappropriate for development through the NEPA process (i.e., the previously proposed Iron Mountain SEZ area; parts of the Pisgah and Riverside East SEZs in California; parts of the De Tilla Gulch, Fourmile East, and Los Mogotes East SEZs in Colorado; and parts of the Amargosa Valley SEZ in Nevada).

27. Lands within the proposed Mojave Trails National Monument in California.[e]

28. BLM-administered lands in California proposed for transfer to the National Park Service with the concurrence of the BLM.[f]

29. Individual additional areas identified by BLM state or field offices as requiring exclusion due to ecological or cultural concerns.

[a] In Nevada, many designated SRMAs are located on semi-degraded lands that might be appropriate for solar development. Decisions on solar ROW applications within Nevada SRMAs will be made on a case-by-case basis. A portion of the Yuma East SRMA was identified as a variance area rather than as an exclusion area based on its designation as VRM Class III and as a rural developed recreation setting, both of which allow for modifications to the natural environment.

[b] In April 2010, the Service published its listing for the greater sage-grouse as "Warranted but Precluded." Inadequacy of regulatory mechanisms was identified as a major threat in the Service finding on the petition to list the greater sage-grouse. The Service has identified the principal regulatory mechanism for the BLM as conservation measures in Resource Management Plans (RMPs). On the basis of the identified threats to the greater sage-grouse and the Service's time line for making a listing decision on this species, the BLM has initiated action to incorporate explicit objectives and adequate conservation measures into RMPs (including PEISs and project EISs) within the next 3 years in order to conserve greater sage-grouse and avoid a potential listing under the ESA. To meet the objectives of BLM's sage-grouse conservation policy, the Solar PEIS has excluded specifically identified sage-grouse habitat (currently occupied, brooding, and winter habitat) located on BLM public lands in Nevada and Utah.

Footnotes continued on next page.

1

TABLE 2-2 (Cont.)

[c] In Utah, VRM Class III lands have also been removed due to the high sensitivity and location proximity to Zion, Bryce, Capital Reef, Arches, and Canyonlands National Parks, and to significant Cultural Resource Special Management Areas (in southeast Utah).

[d] For example, lands considered nondevelopable in the environmental review for the Ivanpah Solar Electric Generating System, Imperial Valley Solar Project, Calico Solar Project, Genesis Ford Dry Lake Solar Project, Blythe Solar Project, and Desert Sunlight Solar Project.

[e] As described in Senate Bill 138, California Desert Protection Act of 2011, introduced in the 112th Congress.

[f] Three specific geographic areas described as (1) the narrow strip of BLM-administered lands between Fort Irwin and Death Valley National Park, (2) an area of public lands on the northeastern side of the Mojave National Preserve adjacent to the California and Nevada border, and (3) an area along the northern boundary of Joshua Tree National Park.

Site- and project-specific data would be assessed in the individual project reviews, and impacts not adequately reduced by the program's administration and authorization policies and design features would be addressed through the implementation of additional requirements incorporated into the project Plan of Development and ROW authorization stipulations. Analysis of an application may result in a decision to deny the application.

The BLM will develop and incorporate into its Solar Energy Program an adaptive management and monitoring plan for solar energy development, in coordination with potentially affected natural resource management agencies, to ensure that data and lessons learned about the impacts of solar energy projects will be collected, reviewed, and, as appropriate, incorporated into the BLM's Solar Energy Program in the future. Changes to the BLM's Solar Energy Program resulting from adaptive management and monitoring will be subject to appropriate land use planning, environmental review, and/or policy development.

The elements of the new Solar Energy Program would be implemented through amendment of the land use plans within the six-state study area.

2.2 REQUIRED PROGRAMMATIC DESIGN FEATURES

An important element of this proposed Solar Energy Program would be the establishment of design features—measures that have been incorporated into the proposed action to avoid or reduce adverse impacts. These proposed design features would be applicable to all utility-scale solar energy projects on BLM-administered lands. They would establish a broad array of requirements applicable to each phase of development (i.e., site evaluation, construction, operation, and decommissioning) to protect natural and cultural resources, resource uses, and specially designated areas. The proposed design features that are relevant to the protection of species listed under the ESA are presented below. A complete list of design features is presented in Appendix A of the PEIS.

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2.2.1 Design Features Related to Siting of Facilities

- To the extent practicable, projects will be sited on previously disturbed lands in close proximity to energy load centers to avoid and minimize impacts on remote, undisturbed lands.

- Existing access roads, utility corridors, and other infrastructure will be used to the maximum extent feasible.

- As practical, staging and parking areas will be located within the site of the utility-scale solar energy facility to minimize habitat disturbance in areas adjacent to the site.

- Appropriate agencies (e.g., the BLM, the Service, and state resource management agencies) will be contacted early in the planning process to identify the known or potential locations of federally listed threatened and endangered species and their habitats, including designated critical habitat, in the area proposed for a solar energy facility and associated access roads and ROWs. This coordination will be used to identify the need for and scope of pre-disturbance surveys of the project area and vicinity.

- All pre-disturbance surveys will be conducted by qualified biologists following accepted protocols established by the Service for the presence of listed species in the project area and to identify and delineate the boundaries of important, sensitive, or unique habitats in the project vicinity that may support listed species (e.g., springs, seeps, ephemeral streams, intermittent streams, 100-year floodplains, ponds and other aquatic habitats, riparian habitat, remnant vegetation associations, and sand dune systems).

- Projects will be sited and designed to avoid direct and indirect impacts on important, sensitive, or unique habitats in the project vicinity, including, but not limited to, waters of the United States, wetlands (both jurisdictional and nonjurisdictional), springs, seeps, streams (ephemeral, intermittent, and perennial), 100-year floodplains, ponds and other aquatic habitats, riparian habitat, remnant vegetation associations, rare or unique biological communities, crucial wildlife habitats, and habitats supporting listed species populations (including designated and proposed critical habitat). For cases in which impacts cannot be avoided, they will be minimized and mitigated appropriately. Project planning will be coordinated with the appropriate federal and state resource management agencies.

- Projects will not be sited in designated critical habitat, Areas of Critical Environmental Concern (ACECs), or other specially designated areas that are considered necessary for listed species and habitat conservation.

- Projects will be designed to avoid, minimize, and mitigate impacts on wetlands, waters of the United States, and other special aquatic sites.

- Project facilities and activities, including associated roads and utility corridors, will not be located in or near occupied habitats of listed animal species. Buffer zones will be established (e.g., identified in the land use plan or substantiated by best available information or science) around these areas to prevent any destructive impacts associated with project activities.

- Buffer zones will be established around sensitive habitats, and project facilities and activities will be excluded or modified within those areas (e.g., identified in the land use plan or substantiated by best available information or science).

- Habitat loss, habitat fragmentation, and resulting edge habitat due to project development will be minimized to the extent practicable. Habitat fragmentation will be reduced by consolidating facilities (e.g., access roads and utilities will share common ROWs, where feasible), reducing the number of access roads to the minimum amount required, minimizing the number of stream crossings within a particular stream or watershed, and locating facilities in areas where habitat disturbance has already occurred. Individual project facilities will be located and designed to minimize disruption of animal movement patterns and connectivity of habitats.

- Locating solar power facilities near open water or other areas that are known to attract a large number of birds will be avoided.

- Plant species that would attract wildlife will not be planted along high-speed or high-traffic roads.

- Tall structures will be located to avoid known flight paths of birds and bats.

- Transmission line conductors will span important or sensitive habitats within the limits of standard structure design.

- Fences will be built (as practicable) to exclude livestock and wildlife from all project facilities, including all water sites.

- Project developers will identify surface water runoff patterns at the project site and develop measures that prevent soil deposition and erosion throughout and downhill from the site.

- Developers will avoid the placement of facilities or roads in drainages and make necessary accommodations for the disruption of runoff.

- Any necessary stream crossings will be designed to provide in-stream conditions that allow for and maintain uninterrupted movement and safe passage of fish during all project periods.

- Projects will avoid surface water or groundwater withdrawals that affect sensitive habitats (e.g., aquatic, wetland, and riparian habitats) and any habitats occupied by listed species. Applicants will demonstrate, through hydrologic modeling, that the withdrawals required for their project are not going to affect groundwater elevations or discharges that support listed species or their habitats.

- The capability of local surface water or groundwater supplies to provide adequate water for the operation of proposed solar facilities will be considered early in the project siting and design. Technologies that would result in large withdrawals that would affect water bodies that support listed species will not be considered.

- New roads will be designed and constructed to meet the appropriate BLM road design standards, such as those described in *BLM Manual 9113* (BLM 1985), and be no larger than necessary to accommodate their intended functions (e.g., traffic volume and weight of vehicles). Roads internal to solar facility sites will be designed to minimize ground disturbance.

- Pipelines that transport hazardous liquids (e.g., oils) that will pass through aquatic or other habitats containing sensitive species will be designed with block or check valves on both sides of the waterway or habitat to minimize the amount of product that could be released as a result of leaks. Such pipelines will be constructed of double-walled pipe at river crossings.

2.2.2 General Design Features Related to Multiple Phases of Facility Development

- Project developers will designate a qualified biologist who will be responsible for overseeing compliance with all design features related to the protection of ecological resources throughout all project phases, particularly in areas requiring avoidance or containing sensitive biological resources, such as listed species and important habitats. Additional qualified biological monitors would be required on-site during all project phases as determined by the BLM, the Service, and appropriate state agencies.

- All personnel will be instructed on the identification and protection of ecological resources (especially for listed species), including knowledge of required design features. Workers must be aware that only qualified biologists are permitted to handle listed species according to specialized protocols approved by the Service. Workers will not approach wildlife for photographs or feed wildlife.

- The collection, harassment, or disturbance of plants, wildlife, and their habitats (particularly listed species) will be reduced through employee and contractor education about applicable state and federal laws. In addition, the following measures will be implemented: (1) all personnel will be instructed to avoid harassment and disturbance of local plants and wildlife; (2) personnel will be made aware of the potential for wildlife interactions around facility structures; (3) food refuse and other garbage will be placed in closed containers so it is not available to scavengers; and (4) workers will be prohibited from bringing firearms and pets to project sites.

- Projects will maintain native vegetation cover and soils to the extent possible and minimize grading to reduce flooding, maintain natural infiltration rates, maintain wildlife habitat, maintain soil health, and reduce erosion potential. All short (i.e., less than 7-in. [18-cm] tall) native vegetation will be retained to the maximum extent possible. Blading within the project site will be minimized to the maximum extent possible. Where necessary and feasible, shrub cover would be mowed and/or raked to smooth out the surface. Retention of native root structure and seeds within the project area would help retain soil stability, minimize soil erosion, and minimize fugitive dust pollution. Retention of native seed and roots within the project site will also facilitate recovery of vegetative cover. Use of native plant species will minimize the need to water the vegetation, because native species are already adapted to the local climate and moisture regime of the area.

- Plants, wildlife, and their habitats will be protected from fugitive dust through measures included in the facility's Dust Abatement Plan.

- Activities will be timed to avoid, minimize, or mitigate impacts on wildlife. If activities are planned during bird breeding seasons, a nesting bird survey will be conducted first. If active nests are detected, the nest area will be flagged, and no activity would take place near the nest (at a distance determined in coordination with the Service) until nesting is completed (i.e., nestlings have fledged or the nest has failed) or until appropriate agencies agree that construction can proceed with the incorporation of agreed-upon monitoring measures. The timing of activities will be coordinated with the BLM, the Service, and appropriate state agencies.

- Noise reduction devices (e.g., mufflers) will be employed to minimize the impacts on wildlife and listed species populations. Explosives will be used only within specified times and at specified distances from sensitive wildlife or surface waters as established by the BLM or other federal and state agencies. Operators will ensure that all equipment is adequately muffled and maintained in order to minimize disturbance to wildlife.

- Design features for hazardous materials and waste management regarding refueling, equipment maintenance, and spill prevention and response will be applied to reduce the potential for impacts on ecological resources.

- Low-water crossings (fords) will be used only as a last resort, and then during the driest time of the year. Rocked approaches to fords will be used. The pre-existing stream channel, including bed and banks, will be restored after the need for a low-water ford has passed.

- The number of areas where wildlife could hide or be trapped (e.g., open sheds, pits, uncovered basins, and laydown areas) will be minimized. For example, an uncovered pipe that has been placed in a trench would be capped at the end of each workday to prevent animals from entering the pipe. If a listed species is discovered inside a component, that component must not be moved or, if necessary, moved only to remove the animal from the path of activity until the animal has escaped.

- During all project phases, buffer zones will be established around sensitive habitats, and project facilities and activities will be excluded or modified within those areas, to the extent practicable.

- Project activities will not be located in or near occupied habitats of listed animal species. Buffer zones will be established around these areas (e.g., identified in the land use plan or substantiated by best available information or science) to prevent any destructive impacts associated with project activities.

- If any federally listed threatened and endangered species are found during any phase of the project, the Service will be consulted as required by Section 7 of the ESA, and an appropriate course of action will be determined to avoid or mitigate impacts.

- Access roads will be appropriately constructed, improved, maintained, and provided with signs to minimize potential wildlife-vehicle collisions and facilitate wildlife movement through the project area.

- Project vehicle speeds will be limited in areas occupied by listed animal species. Traffic will stop to allow wildlife to cross roads. Shuttle vans or car pooling will be used where feasible to reduce the amount of traffic on access roads.

- Unless authorized, personnel will not attempt to move live, injured, or dead wildlife off roads, ROWs, or the project site. Honking horns, revving engines, yelling, and excessive speed are inappropriate and considered a form of harassment. If traffic is being unreasonably delayed by wildlife in roads,

personnel will contact the project biologist and security, who will take any necessary action.

- Road closures or other travel modifications (e.g., lower speed limits, no foot travel) will be considered during crucial periods (e.g., extreme winter conditions, calving/fawning seasons, or raptor nesting). Personnel will be advised to minimize stopping and exiting their vehicles in the winter ranges of large game while there is snow on the ground.

- Any vehicle collisions with listed species or other observed mortality of listed species will be immediately reported to the BLM and the Service. Observations of potential wildlife problems, including wildlife mortality, will be immediately reported to the BLM or other appropriate agency-authorized officer. Procedures for removal of wildlife carcasses on-site and along access roads will be addressed in the Nuisance Animal and Pest Control Plan, to avoid vehicle-related mortality of carrion-eaters.

- A Nuisance Animal and Pest Control Plan will be developed that identifies management practices to minimize increases in nuisance animals and pests in the project area, particularly those individuals and species that would affect human health and safety or have the potential to adversely affect native plants and animals. The plan would identify nuisance and pest species likely to occur in the area, risks associated with these species, species-specific control measures, and monitoring requirements.

- An Integrated Vegetation Management Plan will be developed that is consistent with applicable regulations and agency policies for the control of noxious weeds and invasive plant species. The plan will address monitoring; ROW vegetation management; the use of certified weed-free seed and mulching; the cleaning of vehicles to avoid introducing invasive weeds; and the education of personnel on weed identification, the manner in which weeds spread, and methods for treating infestations. For transmission line ROWs, the plan will be consistent with the existing vegetation management plan for that ROW. Principles of integrated pest management, including biological controls, will be used to prevent the spread of invasive species, per *Final Programmatic Environmental Impact Statement, Vegetation Treatments Using Herbicides on BLM Lands in 17 Western* States (BLM 2007b), and the *2008–2012 National Invasive Species Management Plan* (NISC 2008). The plan will cover periodic monitoring, reporting, and immediate eradication of noxious weed or invasive species occurring within all managed areas. A controlled inspection and cleaning area will be established to visually inspect construction equipment arriving at the project area and to remove and collect seeds that may be adhering to tires and other equipment surfaces. To prevent the spread of invasive species, project developers will work with the local BLM field office to determine whether a pre-activity survey is warranted and, if so, to conduct the survey. If invasive plant species are present, project

developers will work with the local BLM field office to develop a control strategy. The plan will include a post-construction monitoring element that incorporates adaptive management protocols.

- Where revegetation and restoration are used as a tool to mitigate or rehabilitate project impacts following construction and/or decommissioning, the proponent will assist in ongoing BLM efforts to procure and develop locally and regionally appropriate native plant materials. Where conditions permit, the project developer will collect and voucher seeds from native plant species identified on BLM target lists for regional native plant material development by following the BLM Seeds of Success Protocol as described in BLM's Handbook H1740-2, *Integrated Vegetation Management* (BLM 2008a). On the basis of the expected need for native plant materials, the project developer will contribute funding to support the BLM Native Plant Materials Development Program. The suggested funding rate is $100 in U.S. dollars per acre for each acre on which restoration or revegetation will be used to mitigate project impacts and for each acre expected to be rehabilitated following site decommissioning.

- To reduce the risk of non-native and nuisance aquatic species introductions, equipment used in surface water will be decontaminated as appropriate, especially equipment used to convey water (i.e., pumps).

- Herbicide use will be limited to nonpersistent, immobile substances. Only herbicides with low toxicity to wildlife and nontarget native plant species will be used, as determined in consultation with the Service. The typical herbicide application rate rather than the maximum application rate will be used where this rate is effective. All herbicides will be applied in a manner consistent with their label requirements and in accordance with guidance provided in the Final PEIS on vegetation treatments using herbicides. No herbicides would be used near or in surface water, streams (including ephemeral, intermittent, or perennial), riparian areas, or wetlands. Setback distances would be determined through coordination with federal and state resource management agencies. Before herbicide treatments are begun, a qualified biologist will conduct surveys of bird nests and of listed species to identify the special measures or best management practices necessary to avoid and minimize impacts on migratory birds and listed species.

- An Ecological Resources Mitigation and Monitoring Plan will be developed to avoid, minimize, or mitigate adverse impacts on important ecological resources. The plan will include, but not necessarily be limited to, the following elements, where applicable:
  - Revegetation, soil stabilization, and erosion reduction measures that will be implemented to ensure that all temporary use areas are restored. The plan will require that restoration occurs as soon as possible after activities

are completed in order to reduce the amount of habitat converted at any one time and to speed up the recovery to natural habitats.
  - Mitigation and monitoring of unavoidable impacts on waters of the United States, including wetlands.
  - Compensatory mitigation and monitoring to address any significant direct, indirect, and cumulative impacts on, and loss of habitat for, listed plant and animal species.
  - Measures to reduce and monitor impacts on listed species developed in consultation with the appropriate federal and state agencies (e.g., the BLM, the Service, and state resource management agencies).
  - Monitoring the potential for increase in predation of listed species (e.g., desert tortoise and Utah prairie dog [*Cynomys parvidens*]) from ravens (*Corvus corax*) and other species that are attracted to developed areas and use tall structures opportunistically to spot vulnerable prey. Raven and other predator monitoring also would be addressed in the Nuisance Animal and Pest Control Plan.
  - Clearing of project sites and translocation of listed species, including the steps to implement the translocation, as well as the follow-up monitoring of populations in the receptor locations, as determined in coordination with the appropriate federal and state agencies. The need for a Listed Species Clearance and Translocation Plan would be determined on a project-specific basis.

- A Water Resources Mitigation and Monitoring Plan will be developed for each project. Changes in surface water or groundwater quality (e.g., chemical contamination, increased salinity, increased temperature, decreased dissolved oxygen, and increased sediment loads) or flow that result in the alteration of terrestrial plant communities or communities in wetlands, springs, seeps, intermittent streams, perennial streams, and riparian areas (including the alteration of cover and community structure, species composition, and diversity) off the project site will be avoided to the extent practicable. A monitoring plan will be developed that determines the effects of groundwater withdrawals on plant communities.

- The BLM and the developer should ensure that annual consumptive groundwater use within basins supporting the groundwater-dependent species (and those providing significant underflow to those basins) does not increase over current levels as a result of future solar projects (e.g., due to a loss of irrigation return flows and/or the full utilization of groundwater rights that have not been historically fully utilized). Developers should purchase and relinquish existing groundwater rights to support their projects in an amount that offsets any loss of irrigation return flows due to the change in use (e.g., agricultural to industrial), and any probable increase in actual groundwater pumping due to less than full utilization of the rights converted for the project. Other groundwater rights transactions that meet these standards will be considered.

- Future solar projects will not result in points of groundwater withdrawal being moved closer to locations supporting groundwater-dependent species and/or increased pumping in the regional carbonate aquifer in areas with a significant potential to affect habitat for those species (albeit the total consumptive groundwater use may remain the same).

- Ecological monitoring programs will provide for monitoring during all project phases, including periods prior to construction (to establish baseline conditions) and during construction, operations, and decommissioning.

- The monitoring program requirements, including adaptive strategies, will be established at the project level to ensure that potential adverse impacts are mitigated. Monitoring programs will consider the monitoring requirements for each ecological resource present at the project site, establish metrics against which monitoring observations can be measured, identify potential mitigation measures, and establish protocols for incorporating monitoring observations and additional mitigation measures into standard operating procedures.

- A Spill Prevention and Emergency Response Plan will be developed that considers sensitive ecological resources. Spills of any toxic substances will be promptly addressed and cleaned up before they can enter aquatic or other sensitive habitats as a result of runoff or leaching.

- A Fire Management and Protection Plan will be developed to implement measures that minimize the potential for a human-caused fire to affect ecological resources and that respond to natural fire situations.

- A Trash Abatement Plan will be developed that focuses on containing trash and food in closed and secured containers and removing them periodically to reduce their attractiveness to opportunistic species, such as common ravens, coyotes, and feral dogs, that could serve as predators on native wildlife and listed animals.

- Prior to any ground-disturbing activity, seasonally appropriate walkthroughs will be conducted by a qualified biologist or team of biologists to ensure that important or sensitive species or habitats are not present in or near project areas. Attendees at the walkthrough will include appropriate federal agency representatives, state natural resource agencies, and construction contractors, as appropriate. Habitats or locations to be avoided (with appropriately sized buffers) will be clearly marked.

- If it is determined through coordination with the appropriate federal and state agencies (e.g., the BLM, the Service, and state resource management

agencies) that it is necessary to translocate plant and wildlife species from project areas, developers will ensure that qualified biologists conduct pre- and post-translocation surveys for target species (especially if the target species are listed species) and release individuals to protected off-site locations as approved by the federal and state agencies. The biologists will coordinate with appropriate agencies in the safe handling and transport of any listed species encountered.

- In accordance with adaptive management strategies, new BLM Instruction Memoranda addressing wildlife and plants issues will be incorporated as appropriate.

2.2.3 Design Features Related to Site Characterization

- Vehicles and site workers will avoid entering aquatic habitats, such as streams and springs, during site characterization activities until surveys by qualified biologists have evaluated the potential for unique flora and fauna to be present.

- Meteorological towers and solar sensors will be located to avoid sensitive habitats; applicable land use plans or best available information and science will be referred to in order to determine avoidance distances. Guy wires on meteorological towers will be avoided. If guy wires are necessary, permanent markers (bird flight diverters) will be attached to them to increase their visibility.

- Meteorological towers, soil borings, wells, and travel routes will be located to avoid important, sensitive, or unique habitats, including, but not limited to, wetlands, springs, seeps, ephemeral streams, intermittent streams, 100-year floodplains, ponds and other aquatic habitats, riparian habitat, remnant vegetation associations, rare natural communities, and habitats supporting listed species populations as identified in applicable land use plans or best available information and science.

2.2.4 Design Features Related to Construction

- Prior to construction of the facility, environmental training will be provided to contractor personnel whose activities or responsibilities could affect the environment during construction. An environmental compliance officer and other inspectors, the contractor's construction field supervisor(s), and all construction personnel are expected to play an important role in maintaining strict compliance with all permit conditions in order to protect wildlife and their habitats to the extent practicable during construction.

- Prior to construction, all areas to be disturbed will be surveyed by qualified biologists using approved survey techniques or established species-specific survey protocols to determine the presence of listed species in the project area.

- If possible, on-site construction access routes will be rolled and compacted to allow trucks and equipment to access construction locations. Following construction, disturbed areas will be lightly raked and/or ripped and reseeded with seeds from low-stature plant species collected from the immediate vicinity.

- To the extent practicable, vegetation clearing, grading, and other construction activities will occur outside the bird breeding season. If activities are planned for the breeding season, a survey of nesting birds will be conducted first. If active nests are not detected, construction activities will be conducted. If active nests are detected, the nest area will be flagged, and no activity will take place near the nest (at a distance coordinated with the Service) until nesting is completed (i.e., nestlings have fledged or the nest has failed) or until appropriate agencies agree that construction can proceed with the incorporation of agreed-upon monitoring measures. If active nests are not detected, appropriate agencies will be consulted to confirm that construction may proceed.

- Explosives will be used only within specified times and at specified distances from sensitive wildlife or surface waters, as established by the BLM or other federal and state agencies. The occurrence of flyrock from blasting will be limited by using blasting mats.

- The extent of habitat disturbance during construction will be reduced by keeping vehicles on access roads and minimizing foot and vehicle traffic through undisturbed areas.

- Temporary or project-created access roads will be closed to unauthorized vehicle use, where appropriate.

- Where a pipeline trench may drain a wetland, trench breakers will be constructed, and/or the trench bottom will be sealed to maintain the original wetland hydrology.

- Open trenches will be backfilled as quickly as possible. Open trenches could entrap small animals; therefore, escape ramps will be installed along open trench segments at distances identified in the applicable land use plan or best available information and science.

- An appropriate number of qualified biological monitors (as determined by the federal authorizing agency and the Service) will be on-site during initial site preparation and during the construction period to monitor, capture, and

relocate animals that could be harmed and are unable to leave the site on their own.

- When possible, any reptile or amphibian species found in harm's way will be relocated away from the activity.

- Construction debris, especially treated wood, will not be stored or disposed of in areas where it could come in contact with aquatic habitats.

- Project-specific Integrated Vegetation Management Plans will investigate the possibility of revegetating parts of the solar array area. Where revegetation is accomplished, fire breaks are required, such that the vegetated areas would not result in an increased fire hazard.

- Re-establishment of vegetation within temporarily disturbed areas will be done immediately following the completion of construction activities, provided such revegetation will not compromise the function of the buried utilities. Species salvaged during construction will be transplanted into these areas at a density similar to that of preconstruction conditions. Revegetation will focus on the establishment of native plant communities similar to those present in the vicinity of the project site. Species used will consist of native species dominant within the plant communities that exist in adjacent areas and have similar soil conditions. Certified weed-free seed mixes of native shrubs, grasses, and forbs of local origin will be used. In areas where suitable native species are unavailable, other plant species approved by the BLM will be used.

2.2.5 Design Features Related to Operations

- Areas left in a natural condition during construction (e.g., wildlife crossings) will be maintained in as natural a condition as possible within safety and operational constraints.

- To minimize habitat loss and fragmentation, as much habitat as possible will be re-established after construction is complete by maximizing the area reclaimed during solar energy operations.

- Lighting will be designed to provide the minimum illumination needed to achieve safety and security objectives. It will be shielded and orientated to focus illumination on the desired areas and to minimize or eliminate lighting of off-site areas or the sky. All unnecessary lighting will be turned off at night to limit attracting migratory birds or listed species.

- To minimize the potential for bird strikes, applicants will use audio visual warning system (AVWS) technology for any structures exceeding 200 ft

(60 m) in height. If the Federal Aviation Administration (FAA) denies a permit for use of AVWSs, applicants will coordinate with the Service and appropriate state natural resource agencies to identify lighting that meets the minimum FAA safety requirements and minimizes the possibility of bird strikes.

- Evaporation ponds will be fenced and netted to prevent use by wildlife where feasible. Open water sources in the desert provide subsidies to ravens and other predators that feed on listed species (e.g., desert tortoise and Utah prairie dog). In addition, these water sources may have elevated levels of harmful contaminants (e.g., total dissolved solids and selenium) and could attract wildlife into an industrialized area where they are more likely to be killed. The lower 18 in. (46 cm) of the fencing will be a solid barrier that would exclude entrance by amphibians and other small animals.

- To prevent the effects of the West Nile virus on wildlife, a mosquito abatement program will be implemented for all evaporation ponds or other standing bodies of water that have the potential to support mosquito reproduction.

- Pesticide and herbicide use would be conducted in accordance with a Nuisance Animal and Pest Control Plan and an Integrated Vegetation Management Plan.

2.2.6 Design Features Related to Decommissioning and Reclamation

- A Decommissioning and Site Reclamation Plan specific to the project will be developed, approved by the BLM, and implemented, and will include the following elements:
  - The plan will contain an adaptive management component that allows for the incorporation of lessons learned from monitoring data.
  - The plan will require that land surfaces be returned to predevelopment contours to the greatest extent feasible immediately following decommissioning.
  - The plan will be designed to expedite the re-establishment of vegetation and require restoration to be completed as soon as practicable.
  - To ensure rapid and successful re-establishment efforts, the plan will specify site-specific measurable success criteria, including target dates, which will be developed in coordination with the BLM and be required to be met by the operator.
  - Vegetation re-establishment efforts will continue until all success criteria have been met.
  - Bonding to cover the full cost of vegetation re-establishment will be required.

  - Species used for re-establishing vegetation will consist of native species that are dominant within the plant communities in adjacent areas that have similar soil conditions.
  - The plan will require the use of weed-free seed mixes of native shrubs, grasses, and forbs of local sources where available. When available, seeds of known origin, as labeled by state seed certification programs, will be used. Local native genotypes will be used where practicable. If cultivars of native species are used, certified seeds (i.e., blue tag) will be used. "Source identified" seeds (i.e., yellow tag) will be used when native seeds are collected from wildland sites.
  - The cover, species composition, and diversity of the re-established plant community will be similar to those of plant species present on-site prior to project development and in the vicinity of the site. Baseline data would be collected in each project area prior to its development as a benchmark for measuring the success of reclamation efforts. In areas where suitable native species are unavailable, other plant species approved by the BLM will be used. If non-native plants are necessary, they will be noninvasive, noncompetitive, and, ideally, short-lived and have low reproductive capabilities or be self-pollinating to prevent gene flow into the native community. The non-native plants that are used will not exchange genetic material with common native plant species.
  - The plan will be developed in coordination with appropriate federal and state agencies.

- Access roads will be reclaimed when they are no longer needed. However, seasonal restrictions (e.g., nest and brood rearing) will be considered (e.g., identified in the land use plan or substantiated by best available information or science).

- All holes and ruts created by the removal of structures and access roads will be filled or graded.

- While structures are being dismantled, care will be taken to avoid leaving debris on the ground in areas where wildlife regularly moves.

- Post-decommissioning protocols will include monitoring for the recovery of native vegetation, colonization and spread of invasive species, use by wildlife, and use by listed species. Monitoring data will be used to determine the success of reclamation activities and the need for changes in ongoing management or for additional reclamation measures. Ongoing visual inspections for a minimum of 5 years following decommissioning activities will be required to ensure that there is adequate restoration and minimal environmental degradation. This period will be extended until satisfactory results are obtained.

- The facility fence will remain in place for several years to help reclamation (e.g., the fence could preclude large mammals and vehicles from disturbing revegetation efforts). Shorter times for maintaining fencing would be appropriate in cases for which the likelihood of disturbance by cattle and wildlife is low. In some cases, it would be appropriate to replace the original exclusion fence with a new fence that excludes cattle and vehicles but allows for use by pronghorn and large-game wildlife. This secondary fencing will remain in place until the revegetation efforts meet success criteria.

2.2.7 Design Features Related to Transmission Lines and Access Roads

The following design features are specifically applicable to protecting ecological resources and listed species from transmission line construction, operation, and maintenance. These design features will be required as part of the BLM's Solar Energy Program in connection with transmission construction for any solar facilities on BLM-administered lands in the six-state study area.

- The placement of transmission towers within aquatic and wetland habitats will be avoided whenever feasible. If towers must be placed within these habitats, they will not impede flows or fish passage.

- If transmission lines are located near aquatic habitats or riparian areas (e.g., minimum buffers identified in the applicable land use plan or by best available science and information), vegetation maintenance will be limited and performed mechanically rather than with herbicides. Cutting in wetlands or stream and wetland buffers will be done by hand or by feller-bunchers. Tree cutting in stream buffers will target only trees able to grow into a transmission line conductor clearance zone within 3 to 4 years. Cutting in such areas for construction or vegetation management will be minimized, and the disturbance of soil and remaining vegetation will be minimized.

- Habitat disturbance will be minimized by using helicopters for construction to lessen the need for access roads, and by locating transmission facilities in previously disturbed areas. Existing utility corridors and other support structures will be used to the maximum extent feasible.

- The establishment and spread of invasive species and noxious weeds within the ROW and in associated areas where there is ground surface disturbance or vegetation cutting will be prevented. The area will be monitored regularly, and invasive species will be eradicated immediately.

- If needed, temporary access roads will be developed, primarily by the removal of woody vegetation, although temporary timber mats would be used in areas of wet soils. Wide-tracked or balloon-tired equipment, timber corduroy, or timber mat work areas will be used on wet soils where wetland or stream

crossings are unavoidable and where crossing on frozen ground is not possible in winter. Areas rutted by equipment will be immediately regraded and revegetated. Towers will be installed by airlift helicopters, where necessary, to avoid extensive crossing of wetlands or highly sensitive areas (such as those identified as rare natural habitats).

- ROW development and construction activities will adhere to locally established wildlife and/or habitat protection provisions. Exceptions or modifications to spatial buffers or timing limitations will be evaluated on a site-specific and species-specific basis in coordination with the local federal administrator and state wildlife agency.

- Restrictions on timing and duration will be required to minimize impacts on nesting birds (especially neotropical migrants and listed species) and will be developed in coordination with the USFWS.

- To the extent practicable, work personnel will stay within the ROW and/or easements.

- Removal of raptor nests will take place only if the birds are not actively using the nest, particularly during the nesting and brood-rearing period. Nests will be relocated to nesting platforms, when possible; otherwise, they must be destroyed when removed. An annual report on all nests moved or destroyed will be provided to the appropriate federal and/or state agencies. Coordination with the USFWS and BLM project wildlife biologist will occur in the event that a raptor nest is located on a transmission line support structure. Removal or relocation of a golden eagle or bald eagle nest (even an inactive nest) requires a permit from the USFWS.

- Raven nests will be removed from transmission towers to reduce predation pressure on listed species, such as the desert tortoise, greater sage-grouse, and Utah prairie dog. Raven nests can be removed only when inactive (i.e., no eggs or young); if removal is otherwise necessary, an MBTA take permit from the USFWS is required. The removal of raven nests would be addressed in the Nuisance Animal and Pest Control Plan.

- Current guidelines and methodologies would be used in the design and analysis of proposed transmission facilities in order to minimize the potential for raptors and other birds to be electrocuted by them or to collide with them.

- Transmission line support structures and other facility structures will be designed to discourage their use by raptors for perching or nesting (e.g., by use of anti-perching devices). This design would also reduce the potential for increased predation of listed species, such as the desert tortoise, sage-grouse, and Utah prairie dog. Mechanisms to visually warn birds (permanent markers

or bird flight diverters) will be placed on transmission lines at regular intervals to prevent birds from colliding with the lines.

- To the extent practicable, the use of guy wires will be avoided because they pose a collision hazard for birds and bats. Guy wires will be clearly marked with bird flight diverters to reduce the probability of collision.

- Shield wires will be marked with devices that have been scientifically tested and found to significantly reduce the potential for bird collisions.

- Any mortality of listed species associated with power lines will be monitored and reported to the BLM and the USFWS, and measures will be taken to prevent future mortality.

3 CONSULTATION PROTOCOL

This programmatic BA focuses on potential effects resulting from solar energy development within designated SEZs (285,000 acres [1,153 km^2]). Under the proposed action, the BLM will incorporate information in this BA and resulting BO in reviewing applications for a solar energy development ROW within an SEZ and in making decisions regarding ROW authorizations. Additional National Environmental Policy Act (NEPA) analyses and ESA consultation may still be required for federally listed and proposed species at the project level.

Design features for projects have been developed to avoid locations or certain technologies that may affect off-site aquatic, riparian, and groundwater-dependent species and their habitats. For these reasons, it was assumed that impacts on groundwater-dependent species will be minimized. However, an evaluation of water requirements for each development will be determined at the project level. If a future project is determined to have the potential to affect aquatic, semiaquatic, or groundwater-dependent species, additional NEPA evaluation and documentation and consultation with the Service will be required.

In fulfillment of BLM's responsibilities under Section 7(a)(2) of the ESA, this BA focuses on those species that could be affected by site characterization, construction, operations, and decommissioning of solar energy facilities that would be located on designated SEZs. Section 7(a)(2) states that each federal agency will, in consultation with the Secretary, ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. In fulfilling these requirements, each agency is to use the best scientific and commercial data available. This section of the ESA sets out the consultation process, which is further implemented by regulation detailed in 50 CFR Part 402.

The species that are evaluated in this BA are those that could have suitable habitat in the affected area of at least one of the SEZs. See Figures 2-1 through 2-6 for the locations of SEZs. The SEZ affected area includes both the direct and indirect effects areas. The area of direct effects was defined as the area that would be physically modified during project development (i.e., where ground-disturbing activities would occur). The area of direct effects includes the SEZ footprint and the portion of assumed transmission lines and access road corridors where ground-disturbing activities would occur[2] (locations for access roads are unknown, so hypothetical likely locations were assumed; refer to Section 4 and Table 4-1 for SEZ-specific assumptions). The area of indirect effects was defined as the area within 5 mi (8 km) of the SEZ boundary and within the 1-mi (1.6-km) wide assumed access road corridors where ground-disturbing activities

[2] The Draft Solar PEIS also included evaluation of assumed transmission corridors from some of the SEZs to the nearest existing transmission line. Based on comments and further agency evaluation that determined these analyses were speculative and insufficient, the assessment of specific assumed transmission corridors from SEZs was eliminated from the analysis for the Final PEIS. New SEZ transmission analyses that do not hypothesize specific tie-in locations for the SEZs will be included in the Final PEIS. In addition, project-specific analyses would be required to identify specific impacts of new transmission construction and line upgrades for any projects proposed within SEZs.

would not occur but that could be indirectly affected by activities in the area of direct effects. Indirect effects considered in the assessment include effects from surface runoff, dust, noise, lighting, and accidental spills from the SEZ. The potential magnitude of indirect effects would decrease with increasing distance away from the SEZ. The area of indirect effects was considered sufficiently large to substantially bound the area that would be subject to indirect effects, and is consistent with the results of studies that have documented indirect ecological impacts of energy development (e.g., Sawyer et al. 2006).

In addition to the direct and indirect effects areas of each SEZ, assumptions were made regarding the need for new access roads for each SEZ based on the SEZ's proximity to existing access roads. It was assumed that an existing major road (paved U.S., State, or Interstate highway) that intersected or was adjacent to (or within 1 mi [1.6 km] of) the SEZ could provide initial road access to the SEZ (and thus no additional acreage disturbance for access roads was assumed). If an existing major road was not within or adjacent to an SEZ, it was assumed that, at a minimum, an access road would be constructed from the SEZ boundary to the nearest major road to connect the SEZ to the regional transportation system. The assumed access road was a straight-line path between the SEZ and the nearest existing major road. This assumption was made without additional information on the need for upgrade of existing roadways or logistical constraints (i.e., topography).

Any projects that deviated from these assumptions regarding the direct and indirect effects areas of the SEZs and the location of new access roads would require additional consultation from that provided in this programmatic BA.

This BA considers whether or not solar energy development on SEZs is likely to jeopardize the continued existence of any species listed under the ESA. As identified in the design features described in Section 2.2, there are a number of measures that are required of project proponents, as well as requirements to conduct pre-disturbance surveys in consultation with the Service. This BA does not preclude the need to engage in project-specific ESA consultation that could tier from this programmatic BA.

Groundwater-dependent species would require consideration in project-specific consultations. Sufficient site-specific or technology-specific information is not available to programmatically evaluate impacts of solar energy development on groundwater resources and groundwater-dependent species that are not located on the SEZ. Design features for projects in the proposed Solar Energy Program have been developed to avoid locations or certain technologies that may affect groundwater-dependent species. For these reasons, it was assumed that impacts on groundwater-dependent species will be minimized. However, an evaluation of groundwater requirements for each development will be determined at the project level. If a future project is determined to have the potential to affect groundwater-dependent species, additional NEPA evaluation and documentation and consultation with the Service will be required.

4 DESCRIPTION OF THE ACTION AREA

As described in the Draft PEIS and the Supplement, under its proposed Solar Energy Program, the BLM had originally identified 24 proposed SEZs in the six southwestern states of Arizona, California, Colorado, Nevada, New Mexico, and Utah. Based on public comments on the Draft PEIS and further agency evaluation, the BLM decided to eliminate seven SEZs from further consideration. The proposed action now includes 17 SEZs within the 6-state region. The total area encompassed by these 17 SEZs is approximately 285,000 acres (1,153 km^2). There is at least one SEZ in each of the six states (Table 4-1). Together, these SEZs and their affected areas encompass the action area considered in this BA. The locations of the SEZs in each state are shown in Figures 2-1 through 2-6 and are discussed below. Legal descriptions for each of the 17 SEZs are provided in Appendix A.

The SEZ affected areas include the areas of direct and indirect effects from development on the SEZ and from assumed new access roads as described in Section 3. Species that could occur within the SEZ affected areas were determined from natural heritage records available through Nature Serve Explorer (NatureServe 2010) and information provided by the State Natural Resource Agencies, Natural Heritage Programs, state-level Gap Analysis Programs (e.g., California Regional Gap Analysis Project [USGS 2010]), Southwest Regional Gap Analysis Project (SWReGAP) (USGS 2004, 2005, 2007), and USFWS Environmental Conservation Online System (ECOS) (USFWS 2010a). Information reviewed consisted of county-level occurrences as determined from NatureServe, species occurrence records provided by the State Natural Resource and Natural Heritage Programs, and modeled land cover types and predicted suitable habitats for the species within the 50-mi (80-km) region as determined from GAP models.

The geographic setting and development assumptions of each SEZ are provided below (in alphabetical order by state). Table 4-1 lists characteristics of the assumed development areas at each SEZ.

4.1 ARIZONA SEZS

4.1.1 Brenda

The proposed Brenda SEZ is located in La Paz County in west-central Arizona (Figure 4-1), 32 mi (52 km) east of the California border. The SEZ has a total developable area of 3,847 acres (16 km^2). In 2008, the county population was 20,005, while adjacent Riverside County to the west in California had a population of 2,087,917. The towns of Quartzsite and Salome in La Paz County are about 18 mi (29 km) west of and 18 mi (29 km) east of the SEZ respectively. The Phoenix metropolitan area is approximately 100 mi (161 km) to the east of the SEZ, and Los Angeles is approximately 230 mi (370 km) to the west.

TABLE 4-1 Assumed Development Areas for Each SEZ

State	SEZ	SEZ Developable Area (acres)	Length of Assumed Access Road (mi)	Access Road Construction Area (acres)	Indirect Effects Area (acres)	Affected Area (acres)[a]
Arizona	Brenda	3,847	–[b]	–	90,664	94,511
	Gillespie	2,618	3	22	99,221	101,861
California	Imperial East	5,717	–	–	108,370	114,087
	Riverside East	147,910	–	–	566,269	714,179
Colorado	Antonito Southeast	9,712	–	–	113,733	123,445
	De Tilla Gulch	1,064	–	–	70,806	71,870
	Fourmile East	2,882	–	–	88,656	91,538
	Los Mogotes East	2,650	3	22	88,516	91,188
Nevada	Amargosa Valley	8,479	–	–	108,556	117,035
	Dry Lake	5,717	–	–	93,115	98,832
	Dry Lake Valley North	25,069	8	58	157,451	182,578
	Gold Point	4,596	–	–	87,957	92,553
	Millers	16,534	–	–	126,349	142,883
New Mexico	Afton	29,964	–	–	177,171	207,135
Utah	Escalante Valley	6,533	15	109	119,026	125,668
	Milford Flats South	6,252	5	36	107,424	113,712
	Wah Wah Valley	5,873	–	–	95,705	101,578

[a] Affected area is the sum of the SEZ size, access road construction area, and indirect effects area.

[b] A dash indicates the development area is not applicable to the SEZ.

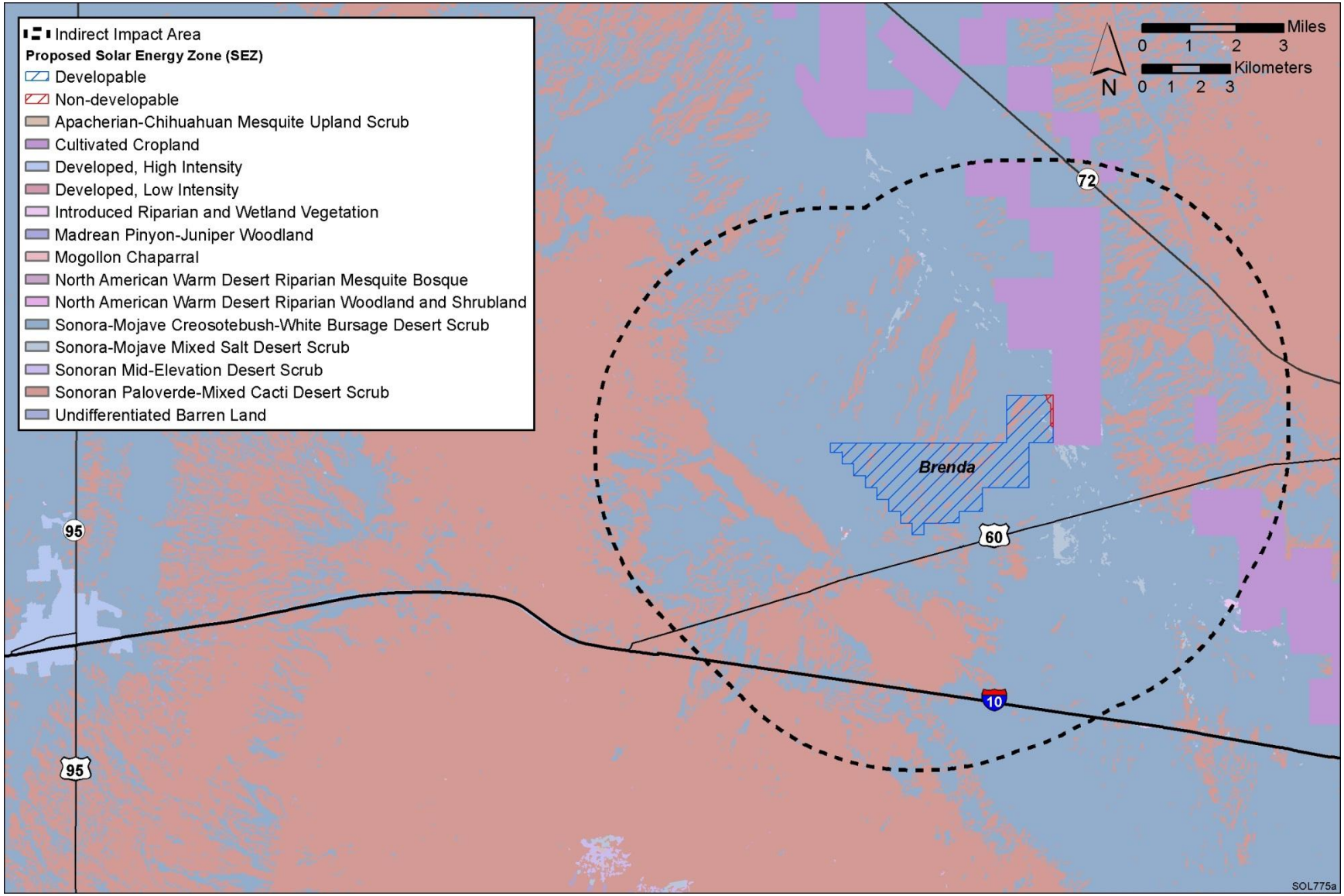

FIGURE 4-1 Proposed Brenda SEZ and Associated Land Cover Types

The nearest major road access to the SEZ is via U.S. 60, which runs southwest to northeast along the southeast border of the Brenda SEZ. It was assumed that no new access road development would be needed to serve the Brenda SEZ (Figure 4-1; Table 4-1).

The proposed Brenda SEZ is located within the Sonoran Basin and Range Level III ecoregion (EPA 2007), which supports creosotebush (*Larrea tridentata*)-white bursage (*Ambrosia dumosa*) plant communities with large areas of palo verde (*Parkinsonia microphylla*)-cactus shrub and saguaro cactus (*Carnegiea gigantea*) communities (EPA 2002). The dominant species of the Lower Colorado River Valley subdivision of the Sonoran Desert are primarily creosotebush, white bursage, and all-scale (*Atriplex polycarpa*), with big galleta (*Pleuraphis rigida*), Palmer alkali heath (*Frankenia palmeri*), brittlebush (*Encelia farinosa*), and western honey mesquite (*Prosopis glandulosa* var. *torreyana*) dominant in some areas (Turner and Brown 1994). Larger drainageways and washes support species of small trees and shrubs that may also occur in adjacent areas, such as western honey mesquite, ironwood (*Olneya tesota*), and blue palo verde (*Parkinsonia florida*), as well as species such as smoketree (*Psorothamnus spinosa*) that are mostly restricted to drainageways. Shrub species found in minor drainages include cat-claw acacia (*Acacia greggii*), burrobrush (*Hymenoclea salsola* var. *pentalepis*), Anderson thornbush (*Lycium andersonii*), and desert broom (*Baccharis sarothroides*). Annual precipitation in the Sonoran Desert occurs in winter and summer (Turner and Brown 1994) and is very low in the area of the SEZ, averaging about 5.6 in. (14 cm).

4.1.2 Gillespie

The proposed Gillespie SEZ is located in Maricopa County in west–central Arizona (Figure 4-2). The SEZ has a total developable area of 2,618 acres (11 km^2). In 2008, the county population was 3,958,263. The nearest town is Arlington, about 7 mi (11 km) northeast of the SEZ, with a population of less than 500, while the larger town of Buckeye is located about 17 mi (27 km) northeast and has a population of more than 50,000. Phoenix, Arizona, is approximately 50 mi (48 km) northeast of the SEZ.

The nearest major road access to the SEZ is via Old U.S. 80, which runs north–south 3 mi (5 km) from the eastern tip of the Gillespie SEZ. It was assumed that a new access road would be needed to provide access from the SEZ to Old U.S. 80 (Figure 4-2; Table 4-1).

The proposed Gillespie SEZ is located within the Sonoran Basin and Range Level III ecoregion (EPA 2007), which supports creosotebush (*Larrea tridentate*)-white bursage (*Ambrosia dumosa*) plant communities with large areas of palo verde (*Parkinsonia microphyla*)-cactus shrub and saguaro cactus (*Carnegiea gigantea*) communities (EPA 2002). The dominant species of the Lower Colorado River Valley subdivision of the Sonoran Desert are primarily creosotebush, white bursage, and all-scale (*Atriplex polycarpa*), with big galleta (*Pleuraphis rigida*), Palmer alkali heath (*Frankenia palmeri*), brittlebush (*Encelia farinosa*), and western honey mesquite (*Prosopis glandulosa* var. *torreyana*) dominant in some areas (Turner and Brown 1994). Larger drainageways and washes support species of small trees and shrubs that may also occur in adjacent areas. Such species include western honey mesquite, ironwood (*Olneya tesota*), and blue palo verde (*Parkinsonia florida*), as well as species such as smoketree

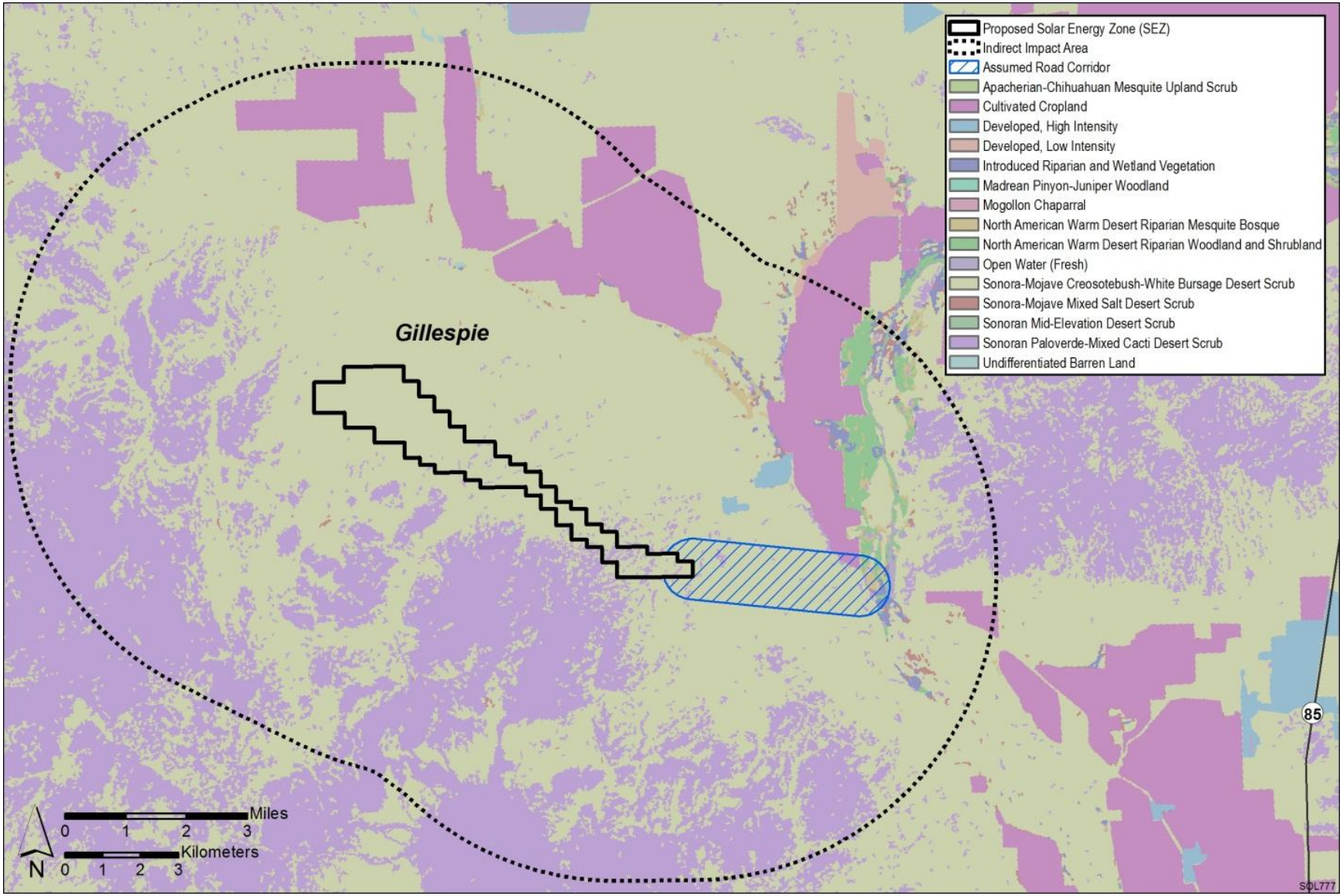

FIGURE 4-2 Proposed Gillespie SEZ and Associated Land Cover Types

(*Psorothamnus spinosus*), which are mostly restricted to drainageways. Shrub species found in minor drainages include cat-claw acacia (*Acacia greggii*), burrobrush (*Hymenoclea salsola* var. *pentalepis*), Anderson thornbush (*Lycium andersonii*), and desert broom (*Baccharis sarothroides*). The proposed Gillespie SEZ is located in an area transitional to the Arizona Upland subdivision, which includes palo verde-cacti-mixed scrub communities. Annual precipitation in the Sonoran Desert occurs primarily in winter and summer (Turner and Brown 1994) and is low in the area of the SEZ, averaging about 7.6 in. (19.3 cm).

4.2 CALIFORNIA SEZS

4.2.1 Imperial East

The proposed Imperial East SEZ has a total developable area of 5,717 acres (23 km^2) and is located in Imperial County in southeastern California, near the United States–Mexico border (Figure 4-3). In 2008, the Imperial County population was 180,493, while the two-county region—Imperial County and Yuma County, Arizona—surrounding the SEZ had a total population of 387,798. Calexico (population of 38,344) is located about 15 mi (24 km) to the west along State Route 98, and El Centro (population of 40,083) lies 19 mi (31 km) to the west along Interstate 8 in Imperial County.

Interstate 8 runs east–west along the northeast edge of the proposed SEZ, while State Route 98, a two-lane highway, passes through the southern edge. San Diego lies 120 mi (194 km) to the west, and the city of Yuma, 29 mi (47 km) to the east via Interstate 8. It was assumed that no new access road development would be needed to serve the Imperial East SEZ(Figure 4-3; Table 4-1).

The proposed Imperial East SEZ is located within the Sonoran Basin and Range Level III ecoregion (EPA 2007), which supports creosotebush (*Larrea tridentata*) and white bursage (*Ambrosia dumosa*) plant communities with large areas of palo verde (*Cercidium microphyllum*)-cactus shrub and saguaro cactus (*Carnegiea gigantea*) communities (EPA 2002). The dominant species of the Lower Colorado River Valley subdivision of the Sonoran Desert are primarily creosotebush, white bursage, and all-scale (*Atriplex polycarpa*), with big galleta (*Pleuraphis rigida*), Palmer alkali heath (*Frankenia palmeri*), brittlebush (*Encelia farinosa*), and western honey mesquite (*Prosopis glandulosa* var. *torreyana*) dominant in some areas (Turner and Brown 1994). Larger drainageways and washes support species of small trees and shrubs that may also occur in adjacent areas, such as western honey mesquite, ironwood (*Olneya tesota*), and blue palo verde (*Cercidium floridum*), as well as species such as smoketree (*Psorothamnus spinosa*), which are mostly restricted to drainageways. Shrub species found in minor drainages include cat-claw acacia (*Acacia greggii*), burrobrush (*Hymenoclea salsola* var. *pentalepis*), Anderson thornbush (*Lycium andersonii*), and desert broom (*Baccharis sarothroides*). Annual precipitation in the Sonoran Desert occurs in winter and summer (Turner and Brown 1994) and is very low in the area of the SEZ, averaging about 2.7 in. (0.7 cm).

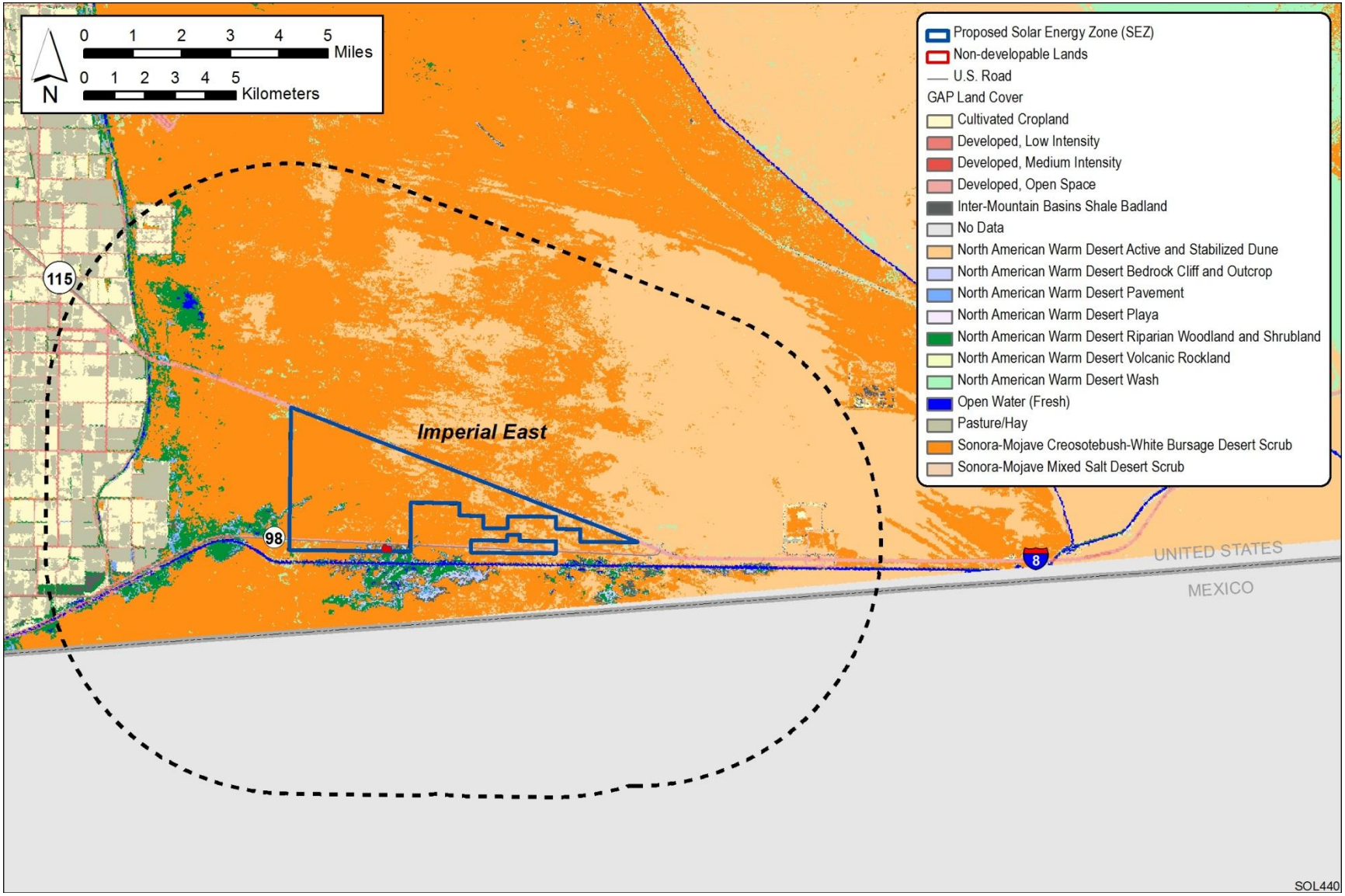

FIGURE 4-3 Proposed Imperial East SEZ and Associated Land Cover Types

4.2.2 Riverside East

The proposed Riverside East SEZ is the largest of the proposed SEZs in the six-state action area**,** with a total developable area of 147,910 acres (599 km^2). The SEZ spans a distance of about 45 mi (72 km) between the points farthest west and east, but it has an irregular shape with a large excluded central area (see Figure 4-4). The eastern boundary of the site is about 6 mi (10 km) west of the Arizona border. The western boundary is about 2 mi (3 km) from Joshua Tree National Park (NP) at its nearest point. The nearest towns with populations greater than 10,000 are Blythe, located about 6 mi (10 km) southeast of the SEZ with a 2008 population of 21,727, and Indio, located about 45 mi (72 km) west of the SEZ on Interstate 10, with a 2008 population of 84,443. The small town of Desert Center (2000 population of 150) is located at the far southwestern edge of the SEZ, along Interstate 10.

The SEZ is located in Riverside County in southeastern California. In 2008, the county population was 84,443. The closest large cities are Moreno Valley, San Bernardino, and Riverside (all located slightly more than 100 mi [161 km] west of the SEZ on Interstate 10). The interstate runs east–west along the southern boundary of the SEZ. Other paved roads that cross parts of the Riverside East SEZ include State Route 177, which runs north–south through the western section of the SEZ, and Midland Road, which crosses the northeastern portion of the SEZ. U.S. 95 runs north–south about 3 mi (5 km) from the eastern boundary of the SEZ and through the town of Blythe. It was assumed that no new access road development would be needed to serve the Riverside East SEZ (Figure 4-4; Table 4-1).

The proposed Riverside East SEZ is located in a transitional area that includes many species associated with the Mojave and Sonoran Deserts. Most of the SEZ is located within the Sonoran Basin and Range Level III ecoregion (EPA 2007), which supports creosotebush (*Larrea tridentata)*-white bursage (*Ambrosia dumosa*) plant communities with large areas of palo verde (*Cercidium microphyllum*)-cactus shrub and saguaro cactus (*Carnegiea gigantea*) communities (EPA 2002). The dominant species of the Lower Colorado River Valley subdivision of the Sonoran Desert are primarily creosotebush, white bursage, and all-scale (*Atriplex polycarpa*), with big galleta (*Pleuraphis rigida*), Palmer alkali heath (*Frankenia palmeri*), brittlebush (*Encelia farinosa*), and western honey mesquite (*Prosopis glandulosa* var. *torreyana*) dominant in some areas (Turner and Brown 1994). Larger drainageways and washes support species of small trees and shrubs that may also occur in adjacent areas, such as western honey mesquite, ironwood (*Olneya tesota*), and blue palo verde (*Cercidium floridum*), as well as species such as smoketree (*Psorothamnus spinosa*), which are mostly restricted to drainageways. Shrub species found in minor drainages include cat-claw acacia (*Acacia greggii*), burrobrush (*Hymenoclea salsola* var. *pentalepis*), Anderson thornbush (*Lycium andersonii*), and desert broom (*Baccharis sarothroides*). Annual precipitation in the Sonoran Desert occurs in winter and summer (Turner and Brown 1994) and is very low in the area of the SEZ, averaging about 3.5 in. (9.0 cm).

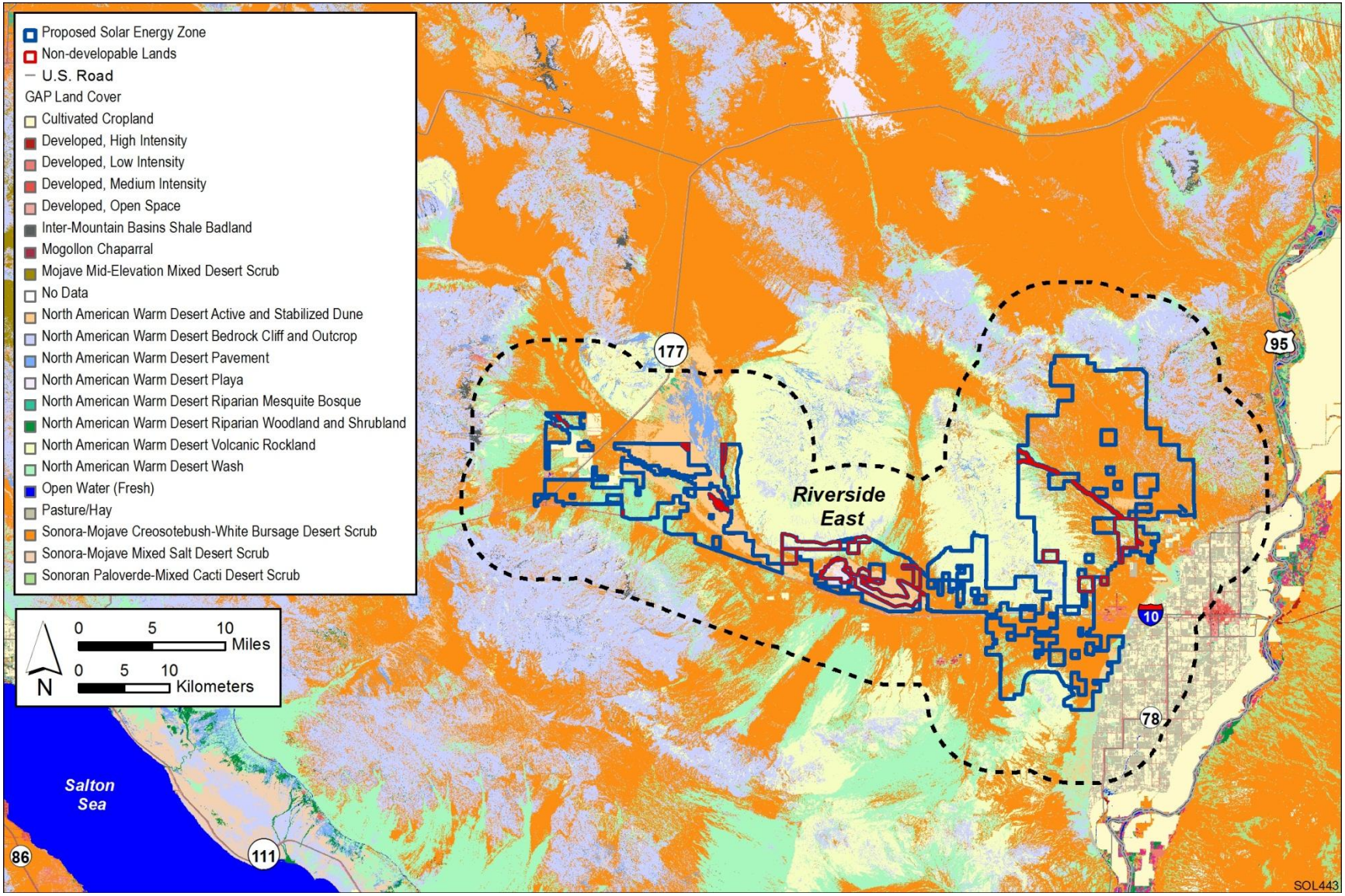

FIGURE 4-4 Proposed Riverside East SEZ and Associated Land Cover Types

4.3 COLORADO SEZS

4.3.1 Antonito Southeast

The proposed Antonito Southeast SEZ has a total developable area of 9,712 acres (39 km^2). The SEZ is located in southeastern Conejos County, on the southern Colorado state boundary with New Mexico (Figure 4-5). In 2008, the county population was 8,232, while the surrounding six-county region in Colorado and New Mexico had a population of 116,511. The largest nearby town of Alamosa (Alamosa County, Colorado), which had a 2008 population of 8,745, is about 34 mi (55 km) to the north. Several small towns lie closer to the SEZ, with Antonito, Colorado, a short distance to the northwest on U.S. 285.

The nearest major road is U.S. 285, which runs north–south along the western boundary of the SEZ. It was assumed that no new access road development would be needed to serve the Antonito Southeast SEZ (Figure 4-5; Table 4-1).

The proposed Antonito Southeast SEZ is located in the south-central part of the San Luis Valley, a high-elevation (approximately 8,000 ft [2,440 m]) basin between two large mountain ranges. The SEZ is located primarily within the San Luis Shrublands and Hills Level IV ecoregion, which supports shrublands, grasslands, and, on upper elevations of the San Luis Hills, pinyon-juniper woodlands (Chapman et al. 2006). The dominant species of the shrubland communities in this ecoregion are big sagebrush (*Artemisia tridentata*), rubber rabbitbrush (*Ericameria nauseosa*), and winterfat (*Krascheninnikovia lanata*). Grassland species include western wheatgrass (*Pascopyrum smithii*), green needlegrass (*Nassella viridula*), blue grama (*Bouteloua gracilis*), and needle-and-thread (*Hesperostipa comata*). Small areas of the northern portions of the SEZ are within the San Luis Alluvial Flats and Wetlands Level IV ecoregion. Although most areas within this ecoregion have been converted to irrigated cropland, remaining shrubland communities include shadscale (*Atriplex confertifolia*), fourwing saltbush (*Atriplex canescens*), and greasewood (*Sarcobatus vermiculatus*). Annual precipitation in the vicinity of the SEZ is very low, averaging 7.3 in. (18.5 cm).

4.3.2 De Tilla Gulch

The proposed De Tilla Gulch SEZ has a total developable area of 1,064 acres (4 km^2) and is located in Saguache County in south-central Colorado (Figure 4-6). In 2008, the county population was 6,903, while the four-county region surrounding the SEZ—Alamosa, Chafee, Saguache, and Rio Grande Counties—had a total population of 51,974. The largest nearby town, which is located about 50 mi (80 km) to the south, is Alamosa with a 2008 population of 8,745. The village of Saguache is located about 8 mi (12 km) west of the SEZ on U.S. 285, which runs along the northwest side of the SEZ. It was assumed that no new access road development would be needed to serve the De Tilla Gulch SEZ (Figure 4-6; Table 4-1).

The proposed De Tilla Gulch SEZ lies in the northwestern portion of the San Luis Valley, part of the San Luis Basin, a large, high-elevation basin within the Rocky Mountains. The

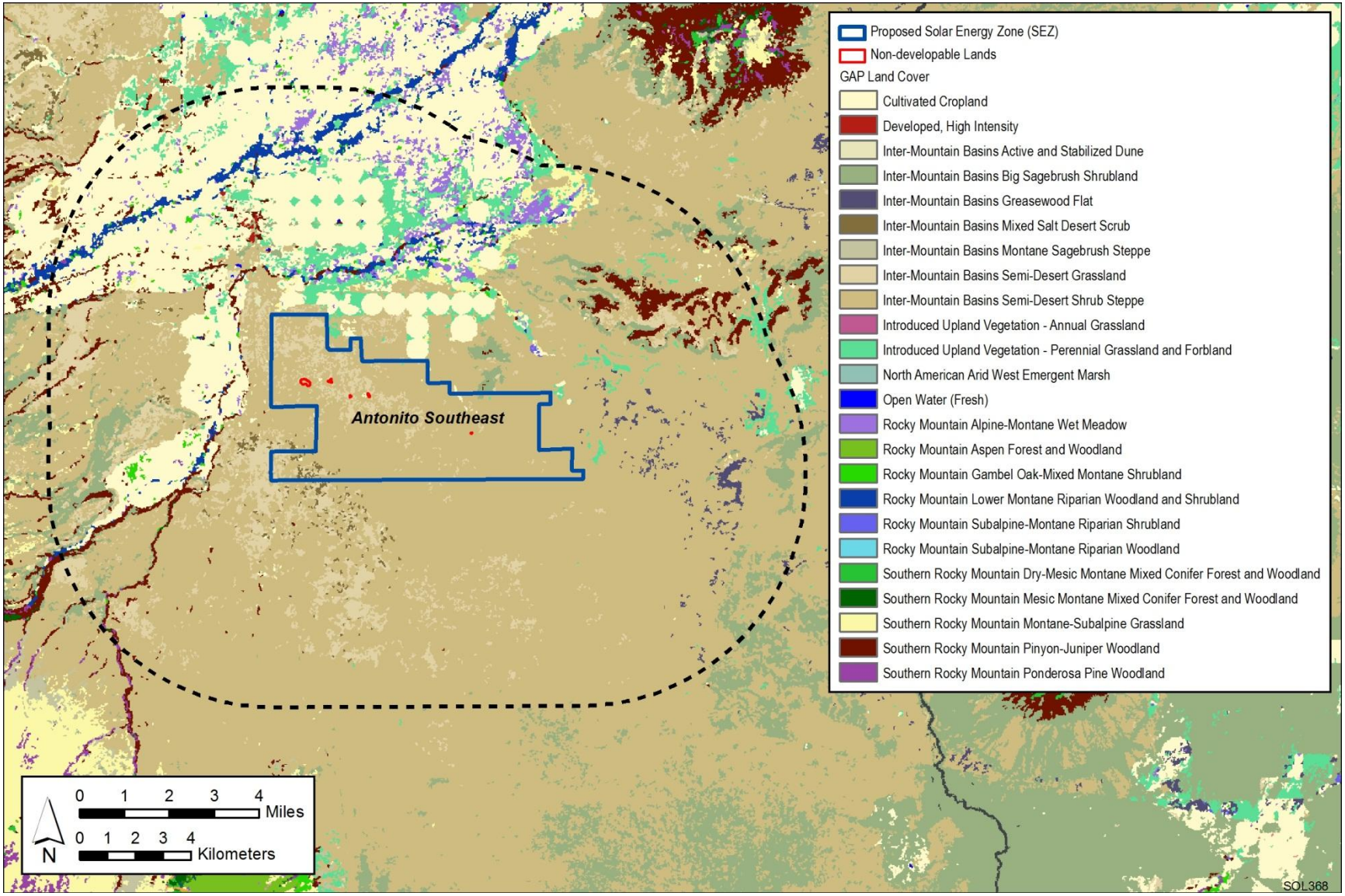

FIGURE 4-5 Proposed Antonito Southeast SEZ and Associated Land Cover Types

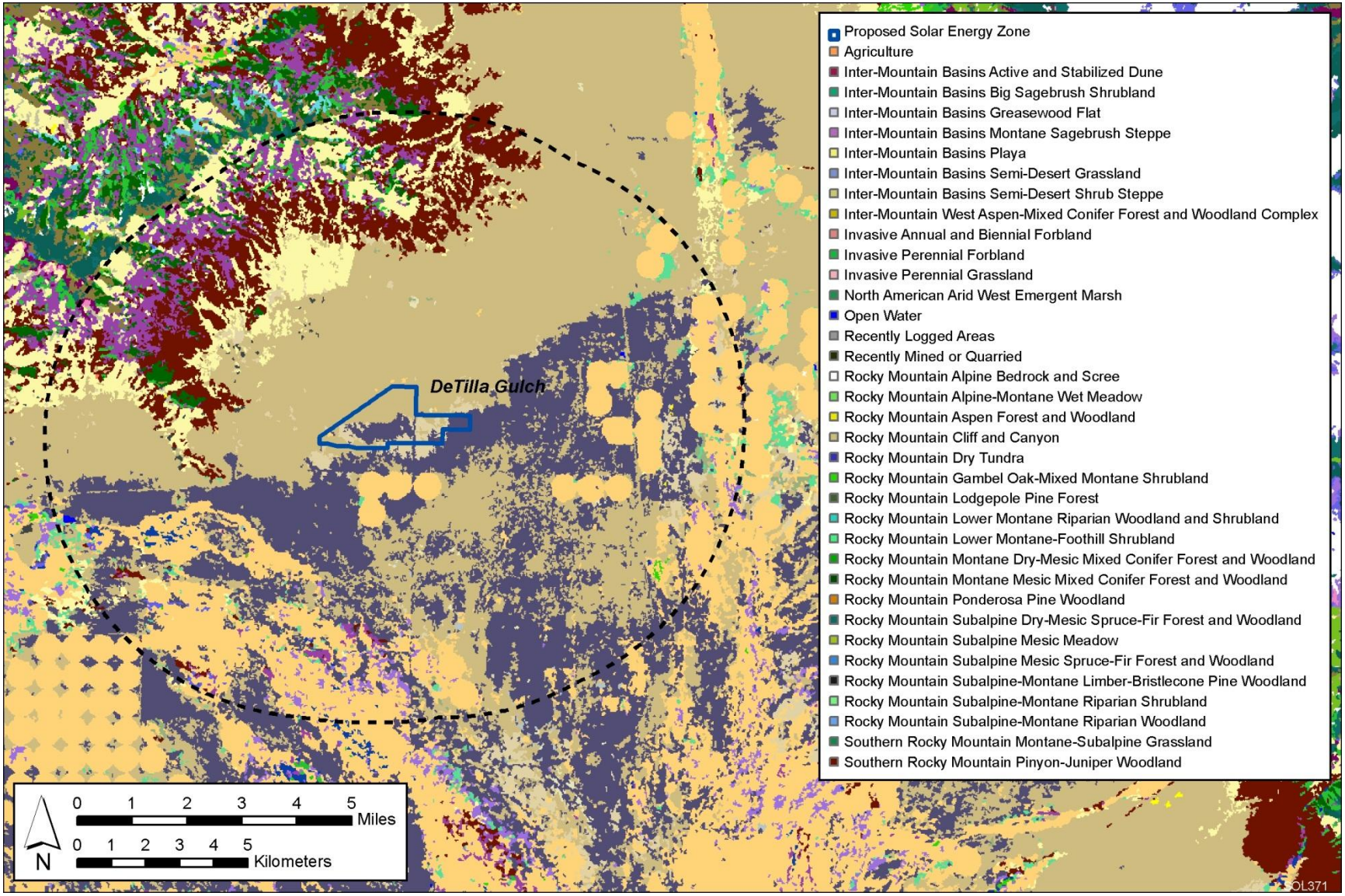

FIGURE 4-6 Proposed De Tilla Gulch SEZ and Associated Land Cover Types

San Juan Mountains to the west and the Sangre de Cristo Range to the east form the rim of the basin. The land within the proposed SEZ is flat and intersected with dry streambeds that run to the southeast. No development exists on the SEZ, nor is there any standing surface water.

The proposed De Tilla Gulch SEZ is located within the San Luis Shrublands and Hills Level IV ecoregion, which supports shrublands, grasslands, and, on upper elevations of the San Luis Hills, pinyon-juniper woodlands (Chapman et al. 2006). The dominant species of the shrubland communities in this ecoregion are big sagebrush (*Artemisia tridentata*), rubber rabbitbrush (*Ericameria nauseosa*), and winterfat (*Krascheninnikovia lanata*). Grassland species include western wheatgrass (*Pascopyrum smithii*), green needlegrass (*Nassella viridula*), blue grama (*Bouteloua gracilis*), and needle-and-thread (*Hesperostipa comata*). This ecoregion is located within the Arizona/New Mexico Plateau Level III ecoregion. Annual precipitation in the vicinity of the SEZ is low, averaging 8.3 in. (21.0 cm).

4.3.3 Fourmile East

The proposed Fourmile East SEZ has a total developable area of 2,882 acres (12 km^2) and is located in Alamosa County in south-central Colorado (Figure 4-7). In 2008, the county population was 15,783, while the four-county region surrounding the SEZ—Alamosa, Conejos, Costilla, and Rio Grande Counties—had a total population of 39,759. The largest nearby town is Alamosa, with an estimated 2008 population of 8,745, which is located about 13 mi (21 km) to the west on U.S. 160.

The nearest major road, CO 150, runs north–south along the eastern boundary of the SEZ. U.S. 160 lies about 0.6 mi (1 km) south of the SEZ. Great Sands Dunes NP is located about 9 mi (14 km) north of the SEZ on CO 150. It was assumed that no new access road development would be needed to serve the Fourmile East SEZ (Figure 4-7; Table 4-1).

The proposed Fourmile East SEZ lies in the eastern San Luis Valley, part of the San Luis Basin, a high-elevation (approximately 8,000 ft [2,440 m]) basin between two large mountain ranges. The San Juan Mountains to the west and the Sangre de Cristo Range to the east form the rim of the basin. The SEZ is located within the Salt Flats Level IV ecoregion, which supports sparse shrubland plant communities (Chapman et al. 2006). The dominant species in this ecoregion are greasewood (*Sarcobatus vermiculatus*), fourwing saltbush (*Atriplex canescens*), shadscale (*Atriplex confertifolia*), horsebrush (*Tetradymia* sp.), spiny hopsage (*Grayia spinosa*), rubber rabbitbrush (*Ericameria nauseosa*), saltgrass (*Distichlis spicata*), and alkali sacaton (*Sporobolus airoides*). This ecoregion is located within the Arizona/New Mexico Plateau Level III ecoregion.

Level IV ecoregions within 5 mi (8 km) of the SEZ include the Sand Dunes and Sand Sheets ecoregion, northwest of the SEZ, which supports scrub communities on sand sheets and sparse vegetation on sand dunes, which are mostly barren. To the northeast, with increasing elevation, lie the Foothill Shrublands ecoregion, which supports shrubland and woodland habitats with interspersed grasslands; the Crystalline Subalpine Forests ecoregion, which supports mostly coniferous forest along with aspen groves and subalpine meadows; and the

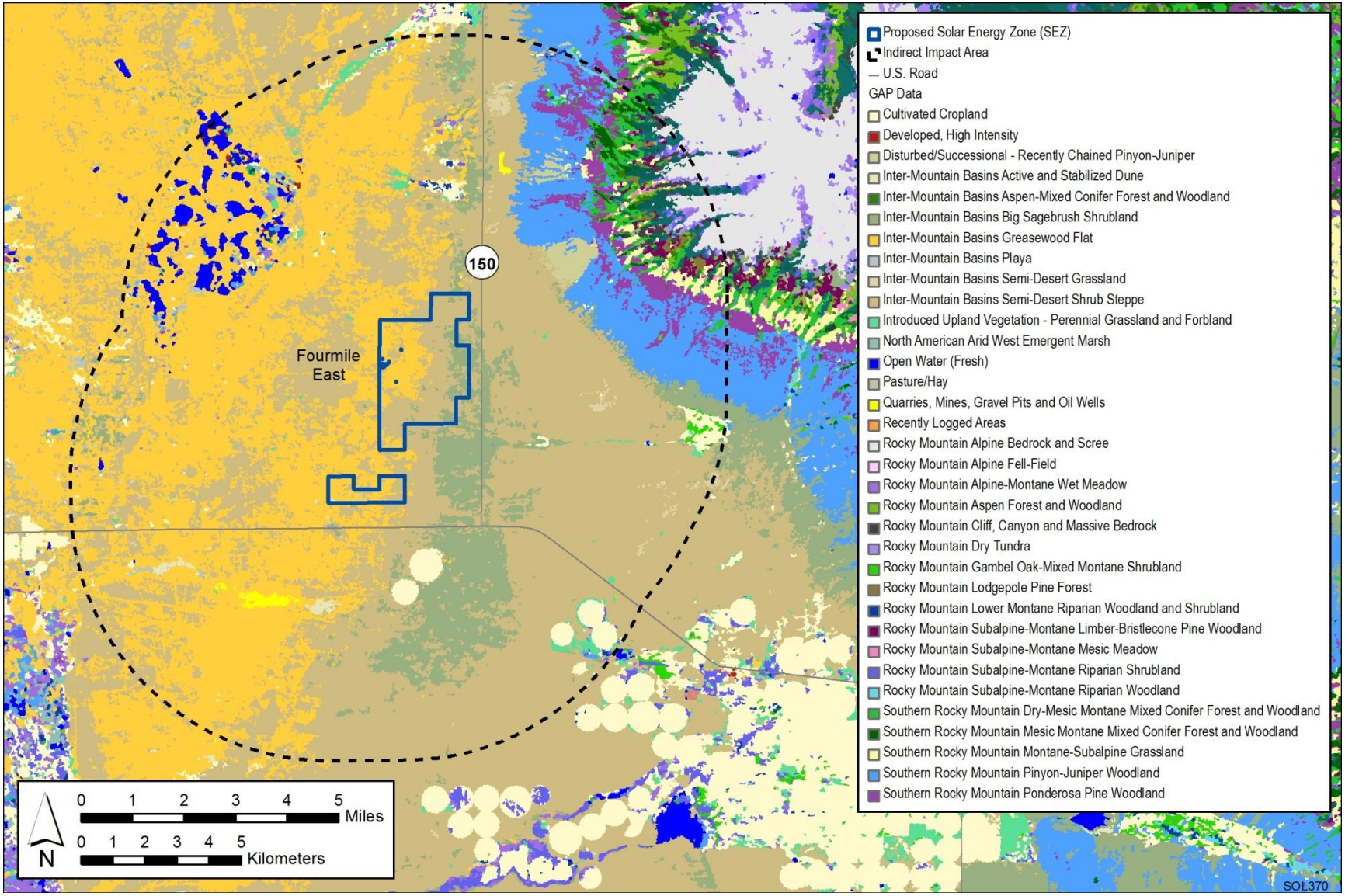

FIGURE 4-7 Proposed Fourmile East SEZ and Associated Land Cover Types

Alpine Zone ecoregion, which supports alpine meadows with sparse stunted trees near the tree line. To the southeast lies the San Luis Alluvial Flats and Wetlands ecoregion, which is mostly irrigated cropland and some remaining shrubland communities. Annual precipitation in the vicinity of the SEZ is low, averaging 7.1 in. (18.1 cm).

4.3.4 Los Mogotes East

The proposed Los Mogotes East SEZ has a total developable area of 2,650 acres (11 km^2). The SEZ is located in Conejos County in south-central Colorado, about 12 mi (19 km) north of the New Mexico border (Figure 4-8). In 2008, the county population was 8,745, while the four-county region surrounding the SEZ—Alamosa, Conejos, Costilla, and Rio Grande Counties—had a total population of 39,759. The largest nearby town is Alamosa, which had a 2008 population of 8,745, located about 22 mi (35 km) to the northeast on U.S. 285. This highway is located about 3 mi (5 km) east of the SEZ. It was assumed that a new access road would be needed to connect the SEZ to U.S. 285 (Figure 4-8; Table 4-1).

The proposed Los Mogotes East SEZ is located in the southwestern San Luis Valley, part of the San Luis Basin, a large, high-elevation basin within the Rocky Mountains. The San Juan Mountains to the west and the Sangre de Cristo Range to the east form the rim of the basin. There is no development on the SEZ, which is currently used for grazing. The SEZ is located primarily within the San Luis Alluvial Flats and Wetlands Level IV ecoregion. Although most areas within this ecoregion have been converted to irrigated cropland, remaining shrubland communities include shadscale (*Atriplex confertifolia*), fourwing saltbush (*Atriplex canescens*), and greasewood (*Sarcobatus vermiculatus*) (Chapman et al. 2006). The northwestern portion of this SEZ is located within the San Luis Shrublands and Hills Level IV ecoregion, which supports shrublands, grasslands, and, on upper elevations of the San Luis Hills, pinyon-juniper woodlands. The dominant species of the shrubland communities in this ecoregion are big sagebrush (*Artemisia tridentata*), rubber rabbitbrush (*Ericameria nauseosa*), and winterfat (*Krascheninnikovia lanata*). Grassland species include western wheatgrass (*Pascopyrum smithii*), green needlegrass (*Nassella viridula*), blue grama (*Bouteloua gracilis*), and needle-and-thread (*Hesperostipa comata*). Land areas surrounding the SEZ lie within the San Luis Alluvial Flats and Wetlands and the San Luis Shrublands and Hills Level IV ecoregions. Annual precipitation in the vicinity of the SEZ is low, averaging 7.3 in. (18.5 cm).

4.4 NEVADA SEZS

4.4.1 Amargosa Valley

The proposed Amargosa Valley SEZ is located in Nye County in southern Nevada near the California border (Figure 4-9). The SEZ has a total developable area of 8,479 acres (34 km^2). In 2008, the county population was 44,175, while adjacent Clark County to the southeast had a population of 1,879,093. The closest towns to the SEZ are Beatty, about 11 mi (18 km) north on

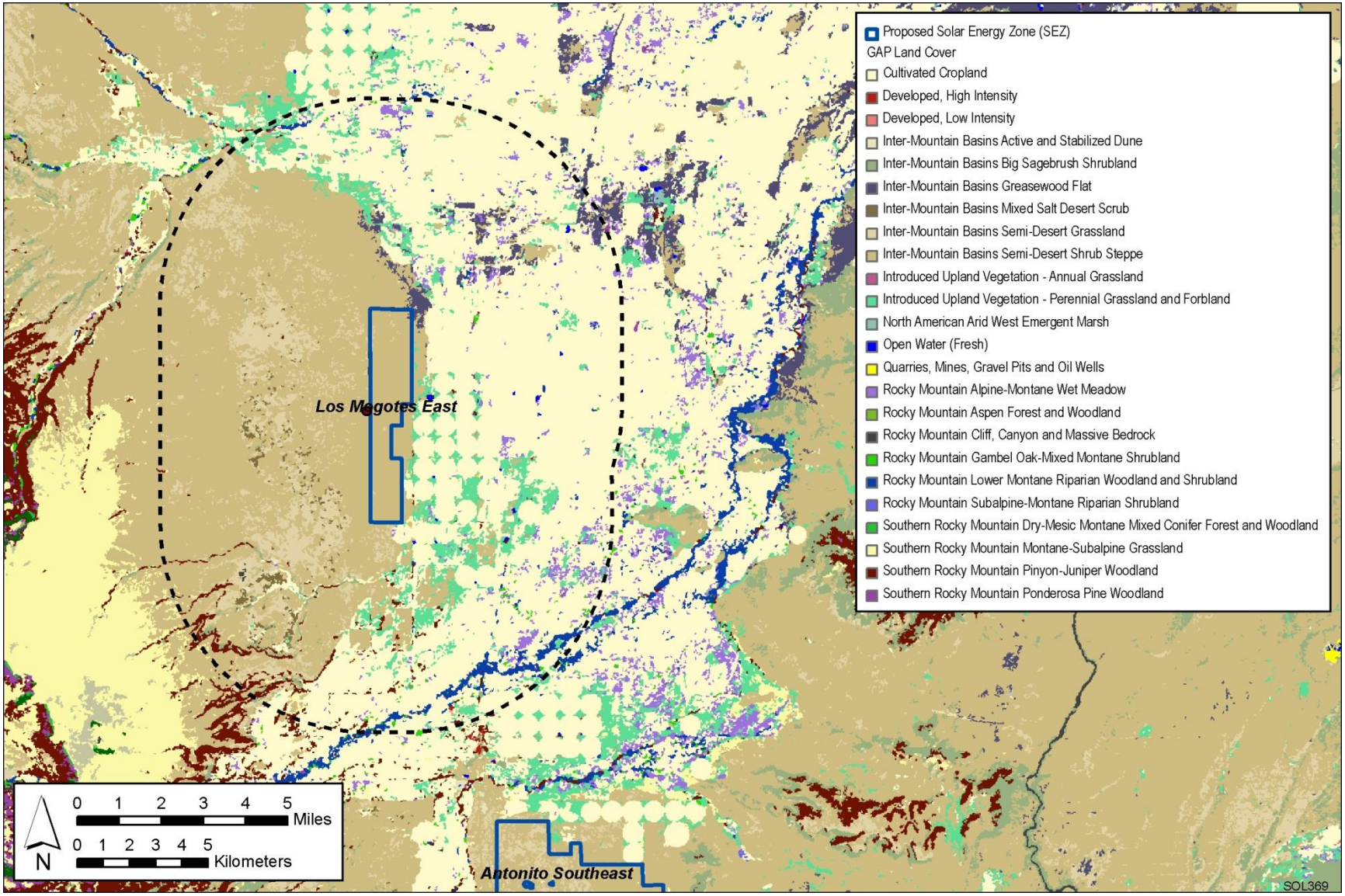

FIGURE 4-8 Proposed Los Mogotes East SEZ and Associated Land Cover Types

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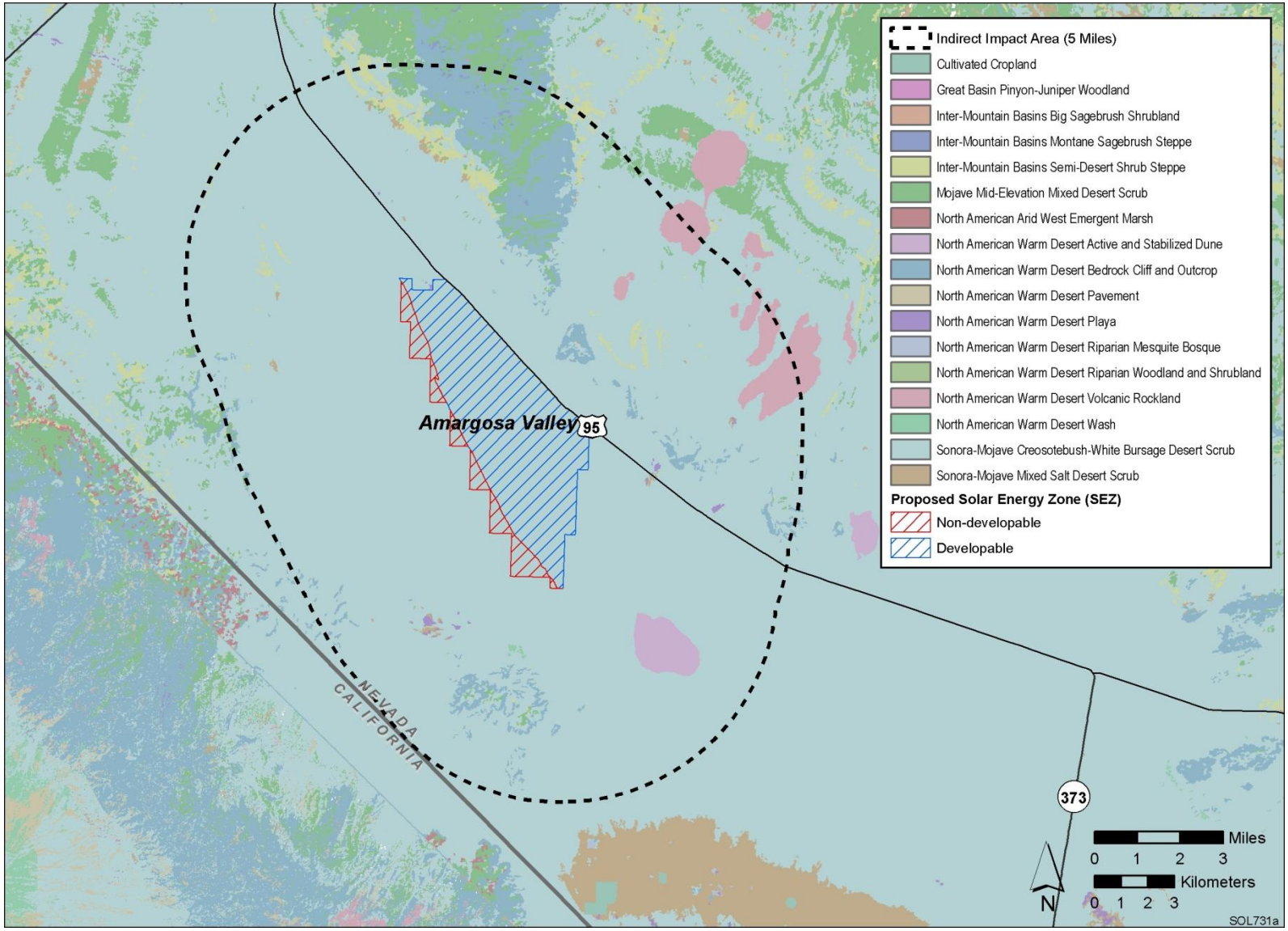

FIGURE 4-9 Proposed Amargosa Valley SEZ and Associated Land Cover Types

U.S. 95, and Amargosa Valley, about 12 mi (20 km) southeast on U.S. 95. Las Vegas is about 84 mi (135 km) southeast.

Access to the Amargosa Valley SEZ is via U.S. 95, which passes along the northeast boundary of the SEZ. Access to the interior of the SEZ is by dirt roads. It was assumed that no new access road development would be needed to serve the Amargosa Valley SEZ (Figure 4-9; Table 4-1).

The proposed Amargosa Valley SEZ is located within the Amargosa Desert Level IV ecoregion, which primarily supports a creosotebush (*Larrea tridentata*) and white bursage (*Ambrosia dumosa*) community (Bryce et al. 2003). Additional commonly occurring species include wolfberry (*Lycium torreyi*), shadscale (*Atriplex confertifolia*), Joshua tree (*Yucca brevifolia*) and other *Yucca* species, and Indian ricegrass (*Achnatherum hymenoides*), a perennial grass. This internally drained ecoregion includes nearly level to rolling valleys and scattered hills. Extensive underground water systems discharge within this ecoregion, resulting in many springs and seeps, including those at Ash Meadows National Wildlife Refuge (NWR), approximately 20 mi (32 km) southeast of the SEZ. Wetland oases form where the Amargosa River surfaces, and intermittent and ephemeral washes and streams commonly have subsurface flow. Many endemic plants occur in this ecoregion, particularly at Ash Meadows.

The Amargosa Desert lies within the Mojave Basin and Range Level III ecoregion. This ecoregion is characterized by broad basins and scattered mountains. Communities of sparse, scattered shrubs and grasses, including creosotebush, white bursage, and big galleta grass (*Pleuraphis rigida*) occur in basins. Joshua tree, other *Yucca* species, and cacti occur on arid footslopes. Woodland and shrubland communities occur on mountain slopes, ridges, and hills (Bryce et al. 2003). Creosotebush, all-scale (*Atriplex polycarpa*), brittlebush (*Encelia farinosa*), desert holly (*Atriplex hymenelytra*), white burrobrush (*Hymenoclea salsola*), shadscale (*Atriplex confertifolia*), blackbrush (*Coleogyne ramosissima*), and Joshua tree are dominant species within the Mojave desertscrub biome (Turner 1994). Precipitation in the Mojave Desert occurs primarily in winter. Many ephemeral species (winter annuals) germinate in response to winter rains (Turner 1994). Annual precipitation in the vicinity of the SEZ is very low, averaging 4.4 in. (11.3 cm).

The area surrounding the SEZ also includes the Arid Footslopes Level IV ecoregion. This ecoregion supports a sparse mixture of Mojave Desert species, such as creosotebush, white bursage, and *Yucca* species, including Joshua tree on alluvial fans, basalt flows, hills, and low mountains. Cacti occur in rocky areas. Blackbrush is dominant on upper-elevation slopes.

4.4.2 Dry Lake

The proposed Dry Lake SEZ is located in Clark County in southern Nevada. The SEZ has a total developable area of 5,717 acres (23 km^2) (Figure 4-10). In 2008, the county population was 1,879,093. The towns of Moapa Town and Overton are as close as 18 mi (29 km) northeast and 23 mi (37 km) east of the SEZ, respectively.

The nearest major roads accessing the proposed Dry Lake SEZ are Interstate 15, which passes along the southeastern boundary of the SEZ, and U.S. 93, which runs from northwest to southeast along the southwest border of the SEZ. It was assumed that no new access road development would be needed to serve the Dry Lake SEZ (Figure 4-10; Table 4-1).

The proposed Dry Lake SEZ is located primarily within the Creosotebush–Dominated Basins Level IV ecoregion (EPA 2007), which includes stream terraces, floodplains, alluvial fans, and eroded washes, as well as isolated hills, mesas, and buttes (Bryce et al. 2003). Plant communities are characterized by sparse creosotebush (*Larrea tridentata*), white bursage (*Ambrosia dumosa*), and big galleta grass (*Pleuraphis rigida*); cacti, yucca (*Yucca* sp.), ephedra (*Ephedra* sp.), and Indian ricegrass (*Achnatherum hymenoides*) are also common, although barren areas occur. In addition, mesquite (*Prosopis* sp.) and acacia (*Acacia* sp.) are present, and blackbrush (*Coleogyne ramosissima*) is common in areas near the Arid Footslopes ecoregion. Riparian habitats include desert willow (*Chilopsis linearis*), coyote willow (*Salix exigua*), and mesquite, with salt cedar (*Tamarix* sp.), a non-native shrub/tree invading riparian areas. Small areas of the northwestern margin of the SEZ are located in the Arid Footslopes Level IV ecoregion. This ecoregion supports a diverse but sparse mixture of Mojave desert forbs, succulents and shrubs, such as creosotebush, white bursage, *Yucca* species, including Joshua tree (*Yucca brevifolia*), winterfat (*Krascheninnikovia lanata*), spiny menodora (*Menodora spinescens*), Nevada ephedra (*Ephedra nevadensis*), big galleta, Indian ricegrass, and annual fescue (*Vulpia myuros*) on alluvial fans, basalt flows, hills, and low mountains (Bryce et al. 2003). Cacti, such as silver cholla (*Cylindropuntia echinocarpa*) and beavertail (*Opuntia basilaris*), occur in rocky areas. Annual plants are abundant with sufficient winter precipitation. The east-central portion of the SEZ is located within the Mojave Playas Level IV ecoregion, which includes broad, nearly level alluvial flats, muddy lake plains, low terraces, sand sheets, and sand dunes (Bryce et al. 2003). These playas are intermittently flooded and mostly barren, with sparse, scattered, highly salt-tolerant vegetation on the margins. Velvet ash (*Fraxinus velutina*), mesquite, or other trees may occur on some playas with sufficient moisture. Scattered creosotebush occurs in some locations. Areas surrounding the SEZ include the Creosotebush–Dominated Basins and Arid Footslopes ecoregions.

These ecoregions are located within the Mojave Basin and Range Level III ecoregion. The Mojave Basin and Range Level III ecoregion is characterized by broad basins and scattered mountains. Communities of sparse, scattered shrubs and grasses, including creosotebush, white bursage, and big galleta grass, occur in basins. Joshua tree, other *Yucca* species, and cacti occur on arid footslopes. Woodland and shrubland communities occur on mountain slopes, ridges, and hills (Bryce et al. 2003). Creosotebush, all-scale (*Atriplex polycarpa*), brittlebush (*Encelia farinosa*), desert holly (*Atriplex hymenelytra*), white burrobrush (*Hymenoclea salsola*), shadscale (*Atriplex confertifolia*), blackbrush, and Joshua tree are dominant species within the Mojave desertscrub biome (Turner 1994). Precipitation in the Mojave Desert occurs primarily in winter. Many ephemeral species (winter annuals) germinate in response to winter rains (Turner 1994). Annual precipitation in the vicinity of the SEZ is low, averaging about 6.5 in. (16.4 cm).

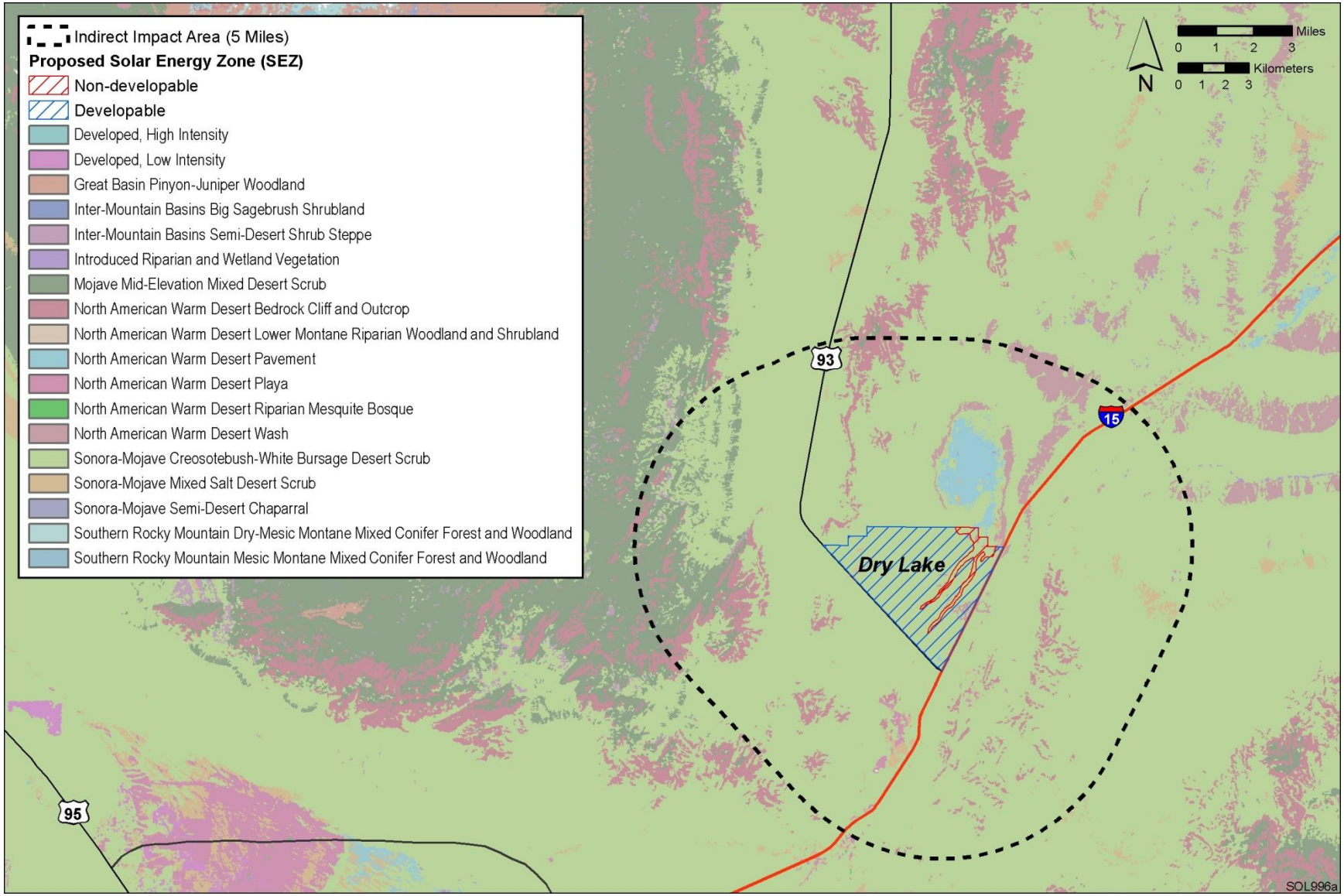

FIGURE 4-10 Proposed Dry Lake SEZ and Associated Land Cover Types

4.4.3 Dry Lake Valley North

The proposed Dry Lake Valley North SEZ is located in Lincoln County in southeastern Nevada. The SEZ has a total developable area of 25,069 acres (101 km^2) (Figure 4-11). In 2008, the county population was 4,643, while adjacent Clark County to the south had a population of 1,879,093. The closest population centers to the SEZ are Pioche, located about 15 mi (24 km) to the east, and Caliente, located about 15 mi (24 km) to the southeast; both communities have populations of about 1,000.

The nearest major road to the Dry Lake Valley North SEZ is State Route 318, which is about 7 mi (11 km) to the west of the SEZ, while U.S. 93 is about 8 mi (13 km) to the south. Access to the interior of the SEZ is by dirt roads. It was assumed that a new access road would be needed to connect the SEZ to U.S. 93 (Figure 4-11; Table 4-1).

The proposed Dry Lake Valley North SEZ is located primarily within the Shadscale-Dominated Saline Basins Level IV ecoregion, which supports shadscale (*Atriplex confertifolia*) and black greasewood (*Sarcobatus vermiculatus*) low scrub communities in valley bottoms, and also includes remnant lake terraces and scattered sand dunes (Bryce et al. 2003). This internally drained nearly flat to gently sloping ecoregion includes soils with high salt and alkali content, which are dry for extended periods. Additional commonly occurring species include bud sagebrush (*Picrothamnus desertorum*), fourwing saltbrush (*Atriplex canescens*), rubber rabbitbrush (*Ericameria nauseosa*), alkali sacaton (*Sporobolus airoides*), bottlebrush squirreltail (*Elymus elymoides*), inland saltgrass (*Distichlis spicata*), Indian ricegrass (*Achnatherum hymenoides*), Great Basin wildrye (*Leymus cinereus*), and galleta (*Pleuraphis jamesii*). The southwestern portion of the SEZ is located within the Salt Deserts Level IV ecoregion, which contains nearly level playas, salt flats, mud flats, and saline lakes (Bryce et al. 2003). These habitats are mostly barren and may be salt encrusted in dry periods. Scattered plants are salt tolerant and include pickleweed (*Salicornia* sp.), seepweed (*Suaeda fruticosa*), iodine bush (*Allenrolfea occidentalis*), black greasewood, alkali sacaton, and inland saltgrass. Scattered sand dunes also occur in this ecoregion, and perennial and intermittent springs are common. The southeastern portion is located within the Carbonate Sagebrush Valleys Level IV ecoregion, which supports sparse Great Basin sagebrush shrub communities of black sagebrush (*Artemisia nova*) and winterfat (*Krascheninnikovia lanata*), with grasses such as blue grama (*Bouteloua gracilis*) (Bryce et al. 2003). Additional species include Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), rabbitbrush (*Ericameria* sp./*Chrysothamnus* sp.), bottlebrush squirreltail, Indian ricegrass, and cheatgrass (*Bromus tectorum*). Annual precipitation in the vicinity of the SEZ is very low, averaging 8.7 in. (22.2 cm).

4.4.4 Gold Point

The proposed Gold Point SEZ is located in Esmeralda County in southwestern Nevada. The SEZ has a total developable area of 4,596 acres (19 km^2) (Figure 4-12). In 2008, the county population was 664, while adjacent Nye County to the east had a population of 44,175. There are no incorporated towns in close proximity to the SEZ. The town of Tonopah is approximately

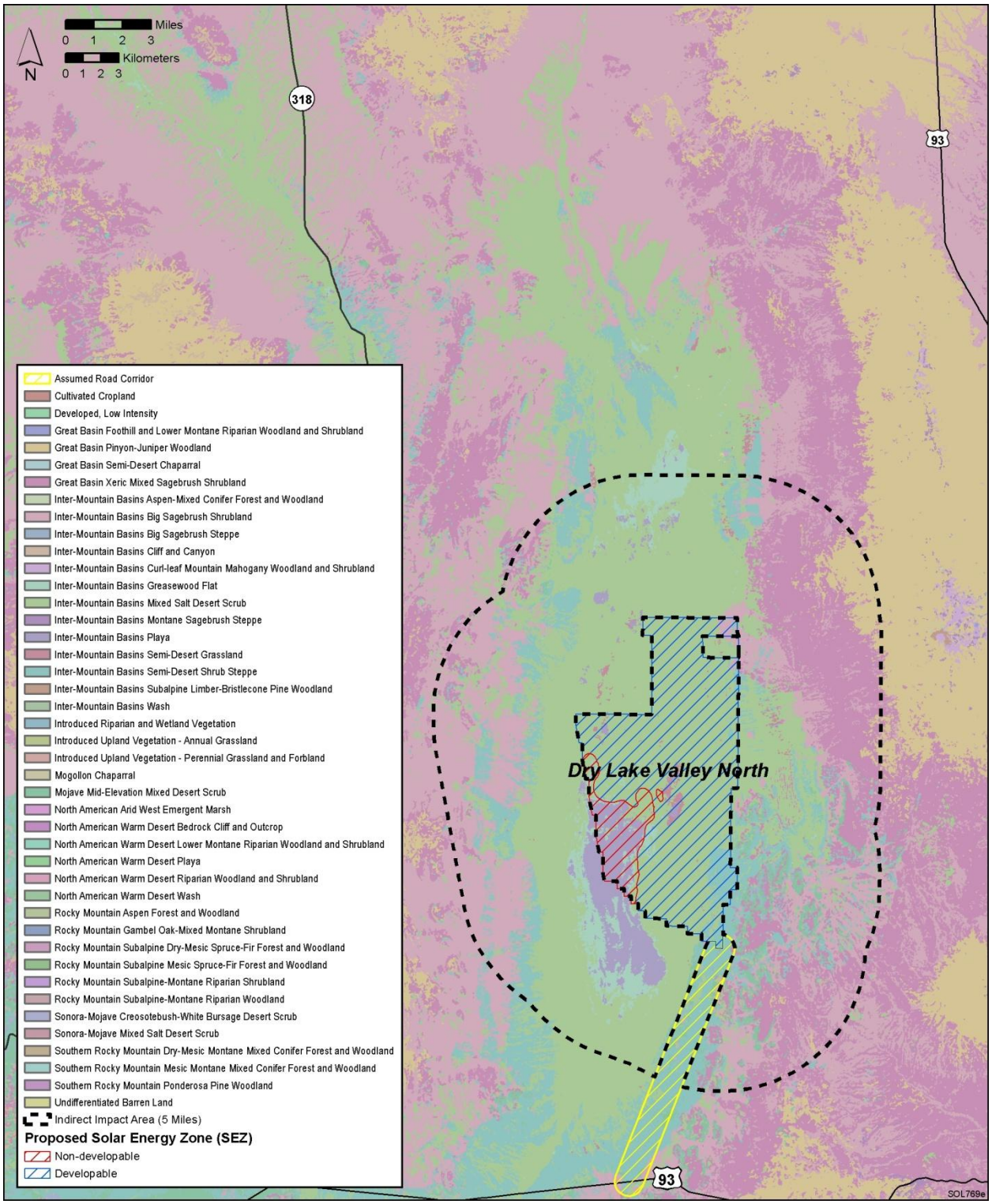

FIGURE 4-11 Proposed Dry Lake Valley North SEZ and Associated Land Cover Types

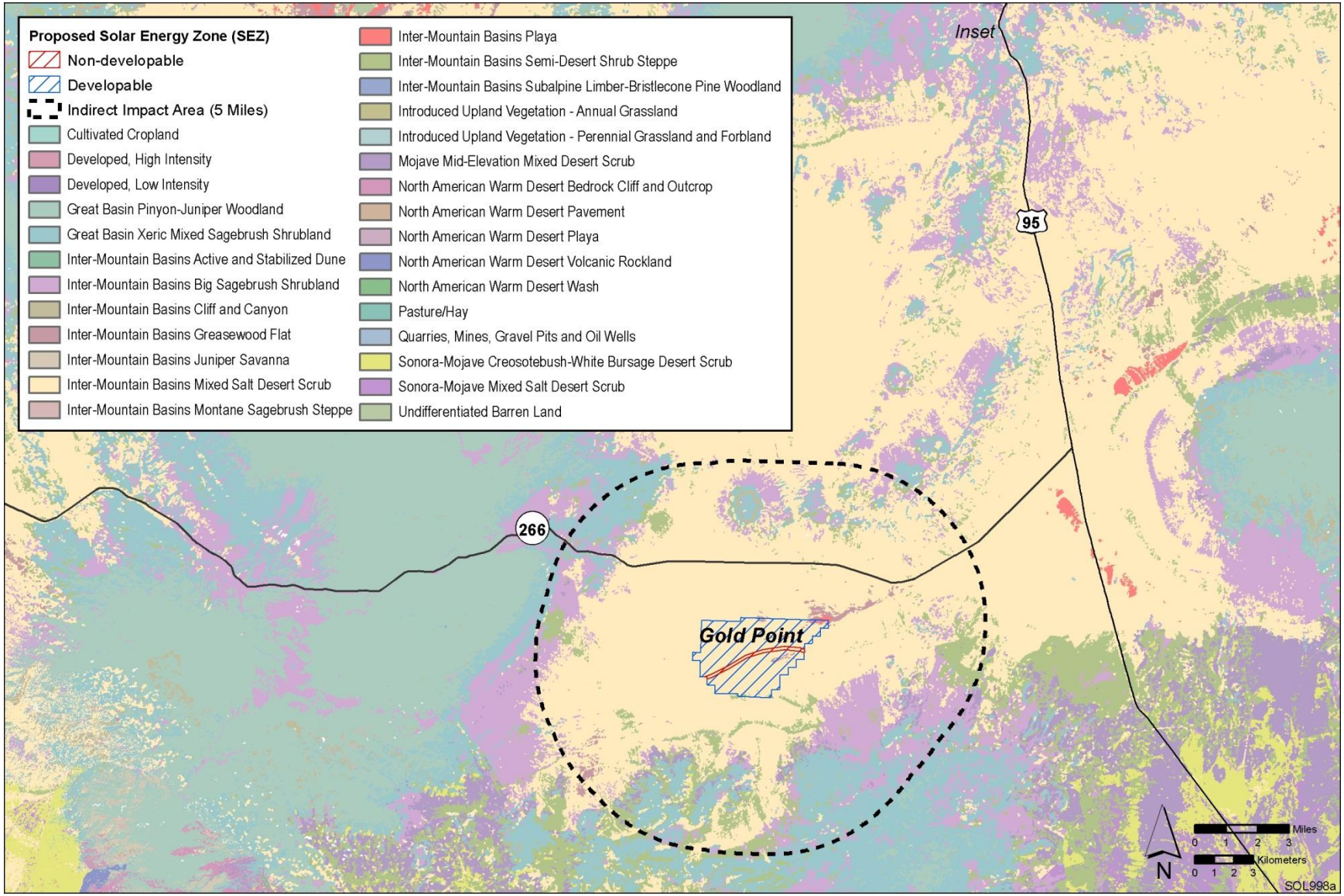

FIGURE 4-12 Proposed Gold Point SEZ and Associated Land Cover Types

50 mi (80 km) to the north, and the Las Vegas metropolitan area is approximately 180 mi (290 km) to the southeast of the SEZ.

The nearest major road access to the proposed Gold Point SEZ is State Route 774, which parallels the eastern edge of the SEZ; U.S. 95 runs north–south as it passes within 9 mi (14 km) to the east of the SEZ. It was assumed that no new access road development would be needed to serve the Gold Point SEZ (Figure 4-12; Table 4-1).

The proposed Gold Point SEZ is located primarily within the Tonopah Basin Level IV ecoregion, which primarily supports sparse shadscale (*Atriplex confertifolia*) communities on broad valleys, hills, bajadas, and alluvial fans (Bryce et al. 2003). Additional commonly occurring shrubs in this ecoregion include bud sagebrush (*Picrothamnus desertorum*), spiny hopsage (*Grayia spinosa*), seepweed (*Suaeda* sp.), fourwing saltbush (*Atriplex canescens*), spiny menodora (*Menodora spinescens*), Nevada ephedra (*Ephedra nevadensis*), littleleaf horsebrush (*Tetradymia glabrata*), Douglas rabbitbrush (*Chrysothamnus viscidiflorus*), and winterfat (*Krascheninnikovia lanata*), which, along with shadscale, often co-dominate in highly diverse mosaics. Warm season grasses, such as Indian rice grass (*Achnatherum hymenoides*) and galleta grass (*Pleuraphis jamesii*), occur in the understory. Stands of inland saltgrass (*Distichlis spicata*) and alkali sacaton (*Sporobolus airoides*) also occur. Bailey greasewood (*Sarcobatus baileyi*) and Shockley wolfberry (*Lycium* sp.) are widespread and often co-dominate on lower alluvial slopes in this ecoregion. Black greasewood (*Sarcobatus vermiculatus*) occurs in saline bottoms. Springs and sporadic precipitation in foothills provide surface water sources.

The Tonopah Basin ecoregion lies within the Central Basin and Range Level III ecoregion, which is part of the Great Basin desertscrub biome. Annual precipitation in the vicinity of the SEZ is low, averaging about 6.1 in. (15.4 cm).

4.4.5 Millers

The proposed Millers SEZ is located in Esmeralda County in southern Nevada, 44 mi (71 km) east of the California border. The SEZ has a total developable area of 16,534 acres (67 km^2) (Figure 4-13). In 2008, the county population was 664, while adjacent Nye County to the west had a population of 44,175. The nearest town is Tonopah, Nevada, about 15 mi (24 km) west in Nye County, with a population of approximately 1,500.

The nearest major road access to the proposed SEZ is via U.S. 95/U.S. 6, which runs east–west along its southern border. It was assumed that no new access road development would be needed to serve the Millers SEZ (Figure 4-13; Table 4-1).

The proposed Millers SEZ is located primarily within the Tonopah Basin Level IV ecoregion, which primarily supports sparse shadscale (*Atriplex confertifolia*) communities on broad valleys, hills, bajadas, and alluvial fans (Bryce et al. 2003). Additional commonly occurring shrubs in this ecoregion include bud sagebrush (*Picrothamnus desertorum*), spiny hopsage (*Grayia spinosa*), seepweed (*Suaeda* sp.), fourwing saltbush (*Atriplex canescens*), spiny menodora (*Menodora spinescens*), Nevada ephedra (*Ephedra nevadensis*), littleleaf horsebrush

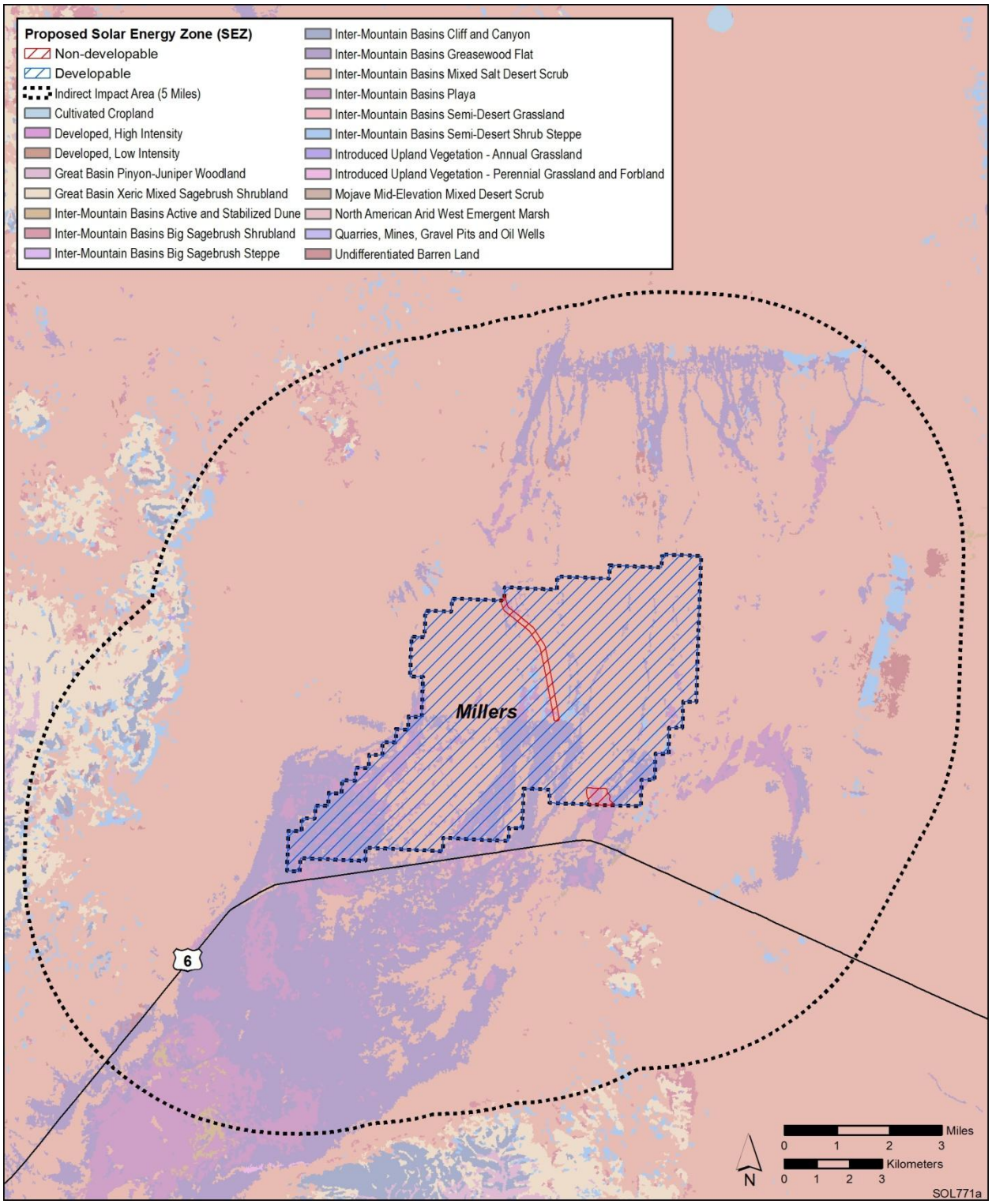

FIGURE 4-13 Proposed Millers SEZ and Associated Land Cover Types

(*Tetradymia glabrata*), Douglas rabbitbrush (*Chrysothamnus viscidiflorus*), and winterfat (*Krascheninnikovia lanata*), which, along with shadscale, often co-dominate in highly diverse mosaics. Warm season grasses, such as Indian ricegrass (*Achnatherum hymenoides*) and galleta grass (*Pleuraphis jamesii*), occur in the understory. Stands of inland saltgrass (*Distichlis spicata*) and alkali sacaton (*Sporobolus airoides*) also occur. Bailey greasewood (*Sarcobatus baileyi*) and Shockley wolfberry (*Lycium* sp.) are widespread and often co-dominate on lower alluvial slopes in this ecoregion. Black greasewood occurs in saline bottoms. Springs and sporadic precipitation in foothills provide surface water sources. The southwestern portion of the Millers SEZ is located within the Lahontan and Tonopah Playas. This Level IV ecoregion is nearly level and contains mud flats, alkali flats, intermittent saline lakes, and low sand dunes. Marshes, remnant lakes, and playas occur within this ecoregion. Rivers terminate in the playas, which during winter fill with seasonal runoff from nearby mountains. Only scattered, highly salt-tolerant plants, such as alkali sacaton, inland saltgrass, and seepweed, occur in this mostly barren ecoregion. Bordering the playas, black greasewood (*Sarcobatus vermiculatus*) or fourwing saltbush may form a transition to the salt shrub community. Playas may be sources of wind-generated salt dust.

The Tonopah Basin and Lahontan and Tonopah Playas ecoregions lie within the Central Basin and Range Level III ecoregion, which is part of the Great Basin desertscrub biome. Annual precipitation in the vicinity of the SEZ is low, averaging about 5.1 in. (12.9 cm).

4.5 NEW MEXICO SEZS

4.5.1 Afton

The proposed Afton SEZ is located in Doña Ana County in southern New Mexico, 21 mi (34 km) north of the border with Mexico (Figure 4-14). The SEZ has a total developable area of 29,964 acres (121 km^2). In 2008, the county population was 206,486. The towns of Las Cruces, Mesilla, Mesquite, University Park, and Vado are all within a 5-mi (8-km) radius of the SEZ. Las Cruces is the largest, with a population of approximately 90,000.

The nearest major road access to the SEZ is via Interstate 10, which runs east–west along approximately 3 mi (5 km) north of the Afton SEZ border. Access to the interior of the SEZ is by dirt roads. Therefore, it was assumed that a new access road would be needed to connect the SEZ to Interstate 10 (Figure 4-14; Table 4-1).

The proposed Afton SEZ is located primarily within the Chihuahuan Basins and Playas Level IV ecoregion (EPA 2007), which supports communities of desert shrubs and grasses on alluvial fans, flat to rolling internally drained basins, and river valleys, and includes areas of saline and alkaline soils, salt flats, sand dunes, and areas of windblown sand (Griffith et al. 2006). The dominant species of the desert shrubland is creosotebush (*Larrea tridentata*), with tarbush (*Flourensia cernua*), yuccas (*Yucca* spp.), sand sage (*Artemisia filifolia*), viscid acacia (*Acacia neovernicosa*), tasajillo (*Cylindropuntia leptocaulis*), lechuguilla (*Agave lechuguilla*), and mesquite (*Prosopis* sp.) also occurring frequently. Gypsum areas support gyp grama

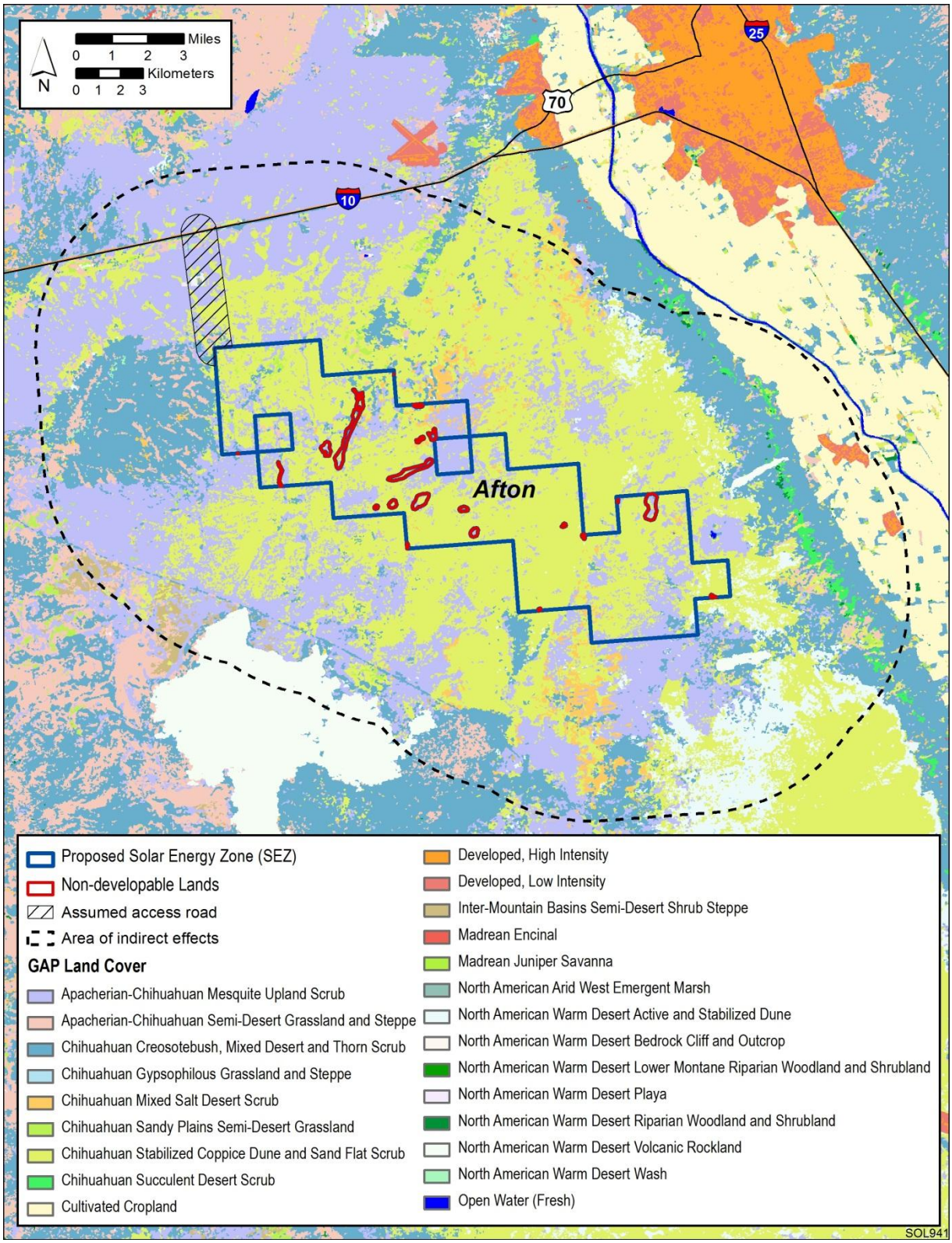

FIGURE 4-14 Proposed Afton SEZ and Associated Land Cover Types

(*Bouteloua breviseta*), gyp mentzelia (*Mentzelia humulis*), and Torrey ephedra (*Ephedra torreyana*). Fourwing saltbush (*Atriplex canescens*), seepweed (*Suaeda* sp.), pickleweed (*Allenrolfea occidentalis*), and alkali sacaton (*Sporobolus airoides*) occur on saline flats and along alkaline playa margins. Cacti, including horse crippler (*Echinocactus texensis*), are common in this ecoregion. Small areas in the eastern portion of the SEZ are located within the Rio Grande Floodplain ecoregion. This ecoregion supports riparian woodlands and shrublands along with agricultural areas (Griffith et al. 2006). Riparian habitats include cottonwood (*Populus* sp.)–willow (*Salix* sp.) communities, along with velvet ash (*Fraxinus velutina*), screwbean mesquite (*Prosopis pubescens*), seep willow (*Baccharis salicifolia*), alkali sacaton, skunkbush (*Rhus trilobata*), and creosotebush. Salt cedar (*Tamarix chinensis*), a woody invasive species, dominates some riparian areas. These ecoregions are located within the Chihuahuan Deserts Level III ecoregion. Annual precipitation in the Chihuahuan Desert occurs mostly in summer (Brown 1994) and is low in the area of the SEZ, averaging about 9.4 in. (24 cm).

4.6 UTAH SEZS

4.6.1 Escalante Valley

The proposed Escalante Valley SEZ is located in Iron County in southwestern Utah (Figure 4-15). The SEZ has a total developable area of 6,533 acres (26 km^2). In 2008, the county population was 45,833, while adjacent Washington County to the south had a population of 148,256. The largest nearby town is Cedar City on Interstate 15 in Iron County; Cedar City had a 2008 population of 28,667 and is located about 30 mi (48 km) to the east-southeast. Several small towns are located closer to the SEZ; Lund is about 4 mi (6 km) to the north, and Zane is about 5 mi (8 km) to the west. Salt Lake City is located about 220 mi (354 km) to the north–northeast.

The nearest major road is State Route 56, about 15 mi (24 km) southeast of the SEZ. Access to the Escalante Valley SEZ is via county road; Lund Highway passes northeast of the SEZ. Access to the interior of the SEZ is by dirt roads. It was assumed that a new access road would be needed to connect the SEZ to State Route 56 (Figure 4-15; Table 4-1).

Much of the proposed Escalante Valley SEZ is located within the Shadscale-dominated Saline Basins Level IV ecoregion, which primarily supports a sparse saltbush-greasewood shrub community (Woods et al. 2001). This ecoregion includes nearly flat to gently sloping valley bottoms and lower hill slopes. Soils have a high salt and alkali content, and plants are salt and drought tolerant. The dominant shrub species in this ecoregion are shadscale (*Atriplex confertifolia*), winterfat (*Krascheninnikovia lanata*), greasewood (*Sarcobatus vermiculatus*), and bud sagebrush (*Picrothamnus desertorum*). Perennial grasses are also typically present and include bottlebrush squirreltail (*Elymus elymoides*), Indian ricegrass (*Achnatherum hymenoides*), and galleta (*Pleuraphis jamesii*). Much of the western portion of the SEZ lies within the Salt Deserts Level IV ecoregion. This ecoregion is mostly barren and contains playas, salt flats, mud flats, low terraces, and saline lakes. Playas and salt flats are ponded during wet periods and subject to wind erosion when they are dry. Soils are poorly drained, have a high salt and alkali

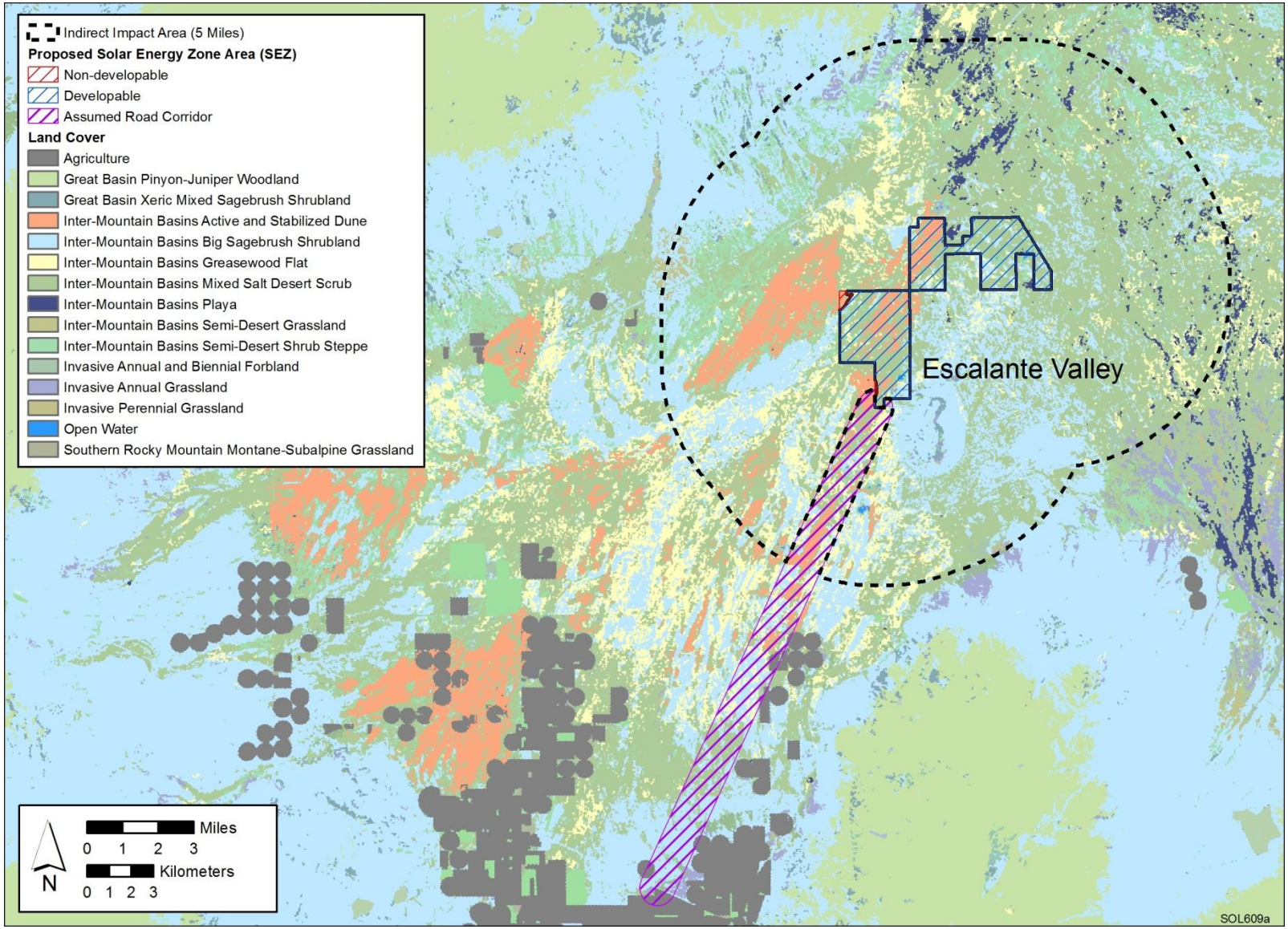

FIGURE 4-15 Proposed Escalante Valley SEZ and Associated Land Cover Types

content, and are often salt-crusted. Plants in this ecoregion are generally sparse and widely scattered, if present at all, and include extremely salt-tolerant species such as salicornia (*Salicornia* sp.), saltgrass (*Distichlis spicata*), alkali sacaton (*Sporobolus airoides*), iodine bush (*Allenrolfea occidentalis*), and greasewood. Annual precipitation in the vicinity of the SEZ is low, averaging 10 in. (25.4 cm).

4.6.2 Milford Flats South

The proposed Milford Flats South SEZ (Figure 4-16) is located in Beaver County in southwestern Utah about 21 mi (34 km) northeast of the Escalante Valley SEZ. The SEZ has a total developable area of 6,252 acres (25 km^2). In 2008, the county population was 7,265, while adjacent Iron County to the south had a population of 45,833. The largest nearby city is Cedar City, about 30 mi (48 km) south–southeast in Iron County. Several small towns are located closer to the SEZ; Minersville is about 5 mi (8 km) east, and Milford is about 13 mi (21 km) north-northeast. Salt Lake City is about 200 mi (322 km) to the north-northeast.

The nearest major road is State Route 21/130, about 5 mi (8 km) east in Minersville. A smaller spur of State Route 129 is about 3 mi (5 km) northwest of the SEZ. Access to the Milford Flats South SEZ is by county and local roads. Access to the interior of the SEZ is by dirt roads. It was assumed that a new access road would be needed to connect the SEZ to State Route 21/130 (Figure 4-16; Table 4-1).

Most of the western and southern portions of the proposed Milford Flats South SEZ are located within the Shadscale-dominated Saline Basins Level IV ecoregion, which primarily supports a sparse saltbush-greasewood shrub community (Woods et al. 2001). This ecoregion includes nearly flat to gently sloping valley bottoms and lower hillslopes. Soils have a high salt and alkali content, and plants are salt and drought tolerant. The dominant shrub species in this ecoregion are shadscale (*Atriplex confertifolia*), winterfat (*Krascheninnikovia lanata*), greasewood (*Sarcobatus vermiculatus*), and bud sagebrush (*Picrothamnus desertorum*). Perennial grasses are also typically present and include bottlebrush squirreltail (*Elymus elymoides*), Indian ricegrass (*Achnatherum hymenoides*), and galleta (*Pleuraphis jamesii*). Most of the eastern portion of the SEZ is within the Sagebrush Basins and Slopes Level IV ecoregion, which supports a Great Basin sagebrush community dominated by Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and includes perennial bunchgrasses. This ecoregion includes valleys, alluvial fans, bajadas, mountain flanks, and stream terraces. Annual precipitation in the vicinity of the SEZ is low, averaging 9.03 in. (22.9 cm).

4.6.3 Wah Wah Valley

The proposed Wah Wah Valley SEZ (Figure 4-17) is located in Beaver County in southwestern Utah about 21 mi (34 km) northwest of the proposed Milford Flats South SEZ. The SEZ has a total developable area of 5,873 acres (24 km^2). In 2008, the county population was 7,265, while adjacent Iron County to the south had a population of 45,833. The largest nearby

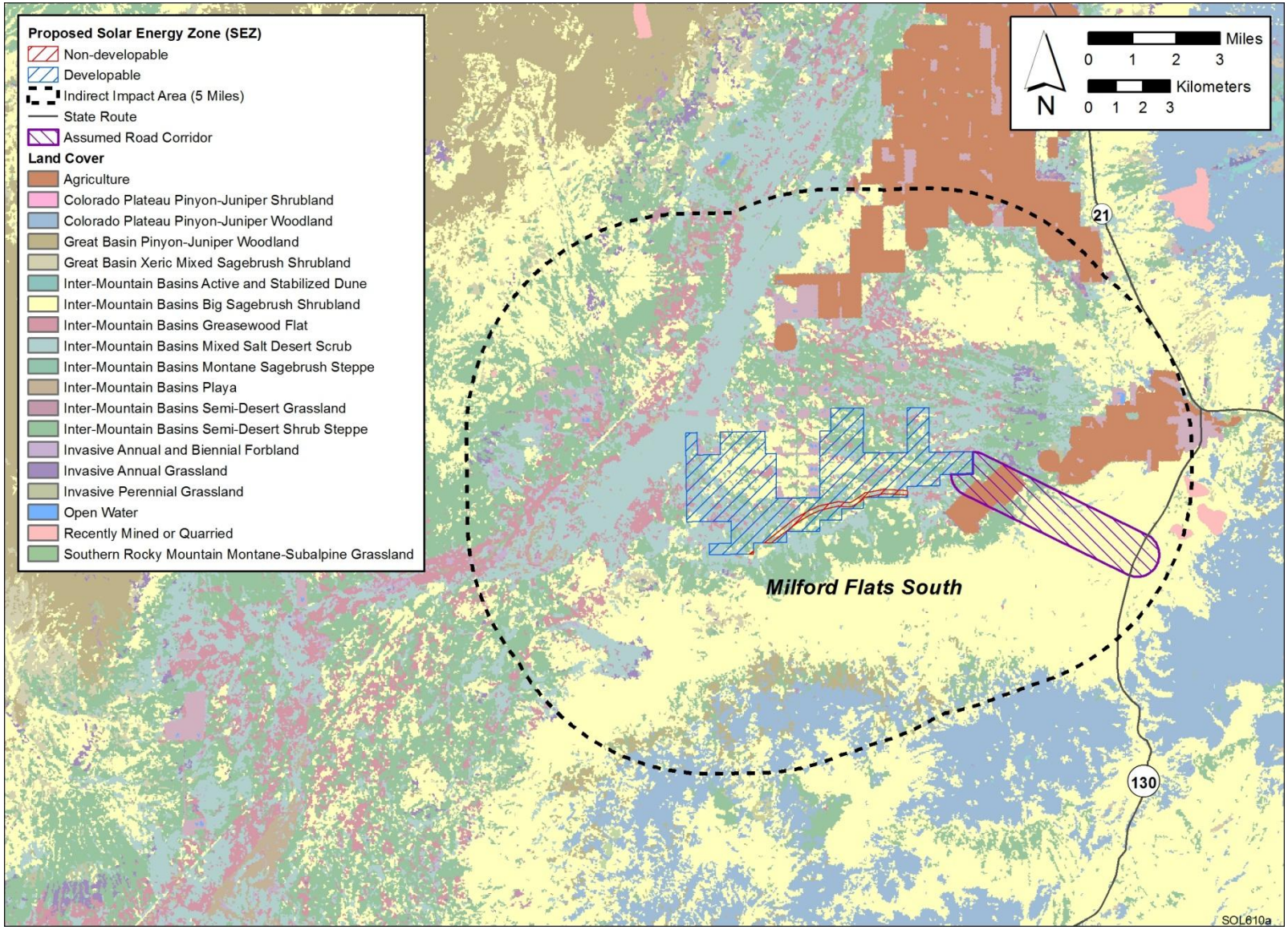

FIGURE 4-16 Proposed Milford Flats South SEZ and Associated Land Cover Types

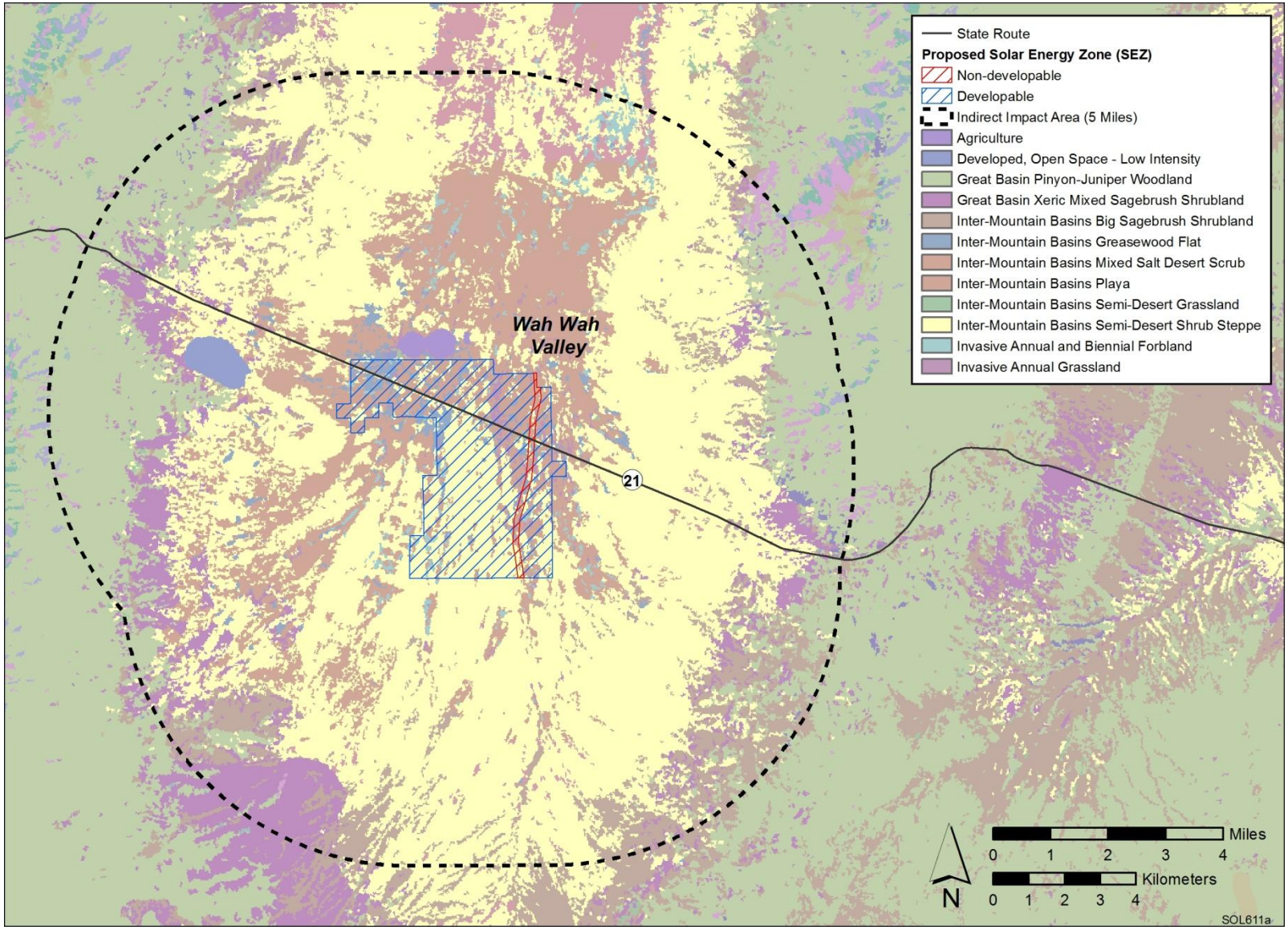

FIGURE 4-17 Proposed Wah Wah Valley SEZ and Associated Land Cover Types

town is Cedar City, Utah, about 50 mi (80 km) southeast in Iron County. The town of Milford is located about 23 mi (37 km) east. Salt Lake City lies about 200 mi (322 km) north–northeast.

There is good access to the SEZ from State Route 21, which runs west–east through the northern half of the SEZ. It was assumed that no new access road development would be needed to serve the Wah Wah Valley SEZ (Figure 4-17; Table 4-1).

The proposed Wah Wah Valley SEZ is located within the Shadscale-Dominated Saline Basins Level IV ecoregion, which primarily supports a sparse saltbush-greasewood shrub community (Woods et al. 2001). This ecoregion includes nearly flat to gently sloping valley bottoms and lower hill slopes. Soils have a high salt and alkali content, and plants are salt and drought tolerant. The dominant shrub species in this ecoregion are shadscale (*Atriplex confertifolia*), winterfat (*Krascheninnikovia lanata*), greasewood (*Sarcobatus vermiculatus*), and bud sagebrush (*Picrothamnus desertorum*). Perennial grasses are also typically present and include bottlebrush squirreltail (*Elymus elymoides*), Indian ricegrass (*Achnatherum hymenoides*), and galleta (*Pleuraphis jamesii*). Annual precipitation in the vicinity of the SEZ is low, averaging 6.77 in. (17.2 cm).

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5 EFFECTS OF THE PROPOSED ACTION ON LISTED SPECIES

This section presents the effects of the proposed action on listed species. Section 5.1 describes the general and technology-specific effects that would occur as a consequence of solar energy development under the proposed action if the design features described in Section 2.2 that are intended to reduce impacts and that would be required for all projects were not implemented. Impacts would be dependent on the specific characteristics of areas to be developed, the resources and species present in project areas, and project-specific characteristics such as the technology to be used, the water requirements of the project, the size of the project footprint, and the need for earth moving and other alteration of surface features. The actual project-specific impacts could differ from those described here.

Section 5.2 presents the potential effects of solar energy development under the proposed action on species that could occur outside of the affected areas of the 17 proposed SEZs, assuming design features described in Section 2.2 are implemented.

Given the uncertainty in size and location of solar energy projects within the SEZs, an accurate analysis of impacts from transmission ROW development or upgrade cannot be performed at this time. General impacts associated with transmission ROW development or upgrade are provided below in Section 5.1.1.5; a programmatic quantification of potential impacts from transmission developments is provided in Section 6. The impact of transmission ROW development and upgrade will need to be evaluated at the project level in consultation with the Service.

5.1 EFFECTS OF SOLAR ENERGY DEVELOPMENT ON SPECIES AND HABITATS

Twenty-one species that are listed as threatened or endangered under the ESA could occur in areas that may be directly or indirectly affected by solar energy development in designated SEZs. Impacts on these species could result from site characterization, facility construction, operations, and decommissioning. Impacts would be directly related to the amount of land disturbance, the duration and timing of construction and operation periods, and the habitats affected by development (i.e., the location of the project). Indirect effects, such as those resulting from the erosion of disturbed land surfaces and disturbance and harassment of animal species, are also possible, but their magnitude is considered proportional to the amount of land disturbance.

5.1.1 Impacts Common to All Solar Technologies

Impacts can vary considerably according to the solar energy technology deployed at a site. This section describes impacts common to all technologies and is presented according to project phase (i.e., site characterization, construction, operations, and decommissioning). Impacting factors, project phase, potential consequences, the expected relative impact on different taxonomic groups, and the ability to reduce impacts are summarized in Table 5-1.

TABLE 5-1 Potential Impacts on Federally Listed Species Associated with Utility-Scale Solar Energy Facilities, Including Associated Access Roads

Impacting Factor	Project Phase	Potential Consequences	Potential Relative Impact[a] for Different Species Groups[b]				Ability to Reduce Impacts[c]
			None	Small	Moderate	Large	
Individual Impacting Factor[d]							
Alteration of topography and drainage patterns	Construction, operations	Changes in surface temperature, soil moisture, and hydrologic regimes and in distribution and extent of aquatic, wetland, and riparian habitats; erosion; changes in groundwater recharge; spread of invasive species.	None	Terrestrial reptiles, mammals	Terrestrial plants, invertebrates, amphibians, and birds	Aquatic, wetland, and riparian plant and animals species	Can be reduced by avoiding development of drainages and using appropriate stormwater management strategies.
Blockage of dispersal and movement	Construction, operations	Genetic isolation, loss of access to important habitats, reduction in diversity, reduction in carrying capacity.	All plants	Invertebrates, fish, birds, bats	Amphibians, reptiles, small mammals	Large mammals	Can be reduced by restricting project size, avoiding important movement corridors.
Erosion	Construction operations, decommissioning	Habitat degradation; loss of plants; sedimentation of adjacent areas especially aquatic, wetland systems; loss of productivity; reduction in carrying capacity; spread of invasive species.	None	Terrestrial plants, invertebrates, amphibians, reptiles, birds, mammals	Aquatic, wetland, and riparian plant and animals species	None	Easily reduced with standard erosion control practices.
Equipment noise	Site characterization, construction, operations, decommissioning	Behavioral disturbance, harassment, nest abandonment, avoidance of areas, territory adjustments, reduction in carrying capacity.	All plants, invertebrates	Amphibians, reptiles, and small mammals	Birds, large mammals	None	Can be reduced by using mufflers and other sound-dampening devices.

TABLE 5-1 (Cont.)

Impacting Factor	Project Phase	Consequence	Potential Relative Impact[a] for Different Species Groups[b]				Ability to Reduce Impacts[c]
			None	Small	Moderate	Large	
Individual Impacting Factor[d] (Cont.)							
Fugitive dust	Site characterization, construction, operations, decommissioning	Decrease in photosynthesis, reduction in productivity, increased turbidity and sedimentation in aquatic habitat, spread of invasive species.	None	Animals	All plants	None	Can be reduced by retaining vegetative cover, soil covers, or soil-stabilizing agents.
Groundwater withdrawal	Construction, operations	Change in hydrologic regime, reduction in surface water, reduction in soil moisture, reduction in productivity.	None	Terrestrial plants and animals	Aquatic, wetland, and riparian plants and animals	None	Can be reduced by reducing water consumption requirements. May be difficult to reduce for all but photovoltaic (PV) systems.
Habitat fragmentation	Construction, operations	Genetic isolation, loss of access to important habitats, reduction in diversity, reduction in carrying capacity, spread of invasive species.	None	None	All plants and animals	None	Difficult to reduce; requires minimizing disruption of intact communities especially by linear features such as transmission lines and roads.
Human presence and activity	Site characterization, construction, operations, decommissioning	Behavioral disturbance, harassment, nest abandonment, avoidance of areas, territory adjustments, reduction in carrying capacity.	All plants	Invertebrates, fish	Amphibians, reptiles, small mammals	Birds, large mammals	Can be reduced during site characterization and construction by timing activities to avoid sensitive periods. Difficult to reduce impacts during operations.
Increased human access	Construction, operations	Harassment, collection, increased predation risk, increased collision mortality risk.	None	Plants	Animals	None	Can be reduced by reducing the number of new transmission lines and roads in important habitats.

TABLE 5-1 (Cont.)

Impacting Factor	Project Phase	Consequence	Potential Relative Impact[a] for Different Species Groups[b]				Ability to Reduce Impacts[c]
			None	Small	Moderate	Large	
Individual Impacting Factor[d] (Cont.)							
Oil and contaminant spills	Site characterization, construction, operations, decommissioning	Death of directly affected individuals, uptake of toxic materials, reproductive impairment, reduction in carrying capacity.	None	None	Terrestrial plants and animals	Aquatic, wetland, and riparian plants and animals	Can be reduced by using best management practices (e.g., pipeline check valves) and spill prevention and response planning.
Project infrastructures	Operations	Increased predation rates from predators using tall structures, collision mortality.	All plants, large mammals	Invertebrates, amphibians	Reptiles, birds, and small mammals	None	Can be reduced by using appropriate warning lights on towers, markers on lines, and guy wires, or elimination of guy wires.
Restoration of topography and drainage patterns	Decommissioning	Beneficial changes in temperature, soil moisture, and hydrologic regimes.	None	None	All plants and animals	None	Mostly beneficial; adverse impacts can be reduced by using standard erosion and runoff control measures.
Restoration of topsoil	Decommissioning	Beneficial changes in soil moisture, increased productivity and carrying capacity.	None	None	All plants and animals	None	Mostly beneficial; adverse impacts can be reduced by using standard erosion and runoff control measures.
Restoration of native vegetation	Decommissioning	Beneficial changes in soil moisture, increased productivity and carrying capacity, increased diversity.	None	None	All plants and animals	None	Mostly beneficial; adverse impacts can be reduced by ensuring species mix used includes a diverse weed-free mix of hardy native species.

TABLE 5-1 (Cont.)

Impacting Factor	Project Phase	Consequence	Potential Relative Impact[a] for Different Species Groups[b]				Ability to Reduce Impacts[c]
			None	Small	Moderate	Large	
Individual Impacting Factor[d] (Cont.)							
Site lighting	Construction, operations	Behavioral disturbance, harassment, nest abandonment, avoidance of areas, territory adjustments, reduction in carrying capacity, collision with structures.	All plants	Fish, invertebrates, amphibians, and reptiles	Birds and mammals	None	Easily reduced by ensuring lighting is minimized to that needed for safe construction and operations and does not project past site boundaries.
Soil compaction	Site characterization, construction, operations, decommissioning	Reduction in productivity, reduction in diversity, reduction in carrying capacity, increased runoff and erosion, spread of invasive species.	None	All plants and animals	None	None	Easily reduced by aerating soil after being compacted.
Topsoil removal	Construction, operations	Reduction in productivity, reduction in diversity, reduction in carrying capacity, direct mortality of individuals, increased sedimentation in aquatic habitat, spread of invasive species.	None	None	All plants and animals	None	Readily reduced by stockpiling soils to maintain seed viability, vegetating to reduce erosion, and replacing at appropriate depths when other site activities are complete.
Vegetation clearing	Construction, operations	Habitat loss, habitat fragmentation, direct mortality of individuals, changes in temperature and moisture regimes, erosion, increased fugitive dust emissions, reduction in productivity, reduction in diversity, reduction in carrying capacity, spread of invasive species.	None	None	None	All plants and animals	Difficult to reduce; most project areas are likely to require clearing. Restoration of a vegetative cover consistent with the intended land use would reduce some impacts.

TABLE 5-1 (Cont.)

Impacting Factor	Project Phase	Consequence	Potential Relative Impact[a] for Different Species Groups[b]				Ability to Reduce Impacts[c]
			None	Small	Moderate	Large	
Individual Impacting Factor[d] (Cont.)							
Vegetation maintenance	Operations	Reduction in vegetation cover or vegetation maintained in early successional stage or low-stature, habitat fragmentation, direct mortality of individuals, reduction in diversity, reduction in carrying capacity, spread of invasive species.	None	Fish	Plants and animals (other than fish)	None	Can be reduced by managing for low-maintenance vegetation (e.g., native shrubs, grasses, and forbs), controlling invasive species, minimizing the use of herbicides near sensitive habitats (e.g., aquatic and wetland habitats), and using only approved herbicides consistent with safe application guidelines.
Vehicle and equipment emissions	Construction, operations	Reduced productivity.	None	All plants and animals	None	None	Readily reduced by maintaining equipment in proper operating condition.
Vehicle and foot traffic	Site characterization, construction, operations, decommissioning	Direct mortality of individuals through collision or crushing, soil compaction, increased fugitive dust emissions.	None	Aquatic and wetland animals, all plants, all invertebrates.	Terrestrial amphibians, reptiles, birds, mammals	None	Can be reduced by using worker education programs, signage, and traffic restrictions.

TABLE 5-1 (Cont.)

Impacting Factor	Project Phase	Consequence	Potential Relative Impact[a] for Different Species Groups[b]				Ability to Reduce Impacts[c]
			None	Small	Moderate	Large	
All Impacting Factors Combined							
	Site characterization	Direct mortality of individuals, habitat loss, behavioral disturbance, soil compaction, increased fugitive dust emissions, increased runoff and erosion, spread of invasive species.	None	All plants and animals	None	None	Relatively easy.
	Construction	Direct mortality of individuals, habitat loss, behavioral disturbance, reduced productivity and diversity, reduced carrying capacity, habitat fragmentation, soil compaction, increased fugitive dust emissions, spread of invasive species, changes in temperature and moisture regimes, increased sedimentation in aquatic habitat, increased runoff and erosion, changes in groundwater recharge.	None	None	None	All plants and animals	Relatively difficult; residual impact mostly dependent on the size of area developed.

TABLE 5-1 (Cont.)

Impacting Factor	Project Phase	Consequence	Potential Relative Impact[a] for Different Species Groups[b]				Ability to Reduce Impacts[c]
			None	Small	Moderate	Large	
All Impacting Factors Combined (Cont.)							
	Operations	Direct mortality of individuals, habitat loss, behavioral disturbance, reduction in vegetation cover or vegetation maintained in early successional stage or low-stature, reduced productivity and diversity, reduced carrying capacity, habitat fragmentation, soil compaction, increased fugitive dust emissions, changes in temperature and moisture regimes, increased sedimentation in aquatic habitat, increased runoff and erosion, changes in groundwater recharge.	None	None	None	All plants and animals	Relatively difficult; residual impact mostly dependent on the size of area developed.
	Decommissioning	Beneficial changes in soil moisture, temperature, and hydrologic regimes, increased productivity and carrying capacity, increased diversity, direct mortality of individuals, habitat loss, behavioral disturbance, soil compaction, increased fugitive dust emissions.	None	None	All plants and animals (benefits)	None	Relatively easy to reduce adverse impacts of decommissioning. May be difficult to achieve restoration objectives.

TABLE 5-1 (Cont.)

Impacting Factor	Project Phase	Consequence	Potential Relative Impact[a] for Different Species Groups[b]				Ability to Reduce Impacts[c]
			None	Small	Moderate	Large	
All Impacting Factors Combined (Cont.)							
	Overall project	Direct mortality of individuals, habitat loss, behavioral disturbance, reduced productivity and diversity, reduced carrying capacity, habitat fragmentation, soil compaction, increased fugitive dust emissions, changes in temperature and moisture regimes, increased sedimentation in aquatic habitat, increased runoff and erosion, changes in groundwater recharge.	None	None	None	All plants and animals	Relatively difficult; residual impact mostly dependent on the size of area developed and the success of restoration activities.

[a] Potential impact magnitude categories were developed by using Council on Environmental Quality (CEQ) regulations for implementing NEPA (40 CFR 1508.27) by defining the significance of impacts based on context and intensity. Similar impact magnitude categories and definitions were used in the *National Environmental Policy Act Handbook H-1790-1* (BLM 2008b) and the *BLM Wind Energy Program Policies and Best Management Practices* (BLM 2008c) and assume no avoidance, minimization, or other mitigation. Impact categories were as follows: (1) *none*—no impact would occur; (2) *small*—effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource (e.g., <1% of the population or its habitat would be lost in the region); (3) *moderate*—effects are sufficient to alter noticeably but not to destabilize important attributes of the resource (e.g., >1 but <10% of the population or its habitat would be lost in the region); and (4) *large*—effects are clearly noticeable and are sufficient to destabilize important attributes of the resource (e.g., >10% of a population or its habitat would be lost in the region). Actual magnitudes of impacts would depend on the location of projects, project-specific design, application of design features, and the status of species and their habitats in project areas.

[b] Listed species are placed into groups based on taxonomy (plants, invertebrates, amphibians, reptiles, birds, and mammals). Other categories such as ecological system (aquatic, wetland, riparian, and terrestrial) or size (e.g., small and large mammals) are used when the category is relevant to impact magnitude.

[c] Actual ability to reduce impacts will depend on site-specific conditions and the species present in the project area. Required design features that would reduce impacts are presented in Section 2.2.

[d] Impacting factors are presented in alphabetical order.

5.1.1.1 Site Characterization

Most characterization activities (e.g., surface hydrology and floodplain mapping) involve minimum or no site disturbance and are unlikely to affect listed species. However, some characterization activities may require ground disturbances that might affect local plants and wildlife species. Some of these activities include the installation of groundwater monitoring wells (for those projects that anticipate the use of groundwater) or the construction of meteorological towers to obtain climatic data for projects in remote areas. In addition, increased human presence in the area may affect local populations of plants and animals through collection, inadvertent or unintentional harassment, or both.

5.1.1.2 Construction

For the analysis, it was assumed that the project area would be graded and all vegetation removed. Plants and animals close to the project area could be affected by runoff from the site due to erosion or sedimentation. In addition, fugitive dust, vehicle emission particulates, and other contaminants (e.g., fuel, oil) may accumulate in areas near the project area, which may be absorbed by plant leaf surfaces and roots. Such processes can reduce photosynthesis and metabolism rates in plants and subsequently affect plant vigor. Disturbed areas within and near the project area could be colonized by exotic invasive plant species. Invasive plant species are generally more tolerant of disturbed conditions, and their establishment within and surrounding the project area could be facilitated by the level of disturbance associated with project activities. Further, invasive plant species, if left unchecked, can develop high population densities, which can exclude the re-establishment of native species for long periods. This may especially affect special status plant species that occur in small populations.

Larger, more mobile animals, such as birds and medium-sized or large mammals, would be most likely to leave the project area during site preparation and construction activities. Development of the site would represent a loss of habitat for these species and potentially a reduction in carrying capacity (i.e., the number of individuals of a species that can be supported in an area). Smaller animals, such as small mammals, tortoises, lizards, snakes, and amphibians, are more likely to be killed during clearing and construction activities. If land-clearing and construction activities occur during the spring and summer, bird nests and nestlings in the project area could be destroyed. Longer term impacts, such as increased vulnerability to predators and diseases, could occur as a result of habitat destruction during the construction phase and may continue to affect listed plants and animals beyond the life of the project.

5.1.1.3 Operations

Throughout the operational period, the site would have reduced plant cover, and the entire site would be fenced. This would represent a direct loss of habitat and productivity on the site, as well as create a barrier to most wildlife movements. Further, during operations, the developed site could lead to fragmentation of otherwise intact habitat and, in some cases, isolation of the remaining suitable habitat patches from one another. Such habitat fragmentation

can have negative effects on some species by increasing the amount of edge habitat, thus making individuals more vulnerable to predation, diseases, and human collection and/or harassment. Listed animal species in and adjacent to project areas could be disturbed by human activities and would tend to avoid the area while activities were occurring. Site lighting, reflectivity, and operational noise from equipment could affect animals on and off the site, resulting in avoidance or reduction in use of an area larger than the project footprint. Runoff from the site during site operations could result in erosion and sedimentation of adjacent habitats. Fugitive dust during operations could affect adjacent plant populations and result in reduced productivity. Long-term changes in surface water or groundwater quality associated with site operations could affect local plant and animal populations. Groundwater withdrawals to support construction and operational needs could result in drawdown of aquifers and subsequent reductions in stream and other surface water levels. These reductions could reduce base flows, reduce aquatic habitat availability and quality, and affect wetlands and riparian habitats dependent on those water levels.

5.1.1.4 Decommissioning and Reclamation

In general, the impacts on listed plant and animal species associated with decommissioning of utility-scale solar energy facilities would be short term and similar to those associated with facility construction. For the most part, decommissioning activities would occur only in areas previously disturbed by project construction activities and operations, although adjacent areas could be affected. Decommissioning would likely include soil disturbances to remove aboveground and belowground structures. During decommissioning, fugitive dust and other particulates may be spread to adjacent areas and adversely affect plant species. Increased human presence, traffic, and noise associated with decommissioning activities may also affect listed animal species through human collection, altered behavioral patterns, or mortality (e.g., vehicle collisions).

Decommissioning activities would include reclamation efforts. During this phase, the site would be regraded if needed and revegetated with native species in attempts to restore the site to pre-disturbance conditions. Other reclamation activities may include re-establishing natural drainage and hydrological processes and limiting human access to the site. Although reclamation efforts may increase habitat availability and quality from project operation conditions, it may take many years, or it may not be possible for the project site to be fully restored to pre-disturbance conditions.

5.1.1.5 Transmission Lines and Access Roads

The impacts on listed species from the construction of new transmission lines and new access roads, maintenance of transmission line ROWs, and upgrades to existing lines and access roads associated with utility-scale solar energy projects would be similar to those from other activities presented in Table 5-1. Potential construction impacts would result primarily from ground disturbance, vegetation removal, and excavation during clearing of the ROWs, construction of access roads and structures (e.g., transmission line towers, substations, or

pipelines), and increased mortality risks from vehicle collisions. Activities include the clearing of land for the establishment of transmission line ROWs, construction of transmission facilities and related infrastructure, and maintenance of ROWs. Impacts on listed species resulting from transmission line and access road construction, operation, and maintenance could include the following:

- Habitat destruction or degradation resulting from clearing of ROWs, construction, altered topography, altered hydrologic patterns, soil removal and/or erosion, sedimentation, fugitive dust, contaminant spills, and the spread of invasive species.

- Habitat and population fragmentation resulting from the establishment of transmission line ROWs and access roads through intact patches of habitat, thereby preventing the movement of organisms throughout the population area. Note that this impact is most likely only in those habitats that would require vegetation clearing and management (e.g., forest). In most parts of the arid West, little if any clearing may be necessary and habitat fragmentation would not be a concern.

- Disturbance and harassment of animals from noise and human activities during construction, ROW maintenance, and operations. Disturbances that occur during the breeding season would have the greatest adverse impacts and could result in animals abandoning traditional breeding grounds and nest sites.

- Mortality from vehicle and transmission infrastructure collisions during construction, operations, and decommissioning.

- Increased predation of listed species resulting from the increase in localized predator populations. Such predators (e.g., raccoons, skunks) are attracted to habitat edges established by transmission line corridors and access roads.

- Aquatic species may be affected by increases in water temperature in areas crossed by transmission facilities resulting from the removal of riparian vegetation that would otherwise shade surface water.

- Plant species may be affected by the spread of invasive exotic species in or near areas that have been disturbed by activities associated with transmission line and access road construction, maintenance, or both. Invasive plant species generally possess characteristics that allow them to thrive in disturbed habitats, thereby displacing native plant species and limiting their ability to compete for sunlight and soil nutrients.

5.1.2 Technology-Specific Impacts

This section discusses the potential impacts on federally listed, proposed, and candidate species associated with specific technologies for utility-scale solar energy development. These impacts are based on the activities anticipated to occur at sites utilizing currently established technologies. The estimated land area and water demands vary among facilities using different technologies.

Maximum estimated land area requirements are greatest for facilities utilizing dish engine and photovoltaic (PV) technologies (6,750 acres [27 km^2] each). Facilities utilizing parabolic trough and power tower technologies would require an estimated maximum land area of 2,000 acres (8 km^2) and 3,600 acres (15 km^2), respectively.

Withdrawals from groundwater or surface water sources may alter hydrological regimes and affect local plant and animal species. Habitat for aquatic and semiaquatic species may be lost or degraded. Hydrological dynamics within wetland and riparian areas may also be affected, thereby potentially affecting the aquatic and terrestrial plant and animal species that utilize these resources. Parabolic trough and power tower technologies require cooling systems; therefore, facilities utilizing these technologies would require greater amounts of water (maximum 6,400 ac-ft/yr [7.8 million m^3/yr]). Dish engine and PV technologies do not require cooling systems. Because of this, dish engine and PV facilities would require less water; water would be needed only for cleaning, dust control, and potable water needs (maximum 375 ac-ft/yr [0.5 million m^3/yr]).

Parabolic trough facilities and power tower facilities use heat transfer fluids (HTFs) (e.g., synthetic oils, molten salt) to store and transfer energy. Dish engine facilities utilize solar insolation to expand gas and generate mechanical energy, which is later converted to electricity. PV facilities utilize solar cells (and associated semiconductors) to convert solar energy to electricity. The accidental release of HTFs (in parabolic trough and power tower technologies) may result in leaching of materials into groundwater or runoff into nearby habitats where plants and aquatic resources may be affected. Wildlife that drink or consume contaminated water or plants may also be affected depending on the concentrations and toxicity of released materials. Noise levels associated with dish engines may also affect local wildlife by deterring their movements and reducing the area's overall carrying capacity. PV projects would not have impacts associated with spills or noise.

5.2 EFFECT DETERMINATIONS FOR SPECIES THAT COULD OCCUR IN AFFECTED AREAS OF SEZS

This section presents the effect determinations for those species that could occur within the affected areas of one or more of the 17 SEZs. General information on each species, the direct and indirect effects of solar energy development in the SEZs, and species-specific avoidance and minimization measures, including required design features (Section 2.2), are presented. The effect determinations are based on the implementation of all required design features and species-specific avoidance and minimization measures.

A summary of effect determinations for all species is provided in Table 5-2.

A total of 21 species that are listed as threatened or endangered under the ESA could occur in areas affected by solar energy development on the SEZs (Table 5-2). Of these species, 11 are listed as endangered and 10 are listed as threatened. Many of these species are groundwater-dependent species that may occur more than 5 mi (8 km) away from the nearest SEZ. Each of these species is discussed below.

5.2.1 Plants

5.2.1.1 Sneed's Pincushion Cactus

The Sneed's pincushion cactus was federally listed as endangered on November 7, 1979 (USFWS 1979). Critical habitat has not been designated. Historically, the Sneed's pincushion cactus was known only from the Anthony Gap area of the Franklin Mountains in Doña Ana County, New Mexico. It is currently known from most of the Franklin Mountains of El Paso County, Texas, and Doña Ana County, New Mexico. It also occurs at the southern end of the Organ Mountains of New Mexico and in the Guadalupe Mountains of Texas and New Mexico. At the time the species recovery plan was written (USFWS 1986a), there were 20 known localities for this species on federal and private land.

The Sneed pincushion cactus is restricted to limestone substrates on terraces, ridgetops, hillsides, and ledges in the high Chihuahuan Desert of the Franklin, Guadalupe, and Organ Mountains of Texas and New Mexico. Plants occur primarily in cracks in the limestone substrate or in shallow pockets of loamy soil on hillsides and ridgetops between 3,900 and 7,700 ft (1,190 and 2,345 m) in elevation. The subspecies typically occurs in semidesert grasslands or woodlands in an agave-juniper association. In the Guadalupe Mountains, it extends upward in elevation to the lower pinyon-juniper woodland. It usually occurs in sparsely vegetated areas with shrubby species, but it is rarely under cover. Associated plant species include lechuguilla (*Agave lechuguilla*), sideoats grama (*Bouteloua curtipendula*), whitecolumn foxtail cactus (*Escobaria albicolumnaria)*, Mormon tea (*Ephedra trifurca*), Apache plume (*Fallugia paradoxa*), Pinchot's juniper (*Juniperus pinchotii*), Texas sacahuista (*Nolina texana*), and cactus apple (*Opuntia engelmannii*).

The Sneed's pincushion cactus is a long-lived, succulent, perennial species. Reproduction is sexual; although plants can be propagated vegetatively for cutting, they have no natural mechanism for doing so. Sneed cactus plants likely germinate from late May to early June but do not begin blooming until after they have attained 3 to 4 years of age. The plants bud in March and April, flower in mid to late April, and fruit from August to November.

This subspecies is threatened by illegal collecting and habitat destruction. Plants are relatively tough, not being affected by many of the fungi and insect predators that adversely affect other cacti.

TABLE 5-2 Effect Determinations for Federally Listed Species That May Occur in the Affected Areas of the SEZs

Common Name	Scientific Name	Status	SEZs and Associated Affected Areas Where Species Could Occur: SEZ	Access Road ROW	Indirect Effects Area	Effect Determination
Plants						
Amargosa niterwort	*Nitrophila mohavensis*	Endangered	None	None	Amargosa Valley (groundwater only)	May affect, likely to adversely affect
Ash Meadows blazing-star	*Mentzelia leucophylla*	Threatened	None	None	Amargosa Valley (groundwater only)	May affect, likely to adversely affect
Ash Meadows gumplant	*Grindelia fraxinopratensis*	Threatened	None	None	Amargosa Valley (groundwater only)	May affect, likely to adversely affect
Ash Meadows ivesia	*Ivesia eremica*	Threatened	None	None	Amargosa Valley (groundwater only)	May affect, likely to adversely affect
Ash Meadows milkvetch	*Astragalus phoenix*	Threatened	None	None	Amargosa Valley (groundwater only)	May affect, likely to adversely affect
Ash Meadows sunray	*Enceliopsis nudicaulis* var. *corrugata*	Threatened	None	None	Amargosa Valley (groundwater only)	May affect, likely to adversely affect
Sneed's pincushion cactus	*Escobaria sneedii* var. *sneedii*	Endangered	None	None	Afton	No effect
Spring-loving centaury	*Centaurium namophilum*	Threatened	None	None	Amargosa Valley (groundwater only)	May affect, likely to adversely affect
Invertebrates						
Ash Meadows naucorid	*Ambrysus amargosus*	Threatened	None	None	Amargosa Valley (groundwater only)	May affect, likely to adversely affect

TABLE 5-2 (Cont.)

Common Name	Scientific Name	Status	SEZs and Associated Affected Areas Where Species Could Occur			Effect Determination
			SEZ	Access Road ROW	Indirect Effects Area	
Fish						
Ash Meadows Amargosa pupfish	*Cyprinodon nevadensis mionectes*	Endangered	None	None	Amargosa Valley (groundwater only)	May affect, likely to adversely affect
Ash Meadows speckled dace	*Rhinichthys osculus nevadensis*	Endangered	None	None	Amargosa Valley (groundwater only)	May affect, likely to adversely affect
Devils Hole pupfish	*Cyprinodon diabolis*	Endangered	None	None	Amargosa Valley (groundwater only)	May affect, likely to adversely affect
Hiko White River springfish	*Crenichthys baileyi grandis*	Endangered	None	None	Dry Lake Valley North (groundwater only)	May affect, likely to adversely affect
Moapa dace	*Moapa coriacea*	Endangered	None	None	Dry Lake (groundwater only)	May affect, likely to adversely affect
Pahranagat roundtail chub	*Gila robusta jordani*	Endangered	None	None	Dry Lake Valley North (groundwater only)	May affect, likely to adversely affect
Pahrump poolfish	*Empetrichthys latos*	Endangered	None	None	Dry Lake (groundwater only)	May affect, not likely to adversely affect
Warm Springs pupfish	*Cyprinodon nevadensis pectoralis*	Endangered	None	None	Amargosa Valley (groundwater only)	May affect, likely to adversely affect

TABLE 5-2 (Cont.)

Common Name	Scientific Name	Status	SEZs and Associated Affected Areas Where Species Could Occur: SEZ	Access Road ROW	Indirect Effects Area	Effect Determination
Fish (Cont.)						
White River springfish	*Crenichthys baileyi baileyi*	Endangered	None	None	Dry Lake Valley North (groundwater only)	May affect, likely to adversely affect
Reptiles						
Desert tortoise (Mojave population)	*Gopherus agassizii*	Threatened	Amargosa Valley, Dry Lake, Riverside East	Dry Lake Valley North	Amargosa Valley, Dry Lake, Dry Lake Valley North, Riverside East	May affect, likely to adversely affect (Amargosa Valley, Dry Lake, and Riverside East) May affect, not likely to adversely affect (Dry Lake Valley North)
Birds						
Mexican spotted owl	*Strix occidentatlis lucida*	Threatened	None	Los Mogotes East	Antonito Southeast, Los Mogotes East	May affect, not likely to adversely affect
Northern aplomado falcon	*Falco femoralis septentrionalis*	Experimental, nonessential population	None	None	Afton	May affect, not likely to adversely affect

TABLE 5-2 (Cont.)

Common Name	Scientific Name	Status	SEZs and Associated Affected Areas Where Species Could Occur: SEZ	Access Road ROW	Indirect Effects Area	Effect Determination
Birds (Cont.)						
Southwestern willow flycatcher	*Empidonax traillii extimus*	Endangered	None	Antonito Southeast, Gillespie	Antonito Southeast, De Tilla Gulch, Dry Lake, Fourmile East, Gillespie, Los Mogotes East	May affect, not likely to adversely affect (Antonito Southeast, De Tilla Gulch, Dry Lake, Fourmile East, Gillespie, and Los Mogotes East)
Yuma clapper rail	*Rallus longirostris yumanensis*	Endangered	Imperial East	Gillespie	Gillespie, Imperial East	May affect, not likely to adversely affect (Gillespie and Imperial East)
Mammals						
Utah prairie dog	*Cynomys parvidens*	Threatened	Escalante Valley, Milford Flats South, Wah Wah Valley	Escalante Valley, Milford Flats South, Wah Wah Valley	Escalante Valley, Milford Flats South, Wah Wah Valley	May affect, not likely to adversely affect (Escalante Valley, Milford Flats South, and Wah Wah Valley)

Given the known distribution of this species, the Sneed's pincushion cactus may be found near the Afton SEZ. Occurrences of this species have been recorded approximately 10 mi (16 km) and 32 mi (51 km) southeast of the Afton SEZ. SWReGAP land cover types that occur in the area of this SEZ that may represent potentially suitable habitat include Warm Desert Bedrock Cliff and Outcrop (S016) (USGS 2004, 2005). SWReGAP data show this land cover type within the SEZ and the area of indirect effects for the Afton SEZ (Figure 5-1). However, field surveys have indicated that no suitable habitat for this species occurs on the Afton SEZ or in the area of direct effects. Given the species' restricted geographic distribution, it is also unlikely that the species could occur in the area of indirect effects outside of the SEZ.

Direct and Indirect Effects of Development on SEZs

Table 5-1 presents the potential impacts on plants that could result from the construction, operation, and decommissioning of utility-scale solar energy facilities, including associated access road corridors. The Sneed's pincushion cactus is unlikely to occur within the boundary of the SEZ based on the current understanding of the species' restricted geographic distribution and affinity for limestone outcrops in Chihuahuan Desert grassland communities. However, potentially suitable habitat for this species may occur outside the Afton SEZ in the area of indirect effects. It is unlikely that solar energy development and construction of ancillary facilities will occur in sloped areas or unique habitats that may represent suitable habitat for this species, such as limestone cliffs and outcrops.

Design Features and Applicable Avoidance and Minimization Measures

As stated above, it is considered unlikely that the Sneed's pincushion cactus would be found on the Afton SEZ, assumed access road corridor, or in the area of potential indirect effects outside of the boundaries of the SEZ. Any necessary future transmission ROW developments or upgrades to serve solar energy development on the SEZ would not likely occur in suitable habitat for this species. Programmatic design features that would be required of all solar energy projects to reduce ecological impacts under the proposed program are listed in Section 2.2. These measures will limit potential adverse effects on the Sneed's pincushion cactus.

For solar energy development within the Afton SEZ, required design features that would reduce the potential for impact on the Sneed's pincushion cactus would focus on limiting the potential for indirect impacts in areas adjacent to the SEZ. Pre-disturbance coordination with the Service would be conducted to determine the potential for the Sneed's pincushion cactus to occur in the vicinity of the proposed project. If the Service determines that the species may be indirectly affected by development, solar facilities would be constructed at an appropriate setback distance within the SEZ, or other actions necessary to reduce the potential for indirect effects would be taken. Development upslope of any nearby populations would be prohibited to prevent site runoff from affecting known populations.

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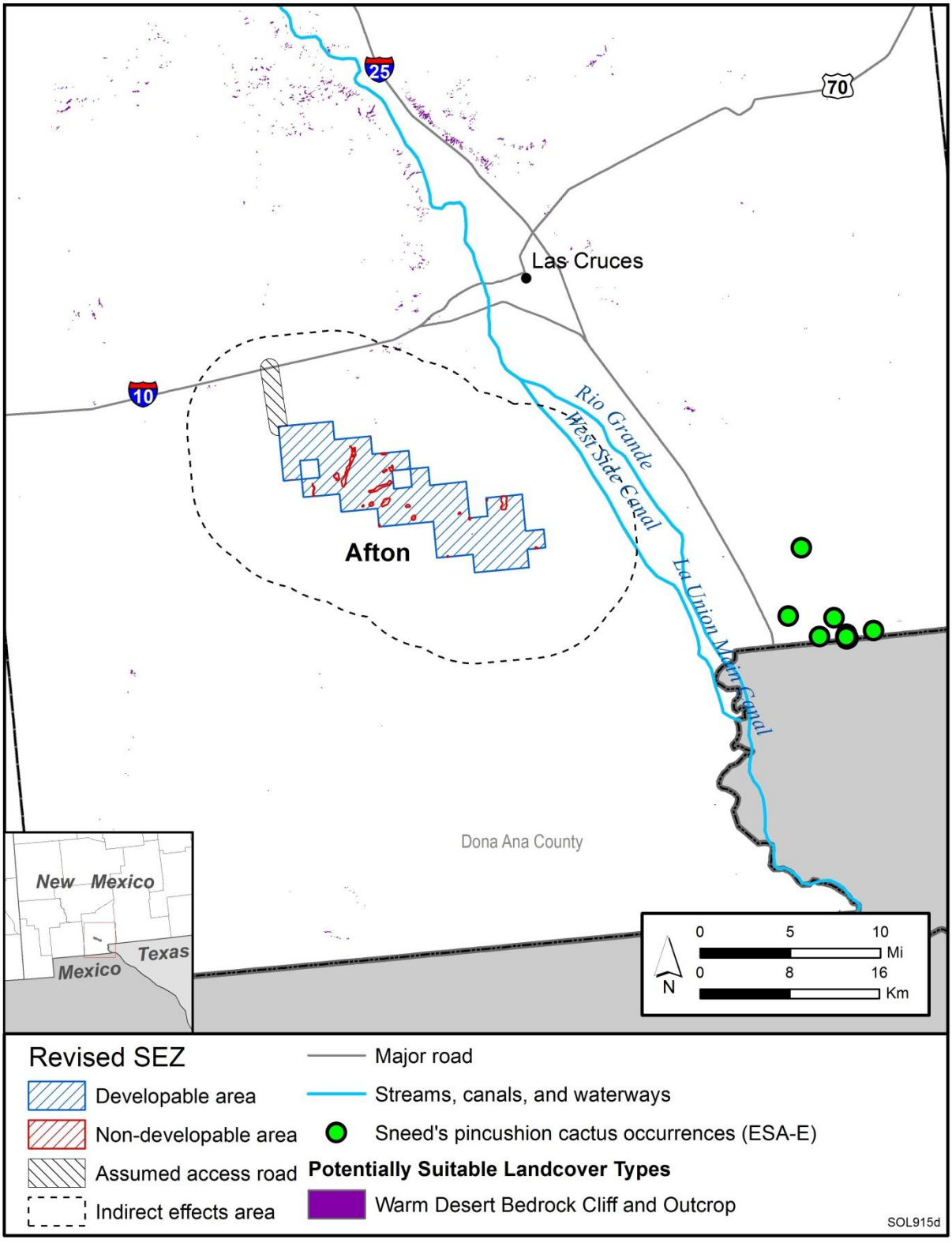

FIGURE 5-1 Known Occurrences and Availability of Potentially Suitable Habitat for the Sneed's Pincushion Cactus in the Affected Area of the Proposed Afton SEZ (Sources: Hewitt 2009; USGS 2004)

Effect Determination

With the implementation of all required design features and species-specific avoidance and minimization measures identified above and in Section 2.2, solar energy development on the Afton SEZ would have no effect on the Sneed's pincushion cactus. Solar energy development on other SEZs would not affect this species.

5.2.2 Reptiles

5.2.2.1 Desert Tortoise (Mojave Population)

The Mojave population of the desert tortoise occurs in desert regions of the southwestern United States and northwestern Mexico, north and west of the Colorado River. The Sonoran population of the desert tortoise occurs south and east of the Colorado River. Within the action area, the Mojave desert tortoise occurs in portions of California, Nevada, and Utah. The Mojave population of desert tortoise was federally listed as threatened on August 20, 1980 (USFWS 1980). On February 8, 1994, the Service designated approximately 6.4 million acres (25,900 km^2) of desert in the states of California, Nevada, and Utah as critical habitat for this species (USFWS 1994). The Mojave population was listed in response to precipitous declines in desert tortoise numbers in many areas. The Sonoran desert tortoise is currently a candidate species for listing under the ESA.

Within the varied plant communities of the Mojave and Sonoran Desert regions, desert tortoises can potentially survive and reproduce where their basic habitat requirements are met. These requirements include sufficient suitable plants for forage and cover and suitable substrates for burrow and nest sites. Desert tortoises occur primarily on flats and bajadas that have soils ranging from sand to sandy-gravel and that are characterized by scattered shrubs and abundant inter-shrub space for growth of herbaceous plants. Desert tortoises are also found on rocky terrain and slopes in parts of the Mojave and Sonoran Desert regions. There is substantial geographic variation in the way tortoises use available resources. Desert tortoises spend much of their lives in burrows, emerging to feed and mate during late winter and early spring. They typically remain active through the spring, and they sometimes emerge again after summer storms. During these activity periods, desert tortoises eat a wide variety of herbaceous plants, particularly grasses and the flowers of annual plants. Desert tortoises exhibit delayed maturity and live a long life. Females typically create a nest under a large shrub or at a burrow entrance and lay from 2 to 14 eggs from May to July (UDWR 2010). Adults are well protected against most predators (apart from humans) and other environmental hazards. During hibernation, several individuals often occupy the same burrow. Their longevity helps compensate for their variable annual reproductive success, which is correlated with environmental conditions (USFWS 2008; NatureServe 2010; UDWR 2010).

Several factors have led to declining populations of the desert tortoise. Reductions in tortoise numbers have been attributed to direct and indirect human-caused mortality, coupled with the inadequacy of existing regulatory mechanisms to protect desert tortoises and their

habitat. Impacts, such as the destruction, degradation, and fragmentation of habitat, result from urbanization, agricultural development, livestock grazing, mining, and roads. An upper respiratory tract disease is an additional major cause of mortality and population decline, particularly in the western Mojave Desert. Predators that prey on adult desert tortoises include the coyote (*Canis latrans*), kit fox (*Vulpes macrotis*), raccoon (*Procyon lotor*), bobcat (*Felis rufus*), badger (*Taxidea taxus),* and feral dog (*Canis familiaris*). Predators of tortoise eggs and young include the common raven (*Corvus corax*), Gila monster (*Heloderma suspectum*), snakes, roadrunner (*Geococcyx californianus*), red-tailed hawk (*Buteo jamaicensis*), and badger (USFWS 2008; NatureServe 2010).

On the basis of recorded observations and the presence of potentially suitable habitat, the Mojave desert tortoise may occur in the affected area of four SEZs in the states of California and Nevada (Table 5-2): California—Riverside East; Nevada—Amargosa Valley, Dry Lake, and Dry Lake Valley North.

Solar Energy Zones in Which the Species May Occur

Riverside East. The Service determined that the desert tortoise has the potential to be affected by solar energy development on the Riverside East SEZ (Stout 2009). According to California Natural Diversity Database (CNDDB) records, this species is known to occur in the western portion of the Riverside East SEZ (Figure 5-2). The tortoise is known to occur in Joshua Tree NP (west of the SEZ) and the Pinto Mountains and Chuckwalla Desert Wildlife Management Areas (DWMAs). Joshua Tree NP is west of the SEZ; the Pinto Mountains DWMA is northwest of the SEZ; and the Chuckwalla DWMA is south of the SEZ. The Pinto Mountains and Chuckwalla DWMAs are designated critical habitats for the Mojave desert tortoise. The Chuckwalla DWMA and Joshua Tree NP are within the area of indirect effects adjacent to the southern and western boundary of the SEZ, respectively. According to the CAReGAP habitat suitability model, approximately 143,600 acres (581 km^2) of potentially suitable habitat for the desert tortoise occurs in the area of direct effects within the Riverside East SEZ. The USGS desert tortoise model (Nussear et al. 2009) indicates that the majority of the SEZ is composed of less suitable habitat than the surrounding landscape (modeled suitability value greater than or equal to 0.5 out of 1.0). About 441,400 acres (1,785 km^2) of suitable habitat occurs in the area of indirect effects (Figure 5-2).

On the basis of surveys conducted in Joshua Tree NP, adjacent to the western border of the SEZ, the Service estimated that the SEZ may support up to 2,865 desert tortoises (Stout 2009). Although designated critical habitat does not occur within the SEZ, portions of the Joshua Tree NP and Chuckwalla DWMA occur in the area of indirect effects within 5 mi (8 km) of the Riverside East SEZ.

Amargosa Valley. The desert tortoise is known to occur throughout the affected area of the Amargosa Valley SEZ. According to the Service (Stout 2009), specific information on the density of tortoises in the vicinity of the Amargosa Valley SEZ is currently not available. However, tortoises have been observed along U.S. 95, which intersects the northeast boundary of

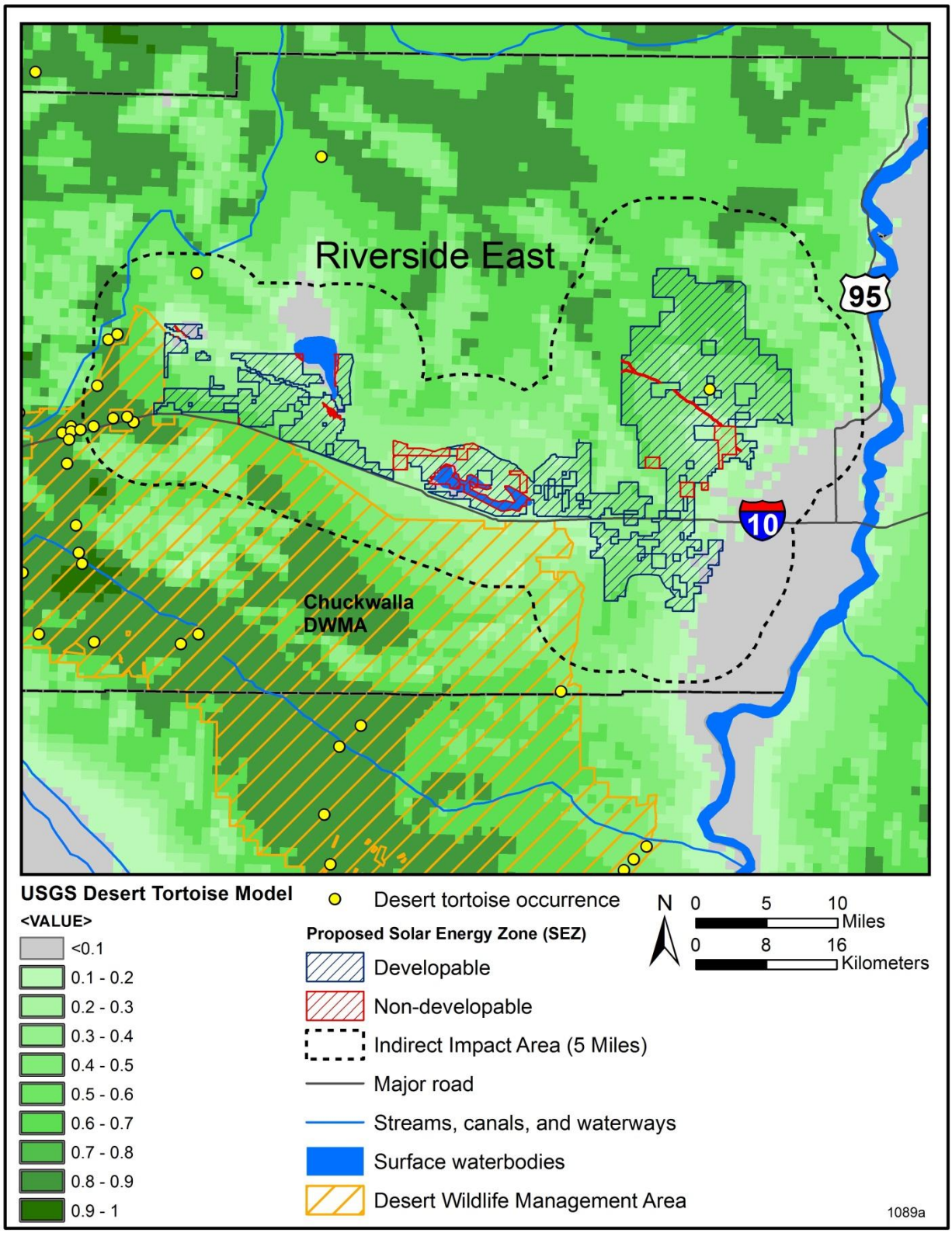

FIGURE 5-2 Known Occurrences and Availability of Potentially Suitable Habitat for the Mojave Desert Tortoise in the Affected Areas of the Proposed Riverside East SEZ (Sources: CDFG 2010a; Nussear et al. 2009)

the SEZ; tortoises have also been observed within the SEZ and throughout the area of indirect effects east and west of the SEZ (Figure 5-3). According to the SWReGAP habitat suitability model, approximately 8,470 acres (34 km^2) of potentially suitable habitat occurs in the area of direct effects within the SEZ. Much of this habitat within the SEZ is considered to be highly suitable (modeled suitability value greater than or equal to 0.5 out of 1.0) according to the USGS desert tortoise habitat suitability model (Nussear et al. 2009). About 92,000 acres (372 km^2) of suitable habitat occurs in the area of potential indirect effects (Figure 5-3). Designated critical habitat for the Mojave desert tortoise does not occur in the vicinity of the Amargosa Valley SEZ.

Dry Lake. The desert tortoise is known to occur on the Dry Lake SEZ and throughout the affected area of the SEZ. According to the Service (Stout 2009), desert tortoise populations have the potential to occur on the Dry Lake SEZ, and designated critical habitat for this species occurs in the Mormon Mesa critical habitat unit west of the SEZ (Figure 5-3). According to the SWReGAP habitat suitability model, approximately 5,665 acres (23 km^2) of potentially suitable habitat for this species occurs in the area of direct effects within the SEZ. The USGS desert tortoise model (Nussear et al. 2009) identifies the SEZ as having overall high habitat suitability for desert tortoise (suitability score greater than or equal to 0.5 out of 1.0). About 70,250 acres (284 km^2) of potentially suitable habitat occurs in the area of indirect effects.

On the basis of surveys conducted in Mormon Mesa critical habitat unit, adjacent to the western border of the SEZ, the Service estimated that the SEZ may support up to 213 desert tortoises (Stout 2009). Although designated critical habitat does not occur within the SEZ, portions of the Mormon Mesa critical habitat unit occur in the area of indirect effects within 5 mi (8 km) west of the Dry Lake SEZ (Figure 5-3).

Dry Lake Valley North. The desert tortoise is known to occur as near as 30 mi (48 km) southwest of the Dry Lake Valley North SEZ. Although the Service determined that the species is not likely to occur on the SEZ because of the lack of suitable habitat (Stout 2009), the species may still occur in the affected area outside the SEZ. Potentially suitable habitat for the desert tortoise is not expected to occur in the area of direct effects within the SEZ; however, potentially suitable habitat may occur in the area of direct effects within the assumed access road corridor and also within the area of indirect effects within 5 mi (8 km) south of the SEZ. According to the SWReGAP habitat suitability model, approximately 540 acres (2 km^2) of potentially suitable habitat occurs in the area of direct effects within the access road corridor. The USGS desert tortoise habitat suitability model (Nussear et al. 2009) indicates low habitat suitability throughout the entire SEZ affected area (modeled suitability value greater than or equal to 0.3 out of 1.0 throughout the affected area). About 1,150 acres (5 km^2) of potentially suitable habitat for this species occurs in the area of indirect effects (Figure 5-4). Designated critical habitat for the desert tortoise does not occur in the vicinity of the Dry Lake Valley North SEZ.

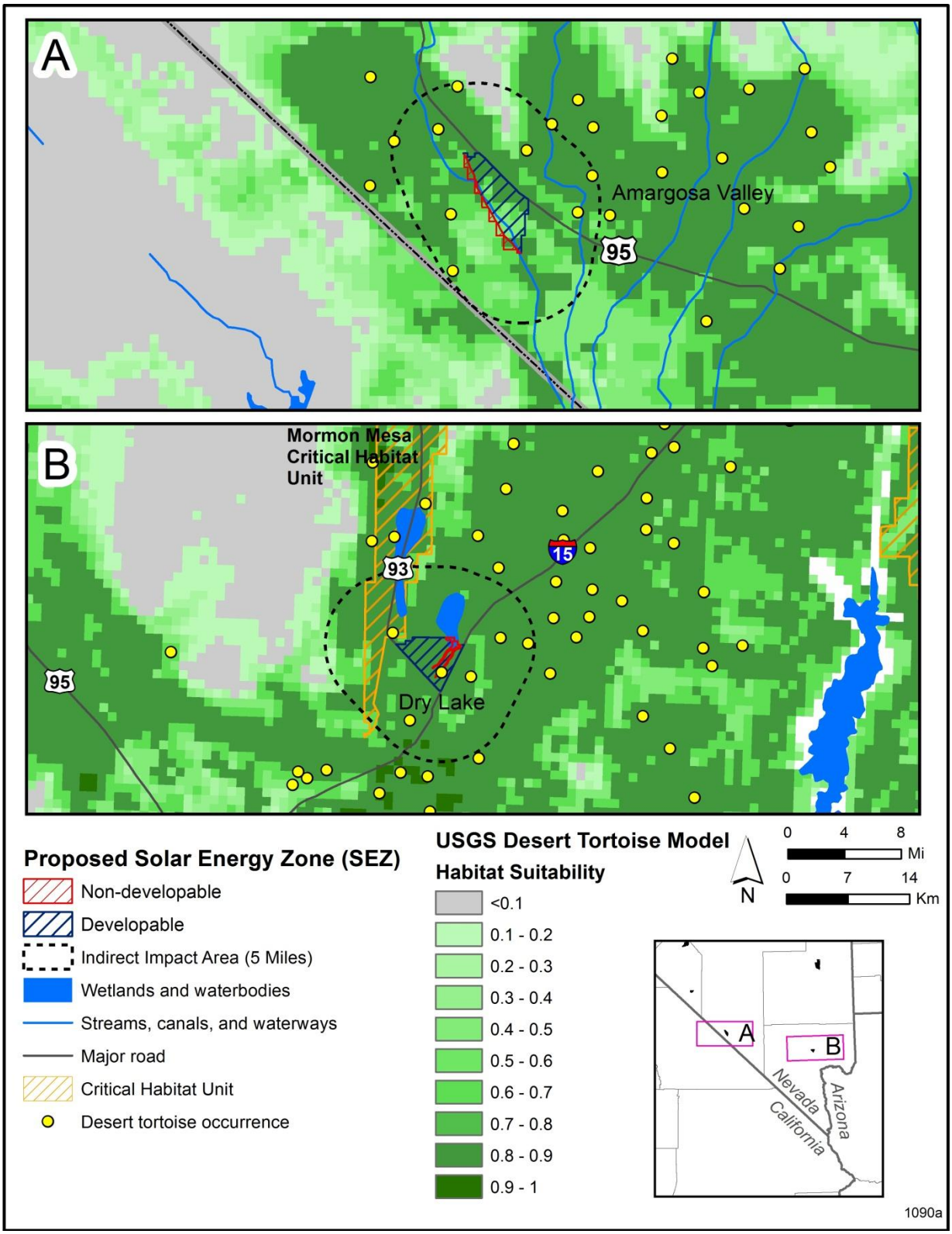

FIGURE 5-3 Known Occurrences and Availability of Potentially Suitable Habitat for the Mojave Desert Tortoise in the Affected Areas of the Proposed (A) Amargosa Valley and (B) Dry Lake SEZs (Sources: Miskow 2009; Nussear et al. 2009)

Direct and Indirect Effects of Development on SEZs

Table 5-1 presents the potential impacts on reptile species that could result from the construction, operation, and decommissioning of utility-scale solar energy facilities, including associated access road corridors. Potentially suitable habitat for the desert tortoise occurs in the area of direct and indirect effects for the Riverside East, Amargosa Valley, Dry Lake, and Dry Lake Valley North SEZs (Table 5-2; Figures 5-2, 5-3, and 5- 4).

Solar energy development on the SEZs may affect the desert tortoise through the loss and degradation of habitat. Individuals may also be killed by project vehicles and equipment during all phases of a solar energy project. Mortality may also occur through increased abundance of predators (e.g., ravens). Any necessary future transmission ROW developments or upgrades to serve solar energy development on these SEZs could also affect the desert tortoise through habitat loss, fragmentation, facilitated spread of diseases or predators, and, potentially, direct mortality. In addition to these direct impacts, facilities on the SEZ could indirectly affect desert tortoises by fragmenting and degrading habitat. Fragmentation would be exacerbated by the installation of exclusionary fencing at the perimeter of the SEZ or individual project areas. If the SEZ is situated between DWMAs or critical habitat units, terrestrial habitats within the SEZ may otherwise provide important linkages between these habitats. In these ways, facilities on the SEZ may affect desert tortoises in nearby DWMAs and designated critical habitat.

Design Features and Applicable Avoidance and Minimization Measures

Programmatic design features that would be required of all solar energy projects to reduce ecological impacts under the proposed program are listed in Section 2.2. However, the implementation of design features alone is unlikely to reduce impacts on the desert tortoise to negligible levels in all SEZs. The appropriateness of some design features and species-specific minimization measures may vary by SEZ depending on the potential for the desert tortoise to occur in the area of direct effects.

For solar energy development within an SEZ that may contain potentially suitable habitat in the areas of direct and indirect effects (Amargosa Valley, Dry Lake, Dry Lake Valley North, and Riverside East), required design features that would reduce the potential for impact on the desert tortoise would focus on determining the potential for the species to occur in the area of direct effects, avoiding inhabited locations in the area of direct effects and avoiding direct and indirect impacts on suitable habitats. For solar energy development within these SEZs, applicable species-specific minimization measures include the following:

- Pre-disturbance surveys for the desert tortoise would be conducted by qualified biologists within the SEZ, and within access road corridors if necessary, to determine the presence of the species and its habitat. If the species or active burrows are found within any potential development areas, those locations would be avoided and adequate setback distances would be established.

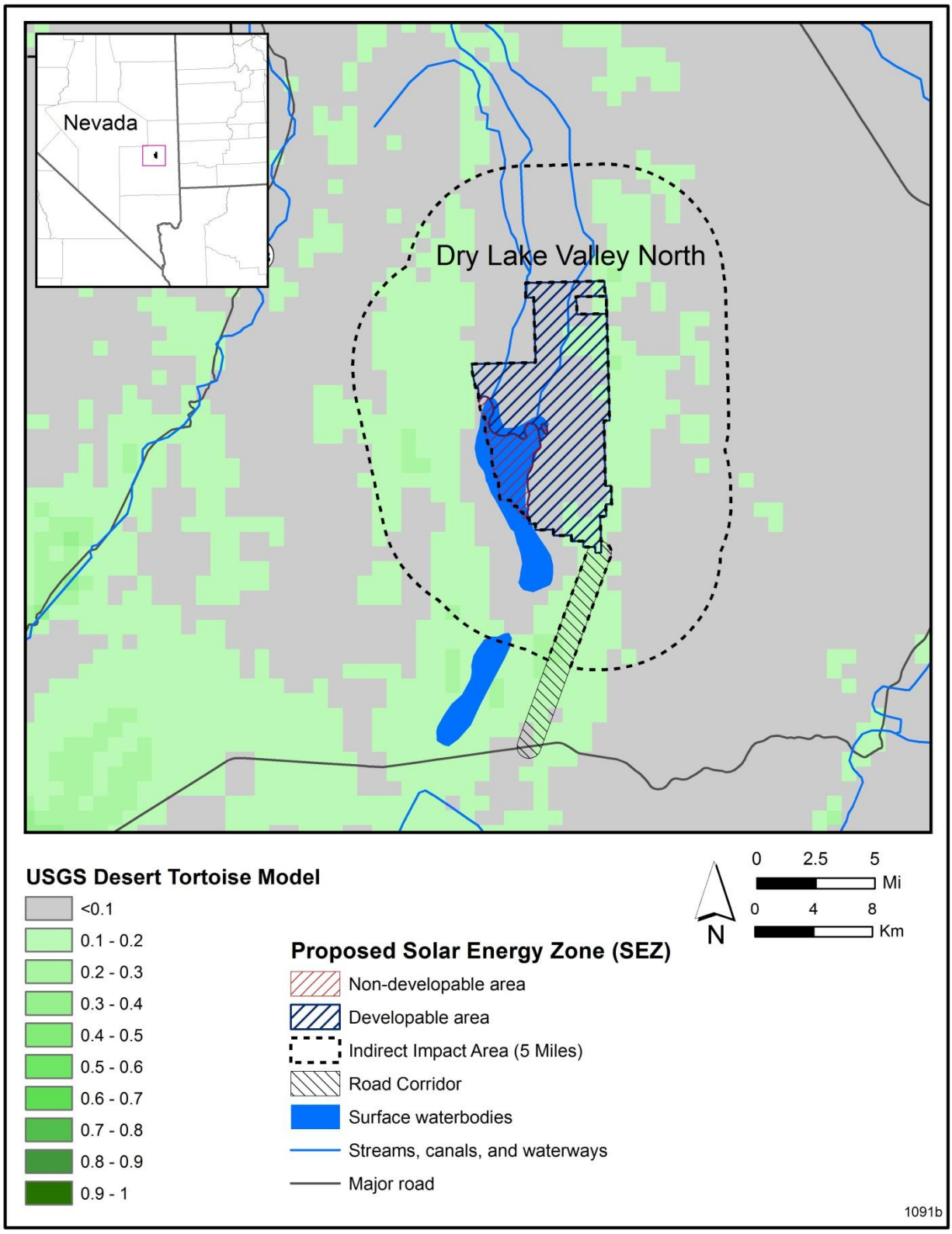

FIGURE 5-4 Known Occurrences and Availability of Potentially Suitable Habitat for the Mojave Desert Tortoise in the Affected Areas of the Proposed Dry Lake Valley North SEZ (Sources: Miskow 2009; Nussear et al. 2009)

- Pre-disturbance coordination with the Service also would be conducted to determine the potential for the desert tortoise to occur outside of the proposed project area, but within the area of potential indirect effects. If the Service determines that the species may be indirectly affected by development, particularly if solar development could disrupt migration between adjacent habitats, solar facilities and access roads would be constructed at appropriate setback distances or other actions necessary to reduce the potential for indirect effects would be taken. Development upslope of any nearby inhabited locations would be prohibited to prevent site runoff from affecting inhabited areas. Noise and lighting restrictions would also be implemented in efforts to avoid disturbing nearby individuals.

In addition to the proposed minimization measures identified above and in Section 2.2, which would reduce the potential for adverse effects from solar energy development on the SEZs, measures that may be considered as compensation for potential effects on the desert tortoise include (1) the funding of land acquisition, enhancement, and protection of Mojave desert tortoise habitat to compensate for any habitat potentially lost or compromised by solar energy development on the SEZs, and (2) the authorization of incidental take statements and implementation of a translocation and monitoring program that would remove individuals from the affected areas to protected areas that would not be directly or indirectly affected by future development. A comprehensive strategy that would include one or more of these measures, as well as additional conservation measures and reasonable and prudent alternatives, would be determined in coordination with the Service.

There are inherent dangers to tortoises associated with their capture, handling, and translocation from the SEZ. These actions, if done improperly, can result in injury or death. To minimize these risks, the desert tortoise translocation plan would be developed in consultation with the Service and follow the *Guidelines for Handling Desert Tortoises during Construction Projects* (Desert Tortoise Council 1994) and other current translocation guidance provided by the Service. Consultation will identify potentially suitable recipient locations, density thresholds for tortoise populations in recipient locations, procedures for pre-disturbance clearance surveys and tortoise handling, as well as disease testing and post-translocation monitoring and reporting requirements.

To offset impacts of solar development on the SEZ, compensation may be needed to balance the acreage of habitat lost with the acquisition of lands that would be improved and protected for desert tortoise populations (USFWS 1994). Compensation can be accomplished by improving the carrying capacity for the desert tortoise on the acquired lands. Other actions to reduce impact may include funding for the habitat enhancement of the desert tortoise on existing federal lands. Consultations with the Service would be necessary to determine the appropriate compensation ratio to acquire, enhance, and preserve desert tortoise habitat.

Effect Determination

With the implementation of all required design features and species-specific avoidance and minimization measures identified above and in Section 2.2, solar energy development in the Amargosa Valley, Dry Lake, and Riverside East SEZs may affect and is likely to adversely affect the desert tortoise. Based on the potential for occurrence of the desert tortoise only in the assumed access road and area of indirect effects of the Dry Lake Valley North SEZ and the expected effectiveness of design features for eliminating indirect effects, solar energy development on that SEZ may affect, but is not likely to adversely affect, the desert tortoise. Solar energy development on other SEZs would not affect this species.

5.2.3 Birds

5.2.3.1 Mexican Spotted Owl

The Mexican spotted owl was listed as a threatened species under the ESA on March 16, 1993 (USFWS 1993). Critical habitat was designated on June 5, 1995, but several court rulings resulted in the Service removing the critical habitat designation on March 25, 1998 (63 FR 14378). Critical habitat for this species was again designated in 2004, comprising approximately 8.6 million acres (35,000 km^2) on federal lands in Arizona, Colorado, New Mexico, and Utah (USFWS 2004). A recovery plan for the Mexican spotted owl was originally published in December 1995 and revised in June 2011 (USFWS 2011a). At the time of federal listing in 1993, the total population of Mexican spotted owls was estimated at 2,100 individuals.

The Mexican spotted owl occurs from southern British Columbia, Canada to central Mexico. It is a rare permanent resident in the southern and eastern parts of Utah and southwestern Colorado (NatureServe 2010; UDWR 2012). The primary habitat of the spotted owl is steep rocky canyons, although forested areas are also important habitat. The spotted owl occupies closed canopy forests in steep canyons with uneven-aged tree stands with high basal area, with an abundance of snags and downed logs. The Mexican spotted owl feeds mainly on rodents but also consumes rabbits, birds, reptiles, and insects. Nest sites are either in trees (typically those with broken tops), tree trunk cavities, and cliffs along canyon walls (NatureServe 2010). Breeding takes place in the spring (March) with egg-laying in late March or early April. After a 30-day incubation period, hatching occurs and fledging takes place in 4 to 5 weeks. The young depend on the adults for food in the summer and eventually disperse from the nesting area in the fall (NatureServe 2010).

Potential threats to the Mexican spotted owl include habitat loss from logging of old-growth forest, disturbance of owls by recreational use on federal lands, overgrazing, loss of habitat and disturbance of owls from road development within canyons, and habitat loss from catastrophic fires.

On the basis of recorded observations and the presence of potentially suitable habitat, the Mexican spotted owl may occur in the affected area of the Antonito Southeast and Los Mogotes East SEZs in Colorado (Table 5-2).

Solar Energy Zones in Which the Species May Occur

Antonito Southeast. The Mexican spotted owl has not been recorded on the Antonito Southeast SEZ or within the affected area. According to the SWReGAP habitat suitability model for the spotted owl (*Strix occidentalis*), potentially suitable habitat for this species does not occur on the SEZ. However, potentially suitable habitat for this species may occur outside of the SEZ within the area of indirect effects. According to the SWReGAP habitat suitability model, approximately 4,800 acres (19 km^2) of potentially suitable habitat for this species may occur in the area of indirect effects outside of the Antonito Southeast SEZ. Designated critical habitat for this species does not occur in the affected area of the Antonito Southeast SEZ.

Los Mogotes East. The Mexican spotted owl has not been recorded on the Los Mogotes East SEZ or within the affected area. According to the SWReGAP habitat suitability model for the spotted owl (*Strix occidentalis*), potentially suitable habitat for this species does not occur on the SEZ. However, potentially suitable habitat for this species may occur outside of the SEZ within the assumed access road corridor and area of indirect effects. According to the SWReGAP habitat suitability model, approximately 14 acres (<0.1 km^2) of potentially suitable habitat for this species may occur in the assumed access road corridor and 3,000 acres (12 km^2) in the area of indirect effects. Designated critical habitat for this species does not occur in the affected area of the Los Mogotes East SEZ.

Direct and Indirect Effects of Development on SEZs

Table 5-1 presents the potential impacts on bird species that could result from the construction, operation, and decommissioning of utility-scale solar energy facilities, including associated access roads. Potentially suitable habitat for the Mexican spotted owl occurs in the areas of direct and indirect effects of the Los Mogotes East SEZ and only within the area of indirect effects of the Antonito Southeast SEZ (Table 5-2; Figure 5-5). Any necessary future transmission ROW developments or upgrades to serve solar energy development on these SEZs are unlikely to occur in suitable habitat for the Mexican spotted owl and are unlikely to directly or indirectly affect this species. The implementation of required design features would avoid disturbing suitable forested habitats and canyonlands for this species, thereby reducing the potential for direct and indirect impacts on this species.

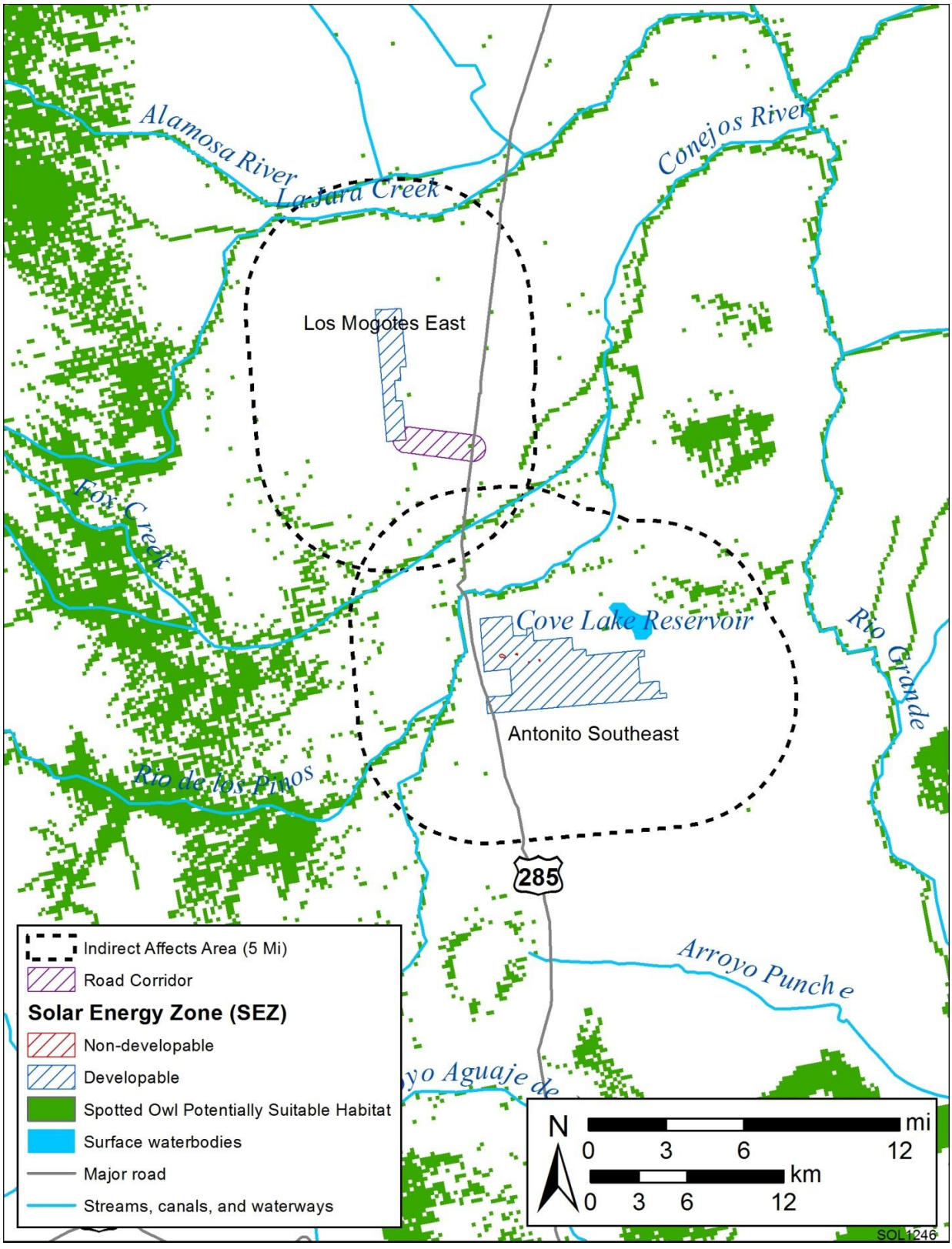

FIGURE 5-5 Availability of Potentially Suitable Habitat for the Mexican Spotted Owl in the Affected Areas of the Antonito Southeast and Los Mogotes East SEZs (Source: USGS 2007)

Design Features and Applicable Avoidance and Minimization Measures

Programmatic design features that would be required of all solar energy projects to reduce ecological impacts under the proposed program are listed in Section 2.2. For solar energy development within the Antonito Southeast and Los Mogotes East SEZs, required design features that would reduce the potential for impact on the Mexican spotted owl would focus on limiting the potential for indirect impacts in areas adjacent to the SEZ. For solar energy development within the Los Mogotes East SEZ, required design features that would reduce the potential for impact on the Mexican spotted owl would focus on limiting the potential for direct impacts resulting from construction and operation of the assumed access road.

For solar energy development within the Antonito Southeast and Los Mogotes East SEZs, required design features that would reduce the potential for impact on the Mexican spotted owl would focus on determining the potential for the species to occur in the area of direct effects, avoiding inhabited locations in the area of direct effects, and avoiding direct and indirect impacts on forested and canyonland habitats. For solar energy development within these SEZs, applicable species-specific avoidance and minimization measures include the following:

- Pre-disturbance surveys for the Mexican spotted owl would be conducted by qualified biologists within the assumed access road corridor to determine the presence of the species and its habitat. If the species or its nests are found within any potential development areas, those locations would be avoided and adequate setback distances would be established.

- Pre-disturbance coordination with the Service would be conducted to determine the potential for the Mexican spotted owl to occur in the vicinity of the proposed project. If the Service determines that the species may be indirectly affected by development, solar facilities and access roads would be constructed at appropriate setback distances or other actions would be taken that are necessary to reduce the potential for indirect effects. Development upslope of any nearby inhabited locations would be prohibited to prevent site runoff from affecting inhabited areas. Noise and lighting restrictions would also be implemented in efforts to avoid disturbing nearby individuals.

- Projects would be sited and designed to avoid direct and indirect impacts on habitats that may be utilized by the Mexican spotted owl. These habitats include coniferous forests and canyonland habitats.

Effect Determination

With the implementation of all required design features and species-specific minimization measures identified above and in Section 2.2, solar energy development in the Antonito Southeast and Los Mogotes East SEZs may affect, but are not likely to adversely affect, the Mexican spotted owl.

5.2.3.2 Northern Aplomado Falcon

The northern aplomado falcon was federally listed as an endangered species under the ESA on February 25, 1986 (USFWS 1986b). Critical habitat for this species has not been designated. The northern aplomado falcon is primarily known from the desert grasslands and savannas of Central America. In the United States, the species is known from southern New Mexico, southern Texas, and southeastern Arizona. This species inhabits desert grasslands with mesquite and yucca, riparian woodlands in open grasslands, and sand ridges with yuccas in coastal prairie regions. In general, open landscapes with scattered trees and shrubs provide good habitat. Other necessary habitat components include moderately low ground cover, an abundance of small to medium-sized birds, and a supply of nesting platforms. Aplomado falcons prey primarily on other birds (e.g., cuckoos, doves, woodpeckers, blackbirds, flycatchers, and thrushes) and supplement their diet with insects, small mammals, reptiles, and amphibians (e.g., grasshoppers, butterflies, crickets, wasps, frogs, lizards, bats, and rodents). Aplomado falcons do not construct their own nests and are thus dependent on nesting platforms constructed by other species, such as the stick nests of Swainson's hawks, crested caracaras, and Chihuahuan ravens. In desert habitats, nest availability is determined by the presence of species that build large nests, such as crows, kites, ravens, or hawks. The breeding season lasts for 6 to 8 months, with most eggs laid between March and May. Clutches consist of 2 to 3 eggs, and the incubation period (both parents tending) lasts 32 days. Nestlings fledge after approximately 35 days and remain in the vicinity of the nest for another month (NatureServe 2010).

At the time of listing, the falcon was no longer breeding in the United States. Prior to listing, the most recent breeding record for the northern aplomado falcon in New Mexico was in 1952. During the 1990s and early 2000s, however, there were occasional sightings of falcons in New Mexico, suggesting that the subspecies is dispersing from breeding locations in Mexico back into the southwestern United States. A total of 22 grassland areas occur within the historical range of the species in southeastern Arizona and southern New Mexico and offer suitable habitat conditions for the aplomado falcon (NMDGF 2010; NatureServe 2010).

The northern aplomado falcon previously experienced large population declines because of pesticides, especially DDT (dichlorodiphenyltrichloroethane) applied in Mexico. It has also lost large areas of suitable desert grassland habitat through brush encroachment and agriculture clearing (NatureServe 2010). Re-introduction of northern aplomado falcons in southern New Mexico and Arizona under Section 10(j) of the ESA began in 2006. These populations are considered to be experimental and non-essential. A nonessential experimental population, as defined in Section 10(j) of the ESA, is a reintroduced population whose loss would not be likely to appreciably reduce the likelihood of survival of the species in the wild; these populations are conferenced with the USFWS as species proposed for listing under the ESA in this BA. The ongoing aplomado falcon reintroduction program in southern New Mexico has thus far reintroduced 305 captive-bred young falcons in the southern part of the state in suitable native grassland habitat. This reintroduction program increases the likelihood of this species' occurrence in suitable habitat near the affected area of the proposed Afton SEZ (Zenone 2012).

Experimental non-essential populations of the northern aplomado falcon may occur throughout southern New Mexico in areas of Chihuahuan desert grassland, especially where

scattered yucca, mesquite, and cactus are present. On the basis of recorded observations and the presence of potentially suitable habitat, introduced experimental non-essential populations of the northern aplomado falcon may occur in the affected area of the Afton SEZ in New Mexico (Table 5-2); however, these populations are unlikely to occur on the SEZ and may only occur within the area of indirect effects. The SEZ is characterized by low habitat suitability for the aplomado falcon (as determined by a field verified habitat suitability model [Young et al. 2002]), but some areas of moderate to high potential suitable habitat occur outside the SEZ in the area of indirect effects (Figure 5-6). There have been only four sightings of aplomado falcons in the Afton SEZ analysis area, ranging from 7 to 13 mi (11 to 21 km) from the Afton SEZ. There are no known nest sites or documented territories within the Afton SEZ (Lister 2012).

According to the SWReGAP habitat suitability model, approximately 1,520 acres (6 km^2) of potentially suitable habitat may occur on the SEZ and 5 acres (<0.1 km^2) within the assumed access road corridor. Approximately 42,180 acres (170 km^2) of potentially suitable habitat occurs in the area of indirect effects. On the basis of SWReGAP land cover data, approximately 50 acres (0.2 km^2) of Chihuahuan grassland habitat occurs on the SEZ. This habitat could represent foraging and nesting habitat. On the basis of this information, it is concluded that portions of the Afton SEZ may provide marginally suitable habitat for the northern aplomado falcon; suitable or highly suitable Chihuahuan desert grassland habitat may occur outside the SEZ in the area of indirect effects (Figure 5-6). Although the SWReGAP land cover and habitat suitability models indicate that potentially suitable habitat for the aplomado falcon may exist on the SEZ, field surveys have indicated that suitable habitat does not exist on the SEZ or within the assumed access road corridor (Lister 2012).

Direct and Indirect Effects of Development on SEZs

Table 5-1 presents the potential impacts on bird species that could result from the construction, operation, and decommissioning of utility-scale solar energy facilities, including associated access roads. Potentially suitable habitat for the northern aplomado falcon does not occur in the area of direct effects of the Afton SEZ; however, field verified potentially suitable habitat occurs in the area of indirect effects. The implementation of required design features would avoid disturbing suitable desert grassland habitats for this species, thereby reducing the potential for direct and indirect impacts on this species. These design features would also minimize or avoid any foreseeable impacts from any necessary future transmission ROW developments or upgrades to the aplomado falcon or its habitat.

Design Features and Applicable Avoidance and Minimization Measures

Programmatic design features that would be required of all solar energy projects to reduce ecological impacts under the proposed program are listed in Section 2.2. For solar energy development within the Afton SEZ, required design features that would reduce the potential for impact on the northern aplomado falcon would focus on determining the potential for the species to occur in the area of direct effects, avoiding inhabited locations in the area of direct effects, and avoiding direct and indirect impacts on Chihuahuan desert grassland habitats. For solar energy

development within the SEZ, applicable species-specific avoidance and minimization measures include the following:

- Pre-disturbance surveys for the northern aplomado falcon would be conducted by qualified biologists within the Afton SEZ area of direct effects to determine the presence of the species and its habitat. If the species or its nests are found within any potential development areas, those locations would be avoided and adequate setback distances would be established. Setback distances around these habitats will be determined during project-level consultation with the Service.

- Pre-disturbance coordination with the Service would be conducted to determine the potential for the northern aplomado falcon to occur in the vicinity of the proposed project. Species survey protocols would be determined in coordination with the Service and the field-verified habitat suitability model (Young et al. 2002) would be used to establish habitat suitability assessment protocols. If necessary, solar facilities and access roads would be constructed at appropriate setback distances or other actions necessary to reduce the potential for indirect effects would be taken. Development upslope of any nearby inhabited locations would be prohibited to prevent site runoff from affecting inhabited areas. Noise and lighting restrictions would also be implemented in efforts to avoid disturbing nearby individuals.

- Projects would be sited and designed to avoid direct and indirect impacts on habitats that may be utilized by the northern aplomado falcon. These habitats include Chihuahuan desert grassland communities. Any necessary setback distances around suitable grassland habitats will be determined during project-level consultation with the Service.

- Projects would be designed to avoid direct and indirect impacts on prey species. Impacts on nesting locations for migratory bird species within the area of direct effects will be avoided as stipulated under the Migratory Bird Treaty Act. In order to minimize impacts on riparian habitats utilized by migratory bird species, there would be no net increase in the rate of groundwater withdrawal to serve development on the SEZ.

- Projects would be designed to avoid direct and indirect impacts on potential nesting habitats for the northern aplomado falcon. The nests of ravens and other raptors within the area of direct effects will be avoided. These nest locations and any other potentially suitable nest trees (especially those containing large abandoned nests) will be avoided within a setback distance approved by the USFWS. The Mimbres RMP currently includes a 0.5 mi (0.8 km) buffer established around known raptor nests for protection from surface disturbance.

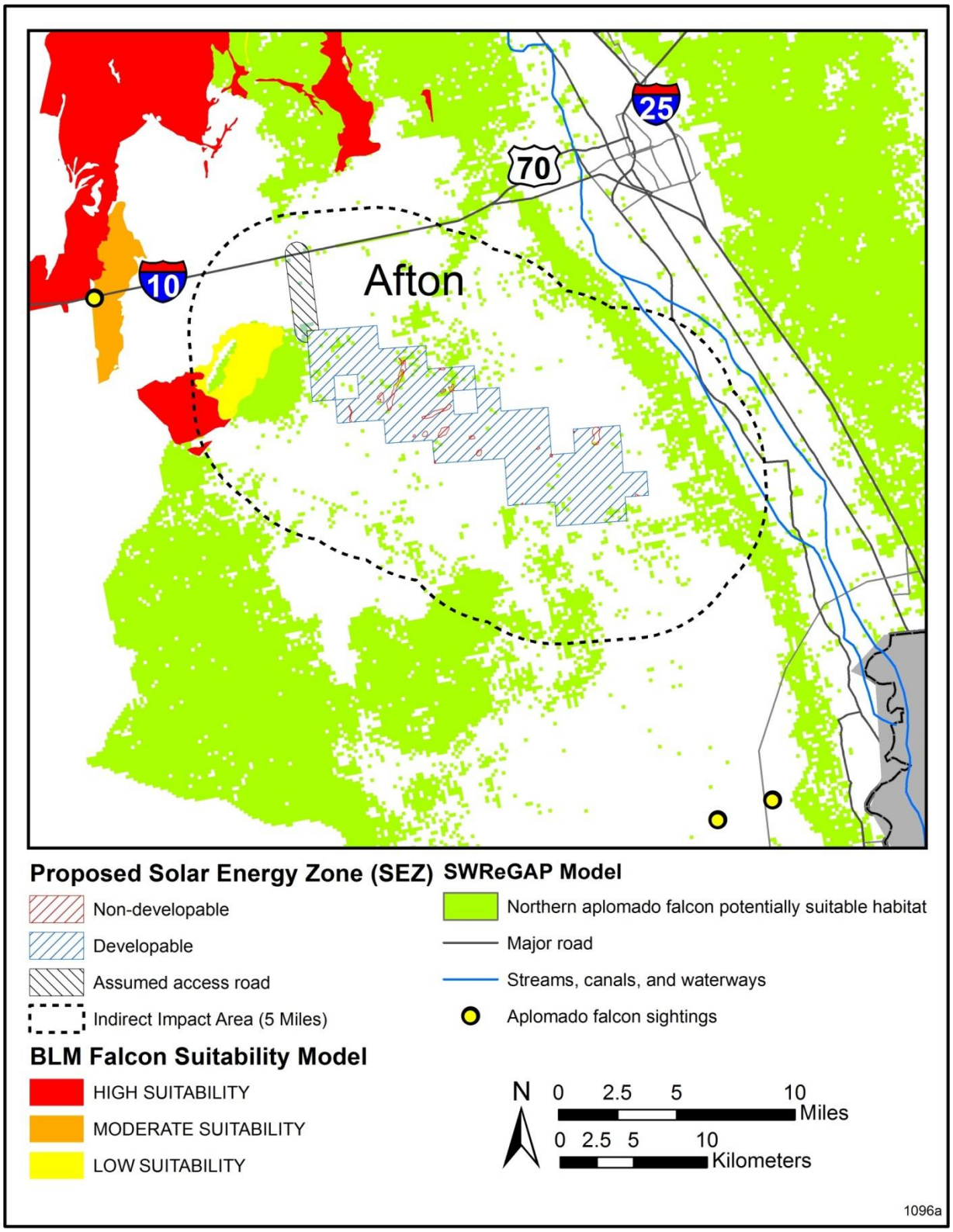

FIGURE 5-6 Known Occurrences and Availability of Potentially Suitable Habitat for the Northern Aplomado Falcon in the Affected Area of the Afton SEZ (Sources: Young et al. 2002; McCullough 2009; USGS 2007)

In addition to the proposed avoidance and minimization measures described above and in Section 2.2, which would reduce the potential for adverse effects from solar energy development on the SEZs, measures that may be considered as compensation for potential effects on the northern aplomado falcon include the funding of land acquisition, enhancement, and protection of northern aplomado falcon habitat, as well as the funding of other recovery actions, to compensate for any habitat potentially lost or compromised by solar energy development on the SEZ. A comprehensive strategy that would include one or more of these measures, as well as additional conservation measures, would be determined in coordination with the Service.

Effect Determination

With the implementation of all required design features and species-specific minimization measures identified above and in Section 2.2, and considering the availability of suitable habitat based on field-verified observations (Young et al. 2002), solar energy development in the Afton SEZ may affect, but is not likely to adversely affect, the northern aplomado falcon. As all potentially affected populations of the northern aplomado falcon are considered nonessential experimental populations (considered as proposed species in this BA), under BLM Manual 6840, the BLM has decided to confer with the Service and to provide information regarding the effect determination for this species.

5.2.3.3 Southwestern Willow Flycatcher

The southwestern willow flycatcher is a subspecies of willow flycatcher that breeds in southern California, southern Nevada, southern Utah, Arizona, New Mexico, western Texas, and extreme northwest Mexico. It may also breed in southwestern Colorado, but nesting records are lacking. All willow flycatchers are migratory. The southwestern willow flycatcher was federally listed as endangered on February 27, 1995 (USFWS 1995). On July 22, 1997, approximately 599 river mi (960 km) of waterways and their adjacent riparian habitats in Arizona, California, and New Mexico were designated as critical habitat (USFWS 1997). On August 15, 2011, the USFWS proposed the expansion the area of critical habitat to include a total of 2,090 stream miles (3,364 km) of habitat for the southwestern willow flycatcher (USFWS 2011b). The stream segments (including the 100-year floodplain or flood-prone areas) included in the current critical habitat proposal occur in Arizona, California, Colorado, Nevada, New Mexico, and Utah.

The southwestern willow flycatcher occurs in riparian habitats along rivers, streams, or other wetlands, where there are dense growths of willows (*Salix* spp.), baccharis (*Baccharis* spp.), cottonwood (*Populus* spp.), buttonbush (*Cephalanthus* spp.), and other deciduous shrubs and trees. Flycatchers nest in thickets of trees and shrubs that are approximately 13 to 23 ft (4 to 7 m) or more in height, have dense foliage from approximately 13 ft (7 m) above the ground, and often have a high percentage of canopy cover. The diversity of nest site plant species may be low or comparatively high, and nest site vegetation may be even- or uneven-aged, but it is usually dense and structurally homogeneous. Although the southwestern willow flycatcher historically

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nested in native plant communities and it still does so when such vegetation is available, the species is now known to nest in thickets dominated by the non-native species (*Tamarix* spp.) and Russian olive (*Elaeagnus angustifolia*). The subspecies virtually always nests near surface water or saturated soil. At some nest sites, surface water may be present early in the breeding season, but by late June or early July, only damp soil is present. Ultimately, a water table close enough to the surface to support riparian vegetation is necessary (NatureServe 2010).

The southwestern willow flycatcher is an insectivore. It forages within and above dense riparian vegetation, taking insects on the wing or gleaning them from foliage. It also forages in areas adjacent to nest sites, which may be more open. No information is available on specific prey species.

Southwestern willow flycatchers arrive at breeding sites and begin singing by mid-May; they build nests in late May and early June. Birds construct a cup-shaped nest in a fork or horizontal branch of a medium-sized bush or small tree, approximately 3.2 to 15 ft (1 to 4.5 m) above the ground. Typically, there is dense vegetation above and around the nest. The subspecies fledges young in early to mid-July. Some variations in these dates have been observed; they may be related to altitude, latitude, and re-nesting.

Threats to this species have primarily included habitat loss and degradation. Extensive loss of habitat has occurred through the conversion of floodplains to agriculture, flood-control projects, and urban development. Other threats include overgrazing and brood-parasitism by the brown-headed cowbird (NatureServe 2010).

On the basis of recorded observations and the presence of potentially suitable habitat, the southwestern willow flycatcher may occur in the affected area of six SEZs in three states (Table 5-2): Arizona (Gillespie); Colorado (Antonito Southeast, De Tilla Gulch, Fourmile East, and Los Mogotes East); and Nevada (Dry Lake).

Solar Energy Zones in Which the Species May Occur

Gillespie. The southwestern willow flycatcher is known to occur along the Gila River within 3 mi (5 km) east of the Gillespie SEZ. Potentially suitable habitat for the southwestern willow flycatcher may occur in the access road corridor and the area of indirect effects of the Gillespie SEZ (Figure 5-7). Habitats that may support the southwestern willow flycatcher may also be supported by groundwater from the same basin that may be used to support solar energy development on the Gillespie SEZ (Table 5-2). According to the SWReGAP habitat suitability model, suitable habitat for the southwestern willow flycatcher does not occur in the affected area of the Gillespie SEZ. On the basis of the SWReGAP land cover model, however, approximately 2,000 acres (8 km^2) of riparian habitat occurs within the affected area (Figure 5-7). Designated critical habitat for this species does not occur in the affected area of the Gillespie SEZ.

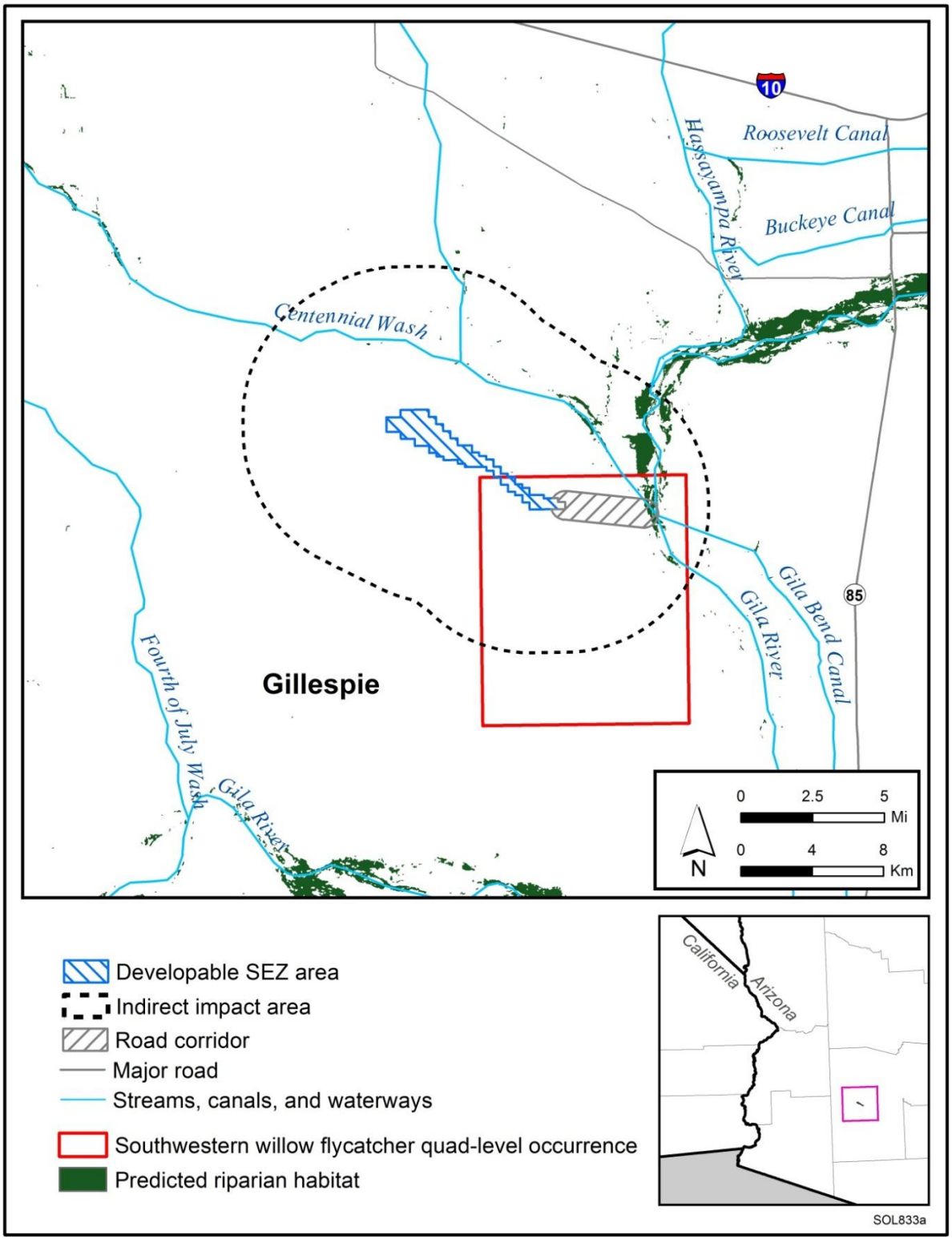

FIGURE 5-7 Known Occurrences and Availability of Potentially Suitable Habitat for the Southwestern Willow Flycatcher in the Affected Area of the Proposed Gillespie SEZ (Sources: Schwartz 2009; USGS 2004, 2007)

Antonito Southeast. The southwestern willow flycatcher is known to occur from the Alamosa NWR, approximately 25 mi (40 km) northeast of the Antonito Southeast SEZ. The species has not been recorded on the SEZ or within the affected area; however, the SWReGAP habitat suitability model predicts the presence of potentially suitable habitat on the SEZ (34 acres [0.1 km^2]) in the vicinity of Alta Lake. Habitats that may support the southwestern willow flycatcher may also be supported by groundwater from the same basin that may be used to support solar energy development on the Antonito Southeast SEZ (Table 5-2). It is unlikely for the species to occur on the SEZ near Alta Lake because of the habitat's small size, isolation, and lack of suitable vegetation, as observed during a July 2009 field visit to the SEZ. Potentially suitable habitat also occurs outside of the SEZ in the area of indirect effects, particularly in riparian areas along the Conejos River and Rio San Antonio (Figure 5-8). According to the SWReGAP habitat suitability model, approximately 5,000 acres (20 km^2) of potentially suitable habitat for this species may occur in the area of indirect effects outside of the Antonito Southeast SEZ. Designated critical habitat for this species does not occur in the affected area of the Antonito Southeast SEZ. However, proposed critical habitat does occur along the Conejos River, which is within the area of indirect effects approximately 4 mi (6 km) north of the SEZ.

De Tilla Gulch. The southwestern willow flycatcher is known to occur from the Alamosa NWR, approximately 38 mi (61 km) southeast of the De Tilla Gulch SEZ. The species has not been recorded on the SEZ or within the area of indirect effects; however, SWReGAP indicates the presence of potentially suitable habitat for the species in the area of indirect effects—particularly in riparian areas along Saguache Creek (Figure 5-9). Habitats that may support the southwestern willow flycatcher may also be supported by groundwater from the same basin that may be used to support solar energy development on the De Tilla Gulch SEZ (Table 5-2). According to the SWReGAP habitat suitability model, approximately 670 acres (3 km^2) of potentially suitable habitat for this species may occur in the area of indirect effects outside of the SEZ. Potentially suitable habitat for the southwestern willow flycatcher does not occur on the SEZ. Designated critical habitat for this species does not occur in the affected area of the De Tilla Gulch SEZ.

Fourmile East. The southwestern willow flycatcher is known to occur from the Alamosa NWR, approximately 8 mi (13 km) southwest of the Fourmile East SEZ. The species has not been recorded on the SEZ or within the affected area. According to the SWReGAP habitat suitability model, potentially suitable habitat for the southwestern willow flycatcher does not occur on the SEZ. However, potentially suitable habitat may occur outside of the SEZ in the area of indirect effects, particularly among habitats associated with the Blanca Wetlands (Figure 5-9). In addition, habitats that may support the southwestern willow flycatcher may also be supported by groundwater from the same basin that may be used to support solar energy development on the Fourmile East SEZ (Table 5-2). According to the SWReGAP habitat suitability model, approximately 525 acres (2 km^2) of potentially suitable habitat for this species may occur in the area of indirect effects outside of the Fourmile East SEZ. Designated critical habitat for this species does not occur in the affected area of the Fourmile East SEZ.

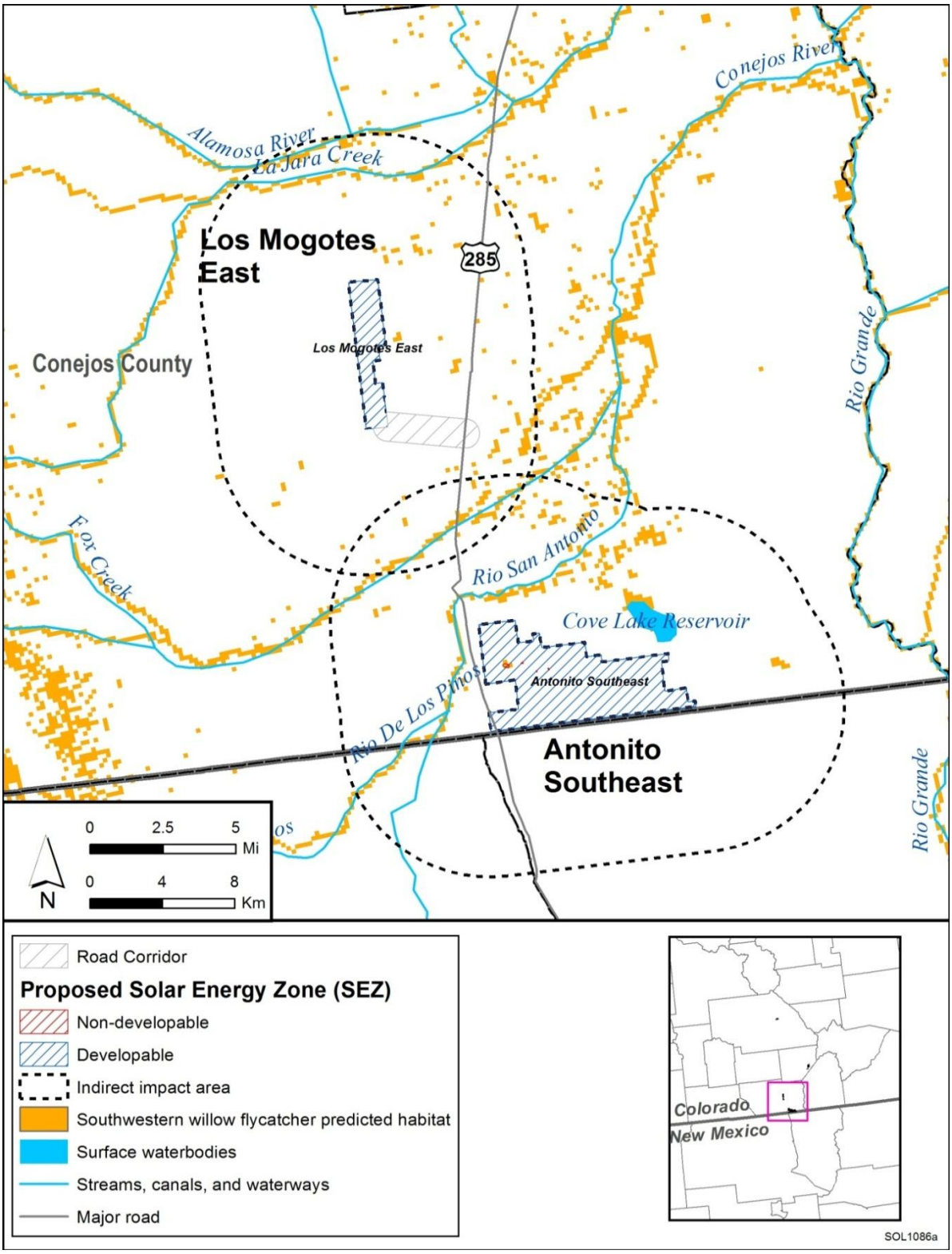

FIGURE 5-8 Availability of Potentially Suitable Habitat for the Southwestern Willow Flycatcher in the Affected Areas of the Antonito Southeast and Los Mogotes East SEZs (Source: USGS 2007)

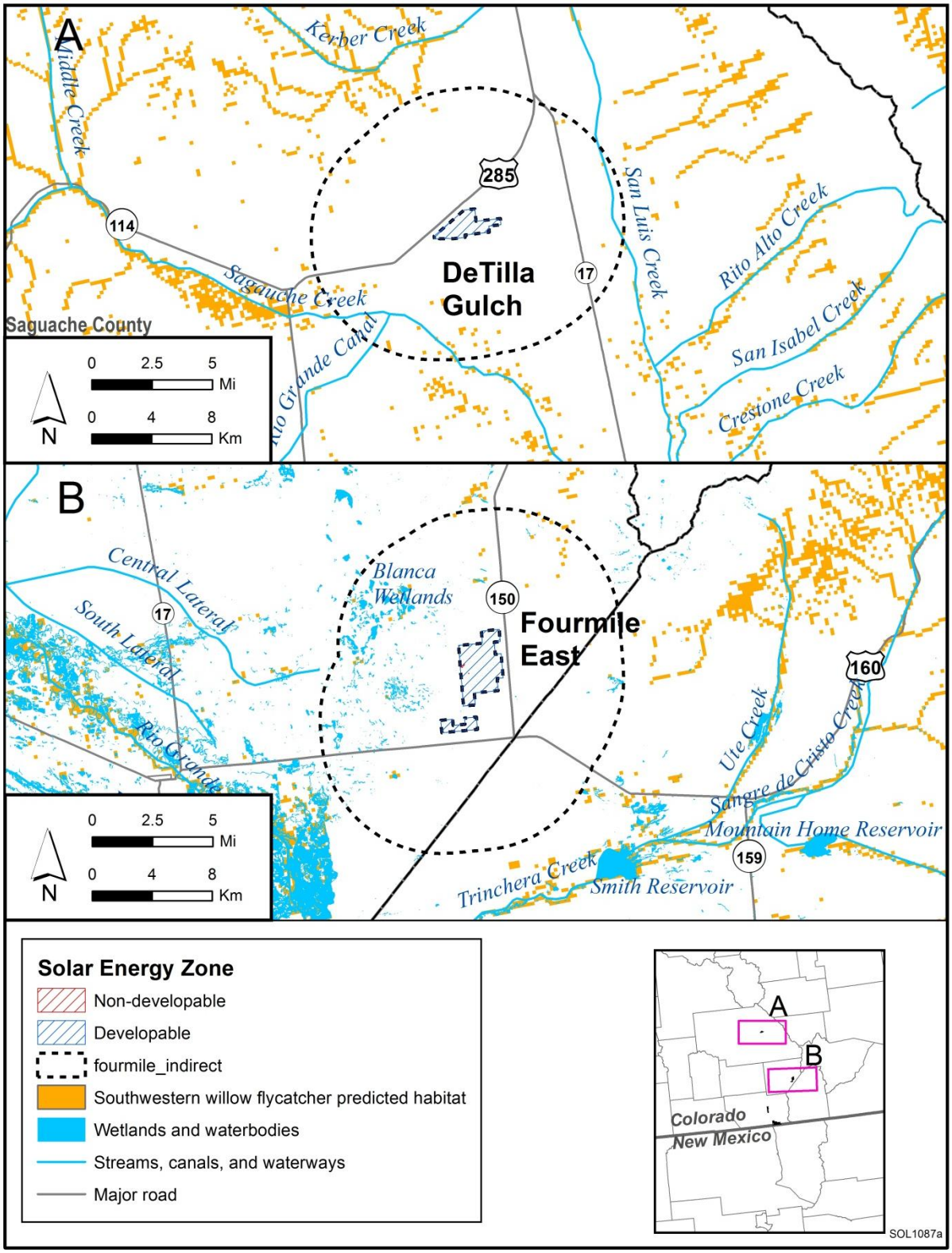

FIGURE 5-9 Availability of Potentially Suitable Habitat for the Southwestern Willow Flycatcher in the Affected Areas of the Proposed (A) De Tilla Gulch and (B) Fourmile East SEZs (Source: USGS 2007)

Los Mogotes East. The southwestern willow flycatcher is known to occur from the Alamosa NWR, approximately 18 mi (29 km) northeast of the Los Mogotes East SEZ. The species has not been recorded on the SEZ or within the affected area. According to the SWReGAP habitat suitability model, potentially suitable habitat for the southwestern willow flycatcher does not occur on the SEZ or within the assumed access road corridor. However, potentially suitable habitat does occur outside of the SEZ in the area of indirect effects, particularly along riparian habitats associated with the Alamosa River, the Conejos River, and La Jara Creek (Figure 5-8). Habitats that may support the southwestern willow flycatcher may also be supported by groundwater from the same basin that may be used to support solar energy development on the Los Mogotes East SEZ (Table 5-2). According to the SWReGAP habitat suitability model, approximately 3,600 acres (15 km^2) of potentially suitable habitat for this species may occur in the area of indirect effects outside of the Los Mogotes East SEZ. Designated critical habitat for this species does not occur in the affected area of the Los Mogotes East SEZ. However, proposed critical habitat does occur along the Conejos River, which is within the area of indirect effects approximately 4 mi (6 km) south of the SEZ.

Dry Lake. The southwestern willow flycatcher is known from the Muddy and Virgin River systems, approximately 20 mi (32 km) east of the Dry Lake SEZ. The species has not been recorded on the Dry Lake SEZ or within the affected area. According to the SWReGAP habitat suitability model, potentially suitable habitat for the southwestern willow flycatcher does not occur on the SEZ. However, approximately 20 acres (0.1 km^2) of potentially suitable habitat for this species may occur in the area of indirect effects outside of the Dry Lake SEZ (Figure 5-10). In addition, habitats that may support the southwestern willow flycatcher may also be supported by groundwater from the same basin that may be used to support solar energy development on the Dry Lake SEZ (Table 5-2). Designated critical habitat for this species does not occur in the affected area of the Dry Lake SEZ.

Direct and Indirect Effects of Development on SEZs

Table 5-1 presents the potential impacts on bird species that could result from the construction, operation, and decommissioning of utility-scale solar energy facilities, including associated access road corridors. Potentially suitable habitat for the southwestern willow flycatcher (as determined by the SWReGAP habitat suitability model) occurs in the areas of direct and indirect effects (includes SEZ, road corridor, or transmission ROW, and area of indirect effects or groundwater) for the Gillespie SEZ in Arizona and the Antonito Southeast SEZ in Colorado (Table 5-2; Figures 5-7 and 5-8). Potentially suitable habitat occurs only in the area of indirect effects (including groundwater) for the Los Mogotes East, De Tilla Gulch, and Fourmile East SEZs in Colorado and the Dry Lake SEZ in Nevada (Table 5-2; Figures 5-8, 5-9, and 5-10). Suitable habitat areas that contain those required elements needed by the southwestern willow flycatcher are not known to occur on any of the SEZs or in any of the areas of direct effects. Thus, implementation of required design features would avoid disturbing suitable habitats as well as other wetland and riparian habitats, thereby minimizing the potential for direct and indirect impacts on this species. These design features would also minimize or avoid any foreseeable impacts on the southwestern willow flycatcher or its habitat from any necessary future transmission ROW developments or upgrades for these SEZs.

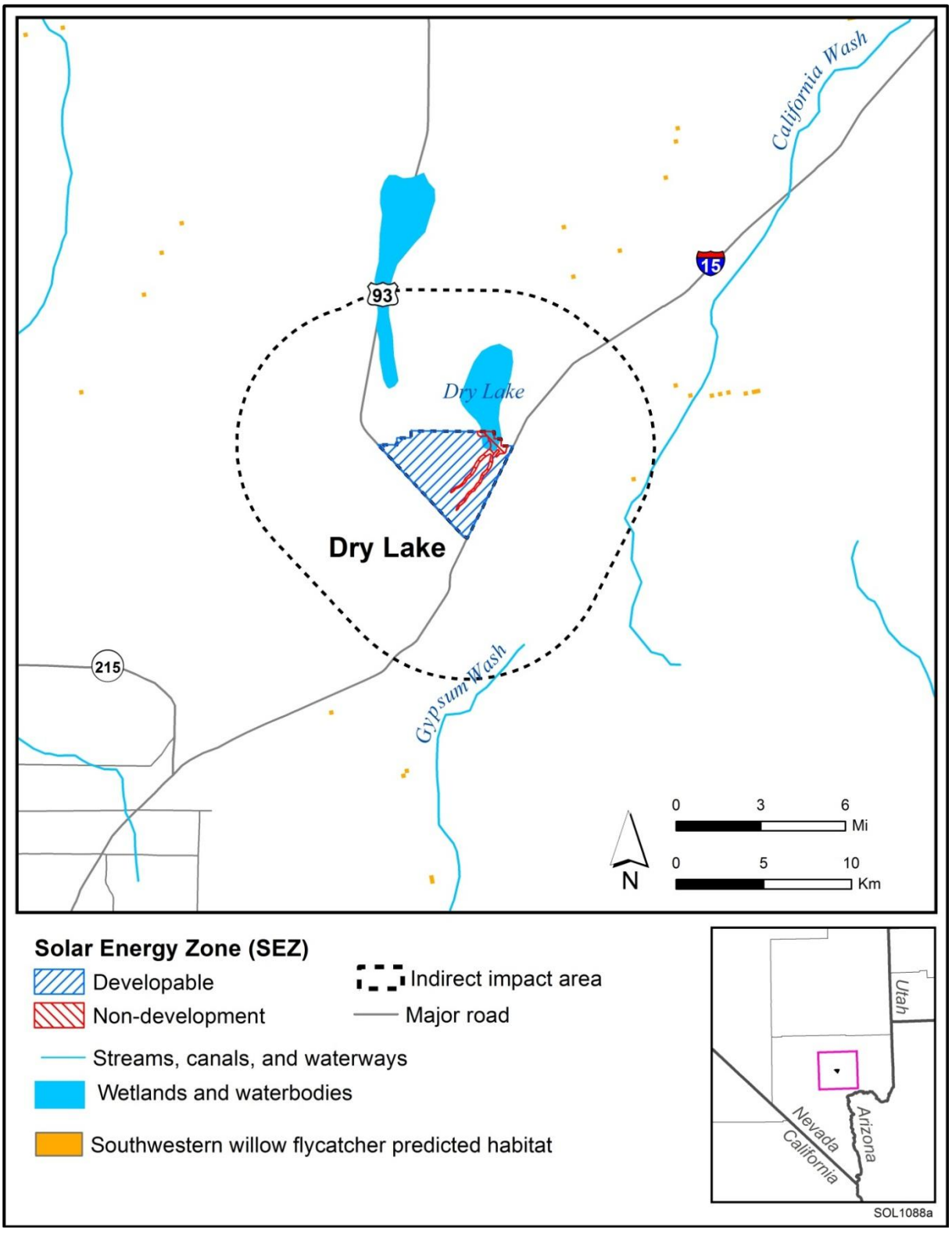

FIGURE 5-10 Known Occurrences and Availability of Potentially Suitable Habitat for the Southwestern Willow Flycatcher in the Affected Area of the Proposed Dry Lake SEZ (Source: USGS 2007)

Design Features and Applicable Avoidance and Minimization Measures

Although potentially suitable habitat for the southwestern willow flycatcher may occur in the affected area of six SEZs in three states, the implementation of design features and species-specific minimization measures would reduce or eliminate impacts of solar energy development within these SEZs on the southwestern willow flycatcher. Programmatic design features that would be required of all solar energy projects to reduce ecological impacts under the proposed program are listed in Section 2.2.

The appropriateness of some design features and species-specific minimization measures may vary by SEZ depending on the currently known potential for the southwestern willow flycatcher to occur in the area of direct effects (SEZ, road corridors, or transmission ROWs).

For solar energy development within an SEZ that may contain potentially suitable habitat in the areas of direct and indirect effects (Antonito Southeast and Gillespie), required design features that would reduce the potential for impact on the southwestern willow flycatcher would focus on determining the potential for the species to occur on the site, avoiding known locations in the area of direct effects, and avoiding direct and indirect impacts on riparian and wetland habitats. For solar energy development within an SEZ that may contain potentially suitable habitat only in the area of indirect effects (De Tilla Gulch, Dry Lake, Fourmile East, and Los Mogotes East), required design features that would reduce the potential for impact on the southwestern willow flycatcher would focus on limiting the potential for indirect impacts on riparian and wetland habitats. Applicable species-specific avoidance and minimization measures include the following:

- Pre-disturbance surveys for the southwestern willow flycatcher would be conducted by qualified biologists within the SEZ, and within access road corridors if necessary, to determine the presence of the southwestern willow flycatcher and its habitat. If the species or suitable habitat is found within any potential development areas, those locations would be avoided and adequate setback distances would be established.

- Pre-disturbance coordination with the Service also would be conducted to determine the potential for the southwestern willow flycatcher to occur outside of the proposed project area, but within the area of potential indirect effects. If the Service determines that the species may be indirectly affected by development, solar facilities and access roads would be constructed at appropriate setback distances or other actions would be taken that are necessary to reduce the potential for indirect effects. Development upslope of any nearby inhabited locations would be prohibited to prevent site runoff from affecting inhabited areas. Noise and lighting restrictions would also be implemented in efforts to avoid disturbing nearby individuals.

- Projects would be sited and designed to avoid direct and indirect impacts on habitats that may be utilized by the southwestern willow flycatcher. These habitats include waters of the United States, streams (ephemeral, intermittent,

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and perennial), springs, seeps, ponds and other aquatic habitats, riparian habitat, marshes, and playas.

Effect Determination

With the implementation of all required design features and species-specific avoidance and minimization measures identified above and in Section 2.2, solar energy development in the Gillespie, Antonito Southeast, Los Mogotes East, De Tilla Gulch, Fourmile East, and Dry Lake SEZs may affect, but is not likely to adversely affect, the southwestern willow flycatcher. Solar energy developments within these SEZs will have no effect on either designated or proposed critical habitat for the southwestern willow flycatcher. Solar energy development on other SEZs would not affect this species.

5.2.3.4 Yuma Clapper Rail

The Yuma clapper rail is a subspecies of clapper rail that occurs in inland habitats in the southwestern United States. The Yuma clapper rail was federally listed as endangered on March 11, 1967 (USFWS 1967). Critical habitat for this species has not been designated. Yuma clapper rails are found in shallow, freshwater marshes containing dense stands of cattails and bulrushes, along the Colorado River from California, southern Nevada, and Arizona south into Mexico. They also occur in dense, near-monotypic stands of cattail at the Salton Sea in Imperial County, California, and in marshes and riparian habitats in western Arizona and southern Nevada. Unlike other clapper rails, which are associated with tidal marshes, the Yuma clapper rail occupies freshwater marshes during the breeding season. Until recently, most of the population was thought to retreat to Mexico during the winter; it is now estimated that more than 70% of the breeding population winters along the Lower Colorado River (AZGFD 2010; CDFG 2010b; NatureServe 2010).

The Yuma clapper rail feeds on crayfish and other crustaceans, and it is believed that the abundance of food animals at a particular site is a better predictor of rail population densities than is vegetation. Yuma clapper rails breed from March through July. Nests are built in three major microhabitats: at the base of living clumps of cattail or bulrush, under wind-thrown bulrush, or on the top of dead cattails remaining from the previous year's growth. Nesting materials and cover are obtained from mature cattail/bulrush stands. Clutch size is typically six to eight eggs, and most eggs hatch during the first week of June (NatureServe 2010).

Threats to continued survival of the Yuma clapper rail include loss and degradation of habitat by activities such as water projects and the draining or filling of marshes for development or agriculture. Other threats to this species include catastrophic flooding; invasion of non-native plant species such as tamarisk; and pollution from urban runoff, industrial discharges, and sewage effluent. Although population numbers of the species appear to be stable, habitat throughout its range is not secure (NatureServe 2010).

On the basis of recorded observations and the presence of potentially suitable habitat, the Yuma clapper rail may occur in the affected area of two SEZs in two states (Table 5-2): Arizona (Gillespie), and California (Imperial East).

Solar Energy Zones in Which the Species May Occur

Gillespie. The Yuma clapper rail is known to occur along the Gila and Hassayampa Rivers about 3 mi (5 km) east of the Gillespie SEZ. On the basis of the SWReGAP habitat suitability model, potentially suitable habitat for this species does not occur on the SEZ. However, potentially suitable habitat may occur within the assumed access road corridor that is in proximity to riparian areas along the Gila River (Figure 5-11). Habitats that may support the Yuma clapper rail may also be supported by groundwater from the same basin that may be used to support solar energy development on the Gillespie SEZ (Table 5-2). According to the SWReGAP habitat suitability model, approximately 2,000 acres (8 km^2) of potentially suitable habitat for the Yuma clapper rail occurs in the affected area of the Gillespie SEZ, of which approximately 2 acres (<0.1 km^2) is estimated to occur in the area of direct effects within the access road corridor. The remaining suitable habitat is estimated to occur in the area of indirect effects within 5 mi (8 km) of the SEZ boundary (Figure 5-11).

Imperial East. The Yuma clapper rail is known to occur along the All-American Canal about 0.5 mi (0.8 km) south of the Imperial East SEZ. Potentially suitable riparian or wetland habitat for this species may occur on the Imperial East SEZ and within the area of indirect effects. The Service has identified seepage wetland habitats associated with the All-American Canal that could occur in or near the SEZ and could provide habitat for this species (Stout 2009). According to the SWReGAP habitat suitability model, approximately 44 acres (0.2 km^2) of potentially suitable wetland habitat is predicted to occur on the SEZ; approximately 3,230 acres (13 km^2) of potentially suitable riparian and wetland habitat is predicted to occur in the area of indirect effects within 5 mi (8 km) of the SEZ boundary (Figure 5-11). A site visit in 2009 confirmed the presence of potentially suitable habitat along the canal, although no individuals were observed. Habitats that may support the Yuma clapper rail may also be supported by groundwater from the same basin that may be used to support solar energy development on the Imperial East SEZ (Table 5-2).

Direct and Indirect Effects of Development on SEZs

Table 5-1 presents the potential impacts on bird species that could result from the construction, operation, and decommissioning of utility-scale solar energy facilities, including associated access road corridors. Potentially suitable habitat for the Yuma clapper rail occurs in the areas of direct and indirect effects for the Imperial East and Gillespie SEZs (Table 5-2; Figure 5-11). However, the implementation of required design features (Section 2.2) would avoid disturbing wetland and riparian habitats, thereby minimizing the potential for direct and indirect impacts on this species. These design features would also minimize or avoid any

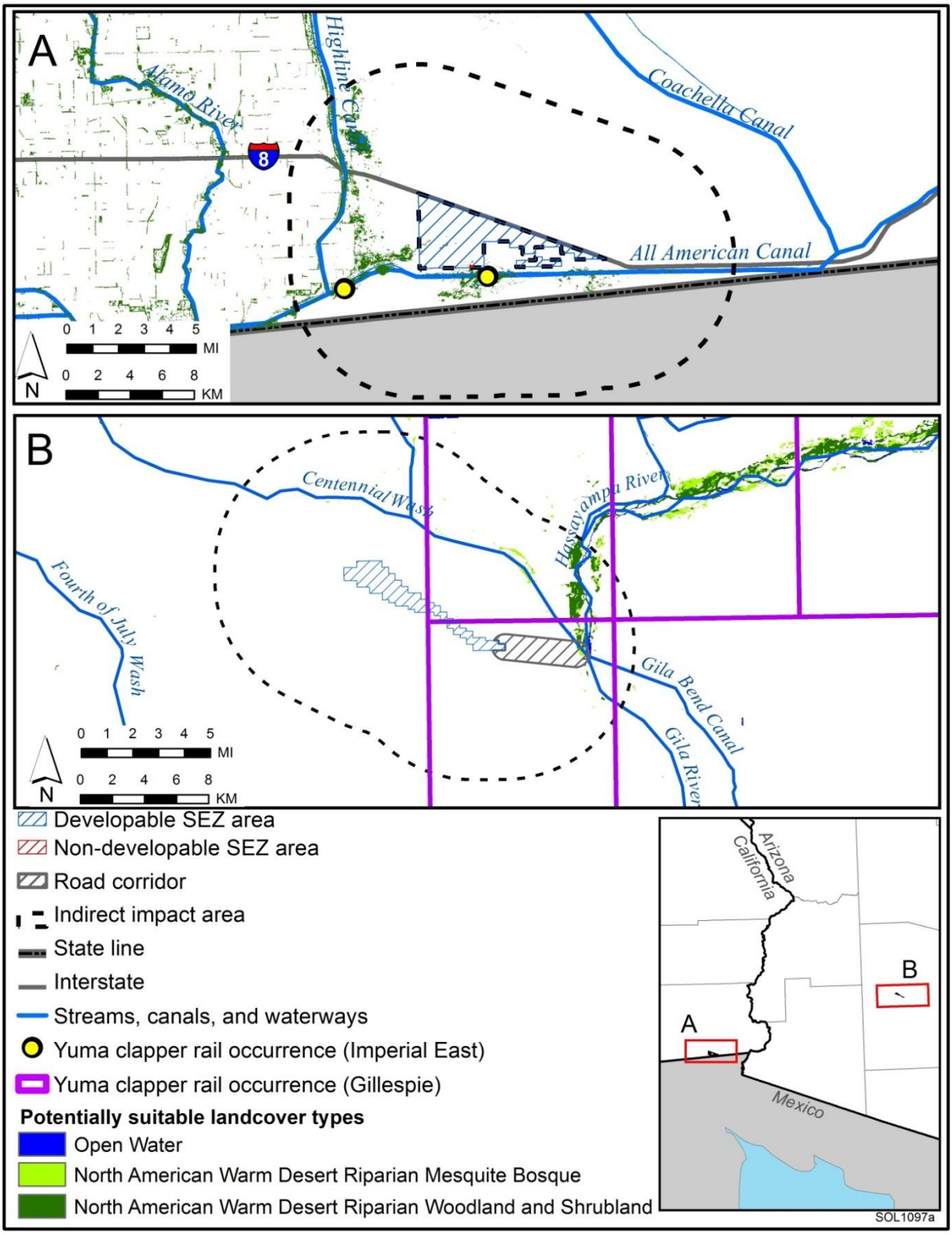

FIGURE 5-11 Known Occurrences and Availability of Potentially Suitable Habitat for the Yuma Clapper Rail in the Affected Areas of the Proposed (A) Imperial East and (B) Gillespie SEZs (Sources: CDFG 2010a; Miskow 2009; USGS 2004)

foreseeable impacts on the Yuma clapper rail or its habitat from any necessary future transmission ROW developments or upgrades for these SEZs.

Design Features and Applicable Avoidance and Minimization Measures

Although potentially suitable habitat for the Yuma clapper rail may occur in the affected area of two SEZs in two states, the implementation of design features and species-specific minimization measures would reduce or eliminate impacts of solar energy development within these SEZs on the Yuma clapper rail. Programmatic design features that would be required of all solar energy projects to reduce ecological impacts under the proposed program are listed in Section 2.2.

For solar energy development within the Imperial East and Gillespie SEZs, required design features that would reduce the potential for impact on the Yuma clapper rail would focus on determining the potential for the species to occur in the area of direct effects, avoiding known locations in the area of direct effects, and avoiding direct and indirect impacts on riparian and wetland habitats. For solar energy development within these SEZs, applicable species-specific avoidance and minimization measures include the following:

- Pre-disturbance surveys for the Yuma clapper rail would be conducted by qualified biologists within the SEZ, and within access road corridors if necessary, to determine the presence of the species and its habitat. If the species is found within any potential development areas, those locations would be avoided and adequate setback distances would be established.

- Projects would be sited and designed to avoid direct and indirect impacts on habitats that may be utilized by the Yuma clapper rail. These habitats include waters of the United States, streams (ephemeral, intermittent, and perennial), springs, seeps, ponds and other aquatic habitats, riparian habitat, marshes, and playas.

Effect Determination

With the implementation of all required design features and species-specific minimization measures identified above and in Section 2.2, solar energy development in the Gillespie and Imperial East SEZs may affect, but is not likely to adversely affect, the Yuma clapper rail. Solar energy development on other SEZs would not affect this species.

5.2.4 Mammals

5.2.4.1 Utah Prairie Dog

The Utah prairie dog is endemic to southwestern Utah, where it occurs in grasslands, level mountain valleys, and areas with deep, well-drained soils and low-growing vegetation that

allows for good visibility. It is one of three prairie dog species in the state of Utah. Utah prairie dogs are diurnal herbivores that live in colonies and spend much of their time underground. They are inactive or torpid in severe winter weather. Adults emerge from mid-March to early April. Breeding occurs in the spring, and young emerge from the burrows during May and early June. Adults are often dormant from mid-July to mid-August and are not often seen above ground during this period. Juveniles enter dormancy during October and November (NatureServe 2010; USFWS 2010b).

The Utah prairie dog feeds primarily on grasses and various seeds and flowers of shrubs and insects when available. Common plant species consumed include alfalfa, leafy aster, European glorybind, and wild buckwheat seeds. The size of the home range of the Utah prairie dog varies, depending on the quality of the habitat, from 3 to 20 acres (0.01 to 0.08 km^2). Available habitat for the Utah prairie dog has declined from an estimated 448,000 acres (1,813 km^2) to less than 7,000 acres (28 km^2) at the present time (NatureServe 2010; USFWS 2010b).

The Utah prairie dog was first listed as federally endangered on June 4, 1973 (USFWS 1973). In 1984, it was reclassified as threatened by the Service (USFWS 1984). Critical habitat has not been designated for the Utah prairie dog. A recovery plan that was prepared in 1991 and revised in 2010 (USFWS 2010b) described the current extent of the existing populations and laid out management goals for ensuring the continued survival of the species. A major goal was to improve the chances of long-term survival of the species in the following areas: West Desert in southern Beaver and Iron Counties; Paunsaugunt in western Garfield County, eastern Iron County, and extreme northwestern Kane County; and the Awapa Plateau, which extends from Sevier County southward through western Wayne and Piute Counties into northern Garfield County. No updated information on the population sizes or the success and locations of transplanted populations has been found. The recovery plan also described plans to transplant Utah prairie dogs to unoccupied habitats, and it defined procedures for monitoring the transplants.

The size of its population has varied considerably during historic times. In 1920, before programs to control the Utah prairie dog, its total population was estimated at 95,000. Shooting and poisoning of the species by ranchers (and likely periodic reductions from the plague) led to a decrease in the size of the population; it was estimated to be about 3,700 by 1984. By the spring of 1989, the adult population reached 9,200. The Service reported that, at this size, the population was considered as being at risk of a crash from a plague outbreak (NatureServe 2010; USFWS 2010b).

On the basis of recorded observations and the presence of potentially suitable habitat, the Utah prairie dog may occur in the affected areas of three SEZs (Escalante Valley, Milford Flats South, and Wah Wah Valley) in Utah (Table 5-2; Figure 5-12).

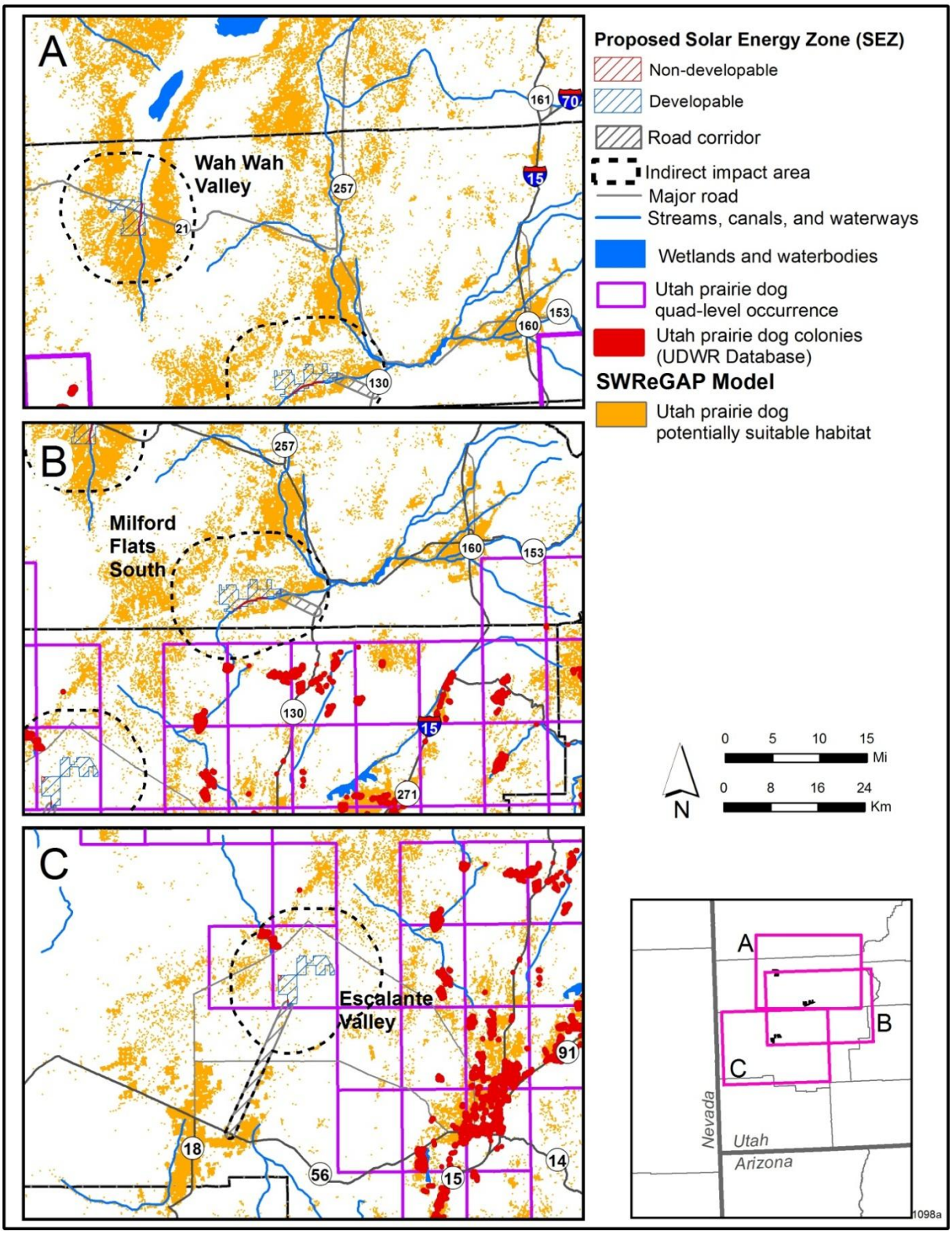

FIGURE 5-12 Known Occurrences and Availability of Potentially Suitable Habitat for the Utah Prairie Dog in the Affected Areas of the Proposed (A) Wah Wah Valley, (B) Milford Flats South, and (C) Escalante Valley SEZs (Sources: UDWR 2009; USGS 2007)

Solar Energy Zones in Which the Species May Occur

Escalante Valley. The Utah prairie dog is known to occur approximately 5 mi (8 km) north of the Escalante Valley SEZ. Data provided by the Utah prairie dog colony tracking database[3] also indicate the presence of active Utah prairie dog colonies within the area of indirect effects, approximately 5 mi (8 km) north of the Escalante Valley SEZ. Potentially suitable habitat for the Utah prairie dog may occur on the Escalante Valley SEZ, within the assumed access road corridor, and within the area of indirect effects. According to the SWReGAP habitat suitability model, approximately 398 acres (2 km^2) of potentially suitable habitat may occur in the area of direct effects within the Escalante Valley SEZ; an additional 8 acres (<0.1 km^2) of potentially suitable habitat may occur in the area of direct effects within the assumed access road corridor. Approximately 10,750 acres (44 km^2) of potentially suitable habitat may occur in the area of indirect effects (Figure 5-12).

Milford Flats South. The Utah prairie dog is known to occur about 5 mi (8 km) from the Milford Flats South SEZ. Data provided by the Utah prairie dog colony tracking database also indicate the presence of active Utah prairie dog colonies outside the affected area, approximately 10 mi (16 km) south of the Milford Flats South SEZ. Potentially suitable habitat for the Utah prairie dog may occur on the Milford Flats South SEZ, within the assumed access road corridor, and within the area of indirect effects. According to the SWReGAP habitat suitability model, approximately 1,800 acres (7 km^2) of potentially suitable habitat may occur in the area of direct effects within the Milford Flats South SEZ. An additional 11 acres (<0.1 km^2) of potentially suitable habitat may occur in the area of direct effects within the assumed access road corridor. Approximately 29,200 acres (118 km^2) of potentially suitable habitat may occur in the area of indirect effects (Figure 5-12).

Wah Wah Valley. Quad-level occurrences for the Utah prairie dog exist approximately 20 mi (32 km) south of the Wah Wah Valley SEZ. Data provided by the Utah prairie dog colony tracking database also indicate the presence of active Utah prairie dog colonies outside the affected area, approximately 18 mi (29 km) southwest of the Wah Wah Valley SEZ. Potentially suitable habitat for the Utah prairie dog may occur on the Wah Wah Valley SEZ and within the area of indirect effects. According to the SWReGAP habitat suitability model, approximately 2,940 acres (12 km^2) of potentially suitable habitat may occur in the area of direct effects within the Wah Wah Valley SEZ. Approximately 47,350 acres (192 km^2) of potentially suitable habitat may occur in the area of indirect effects (Figure 5-12).

[2] The Utah prairie dog colony tracking database contains sensitive data provided by the Utah Division of Wildlife Resources (UDWR) for official use only. These data were used for the analyses in this BA, but the distributions were not displayed on figures in this BA.

Direct and Indirect Effects of Development on SEZs

Table 5-1 presents the potential impacts on mammal species that could result from the construction, operation, and decommissioning of utility-scale solar energy facilities, including associated access road corridors. Potentially suitable habitat for the Utah prairie dog occurs in the areas of direct and indirect effects of the Escalante Valley, Milford Flats South, and Wah Wah Valley SEZs (Table 5-2; Figure 5-12). The implementation of required design features (Section 2.2) and species-specific measures identified below would be sufficient to reduce impacts on this species. These measures would also minimize or avoid any foreseeable impacts on the Utah prairie dog or its habitat from any necessary future transmission ROW developments or upgrades for these SEZs.

Design Features and Applicable Avoidance and Minimization Measures

Programmatic design features that would be required of all solar energy projects to reduce ecological impacts under the proposed program are listed in Section 2.2. For solar energy development within the Escalante Valley, Milford Flats South, and Wah Wah Valley SEZs, required design features that would reduce the potential for impacts on the Utah prairie dog would focus on determining the potential for the species to occur in the area of direct effects and avoiding known locations in the area of direct effects. For solar energy development within these SEZs, applicable species-specific avoidance and minimization measures include the following:

- Pre-disturbance surveys for the Utah prairie dog would be conducted by qualified biologists within each SEZ, and within the assumed access road corridor if necessary, to determine the presence of the species and its habitat. In addition, areas outside of the project area, but within the area of potential indirect effects, would be surveyed for this species. If the species is found within any potential development areas or areas of indirect effects, those locations would be avoided and adequate setback distances would be established.

- The past or current occurrence of Utah prairie dogs in the SEZ affected area will be determined by certified biologists following the *Utah Prairie Dog Occupancy and Habitat Survey Protocol for Federal Section 7 Consultations* (Appendix F of the *Utah Prairie Dog Draft Recovery Plan* [USFWS 2010b]). Surface occupancy or other surface-disturbing activities within a 0.5-mi (0.8-km) buffer around Utah prairie dog habitat, defined as occupied or unoccupied (but previously supported) Utah prairie dog habitat will be avoided. Spatial data for currently known Utah prairie dog habitat are maintained in the Utah prairie dog colony tracking database by the Utah Division of Wildlife and are illustrated in Figure 5-12.

In addition to the proposed avoidance and minimization measures described above and in Section 2.2, which would reduce the potential for adverse effects from solar energy development on the SEZs, measures that may be considered as compensation for potential effects include

(1) buffering potentially suitable habitats and unoccupied burrows that might represent suitable habitat and avoid disturbing those areas; (2) the funding of land acquisition, enhancement, and protection of Utah prairie dog habitat to compensate for any habitat potentially lost or compromised by solar energy development on the SEZs; and (3) the authorization of incidental take statements and implementation of a translocation and monitoring program that would remove individuals from the affected areas to protected areas that would not be directly or indirectly affected by future development. A comprehensive strategy that would include one or more of these measures, as well as additional conservation measures and reasonable and prudent alternatives, would be determined in coordination with the Service.

Effect Determination

With the implementation of all required design features and species-specific avoidance and minimization measures identified above and in Section 2.2, solar energy development in the Escalante Valley, Milford Flats South, and Wah Wah Valley SEZs may affect but is not likely to adversely affect the Utah prairie dog.

5.2.5 Groundwater-Dependent Species

There are 17 ESA-listed aquatic and wetland species with habitats that are dependent upon regional groundwater supplies (Table 5-2). Habitats influenced by groundwater supply include wet meadows, seeps, springs, streams (intermittent, perennial, and permanent), and wetlands. Groundwater withdrawn from this basin to serve construction and operations of solar energy facilities on the SEZ could affect aquatic and wetland habitats for the ESA-listed species that are dependent on groundwater. Such impacts would result from the lowering of the water table and alteration of hydrologic processes.

The 17 groundwater-dependent species may occur in the same groundwater basin as the Amargosa Valley and Dry Lake SEZs (Table 5-2). Impacts of groundwater depletion from solar energy development on the SEZs cannot be quantified without identification of the total amount of groundwater needed to support development. Consequently, the overall effects on these species could vary depending in part on the solar energy technology deployed, the scale of development within the SEZ, the type of cooling system used, and the degree of influence of water withdrawals in the SEZ on drawdown and surface water discharges in habitats supporting these species. However, the implementation of design features identified in Section 2.2 (including the avoidance of groundwater withdrawals from groundwater systems that would adversely affect listed species) may reduce impacts on groundwater-dependent species to small or negligible levels. These measures would also minimize or avoid any foreseeable impacts on groundwater-dependent species or their habitat from any necessary future transmission ROW developments or upgrades for these SEZs. Impacts can be better quantified for specific projects through the identification of water needs and the application of a regional groundwater model.

Design Features and Applicable Avoidance and Minimization Measures

Programmatic design features that would be required of all solar energy projects to reduce ecological impacts under the proposed program are listed in Section 2.2. For solar energy development within the Amargosa and Dry Lake SEZs, required design features that would reduce the potential for impact on groundwater-dependent species would focus on avoiding or minimizing water withdrawals. Applicable avoidance and minimization measures for groundwater-dependent species include the following:

- A Water Resources Mitigation and Monitoring Plan will be developed for each project. Changes in surface water or groundwater quality (e.g., chemical contamination, increased salinity, increased temperature, decreased dissolved oxygen, and increased sediment loads) or flow that result in the alteration of terrestrial plant communities or communities in wetlands, springs, seeps, intermittent streams, perennial streams, and riparian areas (including the alteration of cover and community structure, species composition, and diversity) off the project site will be avoided to the extent practicable. A monitoring plan will be developed that determines the effects of groundwater withdrawals on plant communities.

- The BLM and the developer should ensure that annual consumptive groundwater use within basins supporting the groundwater-dependent species (and those providing significant underflow to those basins) does not increase over current levels as a result of future solar projects (e.g., due to a loss of irrigation return flows and/or the full utilization of groundwater rights that have not been historically fully utilized). Developers should purchase and relinquish existing groundwater rights to support their projects in an amount that offsets any loss of irrigation return flows due to the change in use (e.g., agricultural to industrial), and any probable increase in actual groundwater pumping due to less than full utilization of the rights converted for the project. Other groundwater rights transactions that meet these standards will be considered.

- Future solar projects will not result in points of groundwater withdrawal being moved closer to locations that support groundwater-dependent species and/or increased pumping in the regional carbonate aquifer in areas with a significant potential to affect habitat for those species (albeit the total consumptive groundwater use may remain the same).

Effect Determination

With the implementation of all required design features and avoidance and minimization measures to conserve groundwater resources identified above and in Section 2.2, solar energy development in the SEZs may affect, and is likely to adversely affect 16 of the 17 groundwater-dependent species. There is one groundwater-dependent species that is not likely to be affected

by solar energy development within the SEZs. Solar energy development in the SEZs may affect, but is not likely to adversely affect the Pahrump poolfish. This species occurs approximately 50 mi (80 km) from the nearest SEZ (Dry Lake) and is not likely to share the same groundwater basin as the SEZs.

The 17 species considered to be groundwater-dependent are discussed below.

5.2.5.1 Plants

Amargosa Niterwort

The Amargosa niterwort is a perennial forb that is listed as endangered under the ESA and is known only from the Amargosa Valley in Inyo County, California, and Nye County, Nevada. The nearest known occurrences are approximately 25 mi (40 km) southeast of the Amargosa Valley SEZ in the Ash Meadows NWR, where it occurs in playas and alkaline wetlands. Designated critical habitat for this species occurs within an area of 1,215 acres (5 km^2) to the southwest of the Ash Meadows NWR in Inyo County, California, approximately 25 mi (40 km) southeast of the Amargosa Valley SEZ.

Ash Meadows Blazingstar

The Ash Meadows blazingstar is an annual forb that is listed as threatened under the ESA and is known only from the Ash Meadows region in Nye County, Nevada. It is narrowly confined to spring-fed desert wetlands. The nearest known occurrences are approximately 20 mi (32 km) southeast of the Amargosa Valley SEZ. Designated critical habitat for this species occurs in various spring habitats within an area of 1,240 acres (5 km^2) in the Ash Meadows NWR, about 25 mi (40 km) southeast of the Amargosa Valley SEZ.

Ash Meadows Gumplant

The Ash Meadows gumplant is a perennial forb that is listed as threatened under the ESA and is known only from the Ash Meadows region of Inyo County, California, and Nye County, Nevada. It is restricted to saltgrass meadows along spring-fed streams and pools, where it is dependent upon a constant water supply. The nearest known occurrences are from the Ash Meadows NWR, approximately 22 mi (35 km) southeast of the Amargosa Valley SEZ. Designated critical habitat for this species occurs in various spring-fed habitats encompassing a total area of 2,098 acres (8.5 km^2) within the Ash Meadows NWR and in other portions of the Ash Meadows region in Inyo County, California, and Nye County, Nevada, as near as 23 mi southeast of the Amargosa Valley SEZ.

Ash Meadows Ivesia

The Ash Meadows ivesia is a perennial forb that is listed as threatened under the ESA and is known only from the Ash Meadows region in Nye County, Nevada. The species is narrowly endemic to a single spring-fed wetland area with extremely saline soils where only nine extant occurrences are known. The nearest known occurrence is from the Ash Meadows NWR, approximately 20 mi (32 km) southeast of the Amargosa Valley SEZ. Designated critical habitat for this species occurs in various habitats within a total area of 880 acres (3.5 km^2) in the Ash Meadows NWR, between 20 and 25 mi (32 and 40 km) southeast of the Amargosa Valley SEZ.

Ash Meadows Milkvetch

The Ash Meadows milkvetch is a perennial forb that is listed as threatened under the ESA and is known only from the Ash Meadows region in Nye County, Nevada. The species is confined to seasonally moist flats, washes, and knolls of alkaline soils. The nearest known occurrence is from the Ash Meadows NWR, approximately 20 mi (32 km) southeast of the Amargosa Valley SEZ. Designated critical habitat for this species occurs in various habitats within a total area of 880 acres (3.5 km^2) in the Ash Meadows NWR, between 20 and 25 mi (32 and 40 km) southeast of the Amargosa Valley SEZ.

Ash Meadows Sunray

The Ash Meadows sunray is a perennial forb that is listed as threatened under the ESA and is narrowly endemic to saline soils near springs and dry washes in the Ash Meadows region. The nearest known occurrence is from the Ash Meadows NWR, approximately 20 mi (32 km) southeast of the Amargosa Valley SEZ. Designated critical habitat for this species occurs in various habitats within a total area of 1,760 acres (7 km^2) in the Ash Meadows NWR, between 20 and 25 mi (32 and 40 km) southeast of the Amargosa SEZ.

Spring-Loving Centaury

The spring-loving centaury is an annual forb that is listed as threatened under the ESA and is restricted to moist clay soils along the banks of streams and seeps in the Ash Meadows region. The nearest known occurrence of this species is from the Ash Meadows NWR, approximately 20 mi (32 km) southeast of the Amargosa Valley SEZ. Designated critical habitat for this species occurs in various habitats within a total area of 1,840 acres (7.5 km^2) in the Ash Meadows NWR, between 20 and 25 mi (32 and 40 km) southeast of the Amargosa Valley SEZ.

5.2.5.2 Invertebrates

Ash Meadows Naucorid

The Ash Meadows naucorid is a small aquatic insect that is listed as threatened under the ESA and is restricted to Point of Rocks and Kings Springs in the Ash Meadows NWR, where it inhabits gravel bottoms of the swift-flowing hot springs. The nearest known occurrences of this species are approximately 25 mi (40 km) southeast of the Amargosa Valley SEZ. Designated critical habitat for this species occurs in various habitats within a total area of 650 acres (2.5 km^2) in the Ash Meadows NWR, approximately 25 mi (40 km) southeast of the Amargosa Valley SEZ.

5.2.5.3 Fish

Ash Meadows Amargosa Pupfish

The Ash Meadows Amargosa pupfish is a small fish species that is listed as endangered under the ESA and is endemic to the outflow of warm springs in the Ash Meadows region. The nearest known occurrences are from the Ash Meadows NWR, approximately 20 mi (32 km) southeast of the Amargosa Valley SEZ. Designated critical habitat for this species occurs in various spring habitats within an area of 5,123 acres (21 km^2) in the Ash Meadows NWR, approximately 25 mi (40 km) southeast of the Amargosa Valley SEZ.

Ash Meadows Speckled Dace

The Ash Meadows speckled dace is a small fish species that is listed as endangered under the ESA and is endemic to the outflow of warm springs in the Ash Meadows region. The nearest known occurrences are from the Ash Meadows NWR, approximately 20 mi (32 km) southeast of the Amargosa Valley SEZ. Designated critical habitat for this species occurs in various spring habitats within an area of 1,971 acres (8 km^2) in the Ash Meadows NWR, approximately 25 mi (40 km) southeast of the Amargosa Valley SEZ.

Devils Hole Pupfish

The Devils Hole pupfish is a small fish species that is listed as endangered under the ESA and is endemic to Devils Hole, a cavernous aquifer-fed pool in the Ash Meadows NWR. The single natural occurrence of this species is approximately 24 mi (38 km) southeast of the Amargosa Valley SEZ. Critical habitat has not been designated for this species, but the only known occurrence in Devils Hole is protected and access to the site is limited.

Hiko White River Springfish

The Hiko White River springfish is a small fish listed as endangered under the ESA. This species is endemic to Lincoln and Mineral Counties, Nevada, where it is restricted to the remaining waters of the White River and outflow habitats of Hiko and Crystal Springs. This species has also been introduced into Blue Link Spring. The Hiko White River springfish is one of two subspecies of White River springfish that naturally occurred in Pahranagat Valley. Very little information is available on the life history and habitat requirements of the Hiko White River springfish, but the life history of this species is presumably similar to that of other springfish species (genus *Crenichthys*). The Hiko White River springfish is known to occur in the Hiko and Crystal Springs in Pahranagat Valley, approximately 25 mi (40 km) west of the Dry Lake Valley North SEZ. These locations are also sites of designated critical habitat for this species.

Moapa Dace

The Moapa dace is a small fish listed as endangered under the ESA. This species is endemic to the Muddy (Moapa) River and associated thermal spring systems within the Warm Springs Area of Clark County, Nevada. Historically, the Moapa dace inhabited 25 springs and approximately 10 mi (16 km) of the upper Muddy River system. Currently, the species is restricted to 3 springs and less than 6 mi (10 km) of the Muddy River system. Preferred habitats include spring pools, outflows, and the mainstem of the Muddy River, where water is clear and warm. Habitat use varies with age—juveniles tend to occur in spring pools and outflows, while adults tend to occur in outflows and in the Muddy River. This species is known to occur in spring habitats of the Warm Springs Area, approximately 15 mi (24 km) north of the Dry Lake SEZ. Critical habitat for this species has not been designated.

Pahranagat Roundtail Chub

The Pahranagat roundtail chub is a small fish listed as endangered under the ESA. This species is endemic to the White River system in the Pahranagat Valley, Nevada. The historic range of this species likely included about 18.6 mi (29.8 km) of streams in Pahranagat Valley, including outflows from Hiko, Crystal, and Ash Springs, Pahranagat Creek, Pahranagat Lake, and Maynard Lake. This species is omnivorous, feeding mostly on aquatic insects. Within the aquatic habitats, roundtail chubs are often associated with areas of cover in the form of boulders, overhanging cliffs, undercut banks, or vegetation. The Pahranagat roundtail chub is known to occur in Pahranagat Creek, approximately 26 mi (42 km) west by southwest of the Dry Lake Valley North SEZ. Critical habitat for this species has not been designated.

Pahrump Poolfish

The Pahrump poolfish is a small fish listed as endangered under the ESA. This species is endemic to the Pahrump Valley in southern Nye County, Nevada. Natural populations of this

species have been extirpated, but introduced populations exist in three spring-fed habitats in Clark and White Pine Counties, Nevada: Corn Creek Springs (Desert NWR), Shoshone Springs, and an irrigation reservoir fed by Sandstone Spring (Spring Mountain State Park). The introduced population in Corn Creek Springs is located approximately 23 mi (37 km) west of the Dry Lake SEZ. This habitat is about 5 acres (<0.1 km^2) in size and represents the only available potentially suitable habitat for this species within 50 mi (80 km) of the Dry Lake SEZ. Critical habitat for this species has not been designated.

Warm Springs Amargosa Pupfish

The Warm Springs Amargosa pupfish is a small fish species that is listed as endangered under the ESA and is endemic to the outflow of Lovell's Spring and at 5 additional spring flows within 1 mi (1.6 km) of Lovell's Spring in the Ash Meadows NWR. The nearest known occurrences are approximately 22 mi (35 km) southeast of the Amargosa Valley SEZ. Critical habitat has not been designated for this species, but the only known occurrences for this species are located in the Ash Meadows NWR.

White River Springfish

The White River springfish is a small fish species that is listed as endangered under the ESA and is endemic to thermal pools and outflows created by Ash Springs in the Pahranagat Valley, Lincoln County, Nevada. The locations of Ash Springs and its outflow habitats are approximately 26 mi (42 km) west by southwest of the Dry Lake Valley North SEZ. Critical habitat for this species has not been designated. These locations are also sites of designated critical habitat for the White River springfish.

6 POTENTIAL IMPACTS OF TRANSMISSION LINES ON LISTED SPECIES

6.1 BACKGROUND AND METHODOLOGY

One consideration in selecting the locations for the proposed SEZs was proximity to either existing transmission lines or to designated corridors, in order to facilitate access to the regional transmission grid for these locations. Thus, many of the proposed SEZs are adjacent to (or within 1 mi [1.6 km] of) existing transmission lines or designated corridors. However, 7 of the 17 SEZs currently being evaluated are between 2 and 42 mi (3.2 and 67.6 km) from an existing transmission line. Construction of transmission lines to tie solar energy facilities in these SEZs into the main power grid would be required, resulting in land disturbance and potential impact to habitats and specially designated species.

The location of the tie-in to the transmission grid could be the nearest existing transmission line, if that line had a high enough capacity and sufficient uncommitted capacity to accept the power from the SEZ (or was available to be upgraded to sufficient capacity). In the Draft Solar PEIS the environmental impact analyses for the SEZs without adjacent transmission lines included an assessment of the minimum land disturbance that could occur to provide a transmission tie-in for those SEZs, assuming that a tie-line would be constructed to the nearest existing transmission line. No tie-line construction or land disturbance was evaluated for SEZs that had an existing transmission line within or adjacent to (up to 1 mi [1.6 km] from) the SEZ, assuming that the adjacent line would be used as the tie-line to the transmission grid. Evaluation of the available transmission capacity of the nearest existing lines was considered beyond the scope of the analysis (because the required magnitude of such upgrades was unknown, the upgrades would not be controlled by the solar facility developers, and the upgrades might not be solely for the solar facilities within the SEZs). The results of this minimum land disturbance evaluation for the SEZs are summarized in Section 6.2.

For the Final PEIS, changes have been made to the Draft PEIS analyses to test the assumption that no capacity for SEZ-generated power will be available on existing transmission lines in the future. The new analyses identify the most likely load center or load centers for generation sources in SEZs, and provide an upper-bound estimate of land disturbance that would be caused by construction of all new transmission lines from the SEZs to the load centers. This information helped the BLM refine its impact analysis per the requirements of NEPA. The results of these upper-bound analyses are summarized in Section 6.3 below. As described, there are inherent limitations for how this additional transmission analysis could be used to inform the determination of potential impacts on specific listed species or habitats.

6.2 SUMMARY OF RESULTS OF DRAFT PEIS IMPACT ANALYSIS FOR TIE-LINE TRANSMISSION CONSTRUCTION

For the seven SEZs without adjacent existing transmission lines, an assessment was made of the impacts that would be associated with construction of a tie-line to the nearest existing transmission line with a capacity of 69 kV or more. Although the specific location for such tie-

lines was unknown, for the purposes of the analysis it was assumed that the line would be constructed along the nearest straight-line route from the SEZ to the existing transmission line. The following additional assumptions were used for the impact analysis:

- The newly constructed line would be a 230-kV transmission line constructed to the nearest existing transmission line and delivered as alternating current (AC);
- The corridor ROW width would be up to 250 ft (76 m) (including areas disturbed during construction, and conservatively assuming that the disturbed area is doubled during construction);
- The 250-ft (76.2-m) ROW would result in approximately 30 acres (0.12 km^2) of land disturbance per 1 mi (1.6 km) of transmission line construction;
- The ROWs were assumed to be located within a 1-mi-wide (0.6-km-wide) corridor, and no specific location within the corridor was assumed for construction; and
- If more than one project would be built within an SEZ, transmission lines were assumed to be shared between projects.

6.2.1 SEZs with Assumed Transmission Corridors

As stated above, seven proposed SEZs were assumed to definitely need additional transmission infrastructure outside of the SEZ to support solar energy development within the SEZ (it was acknowledged that the other SEZs might also require additional infrastructure, but no analysis was conducted because there was no basis for assuming the location or amount of construction that would be needed). The seven proposed SEZs included Brenda in Arizona; Antonito Southeast and Fourmile East in Colorado; Gold Point in Nevada; and Escalante Valley, Milford Flats South, and Wah Wah Valley in Utah. The distance to and capacity of the nearest existing transmission line assumed in Draft PEIS analyses for each of these SEZs is provided in Table 6.2-1. The remaining 10 SEZs are situated within 1 mi (1.6 km) of a transmission ROW or intersect a transmission ROW that might be suitable to support solar energy development.

6.2.2 Impacts Associated with Transmission Development

Potentially suitable habitats for special status species occur within the assumed transmission tie-line ROWs and corridors for the seven potentially affected SEZs. Construction of transmission ROWs has the potential to directly and indirectly affect listed species and their habitats. As shown in Table 6.2-2, three species that are listed under the ESA may be affected by transmission ROW construction to facilitate solar energy development on the SEZs. These species are the Mexican spotted owl (Antonito Southeast), southwestern willow flycatcher (Antonito Southeast), and Utah prairie dog (Milford Flats South and Wah Wah Valley).

TABLE 6.2-1 Proximity and Capacity of Nearest Existing Transmission for SEZs Assumed in the Draft Solar PEIS to Require Additional Transmission ROW Construction

SEZ	Proximity to Nearest ROW (mi)[a]	Transmission Rating (kV)
Arizona		
Brenda	19	500
Colorado		
Antonito Southeast	4	69
Fourmile East	2	69
Nevada		
Gold Point	22	120
Utah		
Escalante Valley	3	138
Milford Flats South	19	345
Wah Wah Valley	42	138

[a] On the basis of updated data, it appears that the nearest transmission lines for the Brenda, Antonito Southeast, and Gold Point SEZs are actually 12 mi, 2 mi, and 3 mi from the SEZs, respectively. The analyses done in the Draft Solar PEIS for longer distances were overestimates of likely land disturbance and associated impacts. To convert mi to km, multiply by 1.6.

Construction of the transmission ROWs could affect these species and their habitats; however, the implementation of required programmatic design features could minimize these impacts to negligible levels if suitable habitats were not disturbed. Impacts of transmission ROW construction and maintenance have been incorporated in the overall impact discussion for these species in Section 5.2. No critical habitats are designated for any ESA-listed species that may be affected by the assumed transmission ROW developments for these seven SEZs.

6.3 UPPER-BOUND TRANSMISSION IMPACT ASSESSMENT

As stated above, new analyses were conducted subsequent to the Draft Solar PEIS to estimate an upper-bound land disturbance that could be associated with transmission line construction for each of the SEZs. This analysis illustrates the upper-bound impacts by assuming that no capacity for SEZ-generated power will be available on existing transmission lines.

TABLE 6.2-2 Solar Energy Zones with Assumed Transmission Corridors and Impacts on Species Listed under the Endangered Species Act That May Occur in the Assumed Transmission Corridors

Common Name	Scientific Name	ROW Direct Effects[a]	ROW Indirect Effects[b]	Potential for Effect[c]
Arizona SEZs				
Brenda				
There are no ESA-listed species evaluated in this BA that could occur in the Brenda affected area.				Not applicable.
Colorado SEZs				
Antonito Southeast				
Mexican spotted owl	*Strix occidentalis lucida*	3 acres[d] of potentially suitable habitat lost	250 acres of potentially suitable habitat	Small potential for effect; implementation of design features could eliminate impacts.
Southwestern willow flycatcher	*Empidonax traillii extimus*	34 acres of potentially suitable habitat lost	3,100 acres of potentially suitable habitat	Small potential for effect; implementation of design features could eliminate impacts.
Fourmile East (2-mi[e]-long corridor)				
Southwestern willow flycatcher	*Empidonax traillii extimus*	0 acres	0 acres	No effect.
Nevada SEZs				
Gold Point				
There are no ESA-listed species evaluated in this BA that could occur in the Gold Point affected area.				Not applicable.
Utah SEZs				
Escalante Valley				
Utah prairie dog	*Cynomys parvidens*	0 acres	0 acres	No effect.

TABLE 6.2-2 (Cont.)

Common Name	Scientific Name	ROW Direct Effects[a]	ROW Indirect Effects[b]	Potential for Effect[c]
Utah SEZs (Cont.)				
Milford Flats South				
Utah prairie dog	*Cynomys parvidens*	11 acres of potentially suitable habitat lost	1,000 acres of potentially suitable habitat	Potential for effect; implementation of design features could reduce or mitigate impacts.
Wah Wah Valley				
Utah prairie dog	*Cynomys parvidens*	31 acres of potentially suitable habitat lost	2,850 acres of potentially suitable habitat	Potential for effect; implementation of design features could reduce or mitigate impacts.

[a] Direct effects consist of ground-disturbing activities associated with construction and the maintenance of an altered environment associated with ROW construction, operations, and maintenance. For transmission development, direct effects were estimated within a 250-ft (76-m) wide transmission ROW from the SEZ to the nearest existing line. Direct impacts within this area were determined from the proportion of potentially suitable habitat within the 1-mi (1.6-km) wide transmission corridor.

[b] Area of indirect effects was assumed to be the portion of the transmission corridor where ground-disturbing activities would not occur. Indirect effects include effects from surface runoff, dust, noise, lighting, and so on from project developments. The potential degree of indirect effects would decrease with increasing distance away from the SEZ and transmission ROW.

[c] Required programmatic design features are presented in Section 2.2. The potential for impacts to species was evaluated and included in the overall impact discussion presented in Section 5.2.

[d] To convert acres to km^2, multiply by 0.004047.

[e] To convert mi to km, multiply by 1.6.

The new analyses identify the most likely load center or load centers for generation sources in SEZs on the basis of net present value, and provide an estimate of land disturbance that would be caused by construction of all new transmission lines from the SEZs to the load centers. This information helped the BLM refine its impact analysis per the requirements of NEPA. Specific locations for the new transmission lines were not determined, although the BLM expects that the lines would follow the routes of existing lines in order to minimize land disturbance and make use of existing corridors.

The results of the analysis are presented in Table 6.3-1. The estimated land disturbance for construction of new transmission lines to load centers ranges from 669 acres (2.7 km^2) for the Dry Lake SEZ in Nevada to 717,300 acres (2,900 km^2) for the Riverside East SEZ in California. Since the locations of these hypothetical lines were only generally indicated for these analyses, it was not possible to conduct species-specific impact analyses for these upper-bound transmission impact assessments. Such species-specific impact analyses would be done in preparation for actual transmission line construction if and when specific plans and routing information were available.

TABLE 6.3-1 Upper-Bound Land Disturbance Estimates Associated with Potential Transmission Facility Construction for the SEZs

Solar Energy Zone (SEZ)	Destination for Power[a]	Total Distance (mi)[b]	Number of Substations	Land Disturbance (acres)[c,d]
Arizona				
Brenda	Phoenix, Arizona	120	3	2,242
Gillespie	Phoenix, Arizona	64	2	2,237
California				
Imperial East	Yuma, Arizona; and El Centro and San Diego, California	183	6	3,317
Riverside East[e]	Riverside County, San Diego, Los Angeles, San Francisco, and Sacramento, California; Reno and Las Vegas, Nevada; Yuma, Phoenix, and Tucson, Arizona; Las Cruces, Albuquerque, and Farmington, New Mexico; Denver, Colorado; Salt Lake City, Utah; and El Paso, Dallas, Austin, and San Antonio, Texas	4,264	31	717,300

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TABLE 6.3-1 (Cont.)

Solar Energy Zone (SEZ)	Destination for Power[a]	Total Distance (mi)[b]	Number of Substations	Land Disturbance (acres)[c,d]
Colorado				
Antonito Southeast	Pueblo, Colorado Springs, and Denver, Colorado	263	4	6,092
De Tilla Gulch	Colorado Springs, Colorado	140	4	1,370
Fourmile East	Pueblo, Colorado Springs, and Denver, Colorado	211	4	3,761
Los Mogotes East	Pueblo, Colorado Springs, and Denver, Colorado	244	4	4,461
Nevada				
Amargosa Valley	Las Vegas, Nevada; and Los Angeles, California	389	3	8,284
Dry Lake	Las Vegas, Nevada	31	3	669
Dry Lake Valley North	Los Angeles, California	400	4	9,986
Gold Point	Las Vegas, Nevada	169	2	3,600
Millers	Los Angeles, California	324	3	8,709
New Mexico				
Afton	Tucson, and Phoenix Arizona; Las Vegas, Nevada; Riverside County and San Bernardino County, California; El Paso, Texas; Las Cruces, Albuquerque, and Farmington, New Mexico; and Salt Lake City, Utah	1,876	16	35,469
Utah				
Escalante Valley	St. George, Utah; Las Vegas, Nevada; and San Bernardino-Riverside County, California	422	6	5,948
Milford Flats	St. George, Utah; and Las Vegas, Nevada	262	5	5,282
Wah Wah Valley	Las Vegas, Nevada	226	4	4,852

Footnotes on next page.

TABLE 6.3-1 (Cont.)

[a] The description of method to identify most likely load centers for the SEZs is given in Section G.4 of the Final PEIS; the analyses are provided in the SEZ sections in Chapters 8 through 13. Optimal load centers (on the basis of net present value) are presented. Load centers were assumed to accept a maximum of 20% of their total power demand from solar sources.

[b] To convert mi to km, multiply by 1.6.

[c] Land disturbance is a function of size of the SEZ (which determines amount of power potentially generated to be transmitted), distances to load centers, and power demands of load centers. All new transmission lines were assumed to be constructed to carry the loads from each SEZ; the new transmission lines were assumed to be routed adjacent to existing lines. Land disturbance was estimated assuming a ROW width of 200 ft (60 m). Land disturbance for substations was assumed to be 950 ft^2 (88.3 m^2) per megavolt-ampere (MVA).

[d] To convert acres to km^2, multiply by 0.004047.

[e] The assumed maximum build-out of the Riverside East SEZ is very large, such that under the conservative assumptions of this upper-bound analysis, many load centers were required in order to accommodate the entire hypothetical power generation capacity of the SEZ.

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7 CUMULATIVE EFFECTS

For purposes of the ESA, cumulative effects are those effects of future private, state, or Tribal activities, not involving federal activities, that are reasonably certain to occur within the action area of the federal action subject to consultation (50 CFR 402.02). This definition applies only to Section 7 analyses and would not be confused with the broader use of this term in NEPA or other environmental laws.

The discussion of cumulative effects in this section describes the effects of the proposed action in the context of other activities that also could affect species listed under the ESA (or those species proposed or candidates for listing). Past and existing threats to species are presented in the individual species discussions in Section 5.2. For BLM-administered lands within the six-state action area, actions that are reasonably certain to occur are described in existing land use plans. Future solar energy development activities are expected to occur in addition to current land use practices and other developments on BLM lands and in adjacent areas that may be private or state owned. Individual solar projects on BLM lands would include a comprehensive, ongoing environmental monitoring component to evaluate environmental conditions and adjust activities as necessary. As a result, the BLM's Solar Energy Program would be expected to continue to provide needed protection over time, consistent with an adaptive approach.

Cumulative effects on species that would result from the construction, operation, and decommissioning of solar energy development projects, when added to other future actions that are reasonably certain to occur, are discussed below. Although the locations and sizes of specific state or private activities, not involving federal activities, are not known, on the basis of the reasonably foreseeable development scenario (RFDS) developed for the PEIS, it was assumed that overall solar development in the 6-state action area would be approximately 24,000 MW on BLM-administered lands, with an additional 8,000 MW on non-BLM-administered lands. This level of development would require a corresponding dedicated use of about 214,000 acres (866 km^2) of BLM-administered lands and 71,000 acres (287 km^2) of non-BLM-administered lands. Because of the uncertain nature of future projects in terms of size, number, location, and the types of technology that would be employed, the impacts can only be discussed qualitatively. For those federal projects requiring formal consultation, more detailed analyses would be performed to determine the cumulative effects of future projects in the relevant geographic area.

A number of federal activities are either planned or currently under way in the vicinity of each of the individual SEZs. Some of these activities include BLM land use plan amendments, fast-track solar energy projects, transmission ROW development, and other renewable energy development. These federal activities have been or would be considered under separate Section 7 consultations with the Service and are not included in the cumulative effects discussion in this BA. Because of the geographic locations of the proposed SEZs, the private, state, and Tribal activities most likely to contribute to cumulative effects on ESA-listed species include factors such as urban development, agriculture, water use, and climate change (Table 7-1).

TABLE 7-1 General Trends in the Six-State Study Area

General Trend	Associated Activities
Increased population growth	Agricultural, residential, commercial, and industrial property development adjacent to federal land Urbanization Roads and traffic Land use modification Employment Resource use (e.g., water)
Increased energy demand	Resource use Energy development Energy transmission and distribution
Increased water demand	Resource use
Climate change	Water cycle changes Wildland fires Habitat changes

The West is the fastest growing region in the United States. Between 1990 and 2000, it grew at a faster rate (19.7%) than the nation as a whole (13.2%). Four states within the action area had population increases greater than 25% in the 10-year period, with Nevada growing by more than 66%. The West is also the most urbanized of the four U.S. regions, with more than 88% of the population living in urban areas in 2000. In 2000, the percentages of populations living in urban areas in five of the six states in the action area were above the national average of 79%, with the highest being California (at 94.4%) (BLM 2004).

The increasing human population in the action area could result in increased private and state activities that could affect listed species. Livestock grazing and other agricultural practices on private lands adjacent to public lands would contribute to cumulative effects by reducing habitat quality and quantity in areas near solar energy projects on BLM lands. The full extent of these effects cannot be determined because of the lack of specific proposals or plans.

Water demand in the six-state region is expected to increase to meet the demands of a growing human population. The USGS defines eight categories of water use in the United States: public supply, domestic, irrigation, livestock, aquaculture, industrial, mining, and thermoelectric power. Water utilization in the western United States includes surface and groundwater sources, with surface water contributing nearly 80% of water withdrawals (Kenny et al. 2009). Increased water withdrawals from concurrent state, private, and Tribal activities could affect listed species through the alteration of water tables and natural hydrologic processes. Species that could be affected by water withdrawals are species with habitats that are dependent upon surface or groundwater resources, such as wetlands, riparian habitats, streams and rivers, springs, and playas.

There is a growing consensus in the scientific community that human activity is contributing substantially to the increase in the Earth's surface temperature (USGCRP 2009). The phenomenon is very likely due to human-generated increases in greenhouse gas (GHG) concentrations. GHGs include water vapor, carbon dioxide, methane, ozone, nitrous oxide, and several fluorine- and chlorine-containing gases. Of these gases, carbon dioxide is believed to be contributing the most to recent warming. In the atmosphere, GHGs trap heat that would otherwise escape into space, creating a "greenhouse effect." Since the inception of the industrial era, the burning of fossil fuels and clearing of forests have greatly intensified the natural greenhouse effect, causing global average temperatures to rise at a fast rate; for example, in the United States, average temperatures have risen at a rate of nearly 0.6°F (0.3°C) per decade in the past few decades (NSTC 2008). Increasing temperatures and changes in precipitation patterns may affect listed species by affecting tolerance thresholds and affecting habitat availability and quality. Researchers with the U.S. Global Change Research Program (USGCRP 2009) predicted that water supplies in the western United States will become scarcer as a result of climate change, thereby exacerbating the water needs of a growing human population. These predictions also suggest that climate change may facilitate invasion of non-native species, drought, and wildfires.

The cumulative effects of these factors on species listed under the ESA cannot be quantified without more specific information on proposed projects and ongoing and future trends in the action area. It is clear, however, that the species considered in this BA are vulnerable to cumulative effects, and that an adaptive management program, as proposed by the BLM in the proposed action, will be essential for avoiding jeopardy.

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APPENDIX A

LEGAL DESCRIPTIONS OF THE SOLAR ENERGY ZONES

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ARIZONA

Below are the legal descriptions for the two proposed SEZ land withdrawal areas in Arizona.

Gila and Salt River Meridian

Brenda SEZ:

T. 4 N., R. 16 W.,
sec. 1, lots 3 and 4, S½NW¼, and SW¼;
secs. 2 to 4 inclusive;
sec. 9, NE¼, NE¼NW¼, and NE¼SE¼;
sec. 10, N½, N½S½, and SW¼SW¼;
sec. 11, NW¼.

T. 5 N., R. 15 W.,
sec. 31, lots 1 to 4, inclusive, E½NW¼, and E½SW¼.

The areas described aggregate approximately 3,349 acres (13.55 km^2).

Gillespie SEZ:

T. 2 S., R. 6 W.,
sec. 6, SW¼, W½SE¼, and SE¼SE¼, unsurveyed;
sec. 7, N½, NE¼SW¼, N½SE¼, and SE¼SE¼, unsurveyed;
sec. 8, SE¼NW¼, W½NW¼, SW¼, S½SE¼, and NW¼SE¼, unsurveyed;
sec. 9, SW¼SW¼, unsurveyed;
sec. 15, NW¼SW¼, N½SW¼SW¼, SE¼SW¼, and S½SW¼SE¼, unsurveyed;
sec. 16, S½NE¼, S½NW¼NE¼, NW¼, and N½NE¼SE¼, unsurveyed;
sec. 17, N½NE¼, N½SE¼NE¼, NE¼NW¼, and N½NW¼NW¼, unsurveyed;
sec. 22, S½NE¼NE¼, NW¼NE¼, N½SW¼NE¼, SE¼NE¼, and N½NE¼NW¼, unsurveyed;
sec. 23, SW¼NW¼, N½SW¼, SE¼SW¼, S½NE¼SE¼, NW¼SE¼, and S½SE¼, unsurveyed;
sec. 24, S½NW¼SW¼ and S½SW¼, unsurveyed.

T. 2 S., R. 7 W.,
sec. 1, SE¼SW¼, NE¼SE¼, and S½SE¼;
sec. 12, N½NE¼, SE¼NE¼, and NE¼NW¼.
sec. 23, SW¼NW¼, N½SW¼, SE¼SW¼, S½NE¼SE¼, NW¼SE¼, and S½SE¼, unsurveyed;
sec. 24, S½NW¼SW¼ and S½SW¼, unsurveyed.

T. 2 S., R. 7 W.,
sec. 1, SE¼SW¼, NE¼SE¼, and S½SE¼;
sec. 12, N½NE¼, SE¼NE¼, and NE¼NW¼.

The areas described aggregate approximately 2,607 acres (10.55 km^2).

CALIFORNIA

Below are the legal descriptions for the two proposed SEZ land withdrawal areas in California, as presented in the Draft Solar PEIS.

San Bernardino Meridian

Imperial East SEZ:

T. 16 S., R. 17 E.,
sec. 21, that portion lying 120 ft south of the centerline of Interstate 8 and east of Lake Cahuilla No. 5 ACEC;
secs. 22 to 25, inclusive, those portions lying 120 ft south of the centerline of Interstate 8;
secs. 26 and 27;
secs. 28 and 33, those portions lying east of Lake Cahuilla No. 5 ACEC;
secs. 34 and 35.

T. 16 S., R. 18 E.,
secs. 29 and 30, those portions lying 120 ft south of the centerline of Interstate 8;
sec. 31, lot 3, NE¼, NE¼NW¼, SE¼SW¼, and S½SE¼;
sec. 32, that portion of the N½N½ lying 120 ft south of the centerline of Interstate 8, S½NW¼SW¼, and S½S½;
sec. 33, that portion of the N½ lying 120 ft south of the centerline of Interstate 8 and N½SE¼;
sec. 34, those portions of the N½SW¼ and the NW¼SE¼ lying 120 ft south of the centerline of Interstate 8.

The areas described above aggregate approximately 5,722 acres (23 km^2).

Riverside East SEZ

T. 3 S., R. 15 E.,
sec. 15, SW¼;
sec. 21, NE¼NE¼, E½NW¼NE¼, SW¼NE¼, SE¼NE¼, S½SW¼, NE¼SW¼, S½SE¼NW¼, and SE¼;
sec. 22, SW¼NW¼NE¼, SW¼NE¼, SW¼SE¼NE¼, W½, W½NE¼SE¼, SE¼NE¼SE¼, W½SE¼, and SE¼SE¼;
sec. 23, W½SW¼SW¼;
sec. 26, SW¼NE¼NW¼, W½NW¼, SE¼SE¼NW¼, SW¼ excluding lands within Right-of-Way CALA-051571, W½NW¼SE¼, SW¼SE¼ excluding non-public lands and lands within Right-of-Way CALA-051597, and S½SE¼SE¼;
sec. 27 excluding lands within Right-of-Way CALA-051597;

sec. 28;
sec. 29, E½NE¼, SW¼NE¼, SE¼SE¼NW¼, E½SW¼, SW¼SW¼ excluding non-public lands, and SE¼;
sec. 32, N½, and S½ excluding nonpublic lands and lands within Right-of-Way CALA-051571;
sec. 33, excluding lands within Right-of-Way CALA-051571;
sec. 34, excluding lands within Right-of-Way CALA-051597;
sec. 35, excluding lands within Right-of-Way CALA-052057 and CALA-051206.

T. 4 S., R. 15 E.,
sec. 1, excluding lands within Joshua Tree National Park;
secs. 2 and 3, excluding lands within Right-of-Way CALA-051206;
sec. 4, excluding non-public lands;
sec. 5, excluding non-public lands and lands within Right-of-Way CALA-051571;
sec. 8, excluding lands within Right-of-Way CALA-051571;
sec. 9, excluding lands within Right-of-Way CALA-051206;
sec. 10, excluding lands within Right-of-Way CALA-051206;
secs. 11 and 12;
sec. 13, excluding non-public lands;
secs. 14 and 15;
sec. 17, that portion situated north of Right-of-Way CALA-051206 and north and east of Right-of-Way CALA-051571;
sec. 21, that portion situated north of Right-of-Way CALA-0149780;
secs. 22, 23, and 24;
sec. 25, N½N½, SW¼NE¼, S½NW¼, SW¼ excluding non-public lands, W½SE¼, and SE¼SE¼;
sec. 26, N½, S½SW¼SW¼, SW¼SE¼SW¼, NE¼SE¼, NE¼NW¼SE¼, and NE¼SE¼SE¼;
sec. 27, N½NE¼, N½SE¼NE¼, N½NE¼NW¼, SE¼NE¼SW¼, E½SE¼SW¼, S½SE¼, and S½NW¼SE¼;
sec. 30, lots 1 and 2, W½NE¼, NW¼ unsurveyed, and NW¼SE¼;
sec. 31, N½ of lot 1 in the NW¼ and N½ of lot 2 in the NW¼;
sec. 34, E½ and E½E½W½;
sec. 35, lots 1 and 2, SW¼NE¼NE¼, S½NW¼NE¼, SW¼NE¼, W½SE¼NE¼, SE¼SE¼NE¼, W½, N½SE¼, and SW¼SE¼.

T. 5 S., R. 15 E.,
sec. 3, E½ of lot 1 in the NE¼, E½ lot 2 in the NE¼, and E½SE¼;
sec. 10, E½NE¼ and NE¼SE¼;
sec. 13, S½;
sec. 14, S½;
sec. 15, E½SE¼;
sec. 22, E½NE¼, SW¼, and N½SE¼, excluding nonpublic lands;
sec. 23, N½ and SE¼;
sec. 24, N½, SW¼, E½SE¼, and SW¼SE¼;
sec. 25, N½N½N½;
sec. 27, NW¼NW¼.

T. 3 S., R. 16 E.,
sec. 13;
sec. 14, E½NE¼, SE¼SW¼, and SE¼;
sec. 22, E½SE¼ and SW¼SE¼;
secs. 23 and 24;
sec. 25, excluding non-public lands;
sec. 26, NE¼NE¼.

T. 4 S., R. 16 E.,
sec. 1, excluding lands within Right-of-Way CALA-051207;
sec. 7, lot 3;
sec. 12, excluding lands within Right-of-Way CALA-051207;
sec. 13;
sec. 14, excluding lands within Joshua Tree National Park;
sec. 18, S½ of lot 1 in the NW¼, lot 1 in the E½SW¼, lots 2 and 3, and SW¼SE¼;
sec. 19, excluding non-public lands;
sec. 20, SW¼NW¼, SW¼, W½SE¼, and SE¼SE¼;
sec. 21, SW¼SW¼;
sec. 22, E½SE¼;
sec. 23, excluding lands within Joshua Tree National Park;
secs. 24 and 25;
sec. 26, E½, E½W½, and NW¼NW¼;
sec. 27, N½NE¼;
sec. 28, NW¼, N½SW¼, and SW¼SW¼ excluding lands within Right-of-Way CALA-051221;
sec. 29, N½, W½SW¼, and SE¼;
sec. 30, excluding non-public lands;
sec. 31, lot 3 in the NW¼NW¼, N½ of lot 3 in the SW¼NW¼, and S½ of lot 3 in the SW¼SW¼;
sec. 35;
sec. 36, NE¼, E½NW¼, NE¼SW¼, and S½SE¼.

T. 5 S., R. 16 E.,
secs. 1 and 2;
sec. 3, lots 1 and 2 in the NE¼, lot 1 in the NW¼ excluding nonpublic lands, lot 2 in the NW¼, and SE¼ excluding non-public lands;
sec. 4, N½ of lot 1 in the NE¼ and lot 2 in the NE¼;
sec. 6, lot 1 in the S½NE1/4, S½ of lot 2 in the NE¼NE¼, lot 2 in the NW¼NE¼, and lot 2 in the NW¼;
sec. 8, S½NW¼SW¼ and SW¼SW¼;
sec. 10, N½ excluding nonpublic lands and S½;
sec. 11, N½NE¼, N½SW¼NE¼, SE¼SW¼NE¼, SE¼NE¼, NE¼NW¼, N½NW¼NW¼, SE¼NW¼NW¼, S½SW¼NW¼, SW¼SE¼NW¼, SW¼, S½NW¼SE¼, and S½SE¼;
sec. 12, N½, S½SW¼SW¼, NE¼SE¼, E½NW¼SE¼, NW¼NW¼ SE¼, NW¼SE¼SE¼, and NE¼SW¼SE¼;
sec. 13, S½NE¼, S½N½NE¼, S½NE¼NW¼, SE¼NW¼, W½NW¼, and S½;
sec. 14, E½;

sec. 15, S½;
sec. 17, S½N½ and NW¼NW¼;
sec. 18, lot 1 and 2 in the SW¼ and SE¼;
secs. 19 and 20;
sec. 21, N½;
sec. 22;
sec. 23, E½, E½NW¼, NW¼NW¼, and SW¼;
sec. 24;
sec. 25, W½;
sec. 26;
sec. 27, that portion situated northerly of Right-of-Way CAR-05498;
sec. 28, N½N½N½;
sec. 29, N½N½N½;
sec. 30, N½N½ of lot 1 in the NW¼, N½ of lot 2 in the NW¼, and N½N½NE¼;
sec. 34, those portions of the N½N½N½ situated northerly of Right-of-Way CAR-05498;
sec. 35, N½N½N½.

T. 3 S., R. 17 E.,
sec. 17, excluding the Palen-McCoy Wilderness Area;
secs. 18 and 19;
sec. 20 and 21, excluding the Palen-McCoy Wilderness Area;
sec. 27, SW¼ excluding the Palen-McCoy Wilderness Area;
sec. 28, excluding the Palen-McCoy Wilderness Area;
sec. 29;
sec. 30, lots 1 and 2 in the NW¼, N½ of lots 1 and 2 in the SW¼, NE¼, and N½SE¼;
sec. 31, lot 1 in the E½SW¼ excluding lands within Right-of-Way CAR-06910 and lot 2 in the SW¼ excluding lands within Right-of-Way CAR-06910;
sec. 32, E½, NE¼NW¼, and E½SE¼NW¼;
sec. 33;
sec. 34, excluding the Palen-McCoy Wilderness Area.

T 4 S., R. 17 E.,
sec. 3, excluding the Palen-McCoy Wilderness Area;
sec. 4;
sec. 5, lots 1 and 2 in NE¼, E½SE¼, and E½W½SE¼;
sec. 6, W½ of lots 1 and 2 in the NE¼, W½ of lots 1 and 2 in the NW¼, S½E½ of lot 1 in the NW¼, lots 1 and 2 in the SW¼, and SE¼;
sec. 7;
sec. 8, E½NE¼, E½W½NE¼, and NE¼SE¼;
sec. 9;
sec. 10, excluding the Palen-McCoy Wilderness Area;
sec. 11, excluding the Palen-McCoy Wilderness Area;
sec. 14, excluding the Palen-McCoy Wilderness Area,
sec. 15;
sec. 17, W½SW¼;
secs. 18 and 19;

sec. 20, W½NW¼;
sec. 21, NE¼ and E½SE¼;
sec. 22;
sec. 23, excluding the Palen-McCoy Wilderness Area;
sec. 26, excluding the Palen-McCoy Wilderness Area;
sec. 27;
sec. 28, E½NE¼;
secs. 30 and 31;
sec. 34, E½, E½W½, and E½W½W½;
sec. 35, excluding the Palen-McCoy Wilderness Area.

T. 5 S., R. 17 E.,
sec. 1, excluding the Palen-McCoy Wilderness Area;
sec. 2, excluding the Palen-McCoy Wilderness Area;
sec. 3, E½E½E½;
sec. 5, lots 1 and 2 in the NW¼ and SW¼;
sec. 6;
sec. 7, excluding non-public lands;
sec. 8, W½ and SE¼;
sec. 9, SW¼, W½SE¼, SW¼NE¼SE¼, W½SE¼SE¼, and SE¼SE¼SE¼;
sec. 10, E½E½E½;
sec. 11, excluding the Palen-McCoy Wilderness Area;
sec. 14, excluding the Palen-McCoy Wilderness Area and non-public lands;
sec. 15, NE¼NE¼NE¼, SW¼NW¼SW¼, W½SW¼SW¼, SE¼SW¼SW¼, and S½SE¼SW¼;
sec. 17, excluding non-public lands;
sec. 18, excluding non-public lands;
sec. 19, NE¼, lots 1 and 2 in the NW¼, and lots 1 and 2 in the SW¼;
sec. 20, W½NW¼, SE¼NW¼, and S½;
sec. 21;
sec. 22, SW¼NW¼NE¼, SW¼NE¼, W½, NW¼NE¼SE¼, S½NE¼SE¼, W½SE¼, and SE¼SE¼;
sec. 23, NE¼ excluding the Palen-McCoy Wilderness Area, E½NW¼, E½NE¼SW¼. S½SW¼, and SE¼;
sec. 26, SW¼NW¼ and SW¼;
sec. 27, N½, N½SW¼, SE¼SW¼, and SE¼;
sec. 28;
sec. 29, E½ and SW¼;
secs. 31 to 34 inclusive;
sec. 35, NW¼ excluding non-public lands.

T. 6 S., R. 17 E.,
sec. 1, lots 1 and 2 in the NW¼ and S½;
sec. 2;
sec. 3, excluding non-public lands;
sec. 4, that portion situated northerly of Right-of-Way CAR-05498;
secs. 10, 11, and 12, those portions situated northerly of Right-of-Way CAR-05498.

T. 6 S., R. 18 E.,
secs. 1, 2, 3, and 4 excluding Palen-McCoy Wilderness Area;
sec. 7, lot 1 in the SW¼, lot 2 in the SW¼, and SE¼;
sec. 9;
sec. 10, N½, NE¼SW¼, and N½SE¼;
secs. 11, 12, and 13;
sec. 14, N½, N½S½, and S½SE¼;
sec. 17, that portion situated northerly of Right-of-Way CAR-05498;
sec. 18, those portions of the NE¼ situated northerly of Right-of-Way CAR-05498;
sec. 23, N½NE¼, NE¼NW¼ and that portion of the S½ situated northerly of Right-of-Way CAR-05498;
sec. 24, that portion of the S½ situated northerly of Right-of-Way CAR-05498.

T. 6 S., R. 19 E.,
secs. 3, 4, and 5, excluding the Palen-McCoy Wilderness Area;
sec. 6, N½ excluding the Palen-McCoy Wilderness Area and SE¼;
secs. 7, 8, and 9;
secs. 10, 11, 12, and 13 excluding the Palen-McCoy Wilderness Area;
secs. 14, 15, 17, and 18;
sec. 19, NW¼NE¼, N½ of lots 1 and 2 in the NW¼, S½ of lots 1 and 2 in the SW¼, and SE¼;
secs. 20 to 24, inclusive;
sec. 25, W½;
secs. 26 and 27;
sec. 28, that portion situated northerly of Right-of-Way CALA-0107395;
sec. 29, that portion of the E½ situated northerly of Right-of-Way CALA-0107395;
sec. 33, that portion of the N½ situated northerly of Right-of-Way CALA-0107395;
sec. 34, that portion of the N½ situated northerly of Right-of-Way CALA-0107395;
sec. 35, that portion of the N½ situated northerly of Right-of-Way CALA-0107395.

T. 6 S., R 20 E.,
sec. 3;
sec. 5, S½ excluding the Palen-McCoy Wilderness Area;
sec. 7, excluding the Palen-McCoy Wilderness Area;
sec. 8, excluding the Palen-McCoy Wilderness Area;
secs. 9, 10, and 15;
sec. 16, S½NW¼ and NE¼NW¼;
sec. 17, E½ and NW¼;
sec. 18;
sec. 19, lots 1 and 2 in the SW¼ and W½E½;
sec. 20, W½, E½SE¼, and SW¼SE¼;
sec. 21, E½, W½NW¼, and NE¼NW¼;
sec. 22, N½ and SE¼;
sec. 23, S½;
sec. 24, S½;
sec. 25, N½ and SE¼;
sec. 26;

sec. 27, N½NW¼, SW¼NW¼, and S½;
sec. 28, E½, NE¼SW¼, and S½SW¼;
secs. 29 and 30;
sec. 31, N½ of lot 1 in NW1/4 and N½N½NE¼;
sec. 32, N½N½N½;
sec. 33, N½N½NE¼;
sec. 34, N½N½N½;
sec. 35, NW¼NE¼, N½NW¼, and S½.

T. 7 S., R. 20 E.,
sec. 1, lots 1 and 2 in the NE¼, lots 1 and 2 in the NW¼, and SW¼;
sec. 2, lots 1 and 2 in the NE¼, lots 1 and 2 in the NW¼, and SE¼;
sec. 11, E½NE¼, SW¼NE¼, and S½;
secs. 12, 13, 24, and 25.

T. 4 S., R. 21 E.,
sec. 2, SW¼;
secs. 3 and 4;
sec. 5, E½ of lot 1 in the NE¼, lots 5 to 12, inclusive, and SE¼;
sec. 8, E½;
secs. 9 to 15, inclusive;
secs. 21 to 35, inclusive.

T. 5 S., R. 21 E.,
secs. 1 to 14, inclusive;
sec. 15, S½;
secs. 17 to 23, inclusive;
sec. 24, S½;
secs. 25 to 30, inclusive;
secs. 32 to 35, inclusive.

T. 6 S., R. 21 E.,
Tracts 37 to 47, inclusive;
Tracts 49 to 56, inclusive;
Tracts 58, 59, N½ of 61 and N½ of 62;
Tracts 68, 69, 71, N½ of 73, and 74 to 80, inclusive;
secs. 4, 5, 8, and 9;
sec. 15, lots 1 and 2, SW¼, and W½SE¼;
secs. 19 and 22;
sec. 23, lots 2, 3, 5, and 6, and W½W½;
sec. 26, lot 1;
sec. 27;
sec. 29, N½ and SW¼;
sec. 30;
sec. 31, lots 5, 6, 9, 10, 11, 12, 17, and 18, S½NE¼, and SE¼.
sec. 32, NW¼.

T. 7 S., R. 21 E.,
sec. 2, lots 3, 4, 5, 6, S½N½, E½SW¼, and NW¼SE¼;
sec. 3;
sec. 4, lots 3 and 4, S½NE¼, and S½;
sec. 5, S½S½;
sec. 6, SE¼;
sec. 7;
sec. 8, SW¼;
sec. 9, E½ and SW¼;
sec. 10;
sec. 11, N½ and SW¼;
sec. 12, NW¼ and N½SW¼;
sec. 13;
sec. 14, S½NE¼, NW¼, and S½;
sec. 15, W½ and SE¼;
sec. 17, E½, SE¼NW¼, and SW¼;
sec. 18;
secs. 19, 20, and 21, excluding the Mule Mountains Area of Critical Environmental Concern (ACEC);
sec. 22, N½ and SW¼;
secs. 23 and 24;
sec. 25, S½NW¼ and N½SW¼;
sec. 26, E½;
sec. 27, NW¼ excluding the Mule Mountains ACEC, and S½ excluding the Mule Mountains ACEC;
sec. 28, excluding the Mule Mountains ACEC;
sec. 30, excluding the Mule Mountains ACEC;
sec. 34, excluding the Mule Mountains ACEC;
sec. 35.

T. 4 S., R. 22 E.,
secs. 7, 8, and secs. 17 to 20, inclusive;
secs. 29 to 33, inclusive.

T. 5 S., R. 22 E.,
secs. 2 to 6, inclusive;
sec. 7, lots 1 and 2 in the NW¼ and E½;
secs. 8 to 14, inclusive;
sec. 15, E½;
sec. 17;
sec. 18, NE¼, lots 1 and 2 in the NW¼, and lots 1 and 2 in the SW¼;
secs. 19 and 20;
sec. 21, S½;
secs. 22, 23, and 24;
sec. 25, W½NE¼, NW¼, and N½SW¼;
sec. 26, N½;

sec. 27, N½ and SW¼;
sec. 28, S½;
sec. 29, N½ and SW¼;
sec. 30;
sec. 31, E½;
sec. 32;
sec. 33, SW¼.

T. 6 S., R. 22 E.,
sec. 3, lots 1 and 2 in the NW¼ and SW¼SW¼;
secs. 4 to 7, inclusive;
sec. 8, N½NE¼ and NW¼;
sec. 9, NE¼, N½NW¼, SE¼NW¼, and E½SE¼;
sec. 10, NW¼NW¼;
sec. 18, N½ of lot 1 in the NW¼ and lot 2 in the NW¼.

T. 7 S., R. 22 E.,
sec. 18, lot 4.

The areas described above aggregate approximately 202,896 acres (821 km^2).

COLORADO

Below are the legal descriptions for the four proposed SEZ land withdrawal areas in Colorado.

New Mexico Principal Meridian

Antonito Southeast SEZ:

T. 32 N., R. 9 E.,
sec. 3, lot 4, SW¼NW¼, W½SW¼, SE¼SW¼, SW¼SE¼, and E½SE¼;
secs. 4, 9, 10, and 11;
sec. 12, W½ and SE¼;
secs. 13, 14, 15 and secs 21 to 24 inclusive

T. 32 N., R. 10 E.,
sec. 7, lot 4, SE¼SW¼, and S½SE¼;
sec. 8, S½S½;
sec. 9, SW¼SW¼;
secs. 17 to 20 inclusive;
sec. 21, lots 1 to 4, inclusive, W½NE¼, and NW¼.

The areas described aggregate approximately 10,310 acres (41.72 km^2).

Fourmile East SEZ:

T. 37 N., R. 12 E.,
sec. 2, lots 3 and 4, and S½NW¼;
sec. 3, lots 3 and 4, and S½N½.

T. 38 N., R. 12 E.,
sec. 13, SW¼ and W½SE¼;
sec. 23;
sec. 24, W½ and W½SE¼;
sec. 25, W½NE¼ and W½;
sec. 26;
sec. 35, NW¼.

The areas described aggregate approximately 2,883 acres (11.67 km^2).

Los Mogotes East SEZ:

T. 34 N., R. 8 E.,
sec. 1;
sec. 12;
sec. 13, NE¼NE¼, W½NE¼, W½, and NW¼SE¼;
sec. 24, W½ and W½SE¼;
sec. 25, W½ and W½E½.

The areas described aggregate approximately 2,640 acres (10.68 km^2).

De Tilla Gulch SEZ:

T. 45 N., R. 9 E.,
sec. 29, that portion of the S½ lying one-quarter mile southeasterly and parallel to the centerline of Highway 285;
sec. 30, that portion of the SE¼SE¼ lying one-quarter mile southeasterly and parallel to the centerline of Highway 285;
sec. 31, those portions of the NE¼ and the SE¼NW¼ lying one-quarter mile southeasterly and parallel to the centerline of Highway 285; and those portions of the NE¼SW¼ and the N½SE¼ lying one-quarter mile north of and parallel to the centerline of the Old Spanish National Historic Trail as mapped by the National Park Service;
sec. 32, N½, and that portion of the N½SW¼, lying one-quarter mile north of and parallel to the centerline of the Old Spanish National Historic Trail as mapped by the National Park Service;
sec. 33, N½NE¼ and NW¼.

The areas described aggregate approximately 1,064 acres (4.31 km^2).

NEVADA

Below are the legal descriptions for the five proposed SEZ land withdrawal areas in Nevada.

Mount Diablo Meridian

Amargosa Valley SEZ:

T. 13 S., R. 47 E.,
sec. 35, E½NE¼, SW¼NE¼, NW¼NW¼, S½NW¼, and S½;
sec. 36, that portion south and west of the centerline of I-95.

T. 14 S., R. 47 E.,
sec. 8, E½, unsurveyed;
sec. 9, unsurveyed;
secs. 10, 11, 13, and 14, those portions south and west of the centerline of I-95, unsurveyed.
secs. 15 and 16, unsurveyed;
sec. 21, E½, unsurveyed;
secs. 22 and 23, unsurveyed;
sec. 24, W½E½ and W½, and those portions of the W½NE¼ and W½SE¼ south and west of the centerline of I-95, unsurveyed;
sec. 25, W½NE¼ and W½, unsurveyed;
secs. 26 and 27, unsurveyed;
sec. 34, E½, unsurveyed;
sec. 35, unsurveyed;
sec. 36, W½, unsurveyed.

T. 15 S., R. 47 E.,
sec. 1, W½W½, unsurveyed;
sec. 2, unsurveyed;
sec. 12, NW¼NW¼, unsurveyed.

The areas described aggregate approximately 9,737 acres (39.40 km^2).

Dry Lake SEZ:

T. 17 S., R. 63 E.,
sec. 33, that portion of the S½ north and east of the centerline of Nev 060522;
sec. 34, lots 1 to 4, inclusive, NE¼, S½NW¼, and N½S½;
sec. 35, lots 1 to 4, inclusive, N½, and N½S½;

sec. 36, lots 1 to 4, inclusive, N½, and N½S½.

T. 18 S., R. 63 E.,
secs. 1 to 4, inclusive, and 10;
sec. 11, those portions north and east of the centerline of Nev 060522;
sec. 12;
sec. 13, lots 15 and 16, and that portion of the N½ lying north and west of the westerly right-of-way line of Highway 93;
sec. 14, lot 1.

T. 17 S., R. 64 E.,
sec. 31, lots 5 to 8, inclusive, SW¼NE¼, E½W½, and SE¼;
sec. 32, that portion of the SW¼, lying north and west of the centerline of I-15.

T. 18 S., R. 64 E.,
secs. 6, and 7, those portions lying north and west of the centerline of I-15;

The areas described aggregate approximately 6,186 acres (25.03 km^2).

Dry Lake Valley North SEZ:

T. 1 N., R. 64 E.,
secs. 35 and 36.

T. 1 N., R. 65 E.,
sec. 31;
sec. 32, W½SW¼.

T. 1 S., R. 64 E.,
secs. 1, 12, and 13;
sec. 21, E½ and E½W½;
secs. 22 to 27, inclusive;
sec. 28, E½;
sec. 33, E½E½ and NW¼NE¼;
secs. 34, 35, and 36.

T. 2 S., R. 64 E.,
secs. 1, 2, and 3;
sec. 4, lot 1 and SE¼NE¼;
sec. 10, N½, N½SW¼, SE¼SW¼, and SE¼;
secs. 11 to 14, inclusive;
sec. 15, NE¼, E½NW¼, NE¼SW¼, N½SE¼, and SE¼SE¼;
sec. 23, NE¼, E½NW¼, NW¼NW¼, N½SE¼, and SE¼SE¼;
sec. 24;
sec. 25, N½NE¼.

T. 1 S., R. 65 E.,
sec. 6, lots 3 and 4, and lots 7 to 13, inclusive;
secs. 7, 8, 17 to 20 inclusive, and secs. 29, 30, and 31;
sec. 32, N½, SW¼, and W½SE¼.

T. 2 S., R. 65 E.,
sec. 5, lots 2, 3, and 4, SW¼NE¼, S½NW¼, SW¼, and W½SE¼;
secs. 6 and 7;
sec. 8, W½E½ and W½;
sec. 17, SE¼NE¼, W½NE¼, W½, and SE¼;
secs. 18 and 19;
sec. 20, W½NE¼ and W½;
sec. 29, NW¼, N½SW¼, and SE¼SW¼;
sec. 30, lot 1, NE¼, E½NW¼, and NE¼SE¼.

The areas described aggregate approximately 28,726 acres (116.25 km^2).

Gold Point SEZ:

T. 6 S., R. 41 E.,
sec. 13, S½;
sec. 14, E½SE¼;
sec. 23, E½E½ and NW¼SE¼;
sec. 24;
sec. 25, N½, NE¼SW¼, and N½SE¼;
sec. 26, NE¼NE¼.

T. 6 S., R. 41½ E.,
sec. 13, N½SW¼ and SW¼SW¼, unsurveyed;
sec. 14, S½, unsurveyed;
sec. 15, S½, unsurveyed;
sec. 16, S½, unsurveyed;
secs. 21 and 22, unsurveyed;
sec. 23, N½NE¼, SW¼NE¼, W½, and NW¼SE¼, unsurveyed;
sec. 26, NW¼NW¼, unsurveyed;
sec. 27 N½, SW¼, N½SE¼, and SW¼SE¼, unsurveyed;
sec. 28, unsurveyed.

The areas described aggregate approximately 4,810 acres (19.47 km^2).

Millers SEZ:

T. 3 N., R. 39 E.,
sec. 1;

sec. 2, lot 1, S½NE¼, NE¼SW¼, S½SW¼, and SE¼;
sec. 11, N½N½ and SW¼NW¼;
sec. 12, N½NW¼.

T. 4 N., R. 39 E.,
sec. 36, E½NE¼, SW¼NE¼, NE¼SW¼, S½SW¼, and SE¼.

T. 3 N., R. 40 E.,
sec. 4, lots 3 and 4, S½NW¼, and NW¼SW¼;
sec. 5, lots 1 to 4, inclusive, S½N½, and N½S½;
sec. 6.

T. 4 N., R. 40 E.,
sec. 10, S½S½;
sec. 11, S½;
sec. 12, SW¼NE¼, S½NW¼, SW¼, and W½SE¼;
sec. 13, W½E½ and W½;
secs. 14, 15, and 16;
sec. 17, S½N½ and S½;
sec. 18, SE¼;
sec. 19, E½, E½NW¼, and NE¼SW¼;
secs. 20 to 23, inclusive;
sec. 24, W½E½ and W½;
sec. 25, NW¼ and W½SW¼;
secs. 26 to 29, inclusive;
sec. 30, lot 4, E½, and E½SW¼;
secs. 31 and 32;
sec. 33, N½, N½S½, and S½SW¼;
sec. 34;
sec. 35, N½, SW¼, and W½SE¼.

The areas described aggregate approximately 16,787 acres (67.93 km^2).

NEW MEXICO

Below is the legal description for the proposed Afton SEZ land withdrawal area in New Mexico.

The Afton SEZ lies within Township 24 south, Range 2 west, sections 23 to 26, and 35; Township 24 south, Range 1 west, sections 19, and 28 to 35; Township 25 south, Range 2 west, section 1; Township 25 south, Range 1 west, sections 1, 3 to 6, 8 to 15; and Township 25 south, Range 1 east, Sections 7, 8, 14, 15, 17 to 23, 25 to 30, and 33 to 35 (New Mexico Principal Meridian).

UTAH

Below are the legal descriptions for the three proposed SEZ land withdrawal areas in Utah.

Salt Lake Meridian

Escalante Valley SEZ:

T. 33 S., R. 14 W.,
sec. 8, NE¼, E½NW¼, SW¼NW¼, and S½;
sec. 9, E½NE¼, S½SW¼, and SE¼;
sec. 10;
sec. 11, W½ and W½SE¼, those portions lying west of Railroad Right-of-Way Grant UTSL 0032533;
sec. 14, E½, that portion lying west of Railroad Right-of-Way Grant UTSL 0032533;
secs. 15, 17, 19, 30, and 31.

T. 33 S., R. 15 W.,
secs. 24 and 25.

T. 34 S., R. 14 W.,
sec. 6, lot 4.

The areas described above aggregate approximately 6,614 acres (27 km^2).

Milford Flats South SEZ:

T. 30 S., R. 10 W.,
sec. 18, lots 1 and 2, and E½NW¼.

T. 30 S., R. 11 W.,
sec. 7, lots 3 and 4, and E½SE¼;
sec. 8, SW¼ and W½SE¼;
sec. 10, NE¼, E½NW¼, and S½;
sec. 12, W½;
sec. 13, N½, N½SW¼, and NW¼SE¼;
sec. 14, N½, SW¼, N½SE¼, SW¼SE¼;
secs. 15, 17, and 18;
sec. 19, lots 1 and 2, NE¼, and E½ NW¼;
sec. 20;
sec. 21, N½, N½S½, and SW¼SW¼;

sec. 22, N½NE¼ and NW¼;
sec. 29, N½NW¼;
sec. 30, N½NE¼.

The areas described above aggregate approximately 6,480 acres (26 km^2).

Wah Wah Valley SEZ:

T. 27 S., R. 14 W.,
sec. 8, E½ and SE¼SW¼;
sec. 9, N½, N½SW¼, SE¼SW¼, and SE¼;
sec. 10;
sec. 11, lots 1 and 2, SW¼NE¼, S½NW¼, SW¼, and W½SE¼;
sec. 13, lot 1;
secs. 14 and 15;
sec. 17, NW¼NE¼;
sec. 21, lots 1 and 6, and E½NE¼;
secs. 22 and 23;
sec. 26, N½ and N½S½;
sec. 27, N½ and N½S½;
sec. 28, NE¼ and N½SE¼.

The areas described above aggregate approximately 6,097 acres (25 km^2).

CONDICIÓN AMBIENTAL DE LA CIENEGA DE SANTA CLARA Y SUS ESPECIES ASOCIADAS, A UN AÑO DE OPERACIÓN DE LA PLANTA DESALADORA DE YUMA

REPORTE PARCIAL

INSTITUTO NACIONAL DE ECOLOGIA

PREPARADO POR:

CENTRO DE INVESTIGACIÓN EN ALIMENTACIÓN Y DESARROLLO A.C.

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JULIO 22, 2011

AR073520

1. Introducción

La línea base de las condiciones ambientales de la Ciénega de Santa Clara se obtuvo a partir de estudios realizados del 2006 al 2009. Los resultados de estos estudios indican que la salinidad presente dentro del humedal (2.6 ppt) es adecuada para el establecimiento del tule (*Typha domingensis*). No existen condiciones de eutroficación por exceso de nutrientes y las plantas acuáticas están funcionando como filtros, disminuyendo estos elementos del agua de entrada.

Asimismo, a partir del monitoreo iniciado en el 2010 los datos obtenidos muestran que el riesgo ecotoxicológico por compuestos orgánicos (plaguicidas y policlorobifenilos), al cual están expuestos tanto los organismos acuáticos como las aves, es bajo, ya que las concentraciones que se han detectado en agua y sedimento (las principales vías de exposición) estuvieron por debajo de los límites recomendados. Las concentraciones de metales fueron medidas en agua, sedimento y tejido de peces; en agua fueron altas para mercurio, en tanto que para sedimentos fueron para arsénico; sin embargo, en tejido de peces ningún metal excedió los límites de las normas para consumo humano. Los resultados del levantamiento topográfico mostraron que la sección oeste de la CSC es la más vulnerable a la pérdida de vegetación al presentarse reducción del flujo de entrada de agua, por ser la sección con cota topográfica más baja y por tanto la que recibe menor cantidad de agua.

Lo anterior sugiere que la reducción en la superficie de la CSC, bajo un escenario de menor caudal de entrada, se iniciará en la sección oeste y continuará hacia la porción sur, con la consecuente pérdida de hábitat para la vida silvestre de esas secciones.

Está planeado que la operación piloto de la planta desaladora de Yuma continúe hasta mayo del 2011. Por ello, es importante continuar el monitoreo de la condición de la CSC que permita evaluar el periodo de normalización de las condiciones que requiere la CSC, una vez finalizada la operación piloto.

Los resultados que se obtengan de este proyecto determinarán el efecto que ha tenido la operación de la planta desaladora al 30%, considerando las medidas de mitigación que se llevaron a cabo por parte de Estados Unidos y México, así como el restablecimiento de condiciones, una vez concluido el periodo de prueba.

2. Objetivo

Comparar los cambios en la condición ambiental de la Ciénega de Santa Clara, como resultado de las modificaciones en la cantidad y calidad del agua, durante el tiempo que ha estado en operación la planta desaladora de Yuma y después de que deje de funcionar, en mayo del 2011

3. Actividades a desarrollar

- Monitoreo mensual de calidad de agua (sólidos disueltos totales, pH, oxígeno, salinidad, conductividad eléctrica).
- Monitoreo bimestral de nutrientes en agua.
- Determinación de la concentración de metales pesados y plaguicidas en muestras de agua, sedimento y especies.

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- Evaluación de la salud del pez (*Micropterus salmoides)* por medio de análisis de acetilcolinesterasa.
- Análisis de muestras de agua, sedimentos y peces.
- Análisis de trabajos existentes sobre vegetación y censo de aves e hidrología, bajo distintos escenarios.

4. Resultados del monitoreo mensual de parámetros de calidad de agua y análisis estadístico de SDT con los eventos hidrológicos ocurridos en el periodo de estudio

Para poder analizar las condiciones hidrológicas en la Ciénega de Santa Clara, se propone dividir el tiempo de monitoreo en 4 secciones:

(1) Condiciones de línea base: Se consideran a las condiciones hidrológicas en donde no hay influencia por ningún periodo de operación de la planta desaladora ni por la adición de agua extra antes de la segunda operación:

							ago-06	sep-06	oct-06	nov-06	dic-06
ene-07	feb-07	mar-07	abr-07	may-07	jun-07	jul-07	ago-07	sep-07	oct-07	nov-07	dic-07
ene-08	feb-08	mar-08	abr-08	may-08	jun-08	jul-08	ago-08	sep-08	oct-08	nov-08	dic-08
ene-09	feb-09	mar-09	abr-09	may-09	jun-09	jul-09	ago-09	sep-09	oct-09	nov-09	dic-09
ene-10	feb-10	mar-10	abr-10	may-10	jun-10	jul-10	ago-10	sep-10	oct-10	nov-10	dic-10
ene-11	feb-11	mar-11	abr-11	may-11	jun-11						

(2) Agua "acordada" pero sin operación de la planta: Estas son condiciones en la Ciénega de SC de Dic 2009 a Abril 2010 cuando hubo agua acordada entre Mexico y E.U. para reemplazar el agua que se estaría utilizando en la operación de la planta.

							ago-06	sep-06	oct-06	nov-06	dic-06
ene-07	feb-07	mar-07	abr-07	may-07	jun-07	jul-07	ago-07	sep-07	oct-07	nov-07	dic-07
ene-08	feb-08	mar-08	abr-08	may-08	jun-08	jul-08	ago-08	sep-08	oct-08	nov-08	dic-08
ene-09	feb-09	mar-09	abr-09	may-09	jun-09	jul-09	ago-09	sep-09	oct-09	nov-09	dic-09
ene-10	feb-10	mar-10	abr-10	may-10	jun-10	jul-10	ago-10	sep-10	oct-10	nov-10	dic-10
ene-11	feb-11	mar-11	abr-11	may-11	jun-11						

(3) Solo operación de la Planta Desaladora de Yuma (PDY): estas son condiciones presentadas de Mayo a Agosto 2010 y de enero a marzo 2011, cuando no hubo agua extra entregada

							ago-06	sep-06	oct-06	nov-06	dic-06
ene-07	feb-07	mar-07	abr-07	may-07	jun-07	jul-07	ago-07	sep-07	oct-07	nov-07	dic-07
ene-08	feb-08	mar-08	abr-08	may-08	jun-08	jul-08	ago-08	sep-08	oct-08	nov-08	dic-08
ene-09	feb-09	mar-09	abr-09	may-09	jun-09	jul-09	ago-09	sep-09	oct-09	nov-09	dic-09
ene-10	feb-10	mar-10	abr-10	may-10	jun-10	jul-10	ago-10	sep-10	oct-10	nov-10	dic-10
ene-11	feb-11	mar-11	abr-11	may-11	jun-11						

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(4) Agua acordada y operación de la PDY: estas condiciones se presentaron de Septiembre a Diciembre 2010 cuando se entregó agua durante la operación de la planta

							ago-06	sep-06	oct-06	nov-06	dic-06
ene-07	feb-07	mar-07	abr-07	may-07	jun-07	jul-07	ago-07	sep-07	oct-07	nov-07	dic-07
ene-08	feb-08	mar-08	abr-08	may-08	jun-08	jul-08	ago-08	sep-08	oct-08	nov-08	dic-08
ene-09	feb-09	mar-09	abr-09	may-09	jun-09	jul-09	ago-09	sep-09	oct-09	nov-09	dic-09
ene-10	feb-10	mar-10	abr-10	may-10	jun-10	jul-10	ago-10	sep-10	oct-10	nov-10	dic-10
ene-11	feb-11	mar-11	abr-11	may-11	jun-11						

4.1. SDT

4.1.1 LECTURAS MENSUALES (SONDA YSI)

(1) Condiciones de línea base

Entradas
Bypass drain: los SDT variaron entre 2,210 y 2,832 mg/l con una media de 2,543 ± 148 mg/l (Fig. 1)
Riito-Santa Clara: las concentraciones de SDT variaron entre 2,134 y 4,614 mg/l con una media de 3,435 ± 586 mg/l (Fig. 2)
Porción con vegetación:
Monitoreo en los sitios 1, 2 y 3 empezó en 2006, los SDT para estos tres sitios durante nuestro periodo de línea base variaron entre 2,360 to 5,226 con un promedio de 3,140 ± 552 mg/l (Fig. 3)
Puntos de la orilla:
El sitio 7 también se monitoreó durante el periodo de línea base, los valores variaron entre 2,948 y 5,524 con una media de 4,000 ± 795 mg/l (Fig. 4)

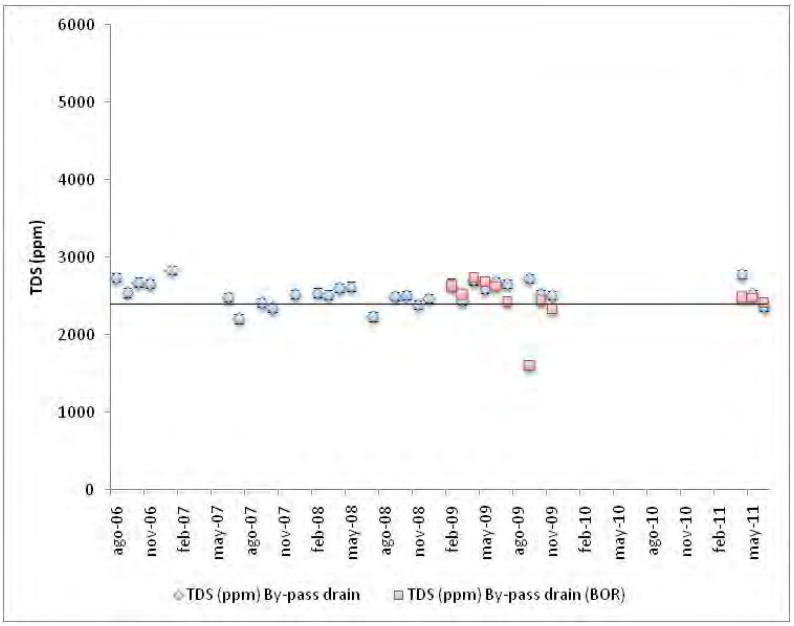


Fig. 1 Línea base de SDT en el Bypass drain (azul) y en rojo SDT (ppm) como se reporta por el Bureau de Reclamation. La línea horizontal muestra la media.

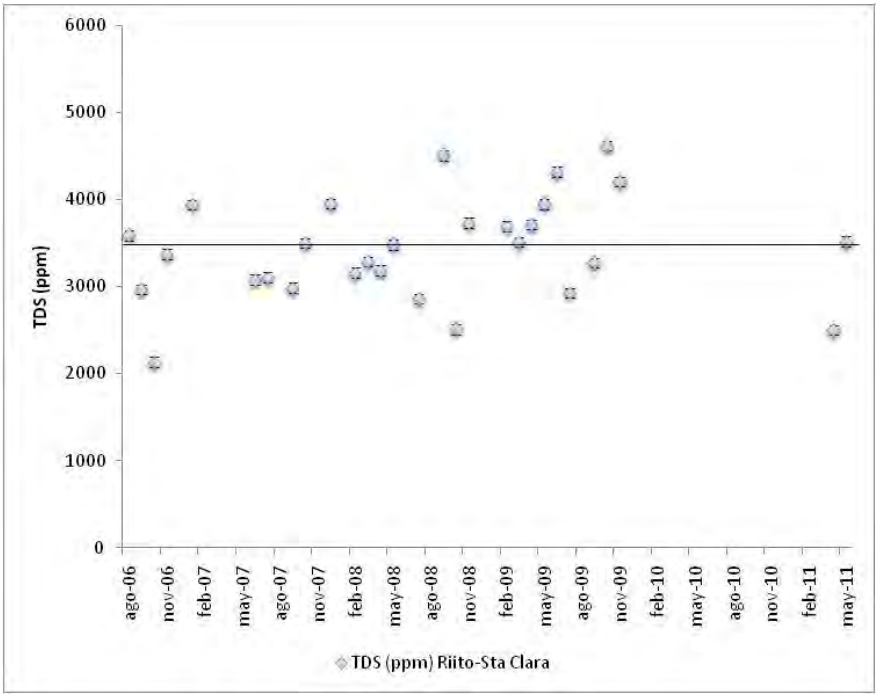


Fig. 2 Línea base de SDT en el dren Riito-Sta. Clara

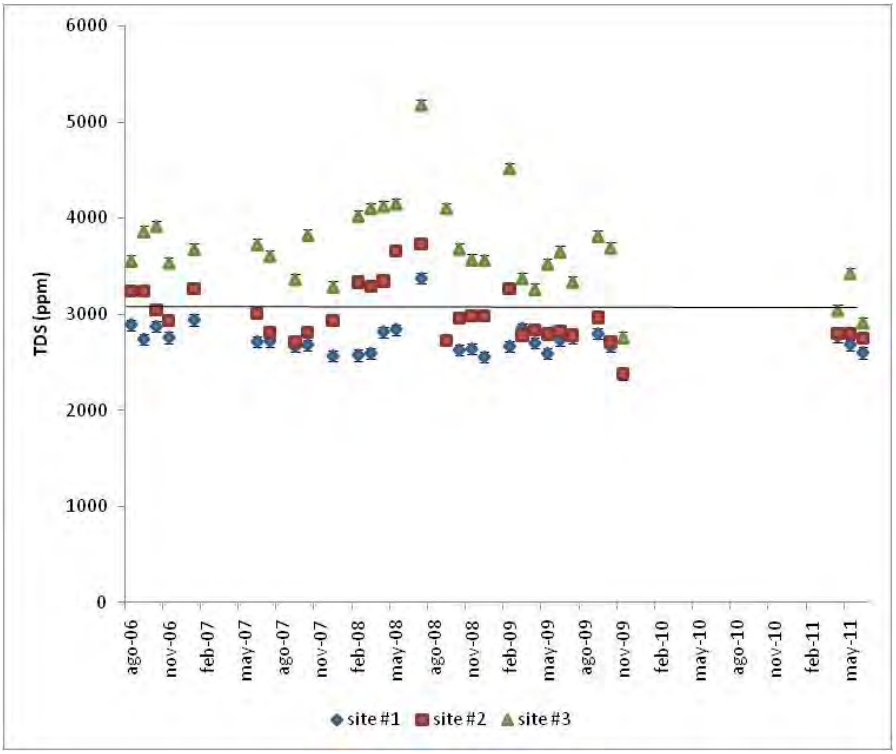


Fig. 3. Línea base de SDT en los sitios 1, 2 y 3 (con vegetación)

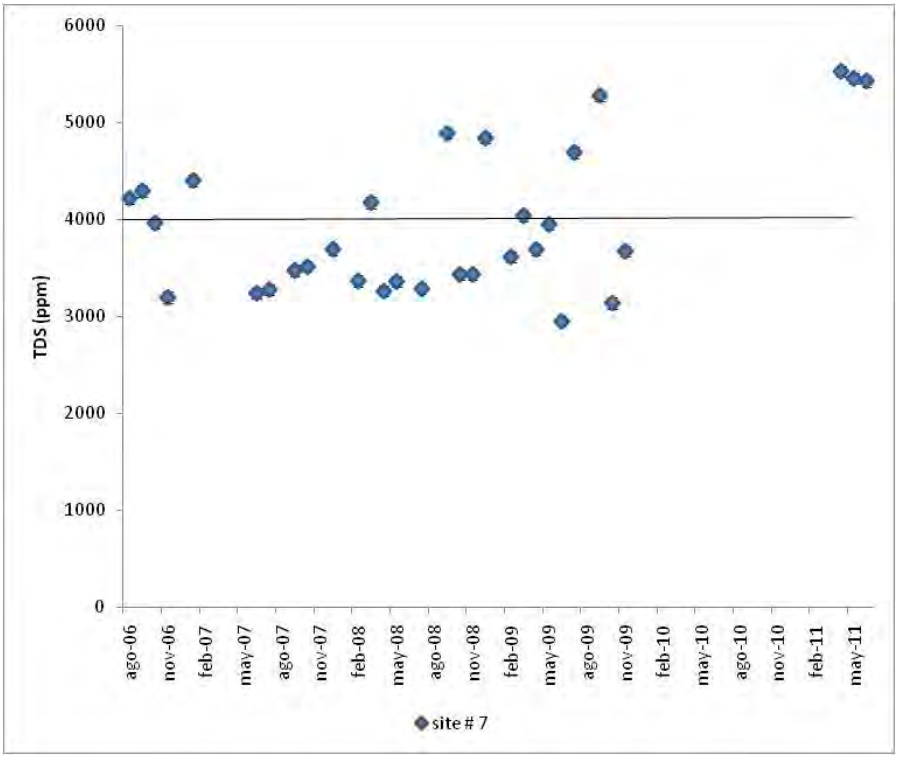


Fig. 4. Línea base SDT en sitio 7 (orilla)

(2) Agua arreglada pero sin operación de la Planta

Entradas
By-pass drain: los SDT variaron de 2,417 a 2,902 mg/l con una media de 2,737 ± 159 mg/l
Riito-Santa Clara: los SDT variaron de 3,029 a 3,752 mg/l con una media de 3,339 ± 248 mg/l
Porción con vegetación:
Los sitios 1,2,3,4,17,18,19 y 20 se monitorearon de Dic 09- Abr 10, los valores de SDT variaron entre 2,345 y 3,911 con una media de 2,688 ± 248 mg/l
Sitios de la orilla:
Los sitios 7,10,11,13,14,15,16,22 y 23 se monitorearon de Dec 09 a Abril 2010, los valores de SDT variaron entre 4,246 a 6,261 con una media de 4,982 ± 795 mg/l

3. Solo operación de la PDY

Entradas
By-pass drain: los valores de SDT variaron entre 2,347 y 3,921 mg/l con un amedia de 3,510 ± 533 mg/l
Riito-Sta. Clara: las concentraciones de TDS variaron entre 3,914 a 4,840 mg/l con una media de 4,403 ± 324 mg/l
Porción con vegetación:

Los sitios 1,2,3,4,17,18,19 y 20 se monitorearon de May a Aug 2010, los valores de SDT variaron entre 3,350 a 4,311 con una media de 3,781 ± 306 mg/l
Sitios de la orilla:
Los sitios 7,10,11,13,14,15,16,22,23 se monitorearon de May-Ago 2010, los valores de SDT variaron entre 4,683 a 8,654 con una media de 6,180 ± 1,260 mg/l

(4) Agua acordada y operación de la planta

Entradas
By-pass drain: los valores de SDT variaron entre 2,183 a 2,835 mg/l con una media de 2,646 ± 311 mg/l
Riito-Sta. Clara: las concentraciones de SDT variaron entre 3,609 y 4,515 mg/l con una media de 4,070 ± 398 mg/l
Porción con vegetación:
Los sitios 1,2,3,4,17,18,19 y 20 se monitorearon de Sep-Dec 2010, los valores de SDT variaron entre 2,757 y 3,404 con una media de 2,987 ± 169 mg/l
Sitios de la orilla:
Los sitios 7,10,11,13,14,15,16,22,23 se monitorearon de Sep-Dec 2010, los valores de SDT variaron entre 3,062 y 9,732 con una media de 5,090 ± 1,338 mg/l

DISTRIBUCIÓN ESPACIAL DE TDS

Fig. 5 Condiciones de línea base (escenario 1) (SDT, ppm)

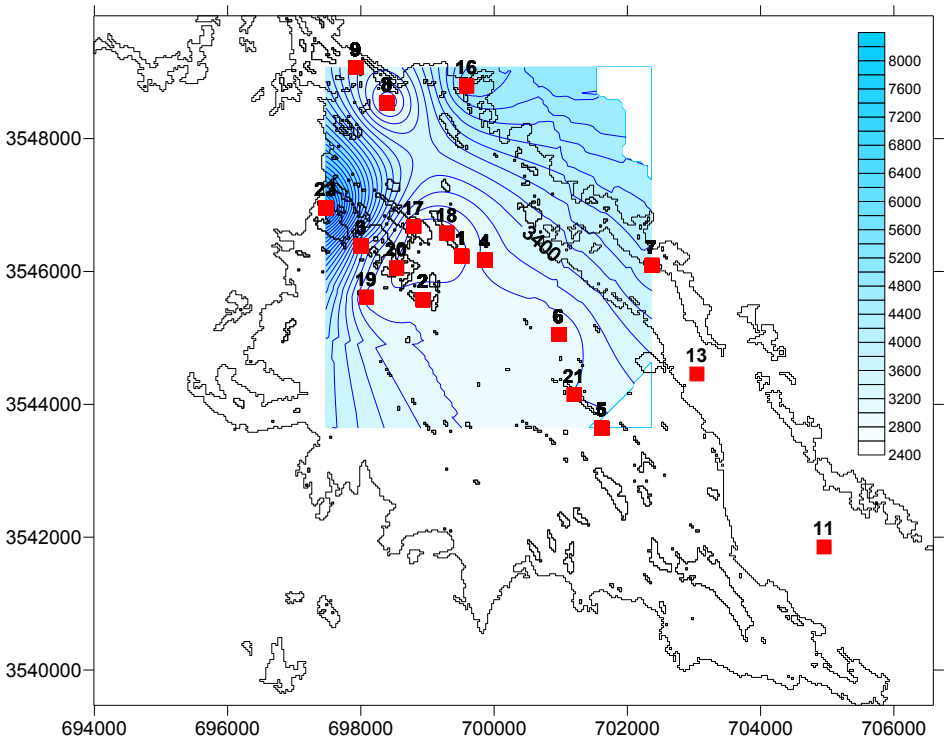


Fig. 6. Agua acordada pero sin operación de la planta (escenario 2) (SDT ppm)

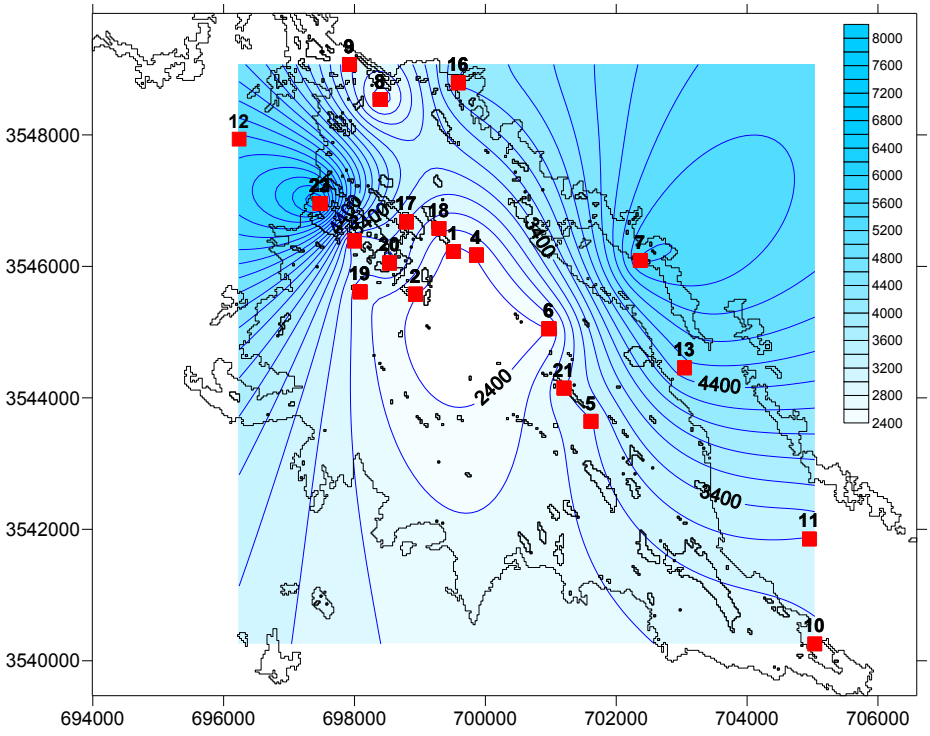


Fig. 7. Solo la operación de la planta (escenario 3) (SDT ppm)

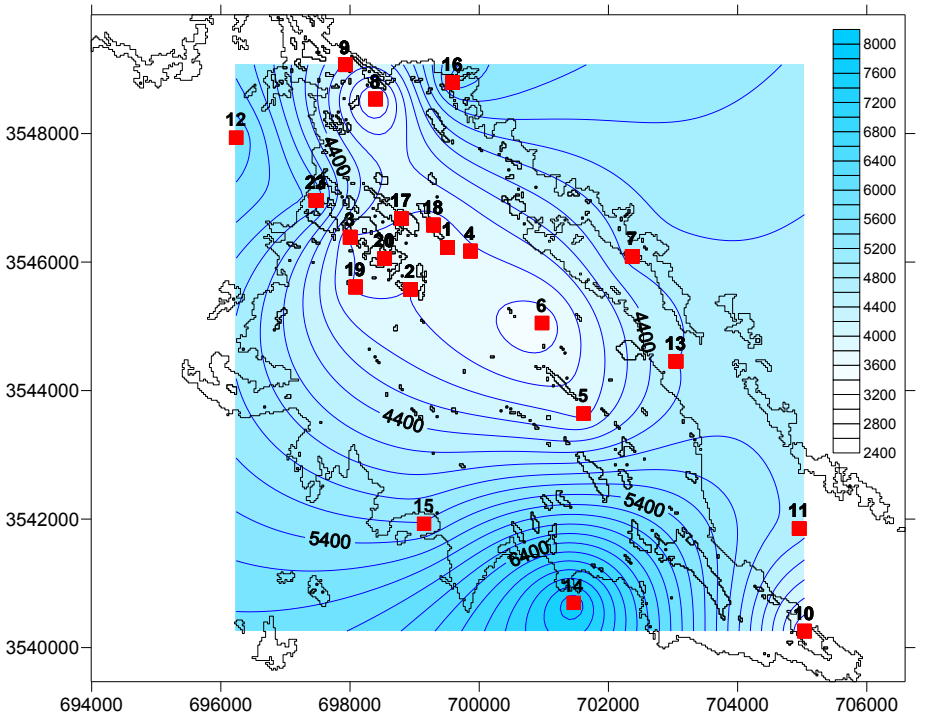
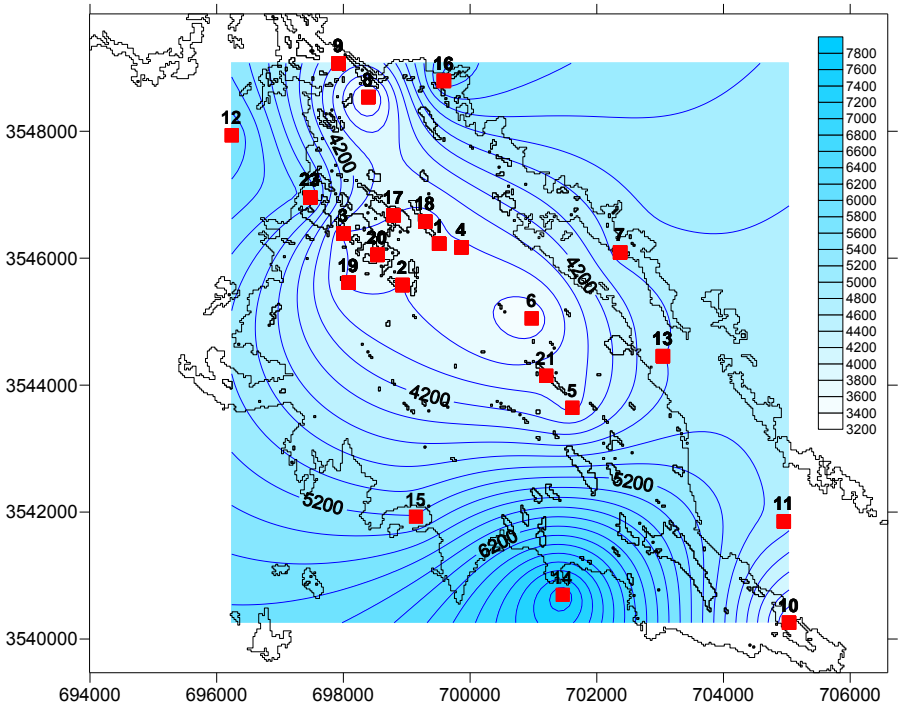


Fig. 8 Agua acrodada y operación de la planta (escenario 4) (SDT ppm)



4.1.2. SDT (LECTURAS AUTOMÁTICAS)

Los loggers o lectores automáticos, se instalaron en los sitios 1, 4, 9, 10, 16 y 19. Lectores de los sitios 1, 4 y 19 estuvieron en la parte con vegetación de la Ciénega, y los lectores 10 y 16 estuvieron en la orilla. También hubo un lector en el dren Riito-Sta Clara (sitio 9). Los SDT (mg/l) se reportan para estos seis lectores en las figuras 9-14.

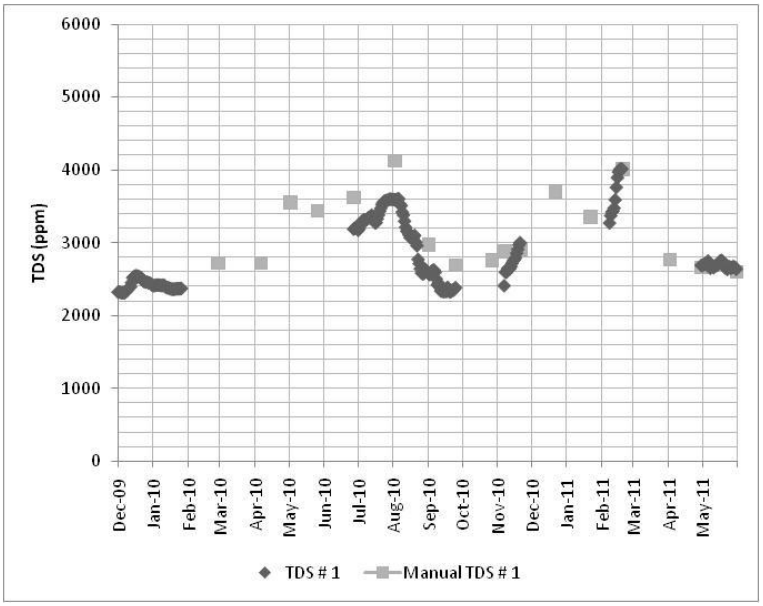


Fig. 9. Promedio mensual (SDT) ppm del lector ubicado en sitio 1

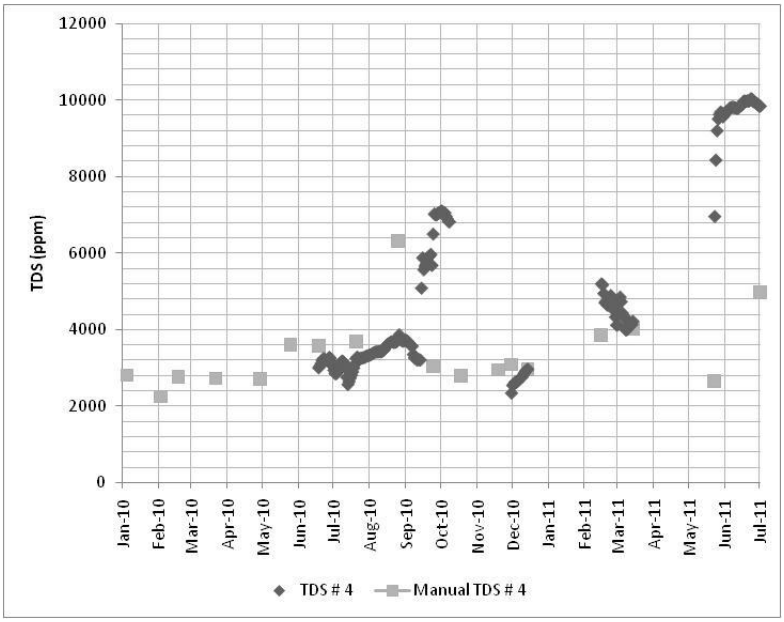


Fig. 10. Promedio mensual (SDT) ppm del lector ubicado en sitio 4.

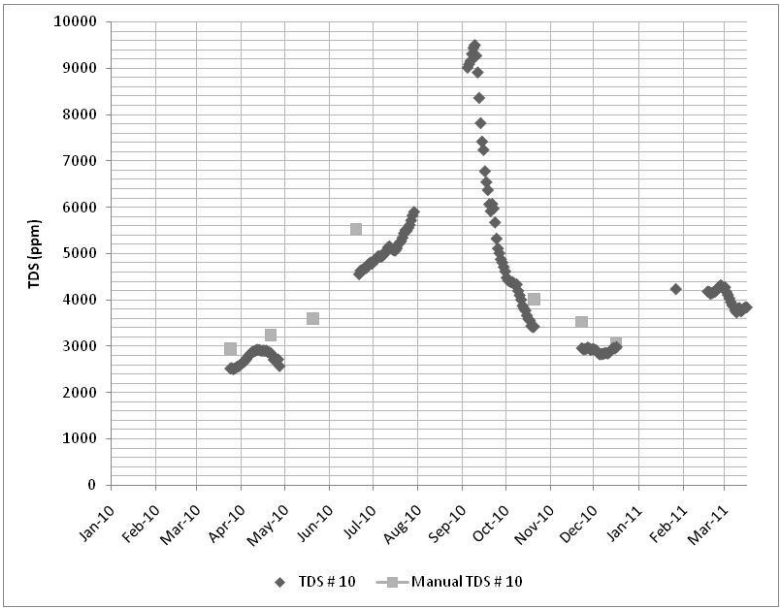


Fig. 11. Promedio mensual de SDT (ppm) del lector ubicado en sitio 10

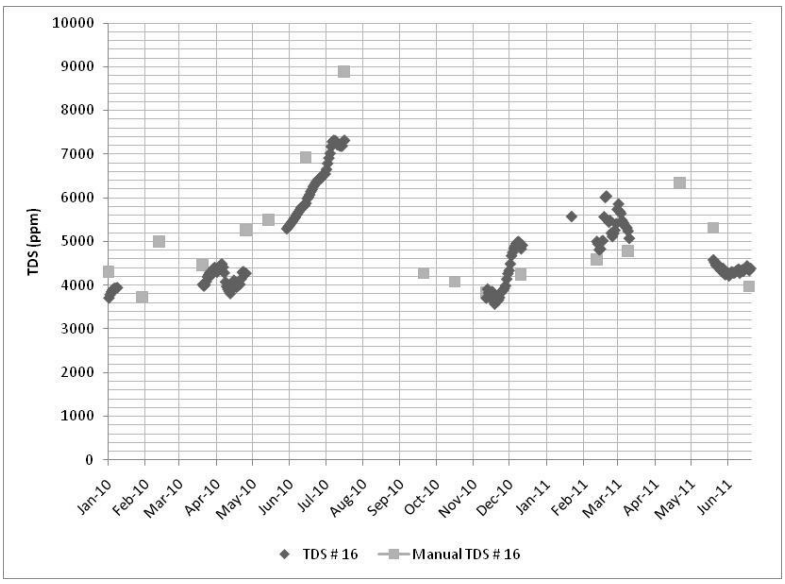


Fig. 12. El promedio mensual de SDT (ppm) del lector ubicado en sitio 16

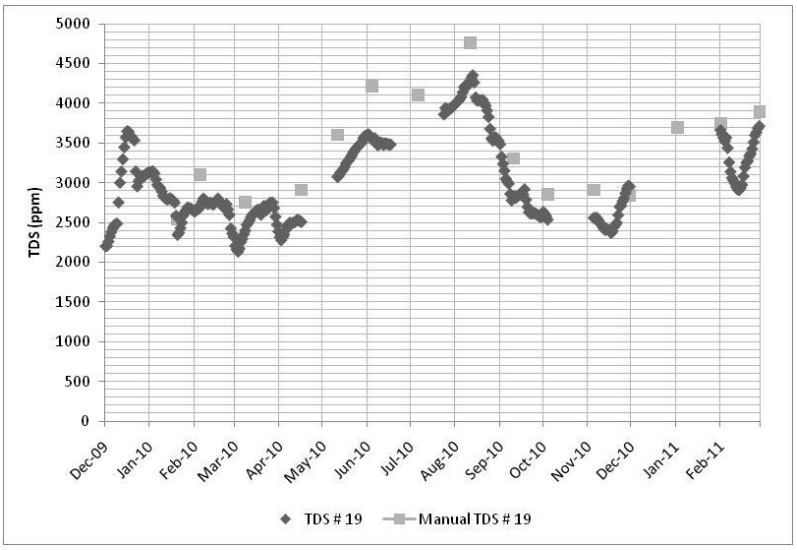


Fig. 13. Promedio mensual de SDT (ppm) del sensor ubicado en sitio 19

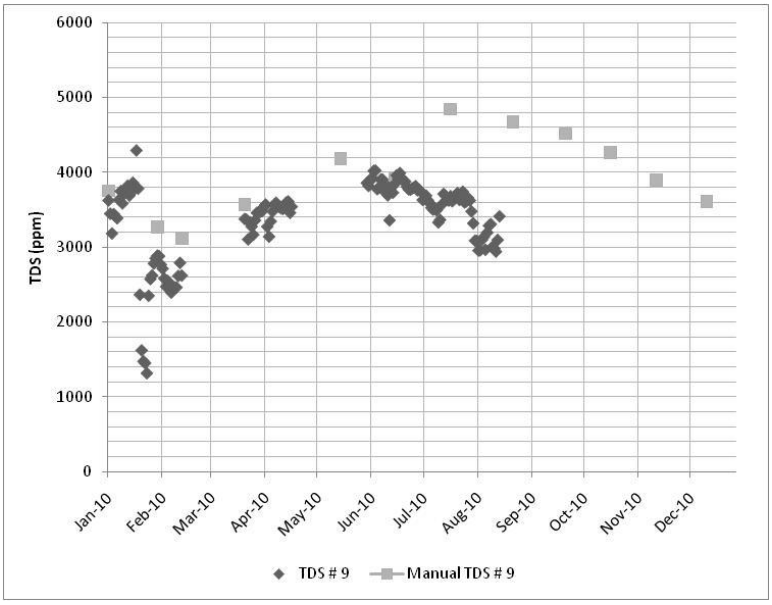


Fig. 14. Promedio mensual SDT (ppm) de los lectores ubicados en sitio 9 (dren Riito-Santa Clara)

DISCUSIÓN DE RESULTADOS DE TDS

Combinando los valores de SDT de la sección con vegetación de la Ciénega (lectores de los sitios 1, 4 y 19) y separando los datos entre los periodos 2, 3 y 4 como se definió anteriormente, encontramos diferencias significativas entre los tres periodos (ANOVA de una vía, *p-value* < 0.0001, Tukey-Kramer HSD alpha = 0.05, Fig. 15). La media de SDT del periodo 2 fue 2,865 ± 38 mg/l, del periodo 3 fue 3,699 ± 45 y del periodo 4 fue 3,307 ± 44.

Por lo tanto, de Dic 2009 a Abr 2010, el agua acordada si bajó la salinidad dentro del humedal. Después de Mayo a Ago 2010, la salinidad se incrementó debido a la operación de la planta y la falta de agua acordada, y de Sept a Diciembre 2010 con la operación de la planta y con agua acordada, los valores de SDT disminuyeron comparados con el periodo de tiempo anterior.

Las diferencias entre los tres escentarios también se pueden observar espacialmente (Figs. 6-8), en donde los tonos mas claros (bajo SDT) se observan bajo el escenario 2 cuando solo hubo agua acordada y no operación de la planta, y tonos mas azules (SDT mayores) se observan bajo el escenario 3 cuanto solo hubo operación de la planta, y el escenario 4 cuando agua acordada y operación de la planta ocurrieron, los tonos azules también son predominantes pero un poco menores que en el escenario 3.

Comparando el periodo completo de la operación de la planta (Dic 2009 a Mar 2011) de los sitios 1,2 y 3 con datos de línea base (escenario 1) utilizando los datos mensuales (sonda YSI), detectamos una diferencia entre los dos grupos de datos (t-test p-value = 0.009, LSD con alpha = 0.05), la línea base de SDT fue de 3,131 ppm ± 523, y la o media durante la operación de la planta fue de 3,388 ppm ± 566 (Fig. 16).

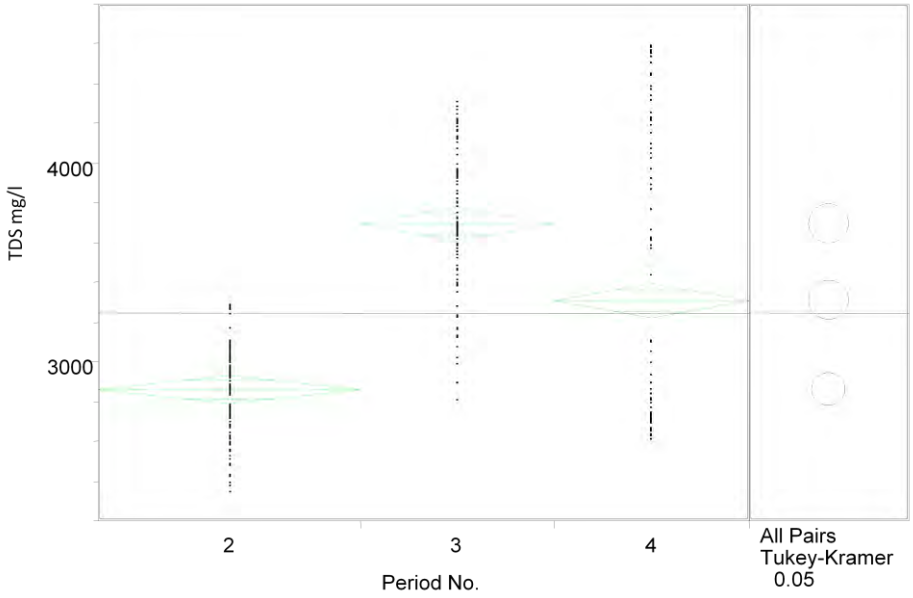


Fig. 15. Comparación entre los tres periodos definidos anteriormente en los sitios dentro de la Ciénega (lectores 1, 4 y 19).

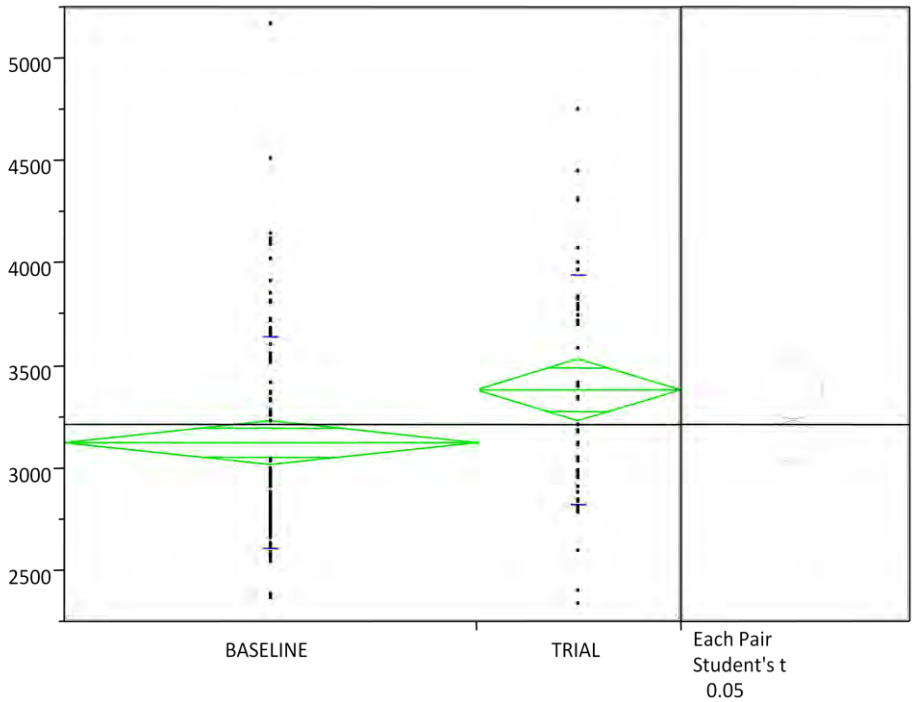


Fig. 16. Comparación entre los valores de línea base y la operación de la planta (ppm)

"CONDICIÓN AMBIENTAL DE LA CIENEGA DE SANTA CLARA Y SUS ESPECIES ASOCIADAS, A UN AÑO DE OPERACIÓN DE LA PLANTA DESALADORA DE YUMA"

REPORTE FINAL

INSTITUTO NACIONAL DE ECOLOGIA (INE)

PREPARADO POR:
CENTRO DE INVESTIGACIÓN EN ALIMENTACIÓN Y DESARROLLO A.C.(CIAD)
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OCTUBRE 24, 2011

AR073533

Resumen

La Ciénega de Santa Clara es un humedal de 6,500 hectáreas localizado en el Sureste del Delta del Río Colorado México. Provee hábitat a un gran número de especies incluyendo el Palmoteador de Yuma, una especie de ave de marisma en peligro de extinción. En mayo de 2010 se inició la operación de la Planta Desaladora de Yuma (PDY) a un 30% de su capacidad. El presente proyecto integra los resultados de calidad del agua, vegetación, topografía y censo de aves durante la operación de la PDY. Los resultados de calidad de agua indican que las concentraciones de sólidos disueltos totales (SDT), que indican salinidad, en la Ciénega fueron mayores en el periodo en donde solamente hubo operación de la PDY sin la presencia de agua "acordada". Sin embargo, si se toma en cuenta todo el periodo de operación de la PDY no se observaron diferencias con las variaciones normales de la línea base. Las concentraciones de metales y compuestos orgánicos en tejido comestible de peces no excedieron los límites para consumo humano y no se observó un incremento en las concentraciones de contaminantes durante la operación de la PDY. No se detectaron efectos celulares por plaguicidas o mercurio en peces. Las concentraciones de nutrientes y otros químicos como sulfatos, cloro total, calcio y dureza no se incrementaron con la operación de la PDY. Se observó que la huella de la vegetación no ha variado de 2008 a 2011, sin embargo, si se observaron cambios en la densidad de la vegetación en Julio 2010 comparada con imágenes previas de verano. Los perfiles batimétricos indican que la Ciénega de Santa Clara se va llenando de NW a SE de forma directa y de forma indirecta hacia el extremo SE. En 2010 antes de la operación de la PDY se estimó una población de 5,438 palmoteadores de Yuma en la Ciénega de Santa Clara la cual no varía mucho comparada con los tres años previos.

Abstract

The Ciénega de Santa Clara is a 6,500 hectares wetland located in the southeast of the Colorado River delta Mexico. It provides habitat to a great number of species, including the Yuma Clapper Rail, an endangered marshbird. In May 2010 the Yuma Desalting Plant (YDP) began operations at 30% capacity. This project integrates results from water quality, vegetation, topography and bird census during the YDP operation. Water quality results indicate that Total Dissolved Solids (TDS) an indication of salinity, in the Cienega de Santa Clara were greater during the period where only operation of the YDP occurred without the presence of "arranged" water. However, if we considered the complete YDP operation period, there were no differences with the normal variations of the baseline. Metal concentrations and organic compounds in edible fish tissue did not exceeded recommended guidelines for human consumption and there was no increase of contaminants during the YDP operation. There were no cellular effects in fish due to pesticides or mercury. Nutrients and other chemicals like chlorine, sulphates and calcium did not increased with the YDP operation. The vegetation footprint of the Cienega de Santa Clara has not changed from 2008 to 2011, however, we did observed changes in vegetation density in July 2010 compared with previous summer images. Bathymetry indicates that the Cienega de Santa Clara gets filled from NW to SE in a direct manner and indirect towards the SE corner. In 2010 before the operation of the YDP the total population of Yuma Clapper Rail was estimated in 5,438 which is similar to the three previous years.

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1. INTRODUCCIÓN

La línea base de las condiciones ambientales de la Ciénega de Santa Clara se obtuvo a partir de estudios realizados del 2006 al 2009. Los resultados de estos estudios indican que la salinidad presente dentro del humedal (2.6 ppt) es adecuada para el establecimiento del tule (*Typha domingensis*). No existen condiciones de eutroficación por exceso de nutrientes y las plantas acuáticas están funcionando como filtros, disminuyendo estos elementos del agua de entrada.

Asimismo, a partir del monitoreo iniciado en el 2010 los datos obtenidos muestran que el riesgo ecotoxicológico por compuestos orgánicos (plaguicidas y policlorobifenilos), al cual están expuestos tanto los organismos acuáticos como las aves, es bajo, ya que las concentraciones que se han detectado en agua y sedimento (las principales vías de exposición) estuvieron por debajo de los límites recomendados. Las concentraciones de metales fueron medidas en agua, sedimento y tejido de peces; en agua fueron altas para mercurio, en tanto que para sedimentos fueron para arsénico; sin embargo, en tejido de peces ningún metal excedió los límites de las normas para consumo humano. Los resultados del levantamiento topográfico mostraron que la sección oeste de la CSC es la más vulnerable a la pérdida de vegetación al presentarse reducción del flujo de entrada de agua, por ser la sección con cota topográfica más baja y por tanto la que recibe menor cantidad de agua.

Lo anterior sugiere que la reducción en la superficie de la CSC, bajo un escenario de menor caudal de entrada, se iniciará en la sección oeste y continuará hacia la porción sur, con la consecuente pérdida de hábitat para la vida silvestre de esas secciones.

Está planeado que la operación piloto de la planta desaladora de Yuma continúe hasta mayo del 2011. Por ello, es importante continuar el monitoreo de la condición de la CSC que permita evaluar el periodo de normalización de las condiciones que requiere la CSC, una vez finalizada la operación piloto.

Los resultados que se obtengan de este proyecto determinarán el efecto que ha tenido la operación de la planta desaladora al 30%, considerando las medidas de mitigación que se llevaron a cabo por parte de Estados Unidos y México, así como el restablecimiento de condiciones, una vez concluido el periodo de prueba.

2. OBJETIVO

Comparar los cambios en la condición ambiental de la Ciénega de Santa Clara, como resultado de las modificaciones en la cantidad y calidad del agua, durante el tiempo que ha estado en operación la planta desaladora de Yuma y después de que deje de funcionar, en mayo del 2011.

3. ACTIVIDADES A DESARROLLAR

- Monitoreo mensual de calidad de agua (sólidos disueltos totales, pH, oxígeno, salinidad, conductividad eléctrica).
- Monitoreo bimestral de nutrientes en agua.
- Determinación de la concentración de metales pesados y plaguicidas en muestras de agua, sedimento y peces.

- Evaluación de la salud del pez (*Micropterus salmoides)* por medio de análisis de acetilcolinesterasa.
- Análisis de trabajos existentes sobre vegetación y censo de aves e hidrología, bajo distintos escenarios.

4. METODOLOGÍA

Se realizaron monitoreos mensuales de calidad de agua en 13 puntos dentro de la Ciénega de Santa Clara (Figura 1 y Tabla 1), en estos sitios se tomaron parámetros de calidad de agua en campo (Temperatura, salinidad, sólidos disueltos totales, pH, oxígeno y conductividad eléctrica) con una sonda multiparámetro YSI 6820 V2 y se tomó una muestra de agua para medir en laboratorio parámetros químicos y bacteriológicos (cloro, sulfatos, dureza, turbidez, nutrientes, *E. coli* y sólidos disueltos totales). También se tomó una muestra de agua y sedimento superficial en 10 puntos de la Ciénega y se colectaron peces (*Micropterus salmoides*) de las lagunas centrales.

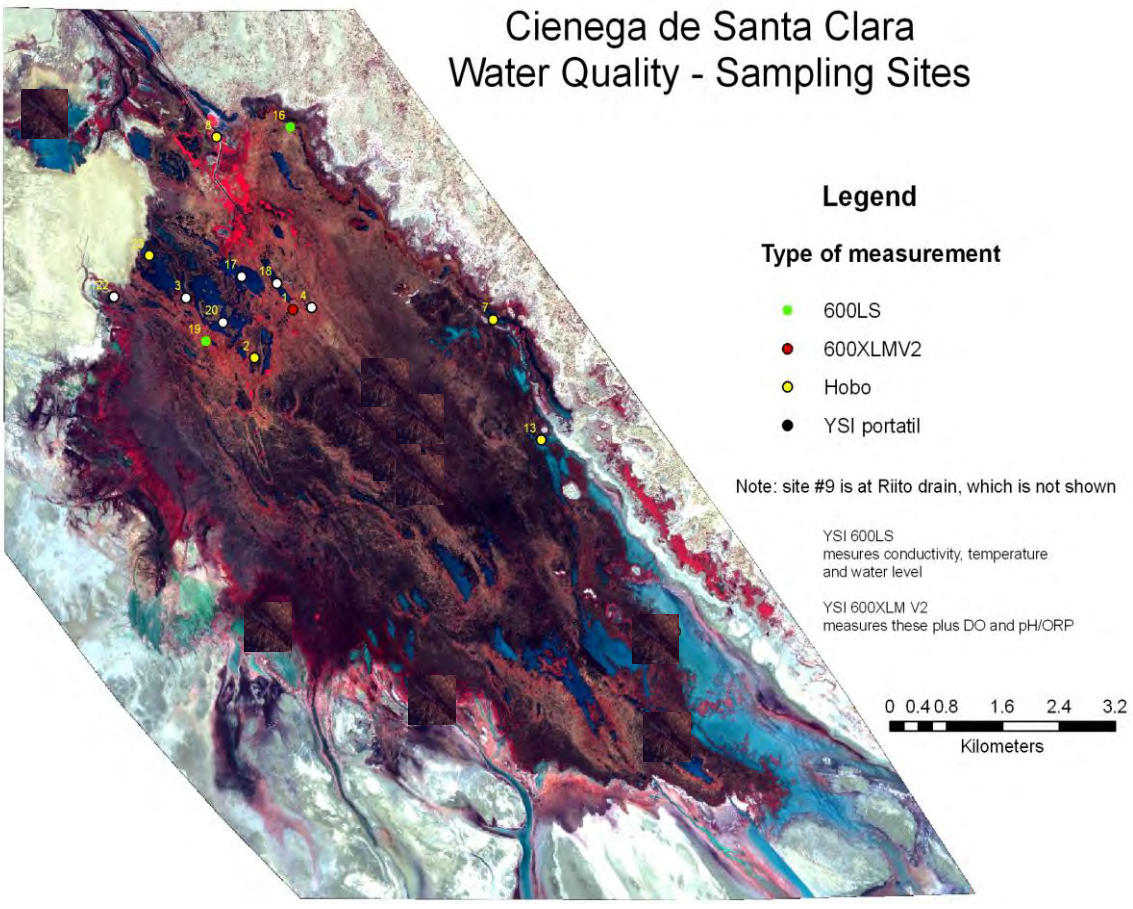

Fig. 1. Localización de estaciones de muestreo dentro de la Ciénega de Santa Clara

Tabla 1. Número, nombre y localización en UTM en la Ciénega de Santa Clara de los sitios de muestreo

Sitio No.	UTMX	UTMY
8 Bypass	698385	3548547
9 Riito	697918	3549079
1	699503	3546235
2	698925	3545585
3	697994	3546396
4	699855	3546180
5	701606	3543651
6	700964	3545060
7	702360	3546099
10	705027	3540265
11	704945	3541861
12	696229	3547944
13	703036	3544465
14	701454	3540705
15	699138	3541936
16	699579	3548801
17	698786	3546685
18	699283	3546585
19	698077	3545621
20	698528	3546060
21	697467	3546964
22	697467	3546964
23	697467	3546964

Los datos de calidad de agua en campo y laboratorio se graficaron por sitio y se compararon con límites establecidos de calidad de agua. Se utilizaron distribuciones de frecuencia (histogramas) con Shapiro-Wilkes para determinar normalidad de los datos y se hizo una prueba de ANOVA comparando datos entre los diferentes periodos de operación de la planta y una prueba de *t-de student* entre la salinidad de línea base y la operación de la planta.

5. RESULTADOS

5.1. Sólidos Disueltos Totales (TDS)

Para analizar y comparar las condiciones de calidad del agua a través del tiempo, dividimos el periodo de monitoreo en los siguientes 4 periodos:

(1) Condiciones de línea base: Se consideran a las condiciones hidrológicas en donde no hay influencia de ningún periodo de operación de la planta desaladora ni por la adición de agua extra antes de la segunda operación. Sin embargo, todas las condiciones tanto

ambientales como antropogénicas si se consideran en este periodo (ej. Reparación del canal Bypass, dragado del canal, y todos los fenómenos naturales):

							ago-06	sep-06	oct-06	nov-06	dic-06
ene-07	feb-07	mar-07	abr-07	may-07	jun-07	jul-07	ago-07	sep-07	oct-07	nov-07	dic-07
ene-08	feb-08	mar-08	abr-08	may-08	jun-08	jul-08	ago-08	sep-08	oct-08	nov-08	dic-08
ene-09	feb-09	mar-09	abr-09	may-09	jun-09	jul-09	ago-09	sep-09	oct-09	nov-09	dic-09
ene-10	feb-10	mar-10	abr-10	may-10	jun-10	jul-10	ago-10	sep-10	oct-10	nov-10	dic-10
ene-11	feb-11	mar-11	abr-11	may-11	jun-11						

(2) Agua "acordada" pero sin operación de la planta: Estas son condiciones en la Ciénega de SC de Octubre 2009 a Abril 2010 cuando hubo agua acordada entre México y E.U. para reemplazar el agua que se estaría utilizando en la operación de la planta.

							ago-06	sep-06	oct-06	nov-06	dic-06
ene-07	feb-07	mar-07	abr-07	may-07	jun-07	jul-07	ago-07	sep-07	oct-07	nov-07	dic-07
ene-08	feb-08	mar-08	abr-08	may-08	jun-08	jul-08	ago-08	sep-08	oct-08	nov-08	dic-08
ene-09	feb-09	mar-09	abr-09	may-09	jun-09	jul-09	ago-09	sep-09	oct-09	nov-09	dic-09
ene-10	feb-10	mar-10	abr-10	may-10	jun-10	jul-10	ago-10	sep-10	oct-10	nov-10	dic-10
ene-11	feb-11	mar-11	abr-11	may-11	jun-11						

(3) Solo operación de la Planta Desaladora de Yuma (PDY): estas son condiciones presentadas de Mayo a Septiembre 2010, cuando no hubo agua extra entregada

							ago-06	sep-06	oct-06	nov-06	dic-06
ene-07	feb-07	mar-07	abr-07	may-07	jun-07	jul-07	ago-07	sep-07	oct-07	nov-07	dic-07
ene-08	feb-08	mar-08	abr-08	may-08	jun-08	jul-08	ago-08	sep-08	oct-08	nov-08	dic-08
ene-09	feb-09	mar-09	abr-09	may-09	jun-09	jul-09	ago-09	sep-09	oct-09	nov-09	dic-09
ene-10	feb-10	mar-10	abr-10	may-10	jun-10	jul-10	ago-10	sep-10	oct-10	nov-10	dic-10
ene-11	feb-11	mar-11	abr-11	may-11	jun-11						

(4) Agua acordada y operación de la PDY: estas condiciones se presentaron de Octubre 2010 a Marzo 2011 cuando se entregó agua durante la operación de la planta

							ago-06	sep-06	oct-06	nov-06	dic-06
ene-07	feb-07	mar-07	abr-07	may-07	jun-07	jul-07	ago-07	sep-07	oct-07	nov-07	dic-07
ene-08	feb-08	mar-08	abr-08	may-08	jun-08	jul-08	ago-08	sep-08	oct-08	nov-08	dic-08
ene-09	feb-09	mar-09	abr-09	may-09	jun-09	jul-09	ago-09	sep-09	oct-09	nov-09	dic-09
ene-10	feb-10	mar-10	abr-10	may-10	jun-10	jul-10	ago-10	sep-10	oct-10	nov-10	dic-10
ene-11	feb-11	mar-11	abr-11	may-11	jun-11						

En este proyecto se usaron dos tipos de medición para los parámetros de calidad de agua. Las mediciones en campo utilizando la sonda multiparámetro YSI (muestreo mensual) y la adquisición de datos continua por medio de sensores YSI que miden conductividad cada media hora.

Los valores de Sólidos Disueltos Totales (SDT) reportados en este documento se obtuvieron de la siguiente manera. Se obtuvieron valores de SDT en laboratorio de muestras de agua colectadas en los puntos de muestreo, estos valores se compararon

con los valores correspondientes de campo de conductividad eléctrica en campo y se construyó un modelo de regresión lineal. Usando la fórmula de la regresión se obtuvieron valores calculados de SDT utilizando los valores de medición en campo de conductividad. Este cálculo de SDT es más preciso que el valor ofrecido por la sonda multiparámetro en campo.

Resultados de SDT (lecturas en campo)

(1) Condiciones de línea base (Ago 2006-Feb 2007 y Jun 2007-Sep 2009)

Entradas

Bypass drain: los SDT variaron entre 2,210 y 2,832 mg/l con una media de 2,551 ± 153 mg/l (Fig. 2)

Riito-Santa Clara: las concentraciones de SDT variaron entre 2,134 y 4,506 mg/l con una media de 3,388 ± 536 mg/l (Fig. 3)

Porción con vegetación:

Monitoreo en los sitios 1, 2 y 3 empezó en 2006, los SDT para estos tres sitios durante nuestro periodo de línea base variaron entre 2,536 a 5,226 con un promedio de 3,199 ± 558 mg/l (Fig. 4)

Puntos de la orilla:

El sitio 7 también se monitoreó durante el periodo de línea base, los valores variaron entre 2,948 y 5,274 con una media de 3,826 ± 612 mg/l (Fig. 5)

La figura 6 muestra un resumen de las concentraciones de SDT en los drenes de entrada y los sitios con vegetación durante el periodo de línea base.

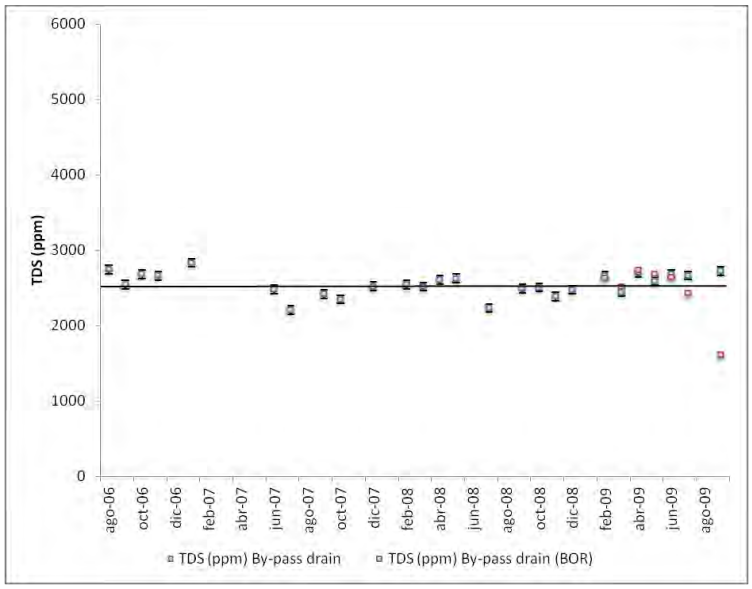

Fig. 2 Línea base de SDT en el Bypass dren (azul) y en rojo SDT (ppm) como se reporta por el Bureau de Reclamación. La línea horizontal muestra la media.

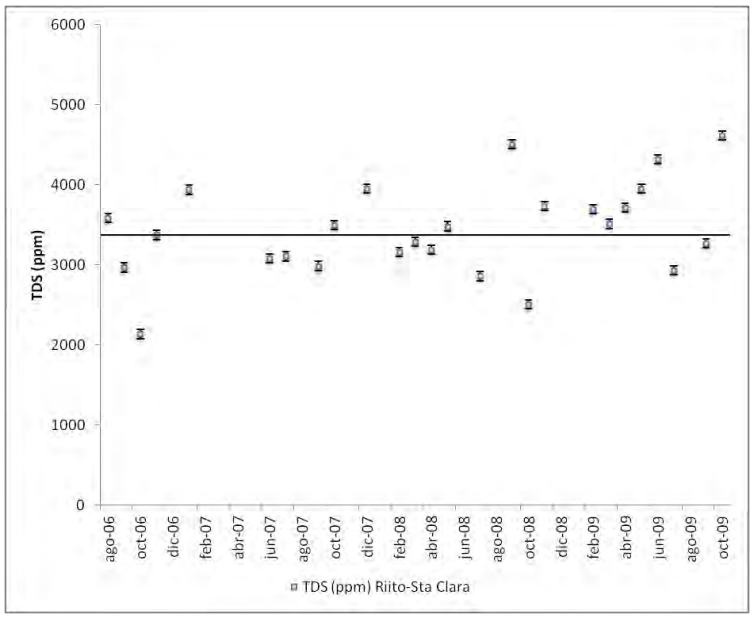

Fig. 3. Línea base de SDT en el dren Riito-Sta. Clara

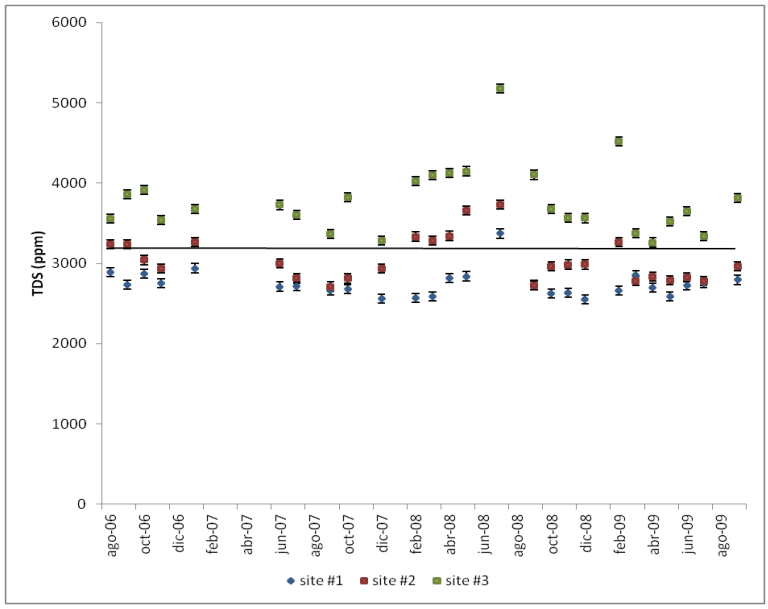

Fig. 4. Línea base de SDT en los sitios 1, 2 y 3 (con vegetación)

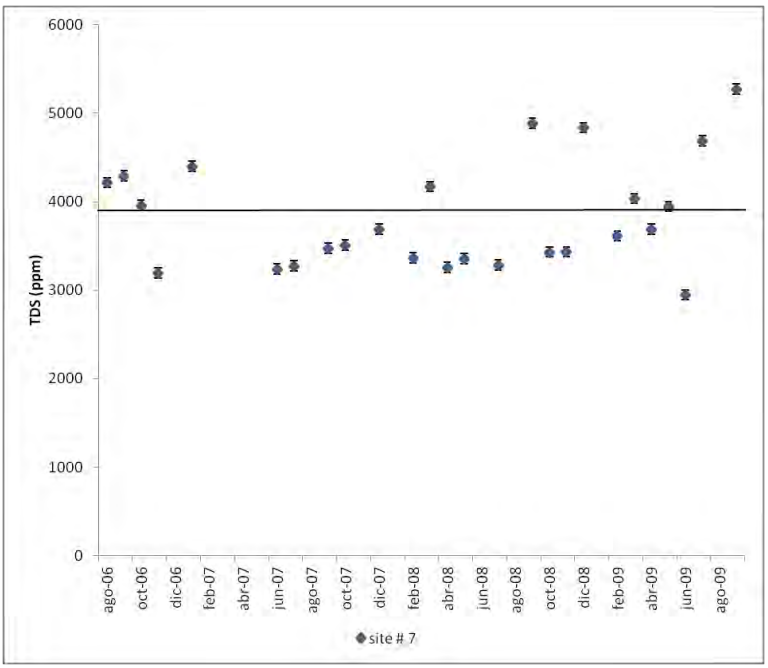

Fig. 5. Línea base SDT en sitio 7 (orilla)

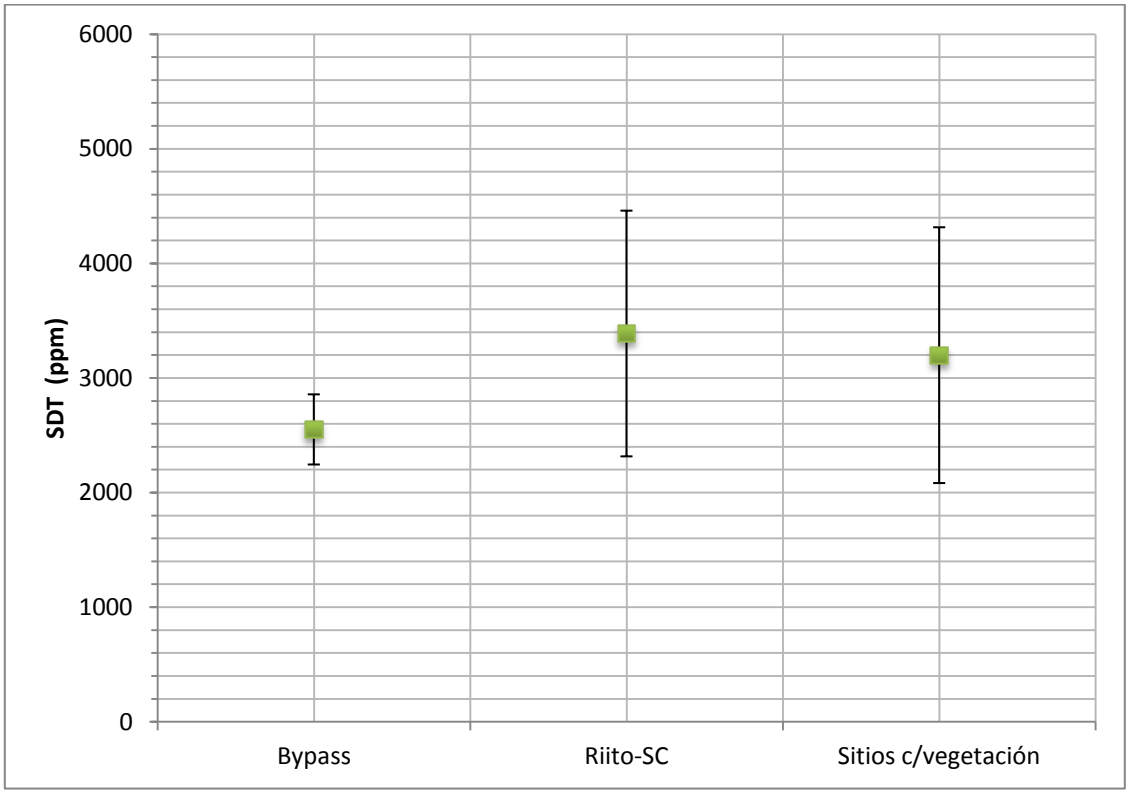

Fig. 6. SDT (ppm) en Dren Bypass, Riito-Santa Clara y sitios con vegetación (1,2,3) durante el periodo de línea base.

(2) Agua acordada pero sin operación de la Planta (Oct 2009 - Abr 2010)

Entradas

By-pass drain: los SDT variaron de 2,366 a 2,902 mg/l con una media de 2,620 ± 184 mg/l

Riito-Santa Clara: los SDT variaron de 2,500 a 4,614 mg/l con una media de 3,458 ± 525 mg/l

Porción con vegetación:

En los sitios 1,2,3,4,17,18,19 y 20, SDT varió entre 2,345 y 4,981 con una media de 2,857 ± 377 mg/l

Sitios de la orilla:

SDT en los sitios 7,10,11,13,14,15,16,22 y 23 variaron entre 2,941 a 17,609 con una media de 5,389 ± 2,733 mg/l

Un resumen de SDT durante este periodo se observa en la Fig. 7

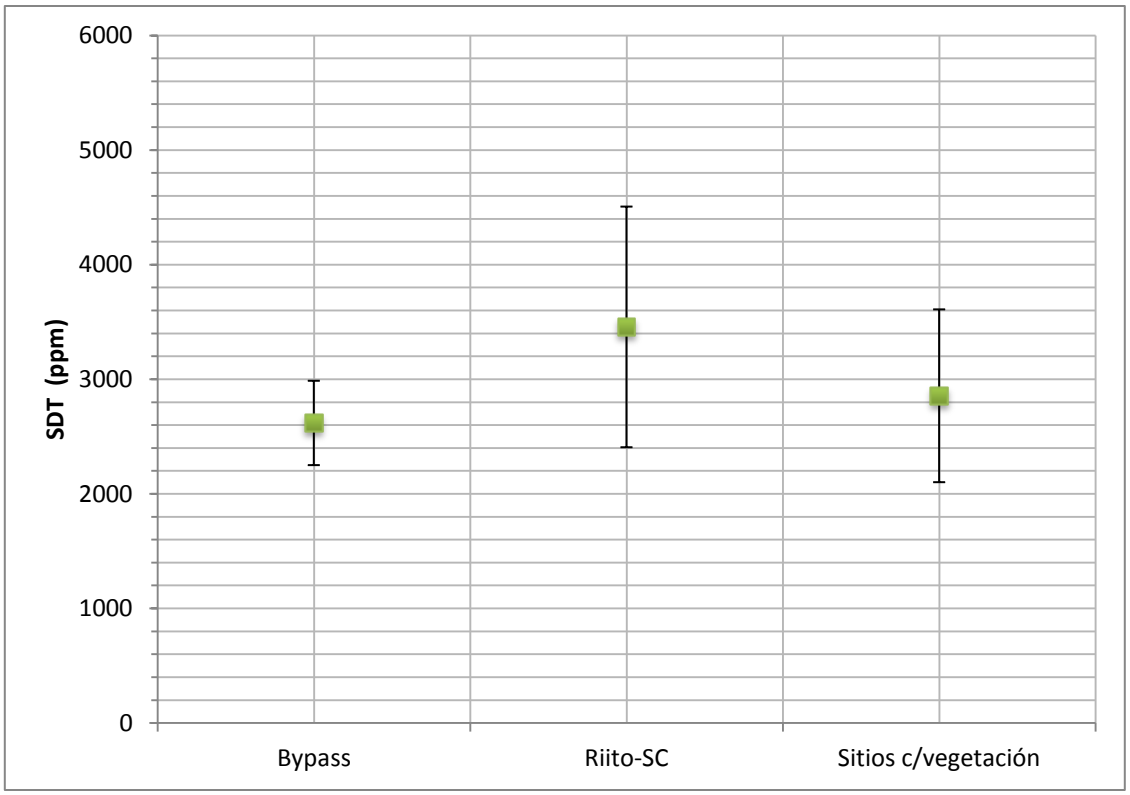

Fig. 7. SDT (ppm) en Dren Bypass, Riito-Santa Clara y sitios con vegetación (1,2,3,4,17,18,19 y 20) durante el periodo de agua acordada pero sin operación de la planta

(3) Solo operación de la PDY

Entradas

By-pass drain: los valores de SDT variaron entre 2,835 y 3,913 mg/l con una media de 3,418 ± 429 mg/l

Riito-Sta. Clara: las concentraciones de TDS variaron entre 3,914 a 4,840 mg/l con una media de 4,424 ± 375 mg/l

Porción con vegetación:

Los sitios 1,2,3,4,17,18,19 y 20 muestran SDT entre 2,971 a 6,609 con una media de 3,876 ± 611 mg/l

Sitios de la orilla:

Los sitios 7,10,11,13,14,15,16,22,23 muestran valores de SDT entre 3,594 a 28,978 con una media de 7,883 ± 5,215 mg/l

Un resumen de SDT durante este periodo se observa en la Fig. 8

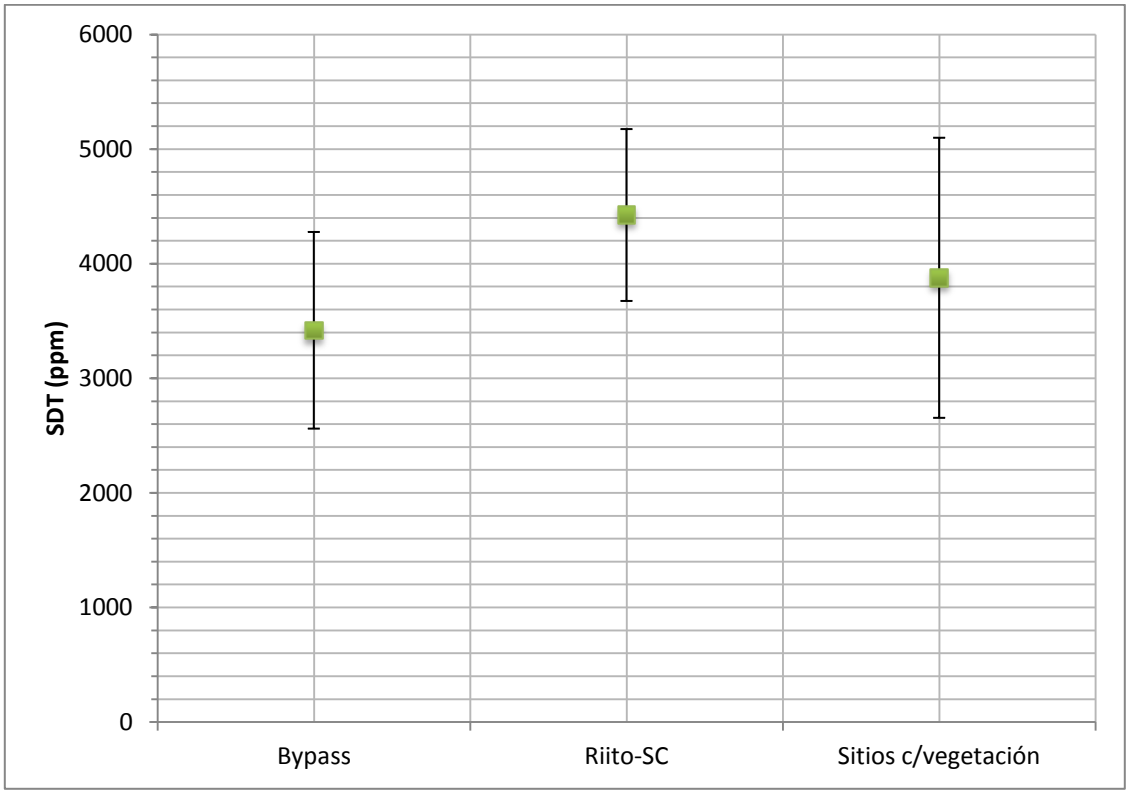

Fig. 8. SDT (ppm) en Dren Bypass, Riito-Santa Clara y sitios con vegetación (1, 2, 3, 4, 17, 18, 19 y 20) durante el periodo de operación de la PDY.

(4) Agua acordada y operación de la planta

Entradas

By-pass drain: los valores de SDT variaron entre 2,347 a 3,922 mg/l con una media de 3,131 ± 670 mg/l

Riito-Sta. Clara: las concentraciones de SDT variaron entre 3,899 a 4,635 mg/l con una media de 4,257 ± 238 mg/l

Porción con vegetación:

Los sitios 1,2,3,4,17,18,19 y 20 muestran valores de SDT entre 2,785 y 4,031 con una media de 3,402 ± 415 mg/l

Sitios de la orilla:

Los sitios 7,10,11,13,14,15,16,22,23 se monitorearon de Sep-Dec 2010, los valores de SDT variaron entre 3,520 a 7,782 con una media de 5,069 ± 990 mg/l

Un resumen de SDT durante este periodo se observa en la Fig. 9

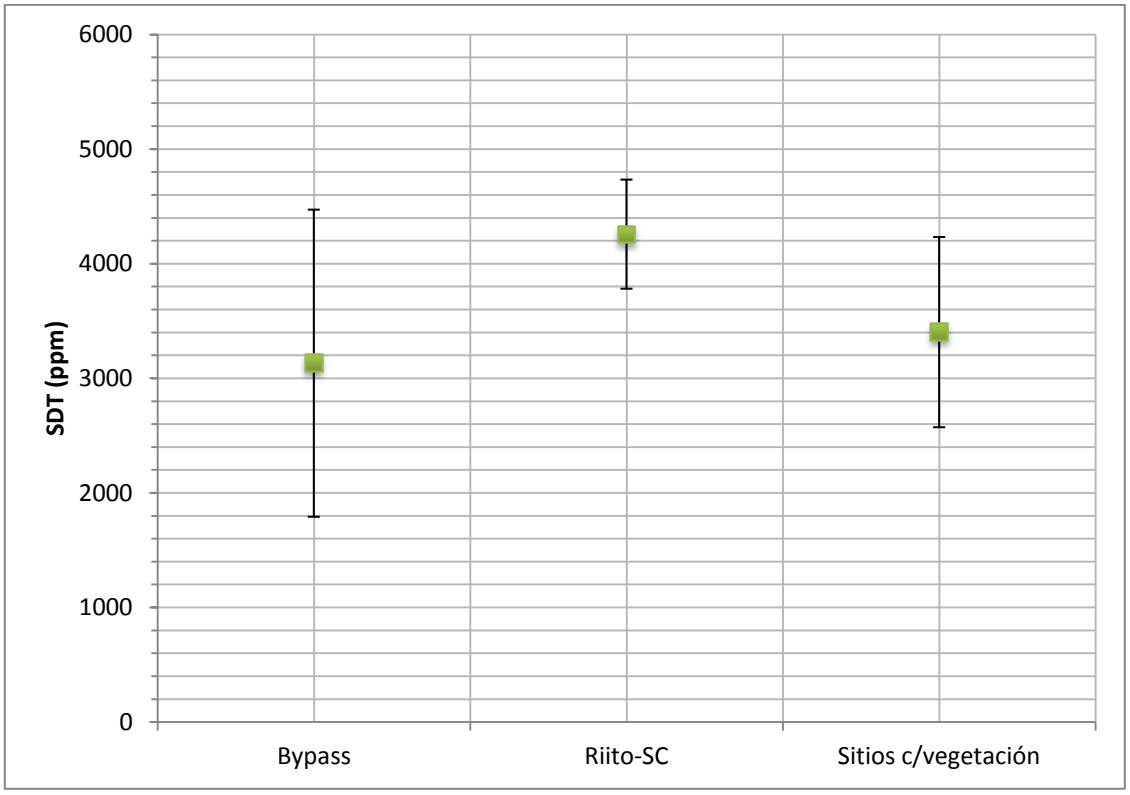

Fig. 9. SDT (ppm) en Dren Bypass, Riito-Santa Clara y sitios con vegetación (1, 2, 3, 4, 17, 18, 19 y 20) durante el periodo de operación de la PDY y agua acordada.

Distribución espacial de SDT

Utilizando los resultados de cada uno de los sitios de muestreo, desarrollamos las siguientes gráficas para demostrar la distribución espacial de SDT para los 4 escenarios descritos anteriormente.

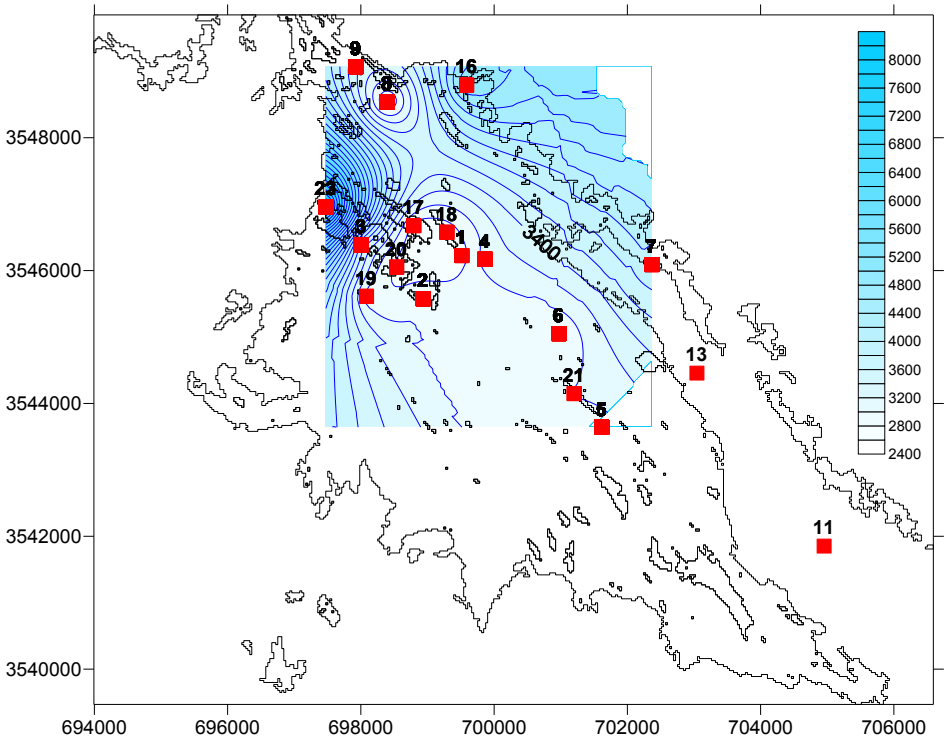

Fig. 10 Condiciones de línea base (SDT, ppm)

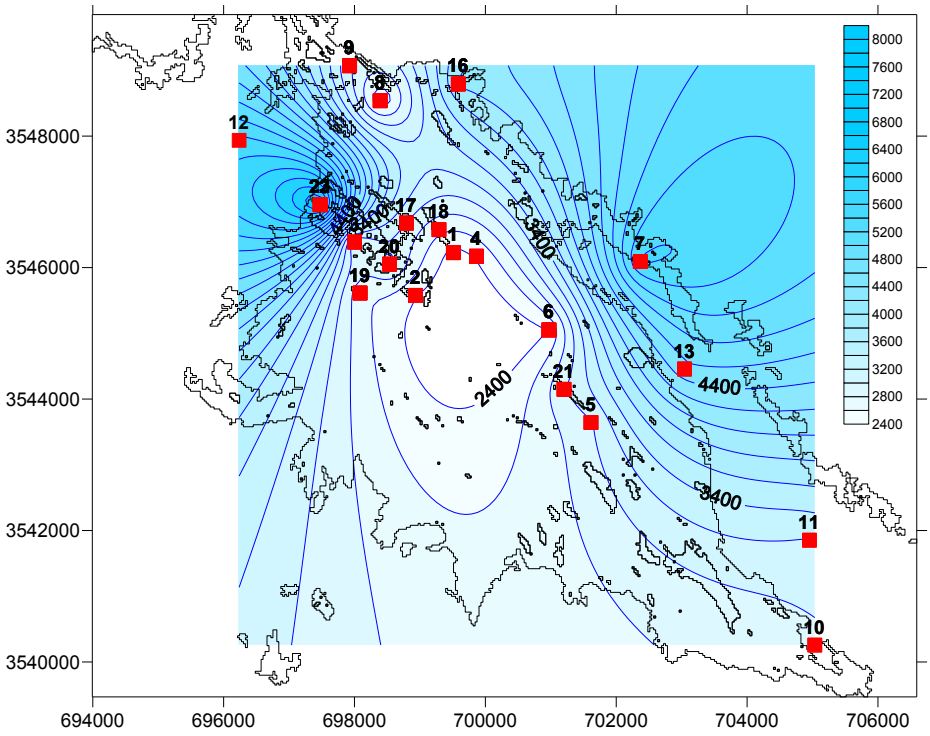

Fig. 11. Agua acordada pero sin operación de la planta (escenario 2) (SDT ppm)

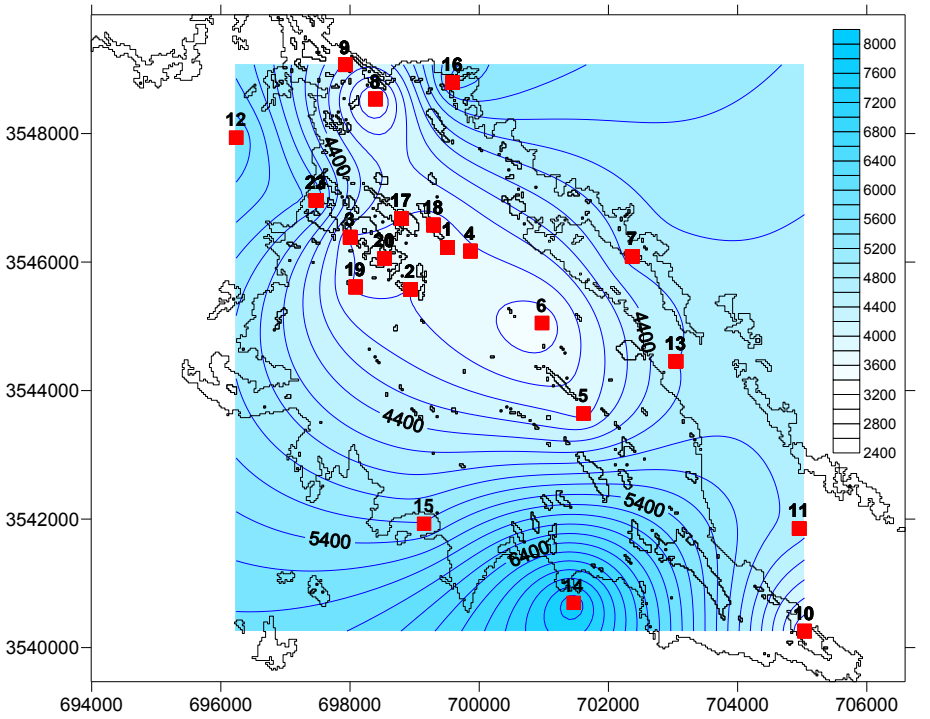

Fig. 12. Solo la operación de la planta (escenario 3) (SDT ppm)

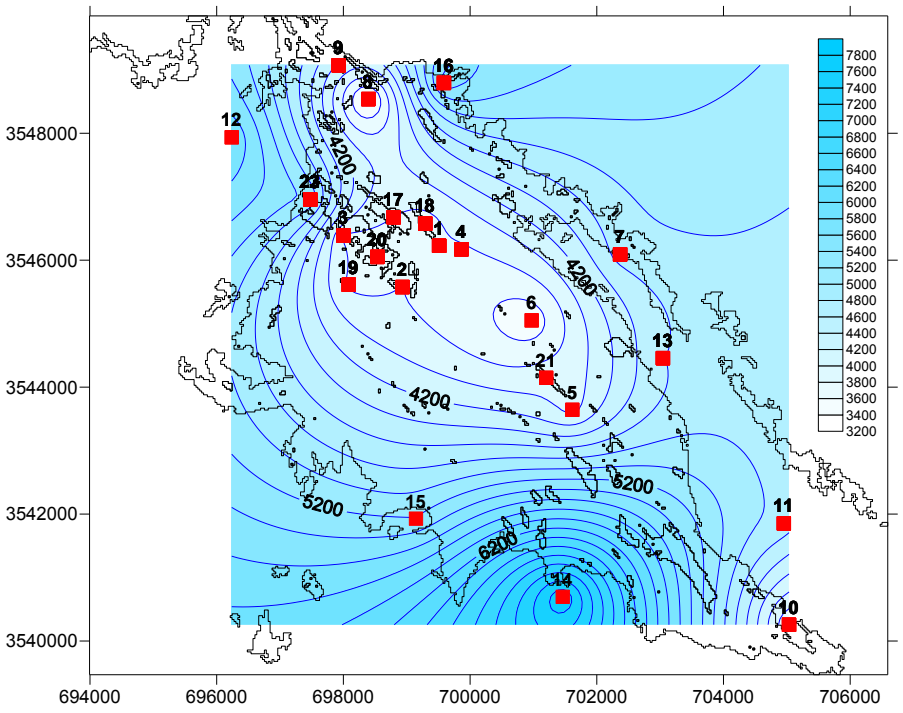

Fig. 13. Agua acordada y operación de la planta (escenario 4) (SDT ppm)

Resultados de SDT (lecturas automáticas)

Los loggers o lectores automáticos, se instalaron en los sitios 1, 4, 9, 10, 16 y 19. Lectores de los sitios 1, 4 y 19 estuvieron en la parte con vegetación de la Ciénega, y los lectores 10 y 16 estuvieron en la orilla. También hubo un lector en el dren Riito-Sta Clara (sitio 9). Los SDT (mg/l) se reportan para estos seis lectores en las figuras 14-19.

.

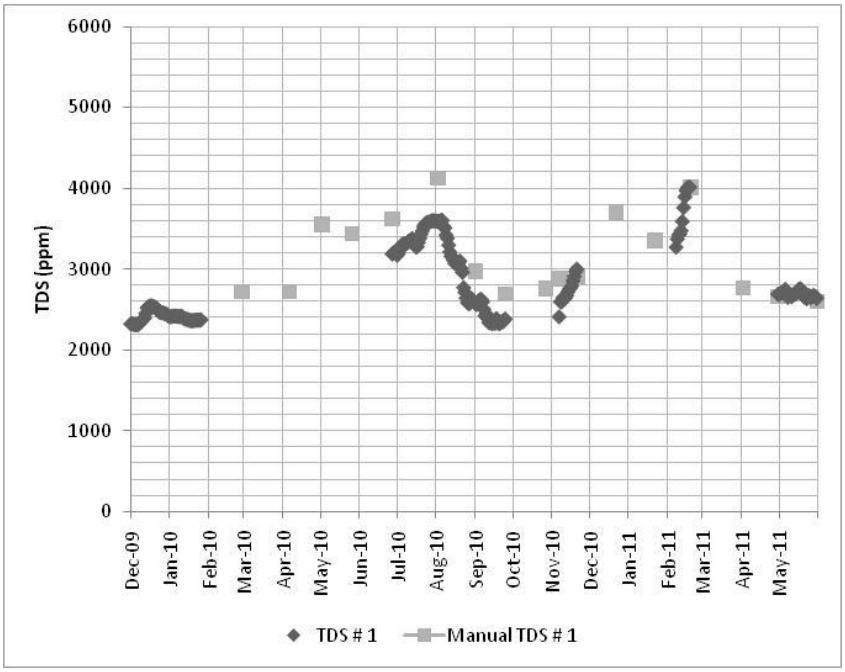

Fig. 14. Promedio diario (SDT) ppm del lector ubicado en sitio 1

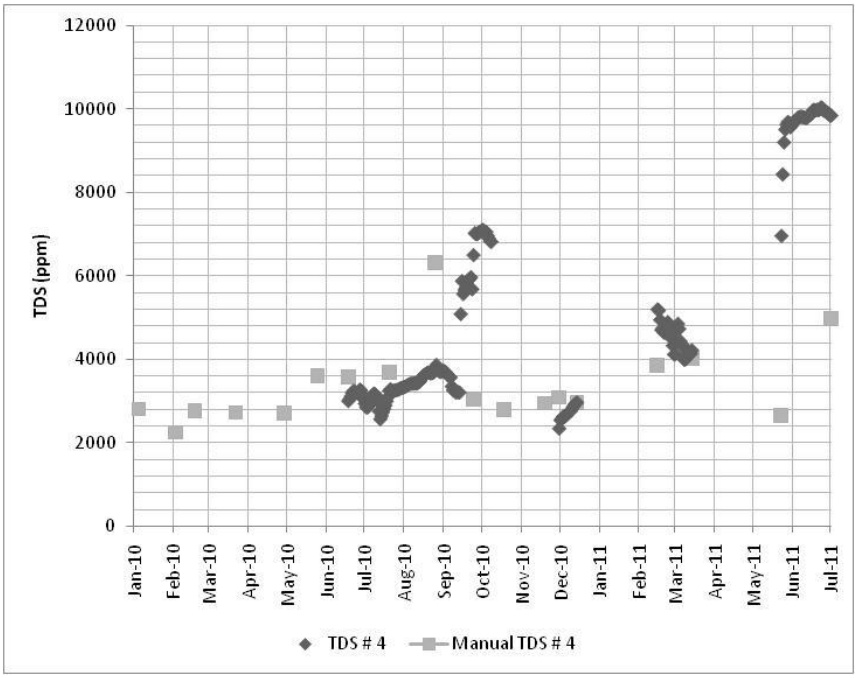

Fig. 15. Promedio mensual (SDT) ppm del lector ubicado en sitio 4.

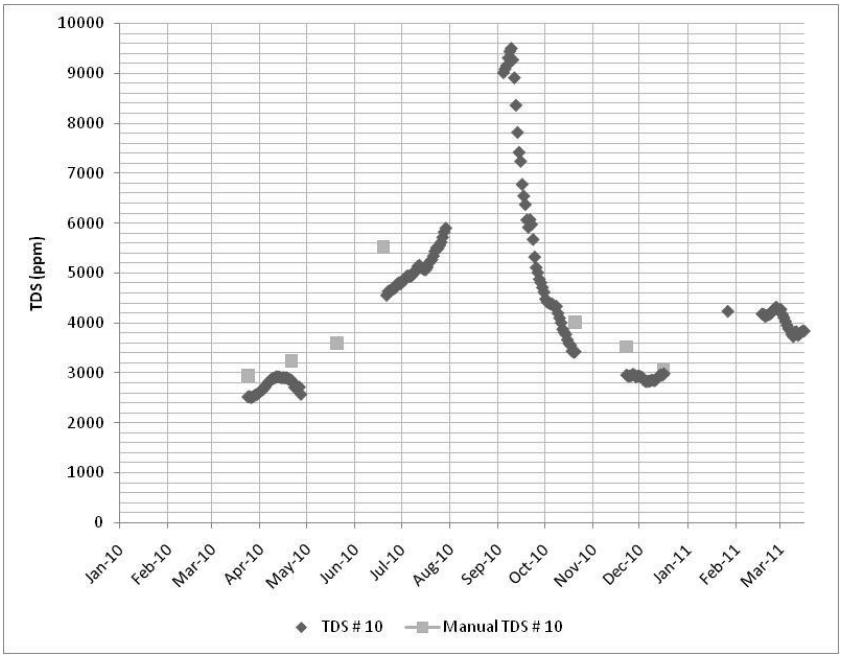

Fig. 16. Promedio mensual de SDT (ppm) del lector ubicado en sitio 10

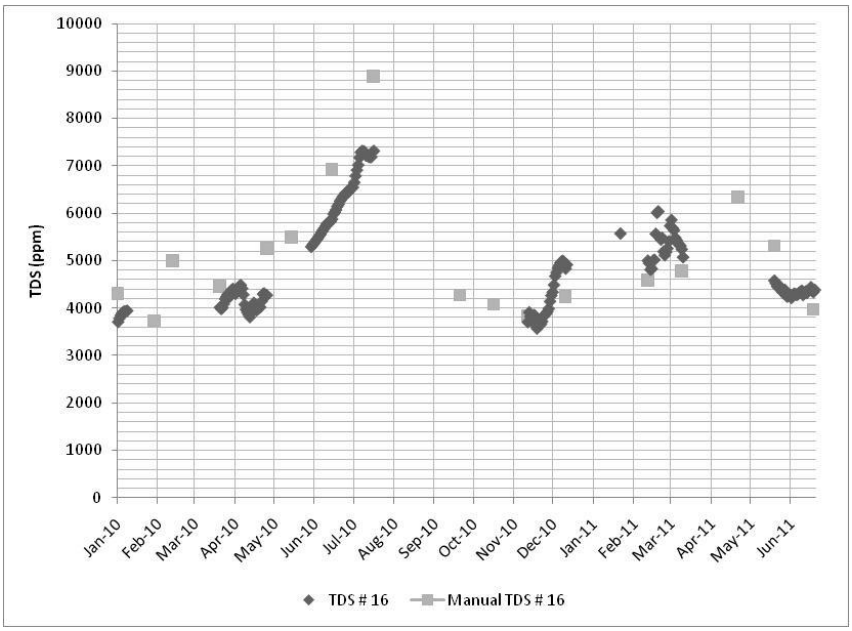

Fig. 17. El promedio mensual de SDT (ppm) del lector ubicado en sitio 16

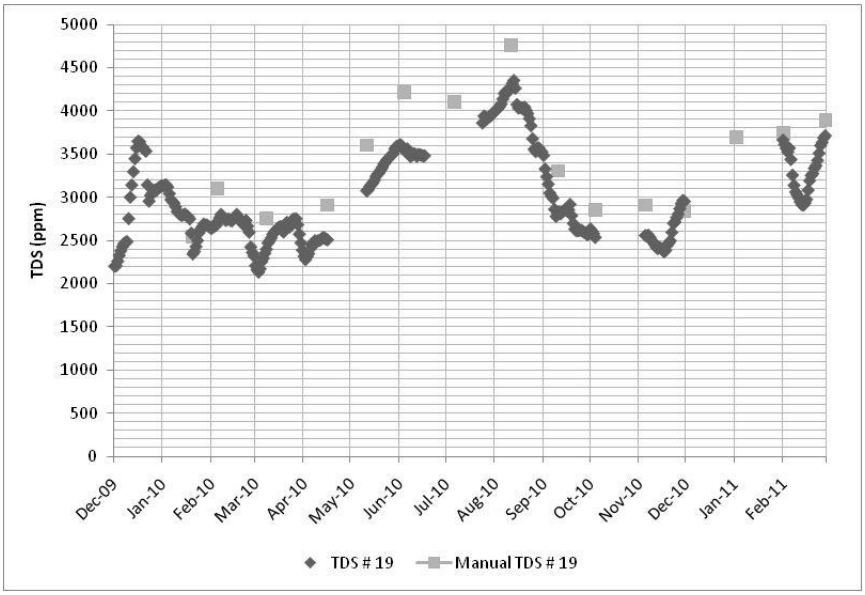

Fig. 18. Promedio mensual de SDT (ppm) del sensor ubicado en sitio 19

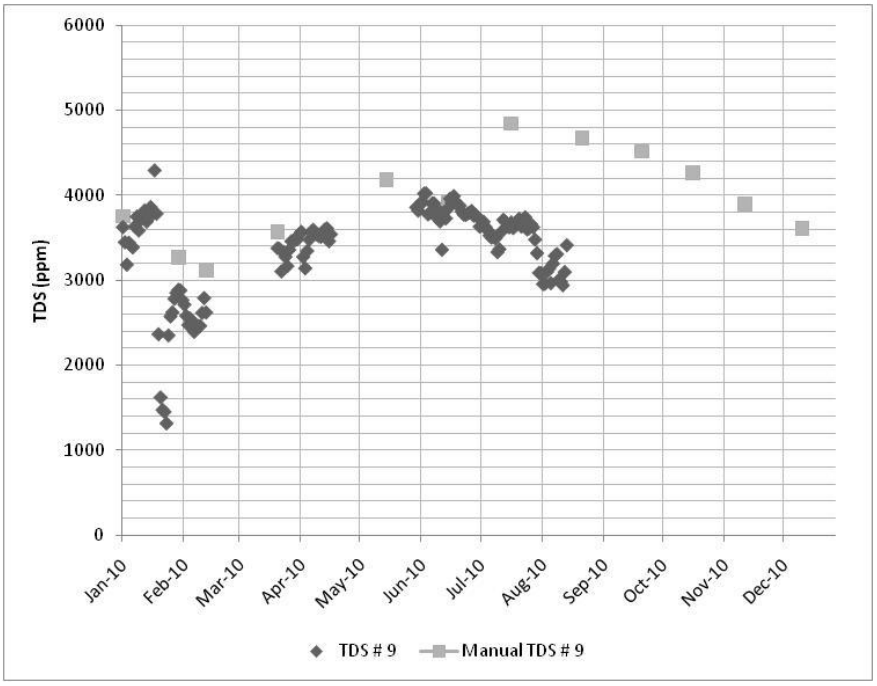

Fig. 19. Promedio mensual SDT (ppm) de los lectores ubicados en sitio 9 (dren Riito-Santa Clara)

Discusión de resultados de SDT

Usando los valores de SDT de la porción con vegetación de la Ciénega (data logger 19, N = 14,225) y separando los datos entre los periodos 2, 3 y 4 como se definió anteriormente, encontramos diferencias significativas entre los tres periodos (ANOVA de una vía, *p-value* < 0.0001, Tukey-Kramer HSD alpha = 0.05). La media de SDT del

periodo 2 fue 2,717 ± 327 mg/l, del periodo 3 fue 3,581 ± 418 y del periodo 4 fue 2,877 ± 392 (Fig. 20).

Por lo tanto, de Octubre 2009 a Abril 2010 y de Abril a Junio 2011, el agua acordada si bajó la salinidad dentro del humedal. Después de Mayo a Septiembre 2010, la salinidad se incrementó debido a la operación de la planta y la falta de agua acordada, y de Octubre 2010 a Mayo 2011 con la operación de la planta pero con agua acordada, los valores de SDT disminuyeron comparados con el periodo de tiempo anterior.

Comparando el periodo completo de la operación de la planta (Octubre 2009 a Marzo 2011 usando datos de campo de los sitios 1, 2 y 3, N = 47) con respecto a los datos de línea base o escenario 1 (utilizando los datos de campo de los mismos sitios, N = 52), no se detectó una diferencia significativa (*t-test* p-value = 0.76), la línea base de SDT fue de 3,316 ppm ± 589, y la media durante la operación de la planta fue de 3,281 ppm ± 561 (Fig. 21).

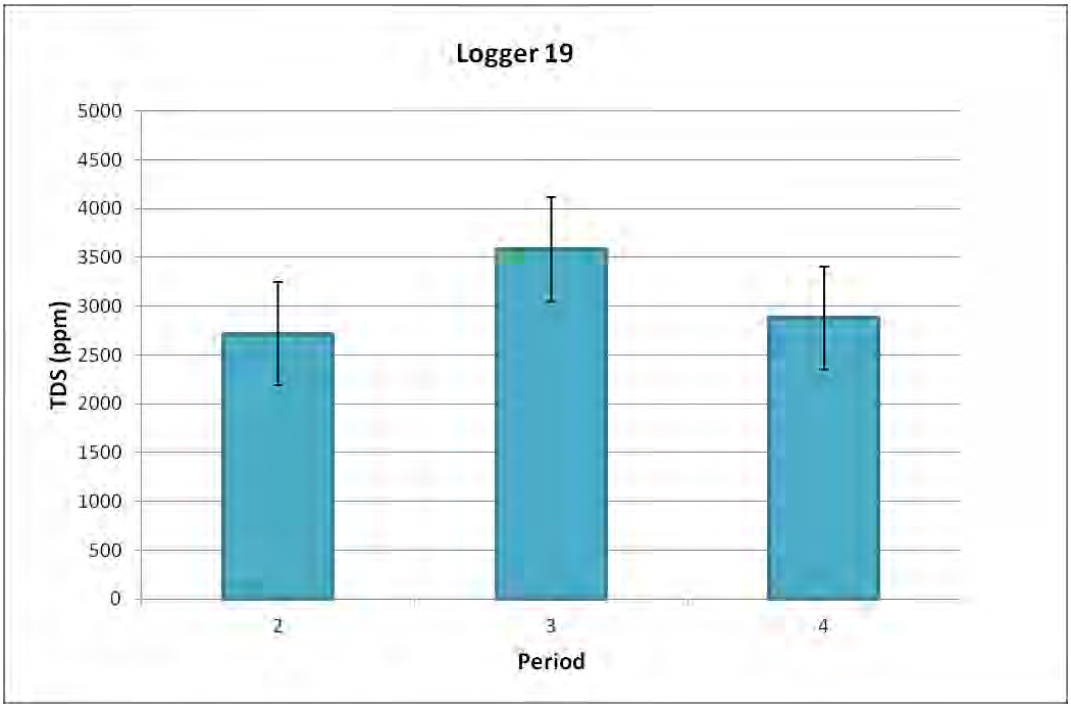

Fig. 20. Comparación entre los tres periodos definidos anteriormente en los sitios dentro de la Ciénega (lectores 1, 4 y 19).

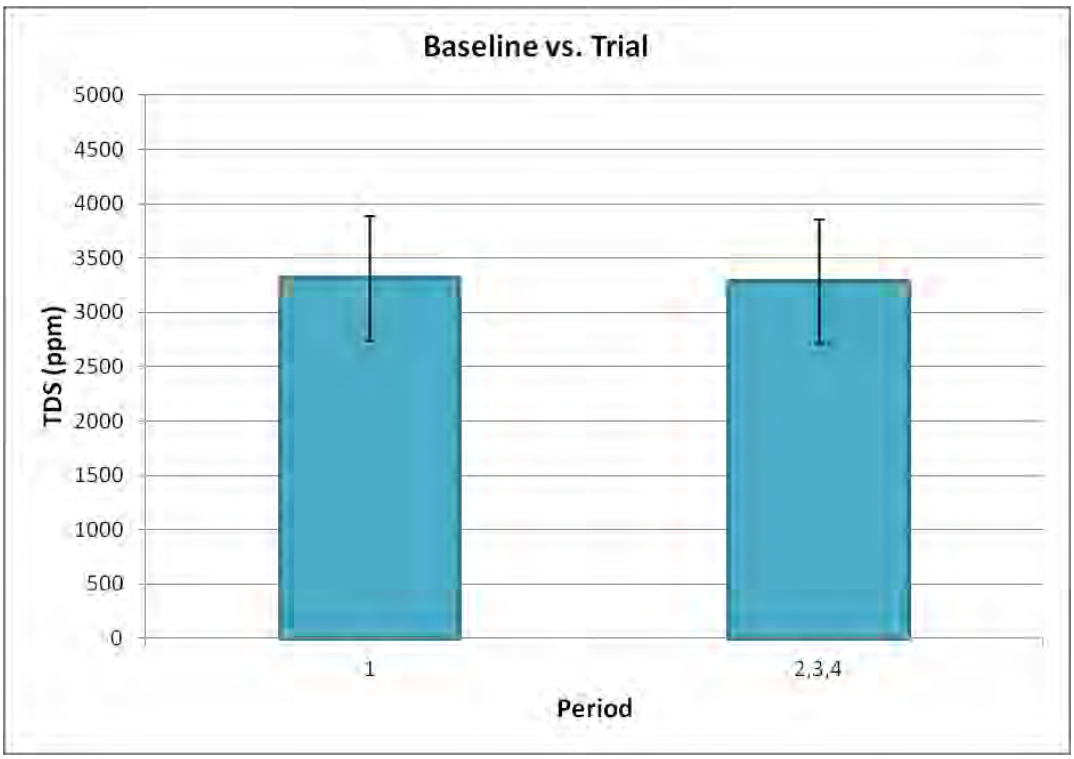

Fig. 21. Comparación entre los valores de línea base (periodo 1) y la operación de la planta (periodos 2,3, y 4) (ppm)

5.2. Parámetros fisicoquímicos

La temperatura de todas las estaciones de Agosto del 2006 a Junio del 2011 varió entre 5.8 y 36.4 °C con un promedio de 20.6 °C y una desviación estándar de 6.4°C. Las mayores temperaturas se detectaron en los meses de verano (Junio a Septiembre) y temperaturas más bajos en el invierno (Diciembre a Febrero), esta tendencia también se observó durante el periodo de prueba de la planta desaladora de Yuma (Fig. 22).

Hubo poca variación en los valores de pH (desv. std = 0.36), los valores oscilaron entre 6.63 y 9.63 con un promedio de 8.04 (Fig. 23), y durante el periodo de prueba de la planta el pH varió entre 6.6 y 9.6 con un promedio de 7.9 una desviación estándar de 0.34, por lo que tampoco hubo alteración en los parámetros de pH tampoco.

Las concentraciones de oxígeno variaron entre 0.17 y 23.48 mg/l con una desviación estándar de 3.8 mg/l. Aunque las mediciones de oxígeno no se hicieron a la misma hora en cada punto, parece haber un patrón en donde se observan mayores concentraciones de oxígeno en el invierno y menores durante el verano este patrón también se observó durante la operación de la planta en 2010 (Fig. 24).

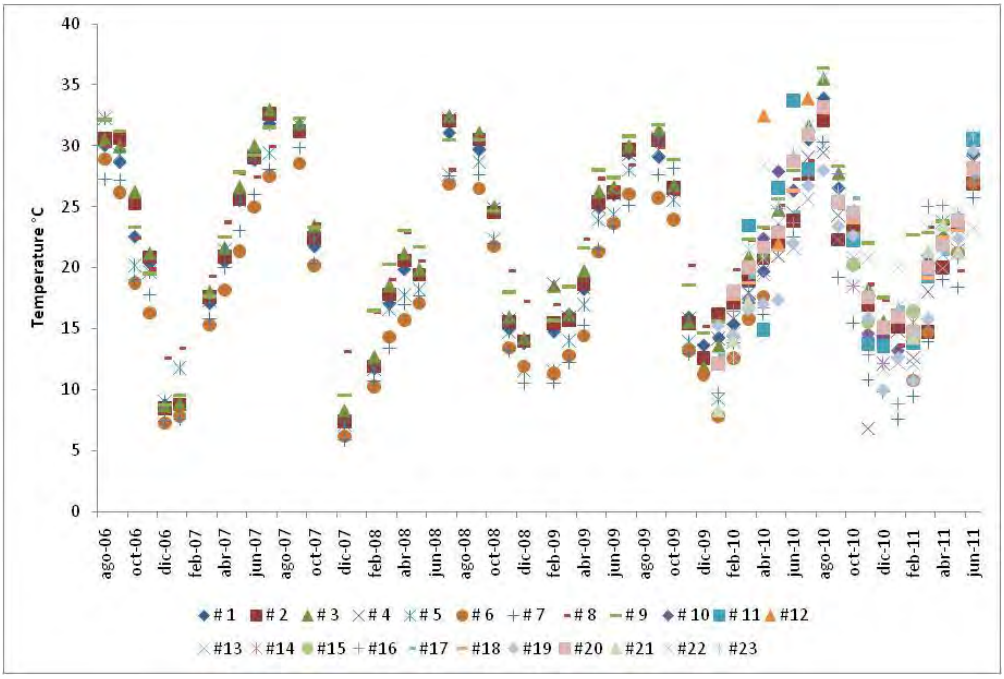

Fig. 22. Variaciones de temperatura en todos los sitios de Agosto 2006 a Junio 2011

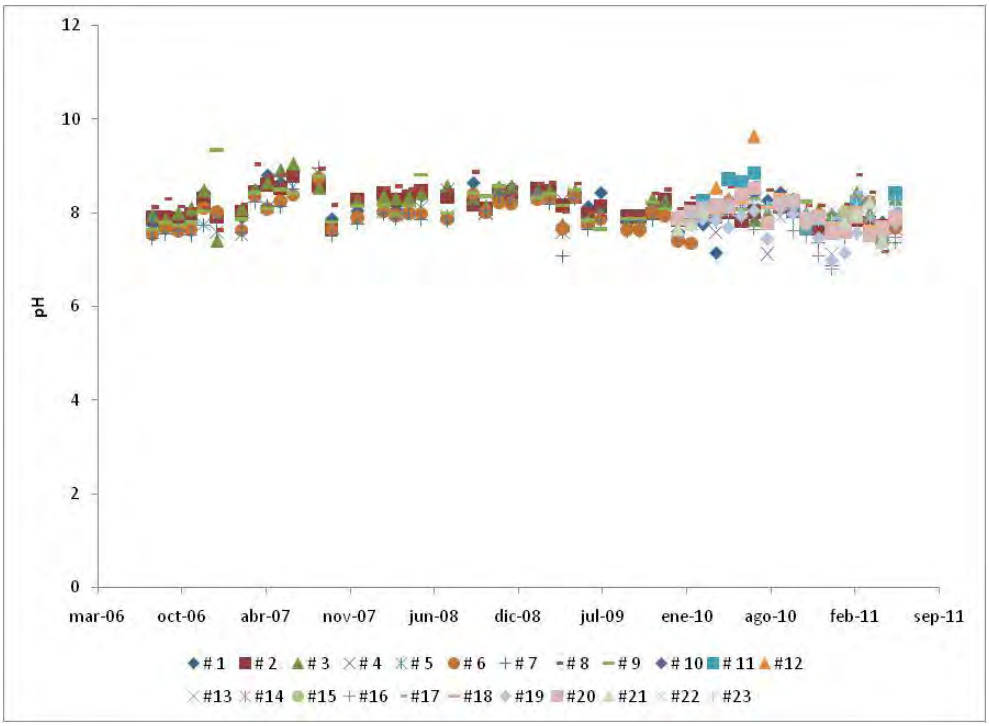

Fig. 23. Variaciones en los valores de pH de Agosto 2006 a Junio 2011 en todos los sitios

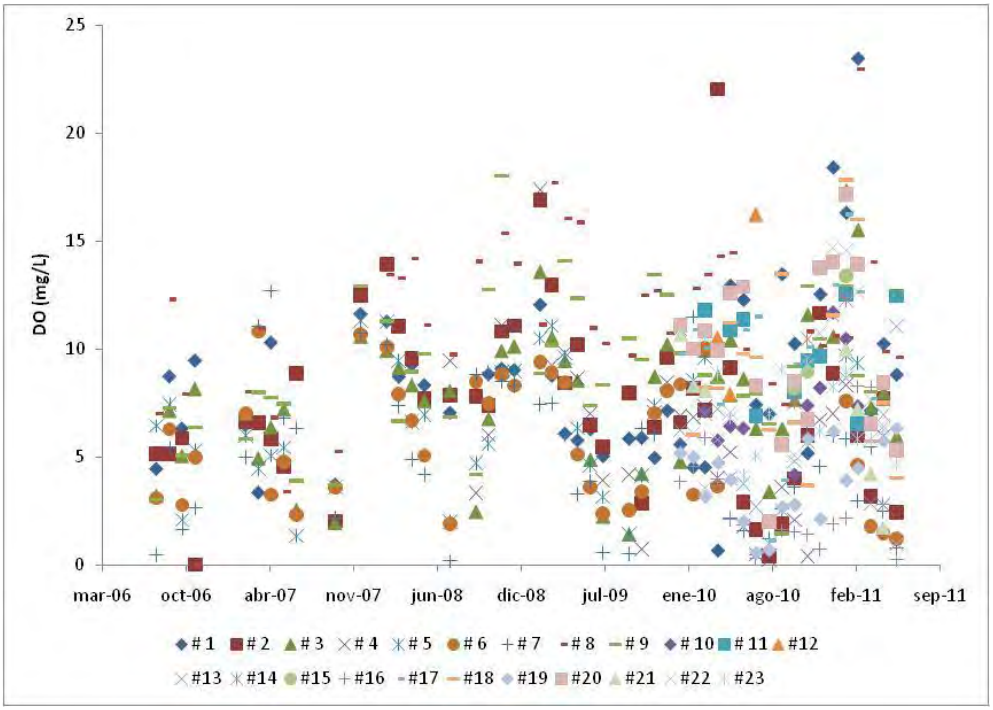

Fig. 24. Variaciones en OD (mg/l) de Agosto 2006 a Sep 2011.

5.3. Contaminantes

El monitoreo a largo plazo de contaminantes en la Ciénega de Santa Clara es necesario ya que es un sistema semi-cerrado que recibe agua de dren agrícola de los E.E.U.U. y de México. Además de Mayo del 2010 a Marzo del 2011 la PDY operó al 50% de capacidad y la salmuera de la planta se reincorporó al canal Bypass que alimenta la Ciénega. Se realizó un muestreo antes de la operación de la planta en 2010 y otro durante la operación en 2011 para evaluar las concentraciones de metales pesados y plaguicidas en agua, sedimento superficial y peces de diferentes estaciones dentro de la Ciénega y de los dos drenes de entrada, el dren Riito y el dren Bypass. Monitorear solamente agua no provee información sobre la posible bioacumulación de contaminantes en la cadena alimenticia, por lo tanto las matrices de sedimento y peces se incluyeron en este esfuerzo.

Muestras de peces (bocón, *Micropterus salmoides*) se colectaron en las lagunas norte en estos dos muestreos (sitios 1, 2, 3). En el muestreo previo a la operación de la planta se colectaron muestras de los sitios 1, 5, 6, 12, 13, 16, 21 y 23 además de los dos drenes de entrada (Fig. 25). El sitio 1 se localiza en la zona en donde desemboca el dren Bypass dentro de la laguna, los sitios 5, 6 y 21 están en la sección central de la parte con vegetación de la Ciénega y el sitio 12 se localizó en una laguna recién formada en la parte norte, los sitios 13 y 16 se localizaron en la parte este de la Ciénega y el sitio 23 cerca del campo ecoturístico en el norte de la laguna.

En el segundo muestreo, algunos de estos sitios estaban inaccesibles debido al temblor y al fuego, por lo tanto no fue posible muestrear en los mismos puntos que en año

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previo, por lo que se muestrearon los sitios 1,2, 10, 13, 14, 15, 16, 23 y las dos entradas (Fig. 26). Los sitios en común fueron el 1, 13, 16, 23 y los dos drenes de entradas.

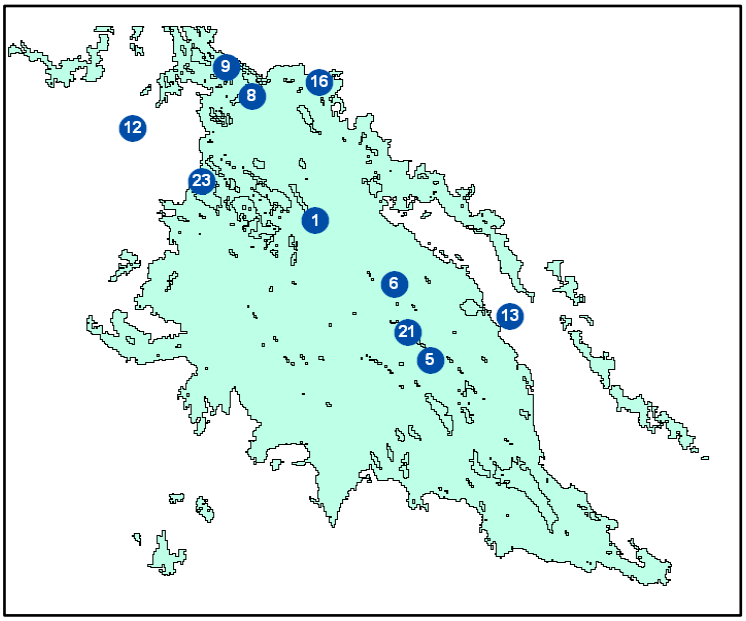

Fig. 25. Localización de las estaciones de muestreo previo a la operación de la planta en 2010

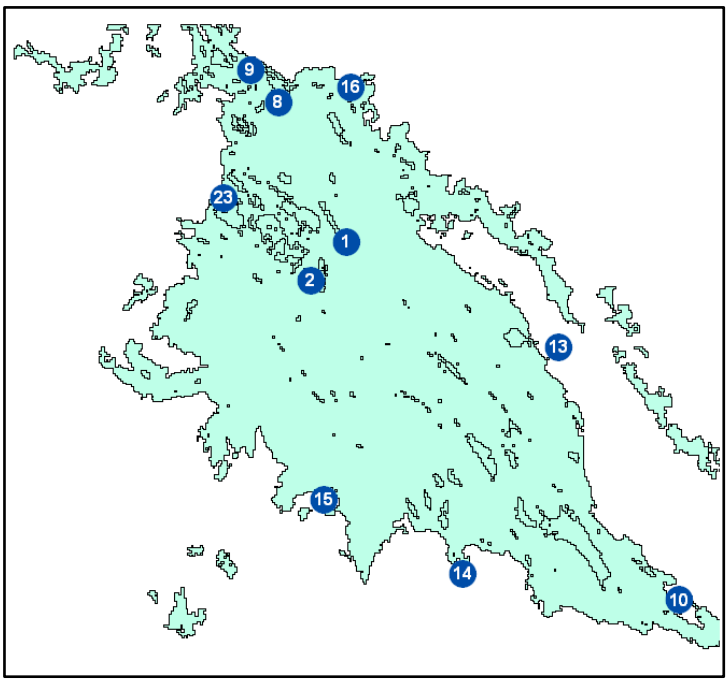

Fig. 26. Localización de los sitios de muestreo durante la operación de la planta en 2011.

5.4. Concentración de metales pesados

El análisis de metales pesados se realizó usando un Espectrofotómetro de absorción atómica (AA) marca Perkin-Elmer 1100B. Para analizar mercurio, el AA se acopló con un generador de hidruros (MHS-20) y el método utilizado fue EPA-7471. Arsénico se analizó en el AA acoplado con horno de grafito y se utilizó el método de la EPA-7060A. Plomo, cadmio y cobre se midieron en el AA acoplado a flama con los métodos 7420, 7130 y 220 respectivamente. Selenio se analizó con un equipo Varian SpectrAA-240-FS acoplado con generación de hidruros modelo VGA-77 y el método usado fue EPA-7741. Los resultados de control de calidad se muestran en la Tabla 2.

Tabla 2. Resultados de Control de Calidad/Aseguramiento de calidad para metales pesados

Metal/Matriz	Límite de detección (µg/l)	%Recuperación*	% Diferencia relativa
Selenio			
water	1		10.0
Sediment	1	191	3.9
fish	1	104	2.7
Mercurio			
water	1		13.2
Sediment	1	82	19.1
fish	1	79	7.5
Arsenico			
water	20		18.9
Sediment	20	126	5.2
fish	20	161	15.7
Plomo	500	73	<DL**
Cadmio	500	120	<DL
Cobre	500	133	<DL

*Para sedimentos usamos material de referencia PACS-2 (Marine sediment reference materials for trace metals and other constituents) y para peces usamos DORM-2 (dogfish muscle reference material for trace metals) y DOLT-4 (Dogfish liver certified reference material for trace metals) todos son material de referencia del National Research Council Canada (NRC-CNRC)

5.5. Selenio

Selenio en agua (selenio total recuperable)

El semi-metal Selenio generalmente ocurre como una mezcla de varias especies químicas en las aguas naturales, sin embargo, dos especies inorgánicas químicas, selenito y selenato, son las predominantes. Las concentraciones normales de Selenio en sitios de agua dulce no contaminados varían entre 0.25 y 0.4 µg/l (ppb) (NIWQP, 1998). Existen límites para protección de vida acuática desarrollados por la U.S. EPA (2009), las

cuales especifican una concentración de 5 µg/l como límite para efectos crónicos y de entre 13 y 186 µg/l para efectos agudos.

En 2010 antes de la operación de la planta y durante el periodo de agua acordada, las concentraciones en el dren Bypass excedieron el límite de daños crónicos en organismos, y dentro del humedal, las concentraciones en dos puntos excedieron el límite agudo (Tabla 3). En 2011 durante la operación de la planta, las concentraciones de selenio disminuyeron en el dren Bypass a la mitad que las del 2010 y también dentro de la Ciénega disminuyeron, ninguno de los valores excedió el límite.

La distribución de selenio en la Ciénega fue consistente en los dos periodos de muestreo, en donde se encontraron menores concentraciones en la orilla Este del humedal (sitios 10 y 13) y concentraciones más altas en la parte central y norte (Figs. 27 y 28).

Tabla 3. Concentraciones de Selenio en Agua de la Ciénega de Santa Clara en 2010

Guía/sitio	**Se en agua (µg/l)**	
SQUIRT[1]	**Crónico**	**Agudo**
	5.0	**13-186**
1	7.31	
5	**13.86**	
6	**20.18**	
12	**13.86**	
13	0.33	
16	0.33	
21	0.54	
23	0.95	
By-pass dren	10.71	
Riito-Sta. Clara	7.56	

[1]Buchman, M.F. 2008. NOAA Screening Quick Reference Tables, NOAA OR&R Report 08-1, Seattle WA, Office of Response and Restoration Division, National Oceanic and Atmospheric Administration, 34 pages.

Tabla 4. Concentraciones de selenio en agua en la Ciénega de Santa Clara en 2011.

Guía/sitio	**Se en agua (µg/l)**	
SQUIRT[1]	**Crónico**	**Agudo**
	5.0	**13-186**
1	7.09	
2	8.44	
10	1.33	
13	1.20	
14	6.89	
15	5.73	
16	5.83	
23	10.59	
By-pass dren	5.36	
Riito-Sta. Clara	1.00	

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[1]Buchman, M.F. 2008. NOAA Screening Quick Reference Tables, NOAA OR&R Report 08-1, Seattle WA, Office of Response and Restoration Division, National Oceanic and Atmospheric Administration, 34 pages.

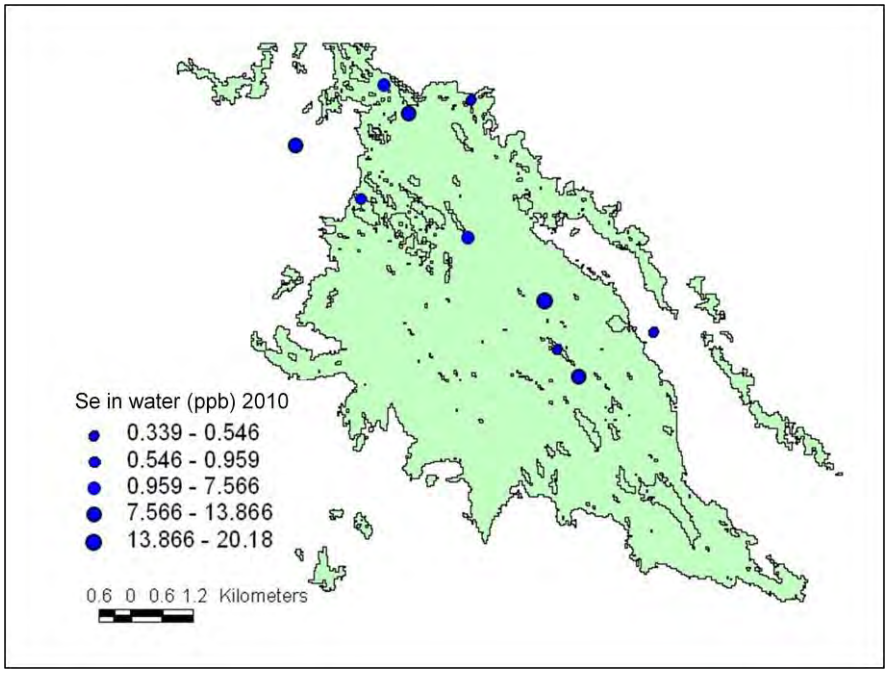

Fig. 27. Distribución de Selenio en agua µg/l durante el muestreo del 2010.

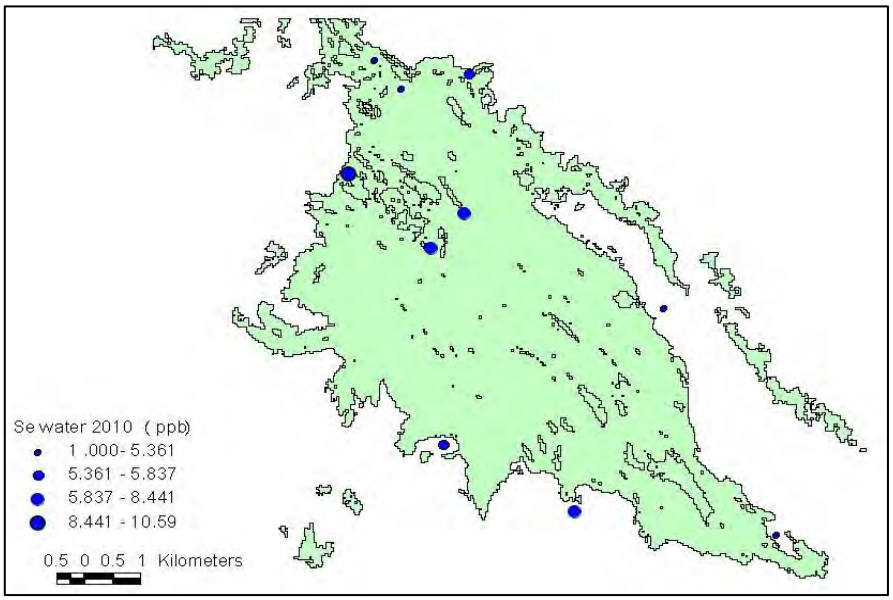

Fig. 28. Distribución de las concentraciones de Selenio (µg/l) durante el 2011.

Selenio en sedimento superficial

Actualmente existe poca información empírica que sustente el riesgo en peces y vida silvestre como una función de la concentración de selenio en sedimento, una comparación mostró poca correlación entre las concentraciones de selenio en sedimento y los invertebrados bentónicos. Como regla general, sin embargo, cuando las concentraciones en sedimento excedan los 5 mg/kg, se recomienda realizar mas investigación (NIWQP, 1998).

Nuestros resultados muestran concentraciones que varían entre 1.3 y 3.0 mg/kg en ambos años (Tablas 5 y 6) ninguna de las muestras estuvo por encima de 5 mg/kg. Igual que en agua, las concentraciones en sedimento también disminuyeron en 2011 comparadas con 2010 en el dren Bypass y en todos los sitios dentro del humedal. Las mayores concentraciones también se observan en la parte central de la laguna especialmente en el muestreo del 2010 (Figuras 29 y 30).

Tabla 5. Concentraciones de selenio en sedimento superficial de la Ciénega de Santa Clara en 2010.

Guía/sitio	**Se en sedimento (mg/kg)**
NIWQP[1]	5
1	1.57
5	3.01
6	1.09
12	2.24
13	2.26
16	1.46
21	1.86
23	1.64
By-pass drain	2.32
Riito-Sta. Clara	2.18

[1]National Irrigation Water Quality Program. 1998. Guidelines for interpretation of the biological effects of selected constituents in biota, water and sediment. Selenium. Information Report No. 3. BOR, USFWS, USGS, BIA. 47 pp.

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Tabla 6. Concentraciones de selenio en sedimento superficial de la Ciénega de Santa Clara in 2011.

Guía/sitio	Se en sedimento (mg/kg)
NIWQP[1]	5
1	1.77
2	1.71
10	1.43
13	1.39
14	1.37
15	1.78
16	1.66
23	1.53
By-pass drain	1.80
Riito-Sta. Clara	1.64

[1]National Irrigation Water Quality Program. 1998. Guidelines for interpretation of the biological effects of selected constituents in biota, water and sediment. Selenium. Information Report No. 3. BOR, USFWS, USGS, BIA. 47 pp.

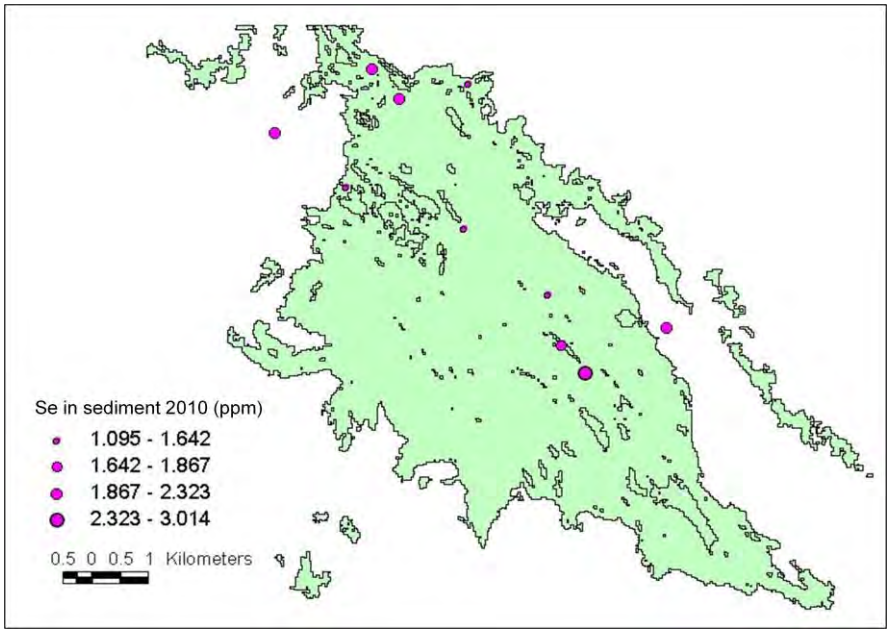

Fig. 29. Distribución de las concentraciones de selenio en sedimento (mg/kg) en 2010

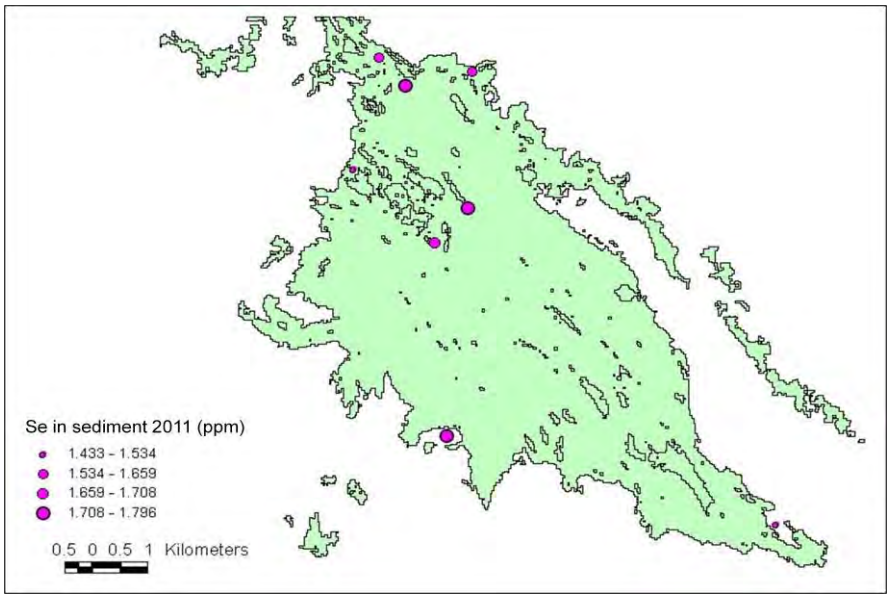

Fig. 30. Distribución de las concentraciones de selenio en sedimento (mg/kg) en 2011

Selenio en tejido de peces

Programas internacionales de monitoreo han revelado que la mayoría de especies de peces tienen un promedio de concentración de selenio menor a 4 mg/kg en una base de cuerpo completo. Los peces muestreados en dos lagos con concentraciones de selenio normales, tuvieron concentraciones menores a 2 mg/kg (NIWQP, 1998).

Nuestros resultados muestran concentraciones de selenio en músculo de bocón (*Micropterus salmoides*) de la Ciénega de Santa Clara colectados en las lagunas norte. Esta especie fue seleccionada ya sostiene a una pesquería deportiva. Las concentraciones de selenio en músculo variaron entre 0.8 y 1.5 mg/kg, ninguna de las muestras excedieron los 4 mg/kg. Al igual que agua y sedimento, las concentraciones de selenio también fueron menores en el 2010 (prueba de t-student, *p-value* = 0.001) (Fig. 31). Una relación negativa se encontró entre la longitud total y las concentraciones de selenio, un 40% de la variación se explica por la talla y peso de los organismos, peces mas grandes y con mas peso tuvieron menores concentraciones de selenio en músculo que individuos mas pequeños.

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Tabla 7. Concentraciones de Selenio en peces (*Micropterus salmoides*) de la Ciénega de Santa Clara, en 2010 y 2011.

Fecha de colecta	**Longitud total (cm)**	**Peso (g)**	**Se (mg/kg)**
NIWQP[1]			2-4
feb-10	38	1000	1.19
feb-10	36	466	1.41
feb-10	42	1000	1.24
feb-10	31	448	1.28
feb-10	32	526	1.49
feb-10	32	476	1.32
feb-10	31	522	1.54
jun-10	51	1.9	0.84
jun-10	41	1.153	1.36
jun-10	18	0.076	0.97
jun-10	47	1.628	0.83
jun-10	45	1.327	0.82
oct-10	36	0.74	1.33
oct-10	30	0.33	1.41
oct-10	42	1.069	0.96
oct-10	47	1.783	0.82
oct-10	49	2.15	1.19
feb-11	36	0.715	1.11
feb-11	37	0.653	1.16
feb-11	34	0.545	1.13
feb-11	30	0.398	1.01
feb-11	32	0.548	1.07
feb-11	43	1.39	1.10

[1]National Irrigation Water Quality Program. 1998. Guidelines for interpretation of the biological effects of selected constituents in biota, water and sediment. Selenium. Information Report No. 3. BOR, USFWS, USGS, BIA. 47 pp.

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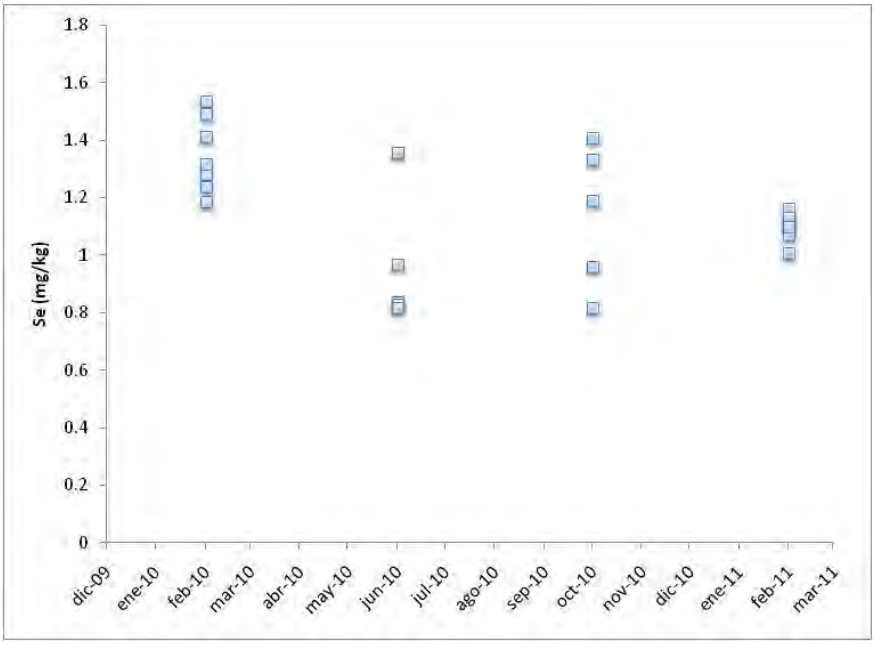

Fig. 31. Concentración de selenio en peces (mg/kg) de la Ciénega de Santa Clara

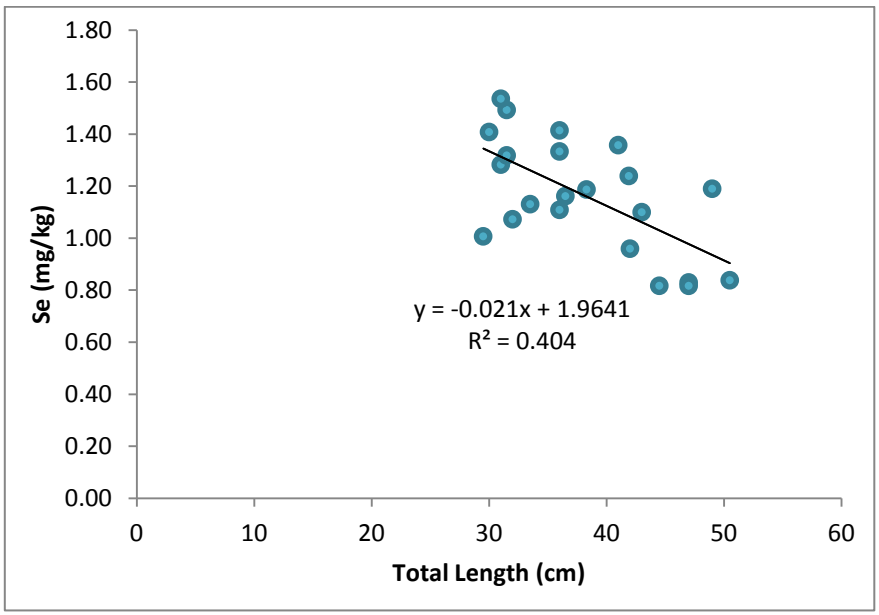

Fig. 32. Regresión linear entre la longitud total de los peces y la concentración de Selenio (mg/kg)

5.6. Mercurio

Mercurio en agua

Las concentraciones de mercurio en agua se utilizan para determinar efectos en peces y vida acuática. Las concentraciones de mercurio total en agua de 100-2000 µg/l causan mortalidad en especies sensibles acuáticas, y las concentraciones entre 30 y 100

µg/l causan efectos subletales en peces (NIWQP, 1998). Las concentraciones de mercurio en agua de la Ciénega variaron entre 0.25 y 7.73 µg/l, lo cual es mayor que las concentraciones de base, pero menores que la guía para protección de vida acuática (Tablas 8 y 9). La distribución de Hg en la Ciénega en 2010 fue menor en la orilla Este y mayor en el norte y centro del humedal, y en 2011 esta distribución varió con mayores concentraciones en las orillas y centro y menores en el norte (Figs. 33 y 34), sin embargo no hubo diferencias significativas entre los dos años.

Tabla 8. Concentraciones de mercurio en la Ciénega de SC en 2010

Guía/sitio	**Hg en agua (µg/l)**
NIWQP[1]	**Límite de toxicidad**
	>30
1	3.08
5	3.92
6	< DL
12	6.68
13	2.85
16	7.73
21	5.38
23	1.43
By-pass dren	5.62
Riito-Sta. Clara	2.83

[1]National Irrigation Water Quality Program. 1998. Guidelines for interpretation of the biological effects of selected constituents in biota, water and sediment. Selenium. Information Report No. 3. BOR, USFWS, USGS, BIA. 47 pp.

Tabla 9. Concentraciones de mercurio en la Ciénega de Santa Clara en 2011

Guía/sitio	**Se en agua (µg/l)**
SQUIRT[1]	**Límite de toxicidad**
	>30
1	7.00
2	2.88
10	1.77
13	5.11
14	2.88
15	5.44
16	2.66
23	1.44
By-pass drain	3.44
Riito-Sta. Clara	5.88

[1]National Irrigation Water Quality Program. 1998. Guidelines for interpretation of the biological effects of selected constituents in biota, water and sediment. Selenium. Information Report No. 3. BOR, USFWS, USGS, BIA. 47 pp.

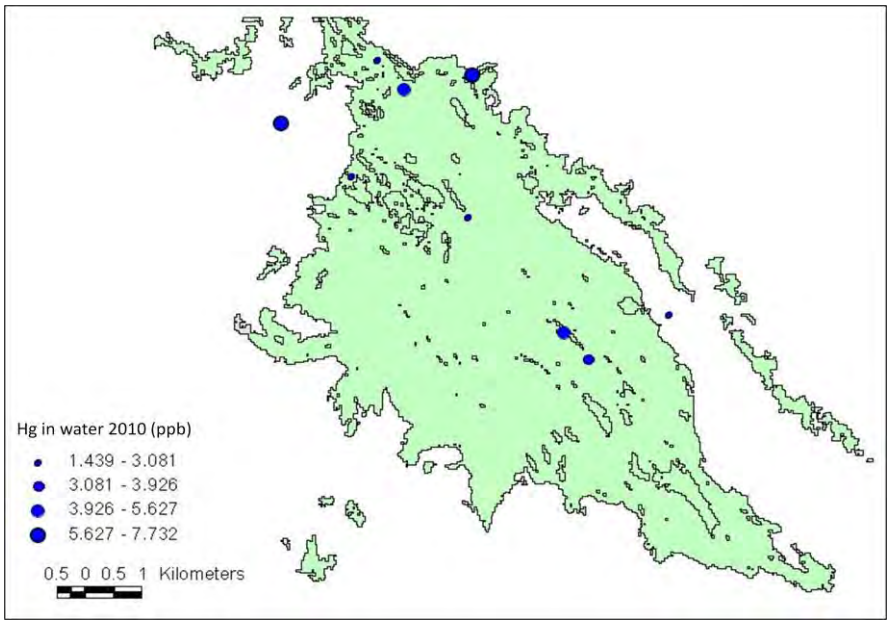

Fig. 33. Distribución de Hg en water (µg/l) en la Ciénega de SC en 2010.

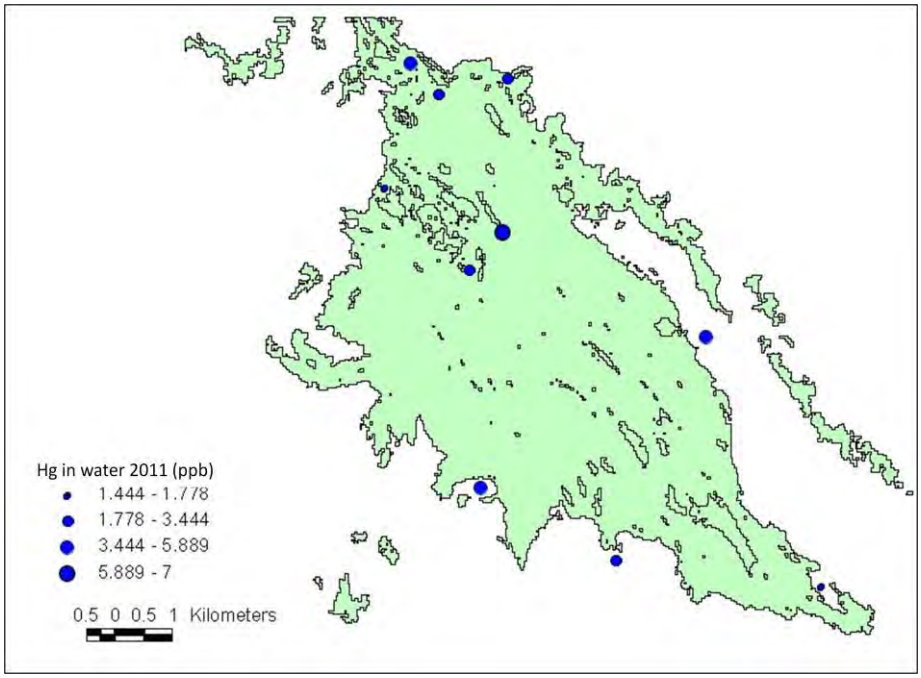

Fig. 34. Distribución de Hg en agua (µg/l) en la Ciénega de Santa Clara en 2011.

Mercurio en sedimento

Las concentraciones de sedimento pueden ser tanto una fuente como un sumidero, dependiendo de las condiciones físicas y biológicas, concentraciones naturales altas generalmente se observan en áreas geotérmicas como el parque Yellowstone en donde se encuentran concentraciones de hasta 500 mg/kg. Se propone un límite de toxicidad

para sedimentos de 0.2 mg/kg de mercurio total para proteger al palmoteador (*Rallus longirostris obsoletus*), un ave forrajeador de sedimento de la Bahía de San Francisco (NIWQP, 1998).

Las concentraciones de mercurio en la Ciénega, variaron de <LD a 1.46 mg/kg (Tablas 10 y 11). Los valores se incrementaron en sedimentos del dren Bypass en 2011 (Figs. 35 y 36). Debido a que las concentraciones en sedimento en 2011 excedieron el límite recomendado para palmoteadores, se recomiendo un monitoreo continuo de este elemento para detectar posibles tendencias y efectos en biota.

Tabla 10. Concentraciones de Hg (mg/kg) en sedimentos superficiales de la Ciénega en 2010.

Guía/sitio	Hg en sedimento (mg/kg dry wt.)
NIWQP[1]	0.2
1	< DL
5	< DL
6	< DL
12	< DL
13	< DL
16	0.35
21	< DL
23	0.47
By-pass dren	0.43
Riito-Sta. Clara	< DL

[1]National Irrigation Water Quality Program. 1998. Guidelines for interpretation of the biological effects of selected constituents in biota, water and sediment Mercury Information Report No. 3. BOR, USFWS, USGS, BIA. 24 pp.

Tabla 11. Concentraciones de Hg (mg/kg) en sedimentos superficiales de la Ciénega en 2011.

Guía/sitio	Hg en sedimento (mg/kg dry wt.)
NIWQP[1]	0.2
1	**0.98**
5	**0.36**
6	**1.06**
12	**0.79**
13	**1.04**
16	**0.79**
21	**1.10**
23	**0.85**
By-pass dren	**1.46**
Riito-Sta. Clara	**0.87**

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[1]National Irrigation Water Quality Program. 1998. Guidelines for interpretation of the biological effects of selected constituents in biota, water and sediment. Mercury Information Report No. 3. BOR, USFWS, USGS, BIA. 24 pp.

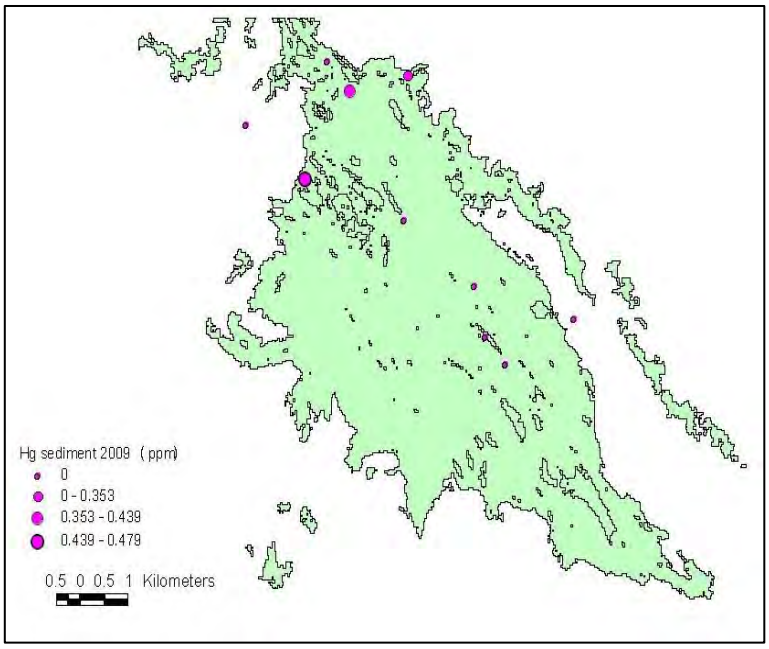

Fig. 35. Distribución de Hg en sedimento superficial (mg/kg dry wt) de la Ciénega en 2010.

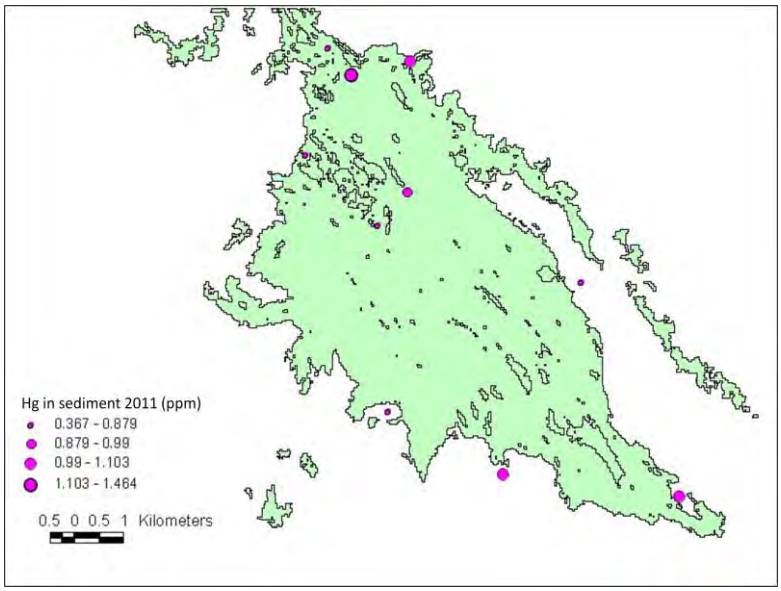

Fig. 36. Distribución de Hg en sedimento superficial (mg/kg dry wt) en la Ciénega en 2011.

Mercurio en peces

El límite de acción para la Secretaría de Salud especifica un máximo de 1 mg/kg en tejido comestible (NOM-027-SSA1-1993). Efectos crónicos en peces también aparecen por encima de esta concentración.

En la Ciénega de Santa Clara, las concentraciones variaron entre < LD a 0.42 mg/kg peso húmedo en tejido de músculo de pez bocón, ninguna de las muestras excedió el límite de 1 mg/kg. Concentraciones menores en músculo fueron detectados en peces colectados en 2011 comparados con el año anterior (prueba de t-student *p-value* = 0.0057).
El mercurio se correlacionó positivamente con las longitudes y peso de los peces (regresión lineal R^2 = 0.48), organismos mas grandes acumularon mas mercurio en sus tejidos que organismos mas jóvenes (Fig. 37). Esta es una tendencia común observada en organismos predadores como tiburones y otras especies (Garcia-Hernandez et al., 2007).

Tabla 7. Concentraciones de Hg en pez bocón de la Ciénega de Santa Clara en 2010 y 2011

Fecha de colecta	**Longitud total (cm)**	**Peso (g)**	**Hg (mg/kg ww)**
FDA[1] and NOM-027[2]			1
feb-10	38	1000	0.09
feb-10	36	466	0.11
feb-10	42	1000	0.02
feb-10	31	448	0.09
feb-10	32	526	0.13
feb-10	32	476	0.14
feb-10	31	522	0.05
jun-10	51	1900	0.38
jun-10	41	1153	0.24
jun-10	18	76	0.40
jun-10	47	1628	0.42
jun-10	45	1327	0.32
oct-10	36	740	0.19
oct-10	30	330	0.17
oct-10	42	1069	0.38
oct-10	47	1783	0.40
oct-10	49	2150	0.33
feb-11	36	715	< DL
feb-11	37	653	< DL
feb-11	34	545	< DL
feb-11	30	398	0.06
feb-11	32	548	< DL
feb-11	43	1390	< DL

[1]Appendix 5-FDA and EPA Safety levels in regulations and guidance 3rd edition. June 2001. Fish and fisheries products hazards and controls guidance.
[2]NOM-027-SSA1-1993. Bienes y servicios. Productos de la pesca. Pescados frescos-refrigerados y congelados. Especificaciones sanitarias

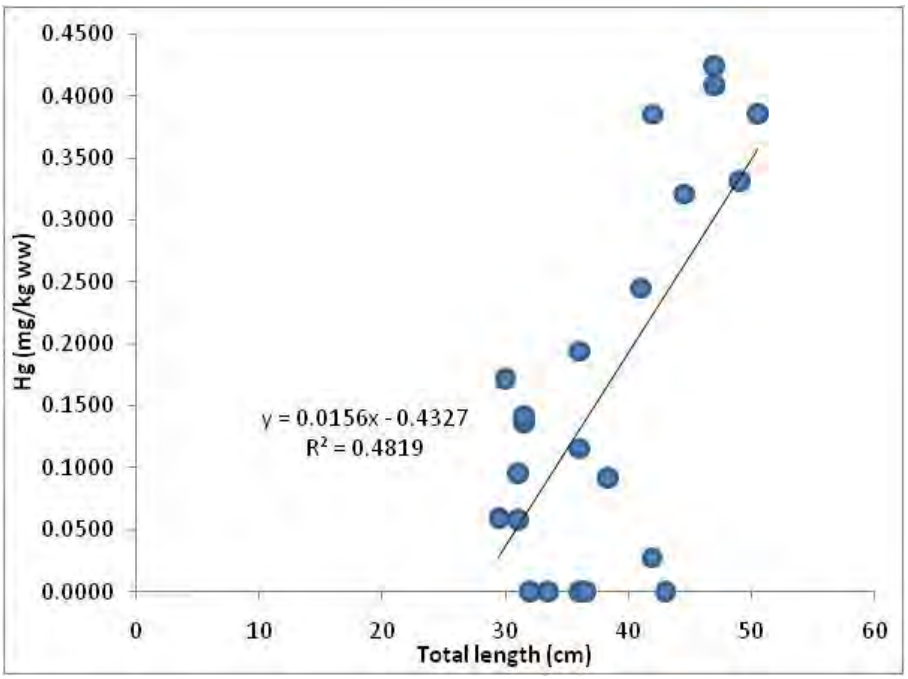

Fig. 37. Longitud total (cm) y concentraciones de Hg (mg/kg ww) en pez bocón de la Ciénega en cuatro muestreos (2010-2011).

5.7. Arsénico

Arsénico en agua

El arsénico no se considera normalmente un elemento esencial para la mayoría de las especies, y se ha demostrado que es teratógeno y cancerígeno para muchas especies de mamíferos. En general las formas inorgánicas de arsénico son más tóxicas que las formas orgánicas (NIWQP, 1998). En el Valle de Mexicali, el arsénico se utilizó como plaguicida antes de la era del DDT, y concentraciones de hasta 30 mg/kg en sedimento se han detectado en muestras de núcleos del Río Hardy (Deasslé et al., 2009).
Las concentraciones de As en agua de la Ciénega variaron entre 28 y 435 µg/l (Tablas 8 y 9). Sin embargo, las mayores concentraciones en 2010 y 2011 fueron detectadas en las orillas de la Ciénega, en los sitios 10, 12, 13, 14, 15 y 16 (Figs. 38 y 39) en donde ocurre una mayor evaporación por lo que es posible que los niveles aumenten. Las concentraciones en el dren Bypass se incrementaron de 2010 a 2011.

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Tabla 8. Concentraciones de As (µg/l) en agua de la Ciénega en 2010

Sitio/Guía	**As (µg/l)**
NIWQP[1]	**Límite de toxicidad**
	190
1	105.56
5	74.07
6	97.78
12	160.00
13	68.89
16	93.33
21	60.00
23	28.89
By-pass drain	94.44
Riito-Sta. Clara	77.78

[1]National Irrigation Water Quality Program. 1998. Guidelines for interpretation of the biological effects of selected constituents in biota, water and sediment. Arsenic Information Report No. 3. BOR, USFWS, USGS, BIA. 17 pp.

Tabla 9. Concentraciones de As (µg/l) en agua de la Ciénega en Febrero 2011

Sitio/Guía	**As (µg/l)**
NIWQP[1]	**Límite de toxicidad**
	190
1	140.00
2	125.78
10	**213.44**
13	**435.00**
14	**306.67**
15	188.22
16	**238.67**
23	**198.11**
By-pass drain	126.78
Riito-Sta. Clara	171.78

[1]National Irrigation Water Quality Program. 1998. Guidelines for interpretation of the biological effects of selected constituents in biota, water and sediment. Arsenic Information Report No. 3. BOR, USFWS, USGS, BIA. 17 pp.

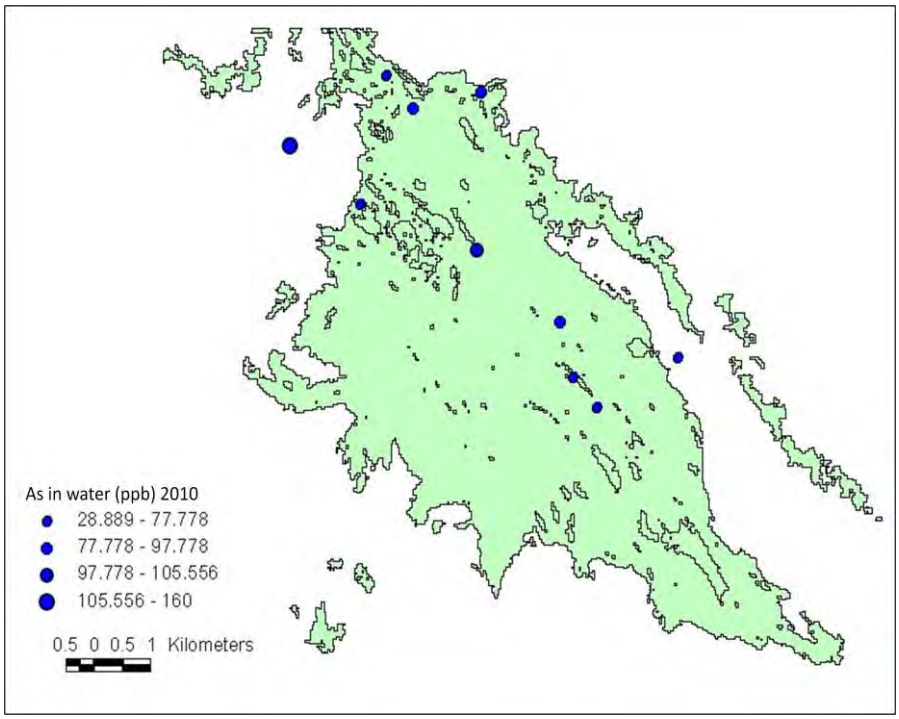

Fig. 38. Distribución de As en agua (µg/l) en la Ciénega de Santa Clara en 2010.

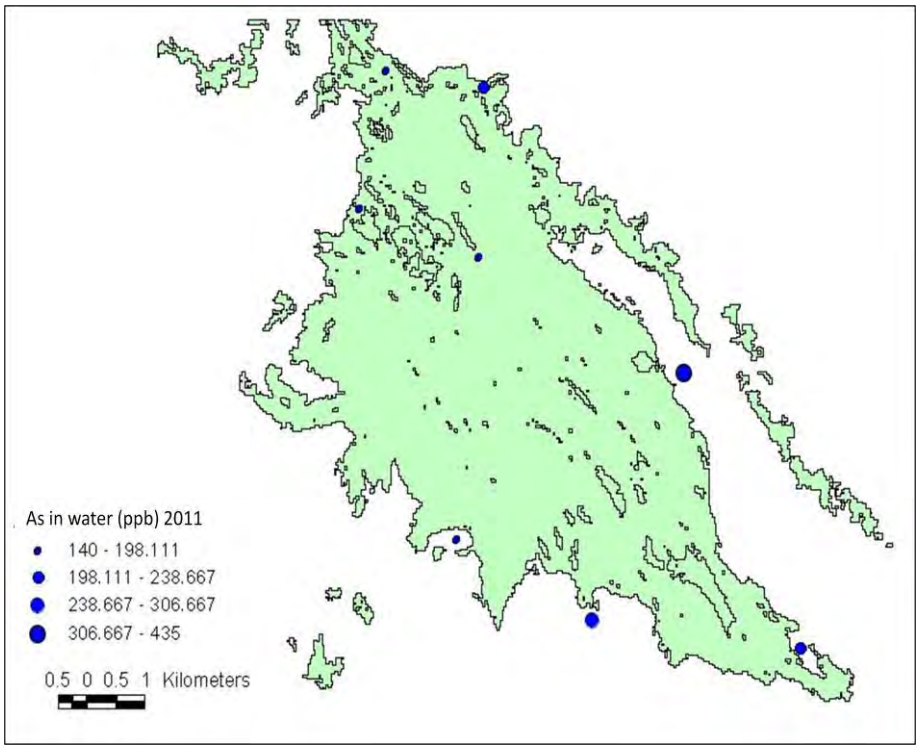

Fig. 39. Distribución de As en agua (µg/l) en la Ciénega de Santa Clara en 2011.

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As en sedimento

Las concentraciones en sedimento de 8.2 mg/kg o menos, generalmente no producen daños biológicos adversos, pero concentraciones de 70 mg/kg o más si pueden causar toxicidad en invertebrados bentónicos, estos estudios se realizaron en sedimentos de lagunas costeras (NIWQP, 1998).

Las concentraciones de As en la Ciénega variaron entre 21.5 y 90.17 mg/kg (Tablas 10 y 11), las concentraciones > 70 mg/kg se encontraron en los sitios 14 y 15 que son las lagunas de la orilla oeste y pudieron estar enriquecidas con arsénico marino derivado de las mareas altas o por procesos de evaporación y concentración (Figs. 40 y 41). También las concentraciones de As en el dren Bypass se duplicaron en 2011.

Tabla 10. Concentraciones de As en sedimento (mg/kg) en la Ciénega en 2010

Sitio/Guía	**As (mg/kg dw)**
NIWQP[1]	**Límite de toxicidad**
	70
1	32.04
5	33.34
6	37.40
12	23.10
13	50.56
16	53.00
21	29.93
23	22.99
By-pass drain	24.07
Riito-Sta. Clara	27.29

[1]National Irrigation Water Quality Program. 1998. Guidelines for interpretation of the biological effects of selected constituents in biota, water and sediment. Arsenic. Information Report No. 3. BOR, USFWS, USGS, BIA. 17 pp.

Tabla 11. Concentraciones de As en sedimento (mg/kg dw) en la Ciénega en 2011

Sitio/Guía	**As (mg/kg dw)**
NIWQP[1]	**Límite de toxicidad**
	70
1	39.73
2	42.44
10	49.06
13	62.36
14	**87.03**
15	**90.17**
16	29.34
23	37.08
By-pass drain	44.00
Riito-Sta. Clara	21.50

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[1]National Irrigation Water Quality Program. 1998. Guidelines for interpretation of the biological effects of selected constituents in biota, water and sediment. Arsenic. Information Report No. 3. BOR, USFWS, USGS, BIA. 17 pp.

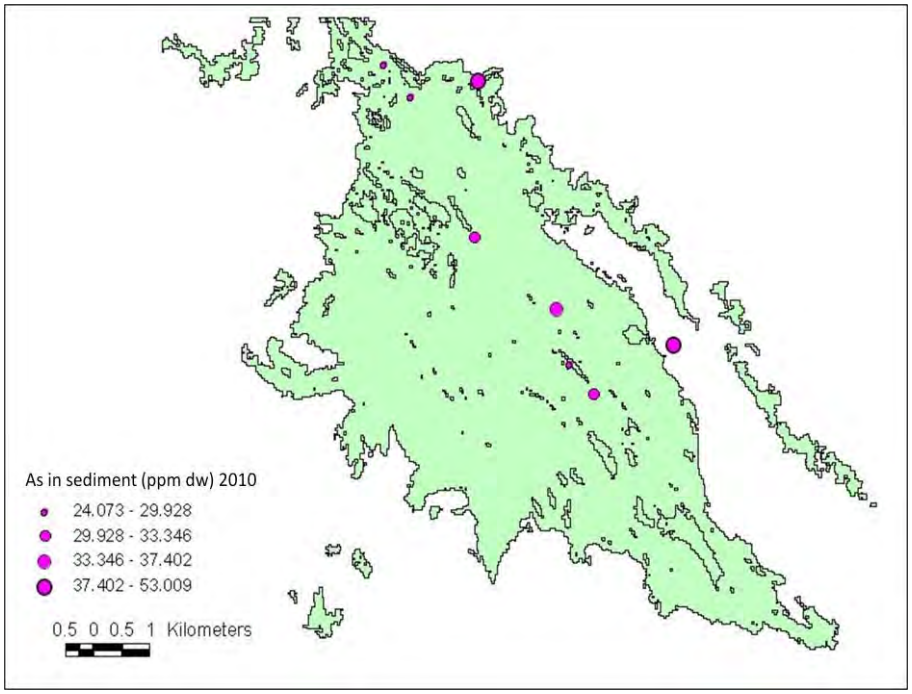

Fig. 40. Distribución de Arsénico (mg/kg dw) en sedimento de la Ciénega de Santa Clara en Febrero del 2010.

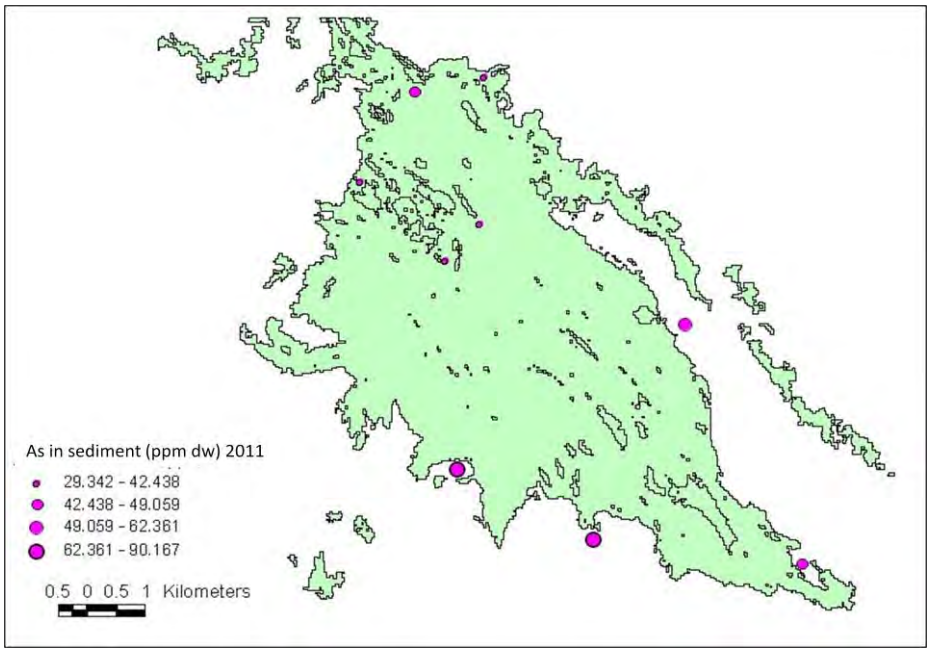

Fig. 41. Distribución de Arsénico (mg/kg dw) en sedimento de la Ciénega de Santa Clara en Febrero del 2011.

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Arsénico en peces

En el ambiente acuático, se han reportado efectos adversos de arsénico en peces dependiendo de concentraciones en agua, sedimento y dieta. La toxicidad en peces se reporta en concentraciones > 12 mg/kg en tejido (NIWQP, 1998). Nuestros resultados muestran concentraciones en el pez bocón que varían entre < LD y 6.2 mg/kg, ninguno de los valores estuvo por encima del nivel de toxicidad para peces o por encima del límite de la FDA para consumo de peces (Tabla 12). No hubo una relación entre las concentraciones de As y las longitudes totales de los peces.

Tabla 12. Concentraciones de As en peces (mg/kg) de la Ciénega en 2010 y 2011

Fecha de colecta	Longitud total (cm)	Peso (g)	As (mg/kg dw)
FDA[1]			86
NIWQP[2]			12
feb-10	38	1000	< DL
feb-10	36	466	< DL
feb-10	42	1000	< DL
feb-10	31	448	< DL
feb-10	32	526	< DL
feb-10	32	476	< DL
feb-10	31	522	< DL
feb-11	36	715	1.42
feb-11	37	653	< DL
feb-11	34	545	0.38
feb-11	30	398	6.26
feb-11	32	548	2.14
feb-11	43	1390	< DL

[1]Appendix 5-FDA and EPA Safety levels in regulations and guidance 3rd edition. June 2001. Fish and fisheries products hazards and controls guidance.

[2]National Irrigation Water Quality Program. 1998. Guidelines for interpretation of the biological effects of selected constituents in biota, water and sediment. Arsenic Information Report No. 3. BOR, USFWS, USGS, BIA. 17 pp.

5.8. Plomo, Cadmio y Cobre en agua, sedimento y peces

Los límites de toxicidad en tejido de peces para Cu es de 13 mg/kg, para Cd es de 50 mg/kg y para Pb es de 20 mg/kg (NIWQP, 1998; Eisler, 1971; USDHHS, 2008). Y los límites para consumo humano de peces es de: Cd 4 mg/kg y Pb 1.7 mg/kg (FDA, 2001). Ninguno de éstos límites fueron excedidos en muestras de peces de la Ciénega de Santa Clara. También las concentraciones de agua y sedimento estuvieron por debajo del nivele de detección para estos tres metales (Tabla 13).

Tabla 13. Concentraciones de Pb, Cd y Cu en agua, sedimento y peces en 2010 y 2011 en muestras de la Cienega de Santa Clara.

Matriz/sitio	**Pb (mg/kg)**	**Cd (mg/kg)**	**Cu (mg/kg)**
Límite de toxicidad en peces*	**20**	**50**	**13**
Agua 2010			
1	< LD**	< LD	< LD
5	< LD	< LD	< LD
6	< LD	< LD	< LD
12	< LD	< LD	< LD
13	< LD	< LD	< LD
16	< LD	< LD	< LD
21	< LD	< LD	< LD
23	< LD	< LD	< LD
By-pass drain	< LD	< LD	< LD
Riito-Sta. Clara	< LD	< LD	< LD
Sedimento 2010			
1	< LD	< LD	< LD
5	< LD	< LD	< LD
6	< LD	< LD	< LD
12	< LD	< LD	< LD
13	< LD	< LD	< LD
16	< LD	< LD	< LD
21	< LD	< LD	< LD
23	< LD	< LD	< LD
By-pass drain	< LD	< LD	< LD
Riito-Sta. Clara	< LD	< LD	< LD
Agua 2011			
1	< LD	< LD	< LD
5	< LD	< LD	< LD
6	< LD	< LD	< LD
12	< LD	< LD	< LD
13	< LD	< LD	< LD
16	< LD	< LD	< LD
21	< LD	< LD	< LD
23	< LD	< LD	< LD
By-pass drain	< LD	< LD	< LD
Riito-Sta. Clara	< LD	< LD	< LD
Sedimento 2011			
1	< LD	< LD	< LD
5	< LD	< LD	< LD
6	< LD	< LD	< LD
12	< LD	< LD	< LD
13	< LD	< LD	< LD
16	< LD	< LD	< LD
21	< LD	< LD	< LD

23	< LD	< LD	< LD
By-pass drain	< LD	< LD	< LD
Riito-Sta. Clara	< LD	< LD	< LD
Peces			
feb-10	< LD	< LD	< LD
feb-10	< LD	< LD	< LD
feb-10	< LD	< LD	< LD
feb-10	< LD	< LD	< LD
feb-10	< LD	< LD	< LD
feb-10	< LD	< LD	< LD
feb-10	< LD	< LD	< LD
jun-10	< LD	< LD	< LD
jun-10	< LD	< LD	< LD
jun-10	< LD	< LD	< LD
jun-10	< LD	< LD	< LD
jun-10	< LD	< LD	< LD
oct-10	< LD	< LD	< LD
oct-10	< LD	< LD	< LD
oct-10	< LD	< LD	< LD
oct-10	< LD	< LD	< LD
oct-10	< LD	< LD	< LD
feb-11	< LD	< LD	< LD
feb-11	< LD	< LD	< LD
feb-11	< LD	< LD	< LD
feb-11	< LD	< LD	< LD
feb-11	< LD	< LD	< LD
feb-11	< LD	< LD	< LD

*Límites de toxicidad en peces para Cu: National Irrigation Water Quality Program (NIWQP). 1998. *Guidelines for interpretation of the Biological Effects of Selected Constituents in Biota, Water and Sediment*, Information Report 3. USDOI. Bureau of Reclamation, Denver, 1998.
Para Cd: Eisler, R.J. 1971. Cadmium poisoning in *Fundulus heteroclitus* (Pisces; Cyprionodontidae) and other marine organisms Journal of the Fisheries Research Board of Canada. 28, 1225.
Para Pb: U.S. Department of Health and Human Services. 2007. Toxicological profile for Lead. 582 pp.
** < LD por debajo del límite de detección

5.9. Compuestos orgánicos

La colección de agua, sedimento y peces se realizó al mismo tiempo y en los mismos sitios que para metales (Figs. 25 y 26). Los análisis de plaguicidas se realizaron en dos laboratorios certificados del CIAD, con los métodos y límites de detección (ppm) especificados en la Tabla 14.

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Tabla 14. Límites de detección y método para cada compuesto orgánico analizado.

Sustancia	Límite de detección (ppm)	Método	Laboratorio
BHC alfa	0.00003	NMX-AA-071-1981	LRT*
BHC beta	0.00175	NMX-AA-071-1981	LRT
lindane	0.00003	NMX-AA-071-1981	LRT
heptachlor	0.00002	NMX-AA-071-1981	LRT
Aldrin	0.000005	NMX-AA-071-1981	LRT
heptachlor epoxide	0.00001	NMX-AA-071-1981	LRT
pp-DDE	0.00005	NMX-AA-071-1981	LRT
dieldrin	0.00005	NMX-AA-071-1981	LRT
endrin	0.0001	NMX-AA-071-1981	LRT
pp-TDE	0.0001	NMX-AA-071-1981	LRT
endosulfansulphate	0.00003	NMX-AA-071-1981	LRT
pp-DDT	0.0002	NMX-AA-071-1981	LRT
metoxichlor	0.0005	NMX-AA-071-1981	LRT
mirex	0.00005	NMX-AA-071-1981	LRT
trichlorphon	0.0001	NMX-AA-071-1981	LRT
dichlorvos	0.00002	NMX-AA-071-1981	LRT
diazinon	0.0002	NMX-AA-071-1981	LRT
methyl parathion	0.0001	NMX-AA-071-1981	LRT
phenitrotion	0.00005	NMX-AA-071-1981	LRT
malathion	0.0002	NMX-AA-071-1981	LRT
phenthion	0.0001	NMX-AA-071-1981	LRT
dioxathion	0.0005	NMX-AA-071-1981	LRT
di-syston	0.0001	NMX-AA-071-1981	LRT
ronnel	0.0001	NMX-AA-071-1981	LRT
chlorphyriphos	0.0001	NMX-AA-071-1981	LRT
chlorphenvinphos	0.0001	NMX-AA-071-1981	LRT
ethion	0.0001	NMX-AA-071-1981	LRT
trithion	0.0001	NMX-AA-071-1981	LRT
coumaphos	0.0001	NMX-AA-071-1981	LRT
BHC alfa	0.0000631	NMX-AA-071-1981	LARP**
BHC beta	0.0000614	NMX-AA-071-1981	LARP
lindane	0.0000569	NMX-AA-071-1981	LARP
heptachlor	0.000063	NMX-AA-071-1981	LARP
Aldrin	0.0000701	NMX-AA-071-1981	LARP
oxichlordane	0.00005	NMX-AA-071-1981	LARP
heptachlor epoxide	0.0000764	NMX-AA-071-1981	LARP
trans chlordane	0.000038	NMX-AA-071-1981	LARP
endosulfan alfa	0.000064	NMX-AA-071-1981	LARP
pp-DDE	0.0000618	NMX-AA-071-1981	LARP
cis-chlordane	0.0000461	NMX-AA-071-1981	LARP
dieldrin	0.0000652	NMX-AA-071-1981	LARP
endrin	0.0000671	NMX-AA-071-1981	LARP
endosulfan beta	0.0000598	NMX-AA-071-1981	LARP

pp-TDE	0.0000653	NMX-AA-071-1981	LARP
endosulfan sulphate	0.0000627	NMX-AA-071-1981	LARP
pp-DDT	0.0002	NMX-AA-071-1981	LARP
op-DDT	0.0000066	NMX-AA-071-1981	LARP
PCBs	0.00005	NMX-AA-071-1981	LARP
bifenthrin	0.000306	NMX-AA-071-1981	LARP
lambda cyalotrin	0.000501	NMX-AA-071-1981	LARP
cyfluthrin	0.000513	NMX-AA-071-1981	LARP
esfenvalerate	0.000305	NMX-AA-071-1981	LARP
deltametrin	0.000303	NMX-AA-071-1981	LARP
chlorothalonil	0.0010584	NMX-AA-071-1981	LARP
triadimefon	0.00104	NMX-AA-071-1981	LARP
fipronil	0.0010264	NMX-AA-071-1981	LARP
captan	0.0010062	NMX-AA-071-1981	LARP
endosulfan alfa	0.0010252	NMX-AA-071-1981	LARP
endosulfan beta	0.0005397	NMX-AA-071-1981	LARP
endosulfan sulphate	0.000501	NMX-AA-071-1981	LARP
permetrin cis	0.000546	NMX-AA-071-1981	LARP
permetrin trans	0.0003549	NMX-AA-071-1981	LARP
cypermetrin	0.0025244	NMX-AA-071-1981	LARP

*Laboratorio de Residuos Tóxicos (LRT). CIAD-Hermosillo.
**Laboratorio de Análisis de Residuos de Plaguicidas (LARP). CIAD-Culiacán.
***NMX-AA-071-1981. Análisis de agua-Determinación de plaguicidas organoclorados. Método de cromatografía de gases.

Se observaron niveles detectables plaguicidas organoclorados en agua y sedimento en 2010 y 2011 (Tablas16 a 21). Algunos de los organoclorados también fueron detectados en peces, sin embargo, las concentraciones fueron en órdenes de magnitud menores que los límites recomendados para consumo de peces (Tabla 15). El pez bocón parece acumular menores concentraciones de plaguicidas que otras especies como la lisa o la carpa, ya que tienen diferentes hábitos alimenticios, el bocón es carnívoro y las otras especies son detritívoras.

Los plaguicidas que se detectaron con más frecuencia en agua fueron pp-DDT, endosulfán sulfato, heptacloro y los BHCs, y en sedimento fueron el trans-clordano, heptacloro epóxido, pp-DDT, endosulfán sulfato, pp-TDE y BHC alfa (Fig. 42). Los plaguicidas organofosforados, piretroides, y PCB´s estuvieron por debajo del nivel de detección en muestras de agua, sedimento y peces.

Tabla 15. Límite de concentraciones de sustancias orgánicas recomendadas por la FDA en la porción comestible de peces (ppm).

Sustancia	**Límite de acción de la FDA (ppm) en la porción comestible de peces (FDA, 2000)**
Aldrin and Dieldrin	0.3
Chlordane	0.3
DDT, DDE, TDE	5.0
Heptachlor and Heptachlor epoxide	0.3
Mirex	0.1

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Tabla 16. Concentraciones de compuestos orgánicos en muestras de AGUA de la Ciénega colectadas en 2010.

Compuesto/Sitio	Bypass	Riito	1	5	6	12	13	16	23	24
Plaguicidas organoclorados(µg/g dw)										
BHC alfa	0.00035	0.00014	0.00009	0.00005	<DL	<DL	0.00008	0.00003	0.00030	0.00018
BHC beta	<DL	0.00059	0.00071	<DL	0.00054	<DL	<DL	0.00067	0.00056	0.00056
lindane	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
heptachlor	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
Aldrin	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
oxichlordane	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
heptachlor epoxide	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
trans chlordane	<DL	0.00000	0.00007	0.00001	<DL	<DL	0.00004	0.00015	0.00004	<DL
endosulfan alfa	0.00073	<DL	<DL	<DL	<DL	<DL	<DL	<DL	0.00012	<DL
pp-DDE	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
cis-chlordane	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
dieldrin	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
endrin	0.00015	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
endosulfan beta	<DL	<DL	<DL	<DL	0.00015	<DL	<DL	<DL	<DL	<DL
pp-TDE	<DL	<DL	<DL	0.00001	<DL	<DL	<DL	0.00023	<DL	<DL
endosulfan sulphate	<DL	<DL	0.00257	<DL	<DL	<DL	<DL	0.00001	<DL	0.00005
pp-DDT	0.00006	0.00010	0.00013	<DL	0.00037	<DL	0.00008	<DL	0.00026	<DL
op-DDT	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
PCBs (µg/g dw)										
PCB28	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
PCB52	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
PCB101	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
PCB118	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
PCB153	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
PCB138	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
PCB180	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
Piretroides (µg/g dw)										
bifenthrin	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
lambda cyalotrin	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
cyfluthrin	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
esfenvalerate	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
deltametrin	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
Mezcla de plaguicidas(µg/g dw)										
chlorothalonil	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
triadimefon	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
fipronil	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
captan	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
endosulfan alfa	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
endosulfan beta	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
endosulfan sulphate	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
permetrin cis	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
permetrin trans	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
cypermetrin	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL

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Tabla 17. Concentraciones de compuestos orgánicos en SEDIMENTO de la Ciénega colectados en 2010

Compuesto/Sitio	Bypass	Riito	1	5	6	12	16	21	23	24
Plaguicidas organoclorados(µg/g dw)										
BHC alfa	0.00549	<DL	<DL	0.00051	<DL	<DL	0.01406	<DL	<DL	<DL
BHC beta	<DL	<DL	<DL	<DL	<DL	<DL	0.02619	<DL	<DL	<DL
lindane	<DL	<DL	<DL	<DL	<DL	0.00168	<DL	0.00105	<DL	0.00024
heptachlor	0.00057	<DL	0.00279	<DL	<DL	<DL	<DL	<DL	<DL	<DL
Aldrin	<DL	<DL	<DL	<DL	<DL	<DL	0.00161	<DL	<DL	<DL
oxichlordane	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
heptachlor epoxide	0.00163	<DL	<DL	<DL	<DL	<DL	0.47532	0.15575	<DL	<DL
trans chlordane	0.00213	<DL	<DL	0.00014	0.00115	<DL	0.00033	0.00041	<DL	0.00051
endosulfan alfa	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
pp-DDE	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
cis-chlordane	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
dieldrin	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
endrin	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
endosulfan beta	<DL	<DL	0.00024	<DL	<DL	<DL	<DL	<DL	<DL	0.00061
pp-TDE	<DL	<DL	0.00014	<DL	<DL	<DL	0.00096	<DL	<DL	0.00223
endosulfan sulphate	0.00688	<DL	0.00603	0.00147	<DL	<DL	<DL	0.00233	<DL	0.00747
pp-DDT	0.00130	<DL	0.00245	<DL	<DL	0.00134	<DL	<DL	<DL	0.00162
op-DDT	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
PCBs										
PCB28	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
PCB52	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
PCB101	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
PCB118	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
PCB153	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
PCB138	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
PCB180	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
Piretroides (µg/g dw)										
bifenthrin	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
lambda cyalotrin	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
cyfluthrin	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
esfenvalerate	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
deltametrin	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
Mezcla de plaguicidas (µg/g dw)										
chlorothalonil	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
triadimefon	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
fipronil	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
captan	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
endosulfan alfa	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
endosulfan beta	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
endosulfan sulphate	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
permetrin cis	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
permetrin trans	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
cypermetrin	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL

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Tabla 18. Concentraciones de compuestos orgánicos en PECES de la Ciénega de Santa Clara colectados en 2010

Compuesto/ Especie	Lisa (N=5)	Bocón (N=2)	Carpa (N=1)	Bocón (N=7)	Tilapia (N=1)	Mojarra (N=1)	Carpa (N=2)	Sunfish (N=7)	Bocón (N=3)	Carpa (N=2)
Plaguicidas organoclorados(µg/g dw)										
BHC alfa	0.05431	<DL	0.00181	<DL	<DL	0.00072	0.00063	<DL	<DL	0.00138
BHC beta	0.17955	<DL	0.03390	0.02238	0.01024	<DL	0.01067	<DL	<DL	<DL
lindane	0.02829	<DL	0.10666	0.01929	0.00273	0.00230	0.00069	<DL	<DL	<DL
heptachlor	0.02462	<DL	0.02043	0.00023	<DL	<DL	<DL	<DL	<DL	<DL
Aldrin	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
oxichlordane	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
heptachlorepoxide	0.08390	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
trans chlordane	0.11719	0.00408	0.01974	0.01929	0.00366	0.00349	0.00312	<DL	<DL	<DL
endosulfan alfa	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
pp-DDE	0.00194	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
cis-chlordane	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
dieldrin	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
endrin	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
endosulfan beta	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
pp-TDE	0.00662	<DL	0.00021	0.01929	<DL	<DL	<DL	<DL	<DL	<DL
endosulfansulphate	<DL	<DL	0.01919	<DL	<DL	<DL	0.00794	0.00254	<DL	<DL
pp-DDT	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
op-DDT	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
PCBs										
PCB28	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
PCB52	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
PCB101	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
PCB118	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
PCB153	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
PCB138	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
PCB180	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
Piretroides (µg/g dw)										
bifenthrin	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
lambda cyalotrin	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
cyfluthrin	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
esfenvalerate	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
deltametrin	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
Mezcla de Plaguicidas (µg/g dw)										
chlorothalonil	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
triadimefon	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
fipronil	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
captan	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
endosulfan alfa	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
endosulfan beta	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
endosulfansulphate	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
permetrin cis	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
permetrin trans	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
cypermetrin	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL

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Tabla 19. Concentraciones de compuestos orgánicos en muestras de AGUA en muestras de la Ciénega en 2011

Compuesto/Sitio	Bypass	Riito	1	2	10	14	16	23
Plaguicidas organoclorados (µg/g dw)								
BHC alfa	<DL	<DL	0.00122	0.00219	<DL	<DL	<DL	<DL
BHC beta	0.05285	<DL	0.50515	0.73235	<DL	<DL	<DL	0.00253
lindane	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
heptachlor	<DL	0.00052	0.00322	0.00096	0.00060	0.00106	0.00173	0.00188
Aldrin	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
heptachlor epoxide	0.00099	<DL	0.00174	0.00090	<DL	0.00081	<DL	0.00067
pp-DDE	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
dieldrin	<DL	<DL	0.00137	0.00078	<DL	<DL	<DL	0.00099
endrin	<DL	<DL	0.00033	0.00103	<DL	<DL	<DL	0.00023
pp-TDE	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
endosulfansulphate	0.00072	0.00063	0.00028	0.00051	0.00043	0.00043	0.00078	0.00047
pp-DDT	0.00127	0.00195	0.00544	0.00016	0.00292	0.00097	0.01103	0.00398
metoxichlor	0.00187	<DL	0.00232	<DL	<DL	<DL	<DL	<DL
mirex	<DL	<DL	0.00119	<DL	<DL	0.00079	<DL	0.00092
Plaguicidas organofosforados (µg/g dw)								
trichlorphon	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
dichlorvos	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
diazinon	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
methyl parathion	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
phenitrotion	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
malathion	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
phenthion	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
dioxathion	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
di-syston	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
ronnel	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
chlorphyriphos	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
chlorphenvinphos	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
ethion	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
trithion	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
coumaphos	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL

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Tabla 20. Concentraciones de compuestos orgánicos en SEDIMENTO de la Ciénega en 2011

Compuesto/Sitio	Bypass	Riito	1	2	3	4	5	10	14	15	23
Plaguicidas organoclorados (µg/g dw)											
BHC alfa	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
BHC beta	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	0.03452
lindane	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
heptachlor	<DL	<DL	<DL	<DL	<DL	0.00036	<DL	<DL	<DL	<DL	<DL
Aldrin	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
heptachlor epoxide	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
pp-DDE	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
dieldrin	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	0.00104	<DL	<DL
endrin	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
pp-TDE	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
endosulfan sulphate	<DL	<DL	<DL	<DL	0.00073	<DL	<DL	<DL	0.00157	0.00044	<DL
pp-DDT	<DL	<DL	<DL	<DL	0.00202	<DL	<DL	<DL	0.01770	<DL	<DL
metoxichlor	<DL	<DL	<DL	<DL	0.04625	<DL	<DL	<DL	<DL	<DL	<DL
mirex	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
Plaguicidas organofosforados (µg/g dw)											
trichlorphon	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
dichlorvos	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
diazinon	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
methyl parathion	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
phenitrotion	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
malathion	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
phenthion	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
dioxathion	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
di-syston	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
ronnel	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
chlorphyriphos	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
chlorphenvinphos	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
ethion	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
trithion	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
coumaphos	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL

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Tabla 21. Concentraciones de compuestos orgánicos en muestras de PECES de la Ciénega colectados en 2011

Fecha de colecta	Longitud total (cm)	Peso (g)	Plaguicidas organoclorados (µg/g dw)	Plaguicidas organofosforados (µg/g dw)
Micropterus salmoides				
feb-10	38	1000	< DL	< DL
feb-10	36	466	< DL	< DL
feb-10	42	1000	< DL	< DL
feb-10	31	448	< DL	< DL
feb-10	32	526	< DL	< DL
feb-10	32	476	< DL	< DL
feb-10	31	522	< DL	< DL
jun-10	51	1900	< DL	< DL
jun-10	41	1153	< DL	< DL
jun-10	18	76	< DL	< DL
jun-10	47	1628	< DL	< DL
jun-10	45	1327	< DL	< DL
oct-10	36	740	< DL	< DL
oct-10	30	330	< DL	< DL
oct-10	42	1069	< DL	< DL
oct-10	47	1783	< DL	< DL
oct-10	49	2150	< DL	< DL
feb-11	36	715	< DL	< DL
feb-11	37	653	< DL	< DL
feb-11	34	545	< DL	< DL
feb-11	30	398	< DL	< DL
feb-11	32	548	< DL	< DL
feb-11	43	1390	< DL	< DL

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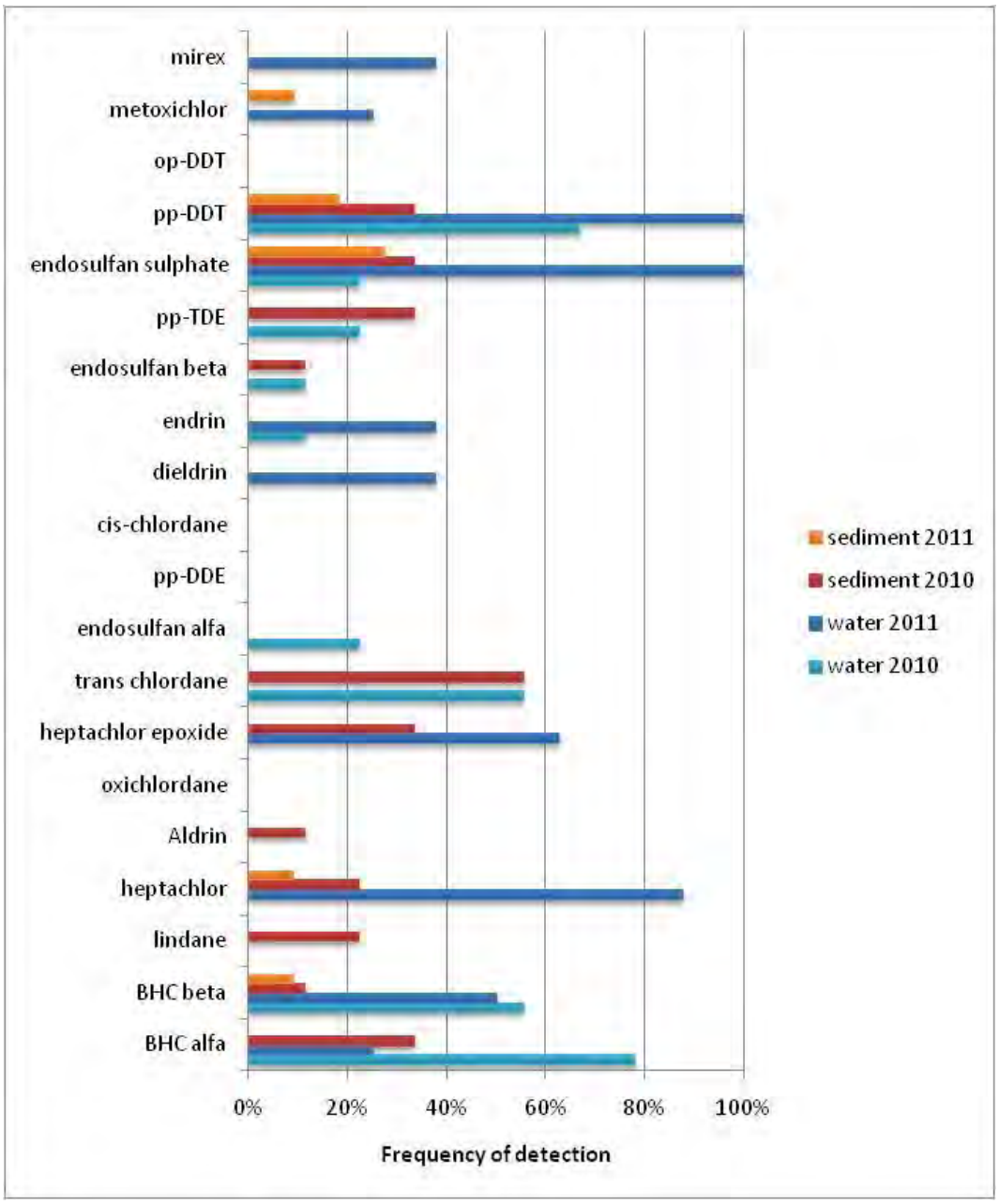

Fig.42. Frecuencia de de detección de plaguicidas organoclorados en muestras de agua y sedimento del 2010 y 2011.

5.10. Evaluación de la salud de los peces

Los contaminantes orgánicos e inorgánicos pueden tener un efecto en la salud de los peces, aún cuando las concentraciones detectadas estén por debajo de los límites recomendados por estándares internacionales. Para este proyecto se seleccionó a el pez bocón (*Micropterus salmoides*) para estudios de efectos en salud, ya que es una especie abundante y tiene un valor comercial (pesca deportiva) además de ser una especie

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carnívora que pudiera estar expuesta a niveles de contaminantes mayores por efecto de bioacumulación.

Se colectaron un total de 97 peces en tres muestreos en la Ciénega de Santa Clara en (Junio, Septiembre y Diciembre, 2010). El peso de los peces varió entre 0.07 kg y 2.56 kg, con una media de 0.90 kg ± 0.60 kg (Fig. 43) y la longitud total varió entre 18 y 56 cm con una media de 37 cm ± 8 cm. Esta es una especie de lento crecimiento, necesitan más de 3 años para alcanzar su talla preferencial de 38 cm (la cual fue nuestra talla promedio) y también tienen un costo energético alto: consumen de 3-7 kg de alimento/kg de pez (Huskey y Turigan, 2001). El hecho de que nuestra talla promedio sea la talla preferencial indica que es una población saludable que no se encuentra bajo un estrés pesquero que esté afectando su estructura poblacional, sin embargo, se recomienda continuar con los estudios pesqueros para corroborar esta hipótesis.

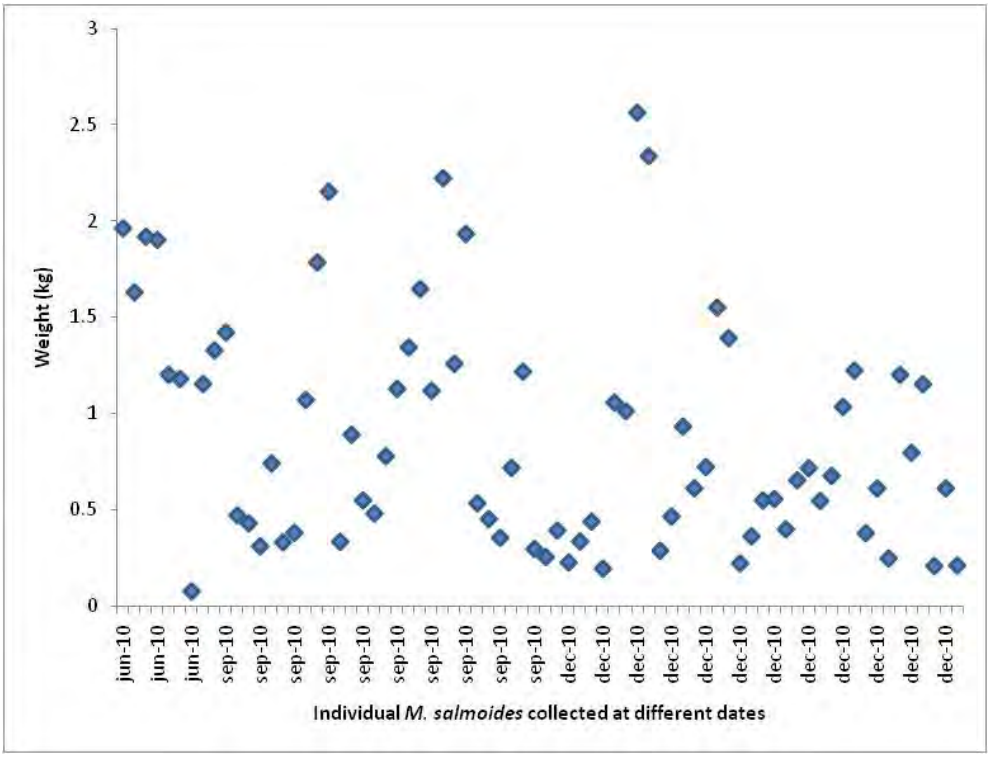

Fig. 43. Peso total de los peces colectados en la Ciénega en Jun, Sep y Dic, 2010

El factor de condición, que es la relación entre el peso total y el peso del hígado, es un indicador sencillo de la salud de los peces. El hígado es el órgano dedicado a la desintoxicación del organismo, por lo que un hígado con mayor masa (i.e. más peso) indica que el organismo está esforzándose para desintoxicarse debido a condiciones externas como presencia de contaminantes en agua o alimento. Por otro lado, el crecimiento de los peces debe ser isométrico, es decir todos los órganos y estructuras deben presentar una relación directa con la talla y/o el peso.

En los organismos muestreados, la longitud total tuvo una relación lineal con el peso del hígado (R^2 = 0.73) con la ecuación para el peso del hígado = 9 (peso total del pez)-0.183 (Fig. 44).

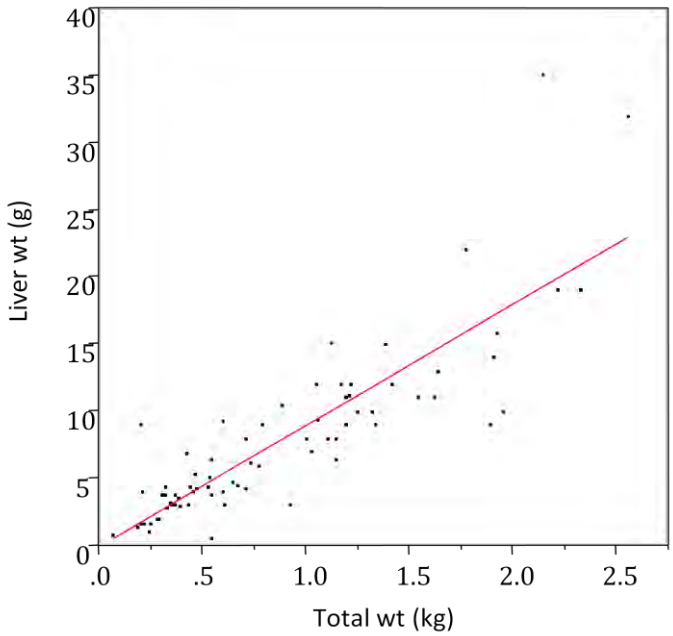

Fig. 44. Peso total (kg) vs. Peso del hígado (g) en *M. salmoides* de la Ciénega de SC

La enzima de la Acetilcolinesterasa es responsable de la correcta transmisión del impulso nervioso en organismos vivos. Cuando existe una inhibición de esta enzima, los organismos se pueden paralizar o si el efecto es muy grande pueden morir. Los plaguicidas organofosforados y el mercurio son neurotóxicos, y en el caso de los plaguicidas están diseñados para interrumpir las señales nerviosas de los insectos, por lo que son altamente tóxicos, aunque su persistencia en el ambiente es muy baja (días a semanas). Debido a que muy pocas concentraciones de plaguicidas pueden afectar los organismos, nosotros analizamos la actividad de la acetilcolinesterasa en el tejido cerebral de los peces colectados.

La actividad total de AchE en 23 individuos de *M. salmoides* varió entre 3.6 y 232.3 µmol min^{-1} mg^{-1} de proteína total, con una media de 64.4 ± 57 µmol min^{-1} mg^{-1} de proteína total. Actividades mayores se detectaron en peces mas pequeños (posiblemente mas jóvenes), ya que ellos tienen un metabolismo mas activo que peces mas grandes (Philips et al., 2002) (Fig. 45.)

No se detectó ninguna inhibición de la enzima AchE en tejido cerebral de *M. salmoides* en ninguno de los tres muestreos. Esto indica que no existen efectos tóxicos derivados de los plaguicidas organofosforados o mercurio en los peces muestreados.

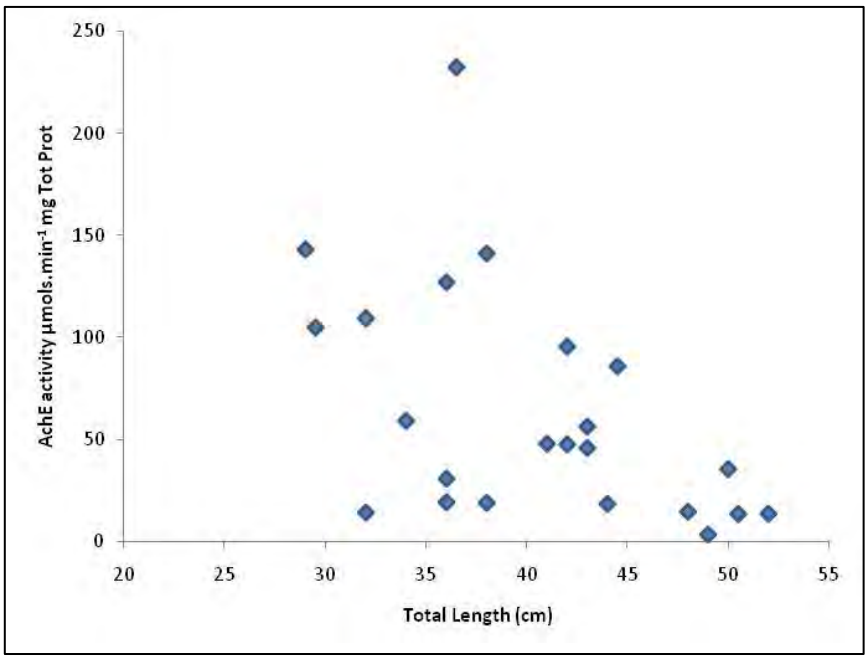

Fig. 45. Actividad de AchE (µmol min^{-1} mg de proteína total) vs. longitud total en *M. salmoides* de la Ciénega de Santa Clara colectados en Jun, Oct and Dec 2010.

5.11. Nutrientes y otros parámetros

Microorganismos patógenos

La presencia de microorganismos patógenos en la Ciénega de Santa Claro es raro; sin embargo, en diciembre del 2009, detectamos descargas en el dren Bypass sitio (8) de 14,000 NMP/100 ml de *E. coli*, la cual está por encima del límite para uso recreativo (Tabla 22). En febrero del 2010, este número disminuyó a 68 NMP/100 ml en el dren Bypass, pero en el sitio 1 todavía permanecía alto (2,000 NMP/100 ml) en Abril las concentraciones se redujeron en todos los sitios (Tabla 23-25). Después de este evento, no se detectaron concentraciones mayores a los límites recomendados, sin embargo, se recomienda continuar con el monitoreo de patógenos a largo plazo para detectar posibles problemas y solucionarlos.

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Tabla 22. Límites Mexicanos y de E.E.U.U. en agua para la protección de la salud humana en humedales

Parámetro	Límite	Referencia
Coliformes fecales (MPN/ml)	2000	NOM-001-ECOL-1996. Norma Oficial Mexicana que establece los limites máximos permisibles de contaminantes en las descargas residuales
E. coli (MPN/100 ml)	126	USEPA.2004. Water Quality Standards for Coastal and Great Lakes Recreation Waters; Final Rules, Part II. Environmental Protection Agency. 67218 Federal Register/vol. 69, No. 220/Rules and Regulations
Nitrógeno orgánico (mg/L)	5	US EPA. 2000.Arizona water quality standards, In: Water quality standards. 40 CFR Ch. I (7-1-00 Edition).
Amonio (mg/L)	1	US EPA. 1985. Ambient water quality criteria for Ammonia. EPA 440/5-85-001. 228 pp
Nitratos (mg/L)	7	US EPA. 2000.Arizona water quality standards, In: Water quality standards. 40 CFR Ch. I (7-1-00 Edition).
Nitrógeno Total (mg/l)	25	NOM-001-ECOL-1996. Norma Oficial Mexicana que establece los limites máximos permisibles de contaminantes en las descargas residuales
Fósforo total (mg/L)	0.1	US EPA. 2000.Arizona water quality standards, In: Water quality standards. 40 CFR Ch. I (7-1-00 Edition).
Fósforo total (mg/)	10	NOM-001-ECOL-1996. Norma Oficial Mexicana que establece los limites máximos permisibles de contaminantes en las descargas residuales
Sólidos (Sólidos Sedimentables), mL/L	2	NOM-001-ECOL-1996. Norma Oficial Mexicana que establece los limites máximos permisibles de contaminantes en las descargas residuales
Sólidos susendidos totales (SST), mg/L	60	NOM-001-ECOL-1996. Norma Oficial Mexicana que establece los limites máximos permisibles de contaminantes en las descargas residuales

Tabla 23. Coliformes totales NMP/100 ml en la Ciénega de Santa Clara en 2010 y 2011

Sitio	Feb-10	Apr-11
Bypass dren	120	23
Riito	11	23
1	2,400	< 3
5	11	NA
6	11	43
13	7	23
16	NA	43
21	4	7.3
23	15	9.1

NA = no analizado debido a inaccesibilidad al sitio

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Tabla 24. Coliformes fecales NMP/100 ml en la Ciénega de Santa Clara en 2010 and 2011

Sitio	Feb-10	Apr-11
Bypass dren	23	23
Riito	< 3	4
1	240	< 3
5	4	NA
6	4	23
13	7	23
16	NA	23
23	15	9.1

Tabla 25. Concentraciones de *Escherichia coli* MPN/100 ml en la Ciénega de Santa Clara

Sitio	Dic-09	Feb-10	Abr-10	Jul-10	Oct-10	Ene-11	Abr-11
Bypass dren	**14,136**	68	12	60	37	25	37
Riito	78	21	14	9	22	13	31
1	121	**2,489**	38	33	48	26	24
5	NA	23	NA	NA	NA	NA	50
6	48	54	78	NA	NA	NA	65
8	**14,136**	68	12	60	37	25	37
9	78	21	14	9	22	13	31
12	NA	NA	0.1	13	NA	NA	NA
13	NA	24	5	49	25	7	19
16	NA	17	24	126	43	9	65
23	NA	37	59	9	19	6	12

Nutrientes

Las concentraciones de nutrientes en la Ciénega de Santa Clara fueron monitoreadas como nitrógeno orgánico (Kjeldahl), N-nitritos ($N\text{-}NH_3$), N-nitratos ($N\text{-}NH_4$), amonio y fósforo total (Tablas 26-30).

Las concentraciones de nitrógeno orgánico variaron entre < 0.10 a 0.78 mg/l, todas las concentraciones estuvieron por debajo del límite de los 5 mg/l (Tabla 26). Las concentraciones fueron mas altas en el dren Bypass, sin embargo, ya adentro del humedal las concentraciones disminuyeron a niveles por debajo del nivel de detección (< 0.1 mg/l). Los nitritos y amonio tuvieron concentraciones por debajo del límite de detección en todas las muestras. Los nitratos se incrementaron en Marzo y Abril en la entrada y adentro de la Ciénega, probablemente en coincidencia con los ciclos agrícolas de la región y el uso de fertilizantes, y después disminuyeron en mayo del 2010. Es importante monitorear nitratos en el humedal para detectar y prevenir problemas de eutroficación ya que es una cuenca semi-cerrada. El fósforo total fue mayor que los límites de detección (1 mg/) en diciembre 2009 y en abril 2010, el resto de los meses estuvo por debajo del nivel de detección. Las normas mexicanas para descargas a

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humedales marcan un límite de 10 mg/l de fósforo total, el cual se cumplió en las entradas; sin embargo, una normativa mas específica para ríos en Arizona recomienda concentraciones menores a 0.1 mg/l, el cual fue excedido en el canal Bypass en Dic 09 y Abril y Mayo 2010. Dentro de las lagunas las concentraciones disminuyeron considerablemente, probablemente debido al filtrado de nutrientes por las plantas emergentes (Tule, *Typha domingensis*).

Tabla 26. Concentraciones de nitrógeno orgánico (Kjeldahl) en la Ciénega de Santa Clara (mg/l)

Sitio	**Dic-09**	**Feb-10**	**Abr-10**	**Jul-10**	**Oct-10**	**Ene-11**	**Abr-11**
Bypass dren	0.75	< 0.1	0.7	0.24	0.89	< 0.1	0.84
Riito	0.08	< 0.1	0.05	< 0.1	< 0.1	< 0.1	NA
1	0.08	1.4	0.32	0.65	0.24	0.6	0.67
5	NA	0.4	NA	NA	NA	NA	0.78
6	0.33	0.5	0.6	NA	NA	NA	0.22
12	NA	NA	< 0.1	< 0.1	NA	NA	NA
13	NA	< 0.1	0.8	< 0.1	< 0.1	< 0.1	0.22
16	NA	< 0.1	0.05	0.12	< 0.1	< 0.1	0.22
21	NA	0.4	NA	NA	NA	NA	0.34
23	NA	< 0.1	0.1	< 0.1	< 0.1	0.7	NA

Tabla 27. Concentraciones de N-Nitrato (mg/l) en la Ciénega de Santa Clara (mg/l)

Sitio	**Dic-09**	**Feb-10**	**Mar-10**	**Apr-10**	**May-10**
Bypass dren	5.53	7.27	**17.27**	**18.64**	2.73
Riito	4.81	6.14	**18.64**	**20.00**	2.27
1	4.6	< 1.0	**10.91**	**12.273**	3.41
2	4.12	NA	NA	NA	2.95
3	2.88	NA	NA	NA	2.27
4	4.17	NA	NA	NA	3.18
5	NA	4.55	**14.09**	NA	2.27
6	3.79	5.23	**25.91**	**12.50**	2.05
12	NA	NA	NA	**27.27**	1.36
13	NA	NA	**16.82**	**8.64**	2.05
16	NA	3.18	**20.91**	**17.27**	3.64
21	NA	4.32	**9.32**	NA	NA
23	NA	< 1.0	**10**	**19.55**	NA

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Tabla 28. Concentraciones de P-total (mg/l) en la Ciénega de Santa Clara (mg/l)

Sitio	Dic-09	Feb-10	Abr-10	May-10	Jul-10	Ago-10	Abr-11
Bypass dren	1.3	<1	1.4	0.25	<1	<1	<1.0
Riito	1.0	<1	<1	0.07	<1	<1	<1.0
1	1.0	<1	<1	0.07	<1	<1	<1.0
2	<1	NA	NA	0.05	NA	NA	NA
3	1.2	NA	NA	0.02	NA	NA	NA
4	1.1	NA	NA	0.04	NA	NA	NA
5	NA	<1	NA	0.01	NA	NA	<1.0
6	1.1	<1	<1	0.10	NA	NA	<1.0
12	NA	NA	<1	<0.01	<1	NA	NA
13	NA	<1	<1	0.03	<1	<1	<1.0
16	NA	<1	1.2	0.06	<1	<1	<1.0
17	NA	NA	NA	0.1	NA	NA	NA
18	NA	NA	NA	0.19	NA	NA	NA
19	NA	NA	NA	0.14	NA	NA	NA
20	NA	NA	NA	<0.01	NA	NA	NA
21	NA	<1	NA	NA	NA	NA	<1.0
22	NA	NA	NA	NA	NA	NA	NA
23	NA	<1	1.2	NA	<1	<1	<1.0

Sólidos

Los sólidos se monitorearon en la Ciénega debido a su importancia y posible variación con la operación de la planta desaladora de Yuma. La Tabla 26 muestra las concentraciones de los Sólidos Disueltos Totales (SDT) medidos en laboratorio de Dic 2009 a May 2011 (Tabla 29). Una discusión completa de este parámetro se dio en la sección de SDT del presente reporte.

Tabla 29. Sólidos Disueltos Totales (SDT) mg/l medidos en el laboratorio

Site	dic-09	ene-10	feb-10	mar-10	abr-10	may-10	jun-10	jul-10	ago-10
Bypass dren	2545	2934	2888	2976	2702	3270	3928	3349	3834
Riito	2833	2848	3088	3420	3302	3368	3368	3578	4254
1	2340	2434	2974	2908	2874	3734	3528	3928	4390
2	2433	2632	3155	3004	2932	3790	3272	3952	4392
3	2790	4297	3744	3018	3152	3710	4376	3934	4784
4	2428	2438	2924	2892	2798	3762	3992	3964	4474
5	NA	NA	2814.5	2670	NA	NA	NA	NA	NA
6	2415	NA	2788	2894	2968	NA	NA	NA	NA
7	NA	NA	5327.5	3944	4352	4386	5762	7048	9022
10	NA	NA	NA	3012	3226	3478	6014	NA	NA
11	NA	NA	3530	3182	4212	4568	NA	34034	NA
12	NA	NA	NA	4782	5172	5608	8214	17246	NA
13	NA	4636	4086	3580	5006	4335	5816	6936	12106

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14	NA	NA	NA	NA	NA	NA	NA	NA	NA
15	NA	NA	NA	NA	NA	NA	NA	NA	NA
16	NA	3842	4672	4154	4852	5024	NA	7980	NA
17	NA	2560	3020	2972	2972	3813	NA	3814	4176
18	NA	2424	2960	2900	2898	3724	3526	3850	4276
19	NA	2736	3066	2892	3058	3761	4450	4242	5182
20	NA	2666		2940	3028	3772	3806	3820	4260
21	NA	NA	2838	2682	NA	NA	NA	NA	NA
22	NA	5664	6963	6602	5974	9573	NA	NA	NA
23	NA	NA	4690	4324	4340	4516	5192	5856	6588

Tabla 29. Continuación

Sitio	**Oct-10**	**Nov-10**	**Dic-10**	**Ene-11**	**Feb-11**	**Mar-11**	**Abr-11**	**May-11**
Bypass dren	2736	2830	2600	3856	2324	3964	2826	2640
Riito	4060	3782	4140	4222	4378	4058	2403	3630
1	2860	2924	3196	3730	3404	4034	2804	2732
2	2844	2964	3390	3770	NA	NA	2758	2908
3	3222	3220	3248	3676	3868	3700	3040	3060
4	2892	2962	3234	3742	3658	4002	NA	2740
5	NA	NA	NA	NA	4020	3796	3234	2888
6	NA	NA	NA	NA	3522	4016	3076	2820
7	4428	4126	5292	5306	5532	5120	5700	5674
10	4134	3674	2810	4316	4612	4006	NA	NA
11	4728	4051	3825	5848	5451	5254	NA	6444
12	NA	NA	NA	NA	NA	NA	NA	NA
13	5280	4666	NA	6040	6273	4822	6606	6146
14	8162	5352	NA	NA	8344	NA	NA	NA
15	6116	4394	NA	NA	5405	NA	NA	NA
16	3444	3586	4440	4614	3802	4102	6052	4334
17	2798	3966	3444	3838	3196	3918	2476	2736
18	2836	2930	3280	3738	3354	4030	2828	2674
19	3002	3090	3504	3788	3772	3870	NA	2944
20	2830	3000	3494	3812	3278	3946	2736	2796
21	NA	NA	NA	NA	4028	3904	3226	2836
22	5852	5566	6960	5124	5652	5674	4854	6620
23	4944	4348	4318	4123	4498	4267	4262	3962

Los sólidos sedimentables presentes en una muestra de agua indican la cantidad de sólidos que pueden sedimentarse en un volumen específico en un tiempo determinado, es la mediada de la cantidad de sólidos que pueden eliminarse por tratamiento primario en una planta de tratamiento. Los sólidos sedimentables fueron detectados en muestras de agua del dren Bypass en diciembre 2009, feb, mar y dic 2010 y en abril y mayo 2011 (Tabla 30). Sin embargo, ninguno de los valores excedió los 2 ml/l recomendados por la Norma mexicana. Valores mayores se detectaron en el sitio 19, el cual está dentro de la vegetación y probablemente tuvo partículas al tratar de colectarlo, pero en general, la

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Ciénega presenta agua clara en todos sus puntos, en parte debido a las bajas concentraciones de sólidos de entrada pero también por la alta densidad de vegetación que atrapa la mayoría de los sólidos.

Tabla 30. Concentración de sólidos sedimentables en muestras de agua (ml/l)

Site	dic-09	feb-10	mar-10	abr-10	may-10	jun-10	jul-10	ago-10	oct-10	nov-10	dic-10	ene-11	feb-11	mar-11	abr-11	may-11
Bp	0.5	0.4	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	<0.1	<0.1	0.2	0.1
Rii	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1	<0.1	1.1	<0.1	0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	NA	<0.1	<0.1
3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1.5	<0.1	NA	<0.1
5	NA	<0.1	<0.1	NA	<0.1	NA	NA	NA	NA	NA	NA	NA	<0.1	<0.1	0.3	0.5
6	0.2	<0.1	<0.1	<0.1	<0.1	NA	NA	NA	NA	NA	NA	NA	<0.1	<0.1	<0.1	<0.1
7	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
8	0.5	0.4	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	<0.1	<0.1	0.2	0.1
9	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
10	NA	NA	<0.1	1	<0.1	<0.1	NA	NA	<0.1	<0.1	0.4	0.4	<0.1	<0.1	NA	NA
11	NA	<0.1	<0.1	<0.1	<0.1	NA	<0.1	NA	<0.1	<0.1	<0.1	<0.1	0.2	0.4	NA	<0.1
12	NA	NA	<0.1	1	<0.1	<0.1	<0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA
13	NA	<0.1	0.2	<0.1	<0.1	<0.1	1	0.5	<0.1	<0.1	NA	<0.1	<0.1	<0.1	<0.1	<0.1
14	NA	NA	NA	NA	<0.1	NA	NA	NA	<0.1	<0.1	NA	NA	<0.1	NA	NA	NA
15	NA	NA	NA	NA	<0.1	NA	NA	NA	<0.1	<0.1	NA	NA	<0.1	NA	NA	NA
16	NA	<0.1	<0.1	<0.1	<0.1	NA	**5**	NA	<0.1	<0.1	<0.1	<0.1	<0.1	**4**	0.8	0.3
17	NA	<0.1	<0.1	<0.1	<0.1	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
18	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
19	NA	1.3	<0.1	<0.1	0.8	0.7	0.6	<0.1	**8**	**2**	<0.1	<0.1	**7.5**	0.3	NA	0.7
20	NA	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**2.9**	<0.1	<0.1	<0.1	<0.1	<0.1
21	NA	<0.1	<0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.1	<0.1	<0.1	<0.1
22	NA	<0.1	0.2	<0.1	0.2	NA	NA	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
23	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	<0.1	<0.1

Los sólidos suspendidos totales (SST) son todos los sólidos que quedan en un filtro de fibra de vidrio incluyendo sales y materia particulada. Altas concentraciones de SST pueden bajar la calidad del agua. La combinación de aguas mas tibias, menos luz y menos oxígeno hace imposible la existencia de la mayoría de vida acuática. Se consideran concentraciones de SST < 20 mg/l como agua clara, agua con SST entre 40-80 mg/l es turbia, mientras concentraciones > 150 mg/l es agua oscura. Las concentraciones de SST en el dren Bypass disminuyeron de Abril de 2010 a Marzo 2011 (Fig. 46). Dentro de la Ciénega las concentraciones se redujeron notablemente comparadas con el dren de entrada a < 20 mg/l que se considera agua clara (Fig. 47), probablemente debido a la presencia de vegetación.

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Tabla 31. Sólidos suspendidos totales (SST) (mg/l) en muestras de agua de la Ciénega de Santa Clara.

Sitio	ene-10	feb-10	mar-10	abr-10	may-10	jun-10	jul-10	ago-10	oct-10	nov-10	dic-10	ene-11	feb-11	mar-11	abr-11	may-11
Bp	27	58	67	16	14	19	13	3	37	10	38	7	13	17	79	87
Rii	4	12	4	9	6	14	8	4	9	6	8	11	23	29	25	4
1	38	41	6	40	13	16	16	9	14	3	7	11	8	22	10	8
2	11	7	12	11	14	11	11	15	27	3	10	8	NA	NA	15	9
3	16.5	4	8	13	13	5	7	4	3	7	3	9	19	26	10	4
4	7	3	6	4	4	5	7	5	5	4	3	4	72	9	NA	9
5	NA	15.5	11	NA	NA	NA	NA	NA	NA	NA	NA	NA	18	17	76	97
6	NA	10	5	4	NA	NA	NA	NA	NA	NA	NA	NA	7	10	5	4
7	NA	2	18	17	3	4	8	4	2	2	6	5	11	9	5	5
10	NA	NA	58	77	47	86	NA	NA	84	130	184	166	109	68	NA	NA
11	NA	7	6	18	69		46	NA	11	33	59	33	111	105	NA	61
12	NA	NA	97	64	51	28	8	NA	NA	NA	NA	NA	NA	NA	NA	NA
13	6	4	88	6	60	30	73	183	17	10	NA	6	56	64	8	22
14	NA	NA	NA	NA	NA	NA	NA	NA	9	2	NA	NA	61	NA	NA	NA
15	NA	NA	NA	NA	NA	NA	NA	NA	18	12	NA	NA	36	NA	NA	NA
16	3	9	2	12	5	NA	36	NA	3	3	3	8	6	361	45	12
17	6	4	5	32	11	NA	16	7	10	8	6	9	10	21	7	8
18	6	4	5	11	3	11	13	5	3	3	9	10	8	9	4	2
19	12	26	2	6	21	33	14	3	151	32	55	4	92	26	NA	15
20	8	NA	9	26	16	12	12	1	8	6	10	10	8	19	12	14
21	NA	38.5	19	NA	NA	NA	NA	NA	NA	NA	NA	NA	23	23	35	3
22	27	31	38	13	118	NA	NA	NA	1	2	11	17	4	42	7	33
23	NA	11	4	6	4	5	5	1	2	10	3	9	48	2	3	5

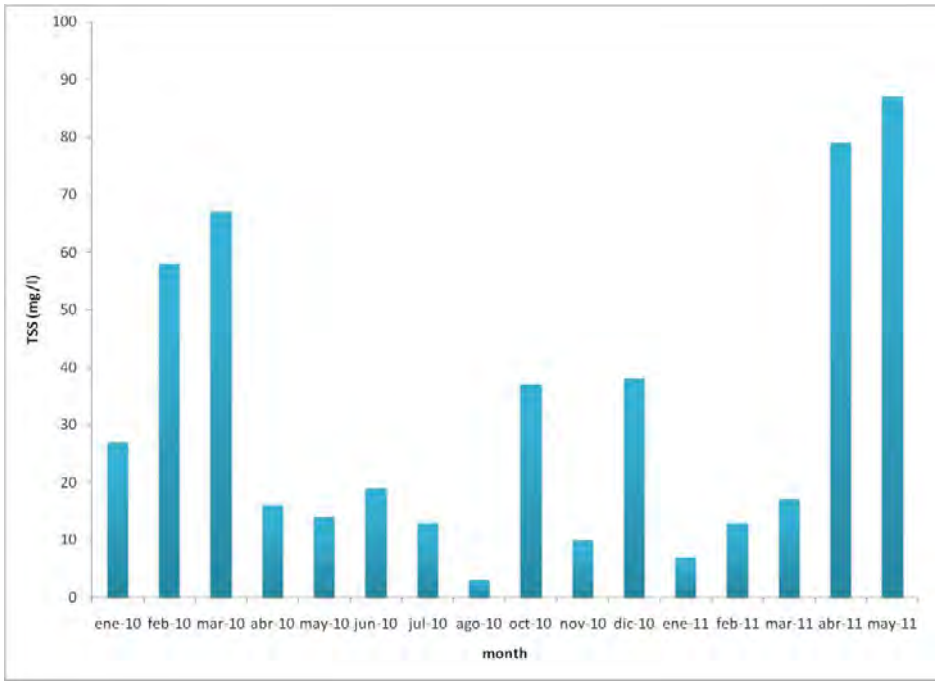

Fig. 46. SST (mg/l) en el dren Bypass durante el periodo de monitoreo

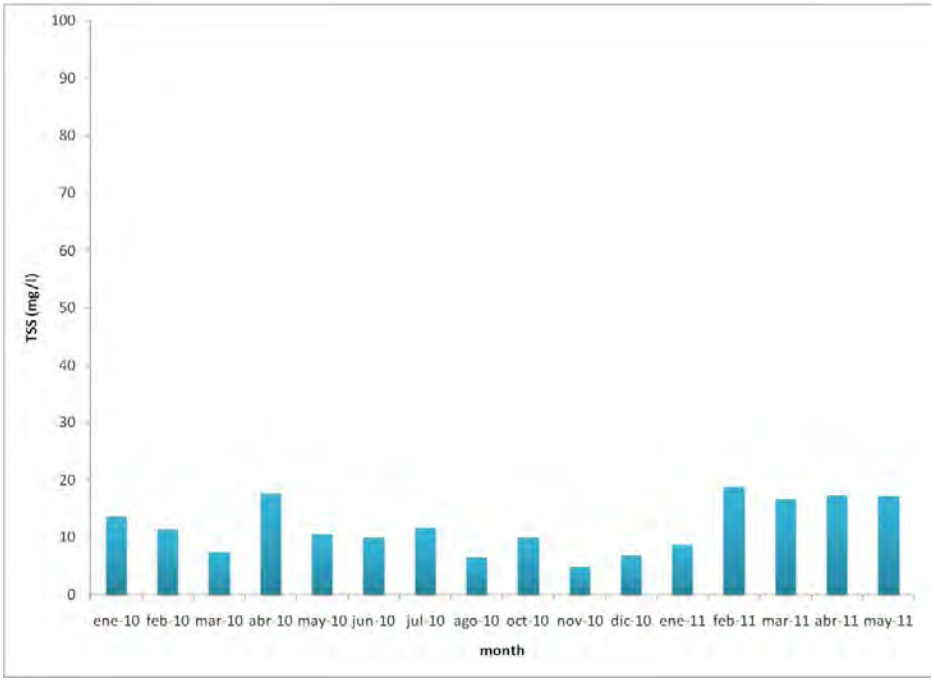

Fig. 47. SST (mg/l) dentro de la porción con vegetación de la Ciénega de Santa Clara

La turbidez también es una medida de la calidad del agua, cuanto material suspendido en el agua disminuye con el paso de luz atreves del agua. La materia suspendida incluye partículas de suelo, algas, plancton, microbios y otras sustancias. Estas partículas son del tamaño de entre 0.004 mm a 1 mm. En la Ciénega, los valores de turbidez (FTU) se incrementaron en Dic 2009 y en Mayo 2010 (Fig. 48) y dentro de la Ciénega se observa un pico en Mayo del 2010 (Fig. 49).

Tabla 31. Turbidez (FTU) en la Ciénega de Santa Clara

Site	dic-09	ene-10	feb-10	mar-10	abr-10	jun-10	jul-10	ago-10	oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11
Bp	7.3	0.8	0.9	1.2	1.2	0.2	0.8	0.8	1.8	1.3	1.5	1.2	0.9	1.2	0.5	0.4
Rii	4.0	1.1	1.1	0.8	2.3	0.6	1.4	1.9	1.3	1.4	1.9	1.8	1.7	1.9	0.7	1.2
1	1.4	0.5	1.0	1.2	2.6	2.4	5.7	2.3	1.4	1.3	2.4	1.3	0.8	2.1	1.0	1.3
2	3.5	1.2	1.1	3.4	2.9	2.4	2.9	2.3	0.9	1.4	2.2	1.4	NA	NA	1.4	1.6
3	4.2	1.8	1.5	2.6	3.5	0.9	2.0	1.0	0.9	1.4	1.3	1.3	1.4	2.8	2.2	1.5
4	3.6	0.6	0.7	0.7	2.0	0.7	2.6	2.8	1.1	0.8	1.3	0.6	0.8	1.8		0.9
5	NA	NA	6.1	1.1	NA	NA	NA	NA	NA	NA	NA	NA	3.3	4.6	1.3	1.2
6	5.3	NA	5.5	0.7	1.0	NA	NA	NA	NA	NA	NA	NA	0.8	1.5	2.1	0.7
7	NA	NA	2.3	2.0	4.4	0.4	3.3	2.0	1.1	0.6	1.3	1.5	2.0	1.5	1.0	0.7
10	NA	NA	NA	4.2	20.3	0.6	NA	NA	1.3	7.5	3.2	6.5	8.9	5.2	NA	NA
11	NA	NA	3.1	1.4	5.5	NA	14	NA	0.8	2.8	2.6	7.6	5.0	24.4	NA	2.7
12	NA	NA	NA	9.6	26.4	2.5	4.8	NA	NA	NA	NA	NA	NA	NA	NA	NA
13	NA	1.8	0.9	11.2	2.8	1.2	13	1.7	1.3	0.9	NA	2.1	4.6	4.8	1.3	2.6
14	NA	NA	NA	NA	NA	NA	NA	NA	1.1	0.5	NA	NA	1.4	NA	NA	NA
15	NA	NA	NA	NA	NA	NA	NA	NA	1.3	1.1	NA	NA	1.8	NA	NA	NA

16	NA	0.9	1.2	1.1	1.9	NA	69	NA	1.1	0.7	1.2	2.4	1.0	1.4	0.7	0.9
17	NA	0.8	0.8	1.5	4.3	NA	3.7	1.4	1.0	1.5	2.1	1.5	1.6	1.6	0.6	0.7
18	NA	0.9	1.0	0.6	0.8	0.5	4.7	1.3	0.7	0.8	2.0	1.1	1.2	2.1	0.9	0.9
19	NA	0.9	0.8	0.5	1.9	0.7	0.8	0.3	0.4	0.7	0.4	0.6	0.6	1.5	NA	0.8
20	NA	0.6	NA	1.3	3.0	0.4	2.7	0.7	0.7	1.3	1.9	1.4	1.6	2.3	1.2	1.2
21	NA	NA	15.7	0.1	NA	NA	NA	NA	NA	NA	NA	NA	3.1	5.9	0.8	0.5
22	NA	1.8	2.4	3.3	5.2	NA	NA	NA	0.4	0.9	2.0	1.3	0.6	2.8	0.9	0.7
23	NA	NA	1.2	0.4	1.5	0.9	1.2	0.7	0.6	0.9	0.8	0.7	0.3	0.5	1.0	0.9

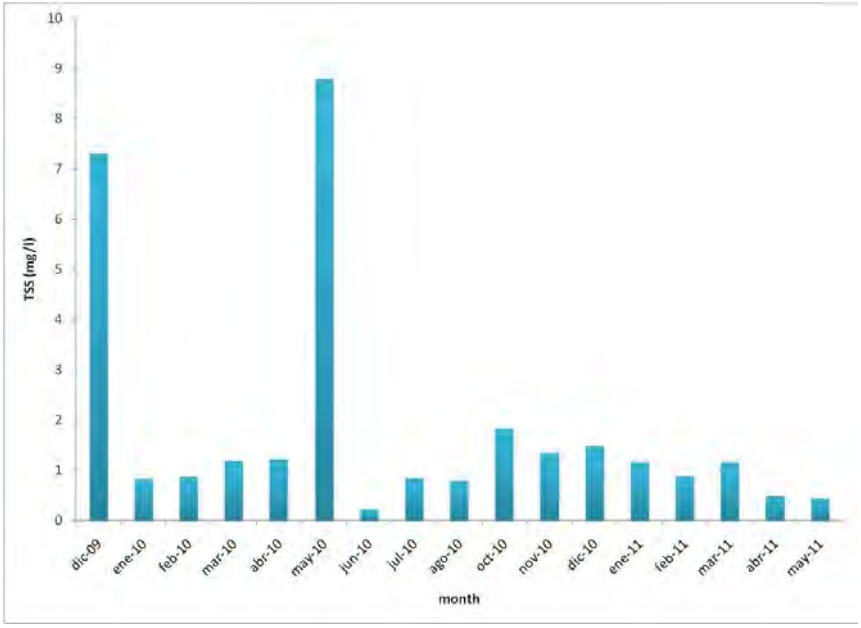

Fig. 48. Turbidez (FTU) en el dren Bypass durante el periodo de monitoreo

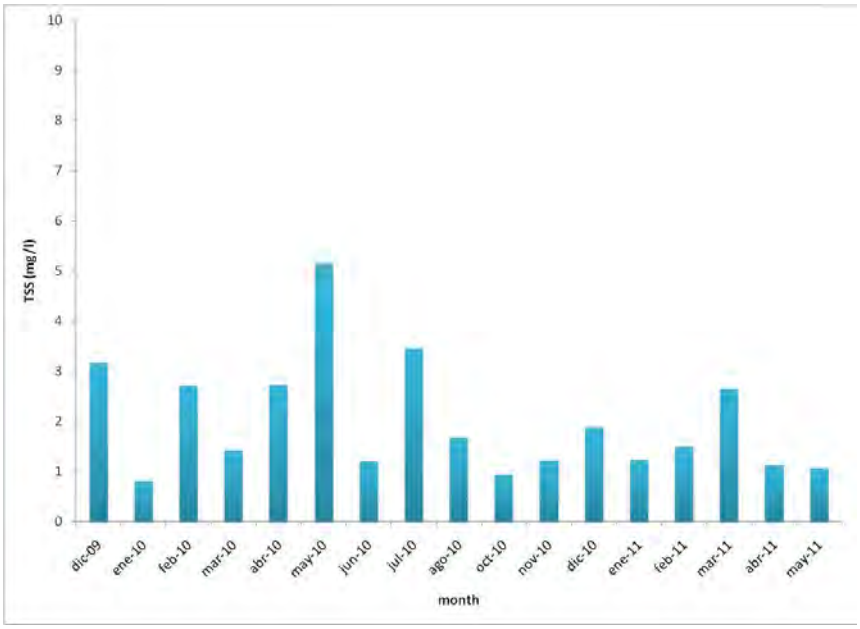

Fig. 49. Turbidez en la porción con vegetación de la Ciénega

Otros parámetros como sulfatos, cloro total, calcio y dureza también se monitoreo. No se observó un claro incremento en las concentraciones de estos parámetros en el dren Bypass, o dentro del humedal durante la operación de la planta (Tablas 32-35).

Tabla 32 Concentraciones de sulfato (mg/l) en agua de la Ciénega de Santa Clara

Site	Feb-10	Apr-10	Jul-10	Oct-10	Jan-11	Apr-11
Bypass	930	840	1190	970	1380	970
Riito	890	730	930	980	1020	770
1	1050	960	1460	930	1340	890
5	880	NA	NA	NA	NA	940
6	950	850	NA	NA	NA	990
12	NA	1300	3920	NA	NA	NA
13	1020	1030	1830	1530	1380	1630
16	870	810	850	1060	740	1060
21	960	NA	NA	NA	NA	1000
23	1250	1120	1770	1370	1280	1170

Tabla 33. Concentraciones de cloro total (mg/l) en agua de la Ciénega de Santa Clara

Site	Feb-10	Apr-10	Jul-10	Oct-10	Jan-11	Apr-11
Bypass	0.6	< 0.1	1.1	0.2	0.77	0.2
Riito	0.5	< 0.1	< 0.1	< 0.1	0.19	< 0.1
1	< 0.1	< 0.1	0.54	< 0.1	< 0.1	0.14
5	< 0.1	NA	NA	NA	NA	< 0.1
6	< 0.1	< 0.1	NA	NA	NA	0.14
12	NA	< 0.1	< 0.1	NA	NA	NA
13	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
16	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
21	< 0.1	NA	NA	NA	NA	< 0.1
23	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

Tabla 34. Concentraciones de Calcio (mg/l) in agua de la Ciénega de Santa Clara

Sitio	Feb-10	Apr-10	Jul-10	Oct-10	Jan-11	Apr-11
Bypass	162.7	142	170	169	219	312
Riito	178.6	190	170	190	177	142
1	162.7	149	174	165	202	154
5	162.7	NA	NA	NA	NA	170
6	166.7	138	NA	NA	NA	158
8	162.7	142	170	169	219	312
9	178.6	190	170	190	177	142
12	NA	190	413	NA	NA	NA
13	182.5	198	259	244	206	231
16	186.5	182	239	194	168	202
21	166.7	NA	NA	NA	NA	166
23	186.5	170	198	219	202	178

Tabla 35. Dureza (mg/l) en agua de la Ciénega

Site	Feb-10	Apr-10	Jul-10	Oct-10	Jan-11	Apr-11
Bypass	770	697	788	704	977	687
Riito	780	828	717	798	746	556
1	770	707	838	714	924	677
5	790	NA	NA	NA	NA	758
6	780	737	NA	NA	NA	737
12	NA	990	2424	NA	NA	NA
13	928	990	1414	1134	1050	1233
16	810	789	939	198	588	848
21	790	NA	NA	NA	NA	758
22	NA	NA	NA	NA	NA	NA
23	1008	889	1111	1050	882	899

5.12. Análisis de la Vegetación bajo distintos escenarios de 2008 a 2011

Para el análisis de la vegetación en la Ciénega de Santa Clara, se utilizaron imágenes Quickbird y WorldView 2 para detectar cambios estacionales en la vegetación de la Ciénega de Santa Clara. Analizamos la temporada de invierno, primavera y verano para 2008-2011. Las bandas del rojo y las cercanas al infra-rojo (NIR) se convirtieron a el índice NDVI (Normalized Difference Vegetation Index) y un programa de clasificación no supervisada se usó para separar los valores en rangos representando agua, suelo sin vegetación o tule (*Typha domingensis*) en dormancia y cuatro clases de vegetación correspondientes a las diferentes densidades de foliaje. Las densidades de foliaje variaron de bajo a muy alto, dependiendo de los valores de NDVI.

La interpretación de las imágenes clasificadas mostró en términos generales que la huella de vegetación de la Ciénega de Santa Clara, fue estable de 2008 a 2011, pero si se llevaron a cabo cambios en la densidad de la vegetación (Tablas 38 y 39). En Septiembre 2008, el brazo oeste de la Ciénega tuvo una menor densidad de vegetación. Esa porción re-verdeció en los veranos de 2009 y 2010, después del dragado del canal Bypass por la CONAGUA. Las imágenes de invierno y primavera de 2009 y 2010 muestran áreas con zonas de vegetación (*T. domingensis*) en dormancia y también se muestran parches de carrizo común (*Phragmites australis*), el cual es evidente en esta temporada porque a diferencia del tule, el carrizo es verde todo el año Finalmente, en julio del 2010 se observó una marcada reducción en la vegetación clasificada como de “mas alta” densidad, en relación a imágenes previas del verano (Figs. 50-57). La disminución de NDVI durante este periodo de tiempo estuvo dentro del rango normal de la variación anual de la densidad de vegetación en este humedal.

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Tabla 36. Número de hectáreas en cada clase de cobertura vegetal en imágenes Quickbird o World View 2 de la Ciénega de Santa Clara, en. “Baja, media, alta y muy alta” se refiere a la intensidad del verdor, no a la elevación del suelo.

Clase	Sep-08	Feb-09	Abr-09	Ago-09	Ene-10	Abr-10	Jul-10
Agua	1007	958	869	543	759	569	465
Suelo/Vegetación seca	1736	2249	1581	1509	1483	474	1682
Densidad de Vegetación “Baja”	1886	3027	3786	1335	3991	2569	1442
Densidad de Vegetación “Media”	726	313	257	1311	250	1949	1535
Densidad de Vegetación “Alta”	779	92	0	1421	0	820	1261
Densidad de Vegetación “Muy alta”	406	0	45	419	50	145	150
Total	6540	6639	6538	6538	6533	6535	6534

Tabla 37. Número de hectáreas en cada clase de cobertura vegetal en imágenes Quickbird o World View 2 de la Ciénega de Santa Clara en Abril 2011.

Clase	Abril 2011
Agua	478
Suelo/Vegetación seca	1,087
Densidad de Vegetación “Baja”	1,952
Densidad de Vegetación “Media”	1,380
Densidad de Vegetación “Alta”	1,296
Densidad de Vegetación “Muy alta”	337
Total	6,530

Nota: En el verano, la clasificación “suelo/vegetación seca” es predominantemente suelo, porque la vegetación esta verde en esa época del año, en otra época fuera de la de verano esta clasificación si se refiere a suelo o vegetación seca, ya que no se pudo separar en dos clasificaciones porque los valores de NDVI se sobrelapan. Esta aclaración también aplica a las imágenes siguientes, en donde se muestra visualmente la frecuencia de cada clase.

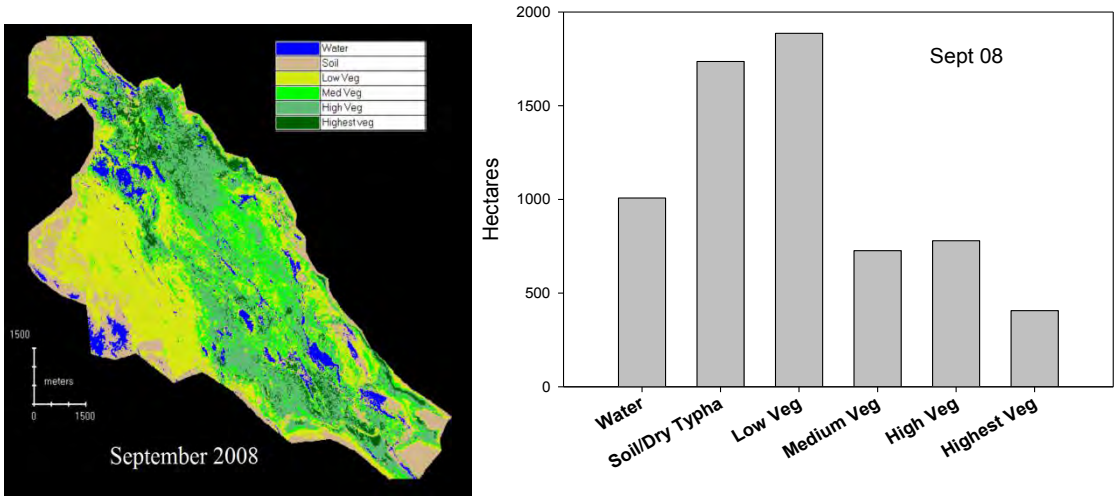

Fig. 50. Imagen clasificada de la Ciénega de Santa Clara e histograma, Septiembre 2008

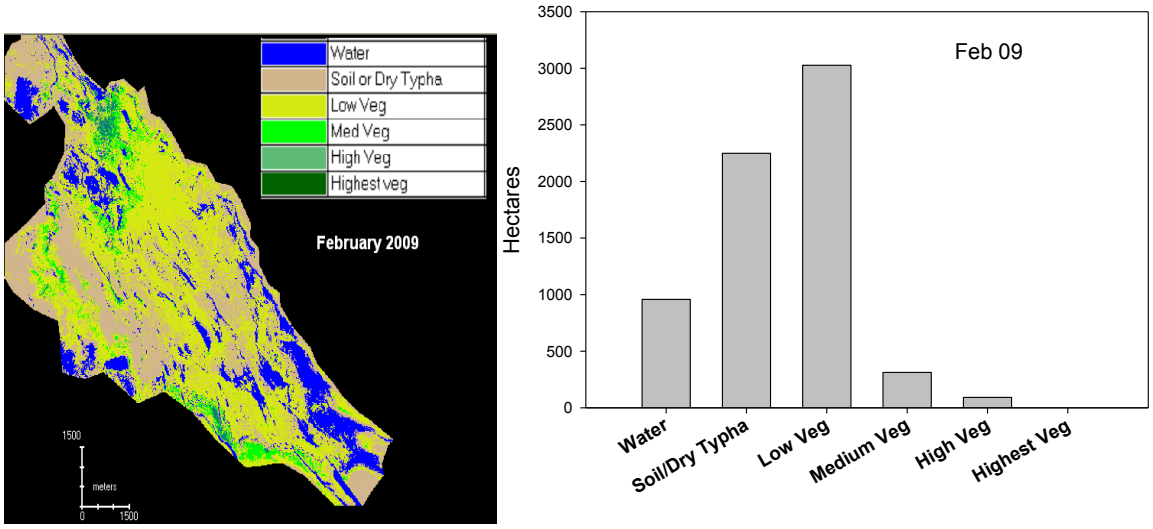

Fig. 51. Imagen clasificada de la Ciénega de Santa Clara e histograma, Febrero 2009.

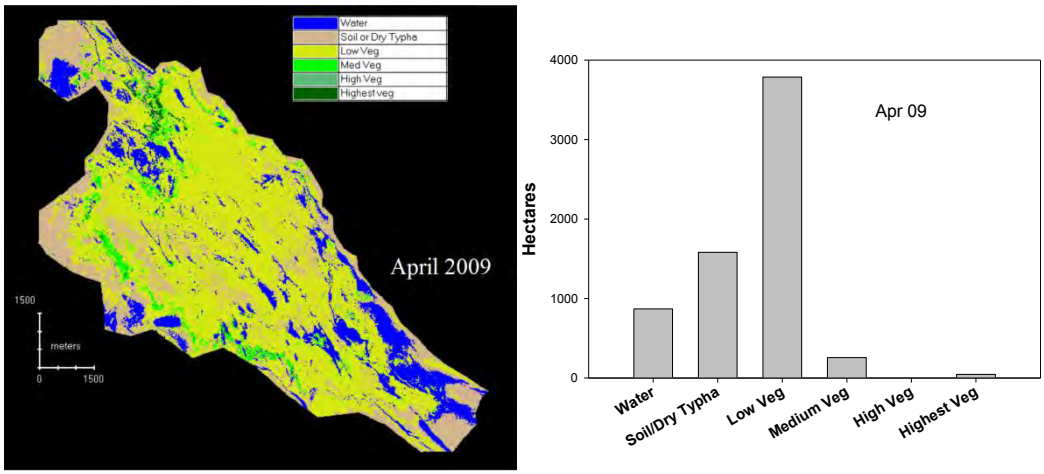

Fig. 52. Imagen clasificada de la Ciénega de Santa Clara e histograma, Abril, 2009

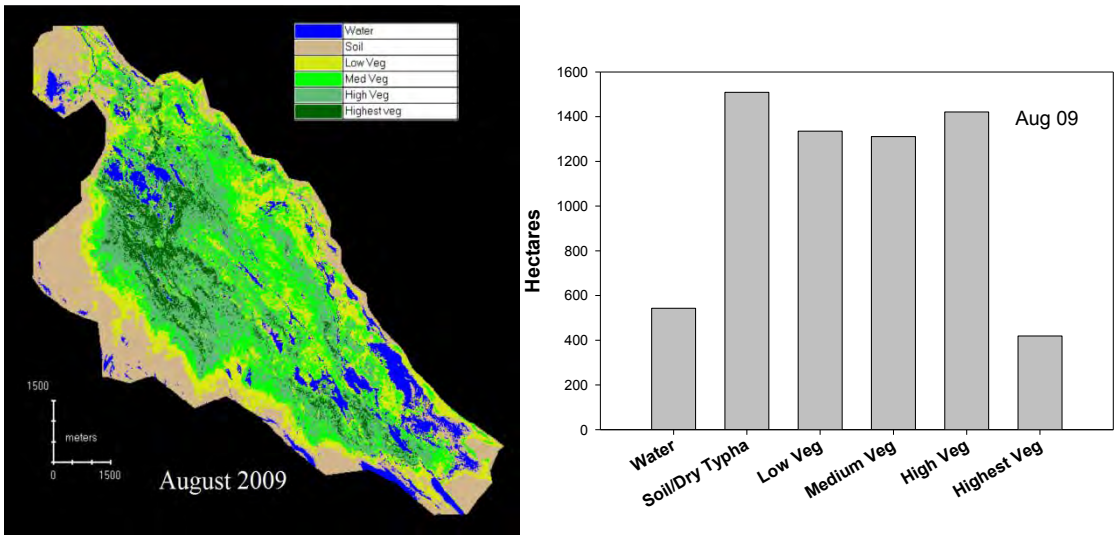

Fig. 53. Imagen clasificada de la Ciénega de Santa Clara e histograma, Agosto, 2009

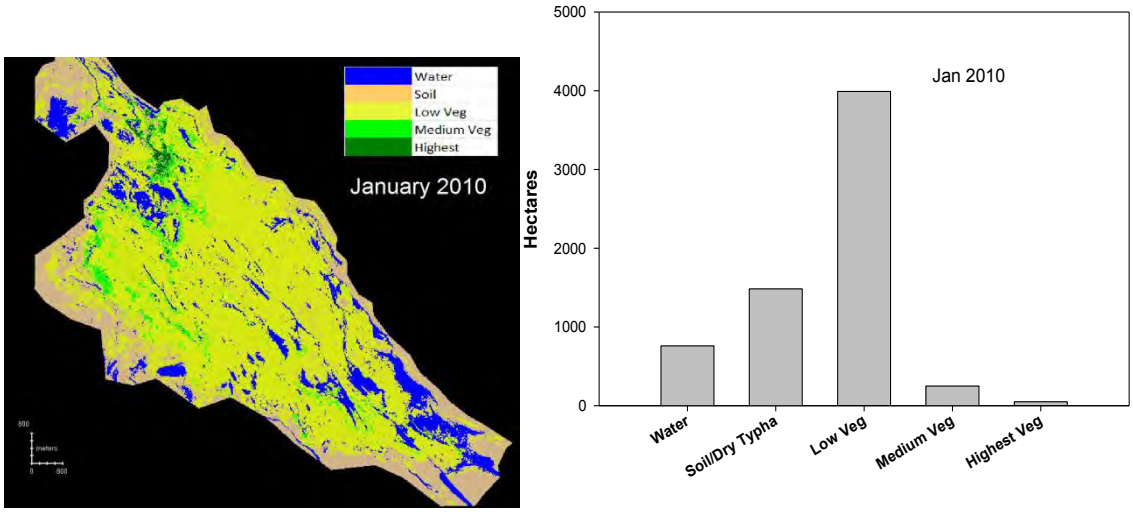

Fig. 54. Imagen clasificada de la Ciénega de Santa Clara e histograma, Enero, 2010

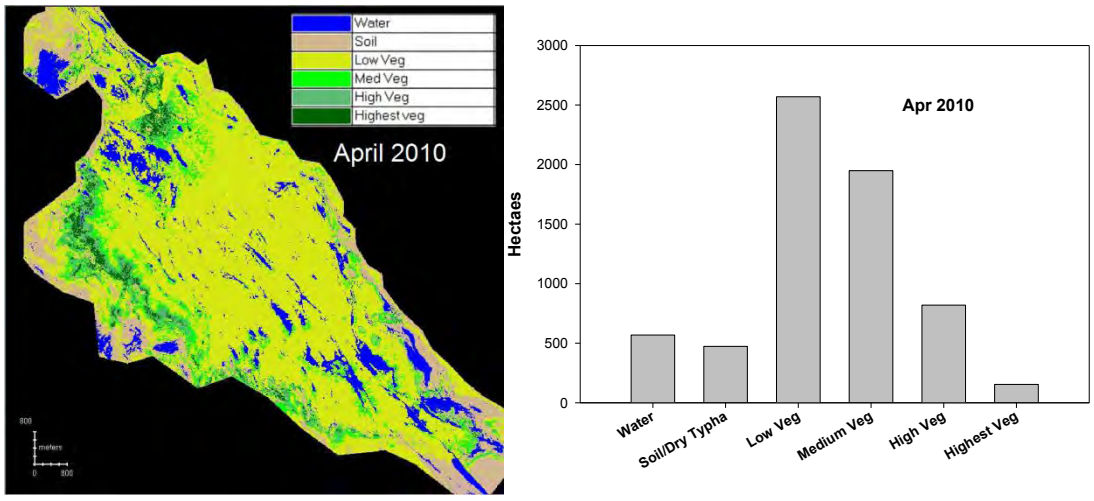

Fig. 55. Imagen clasificada de la Ciénega de Santa Clara e histograma, Abril 2010.

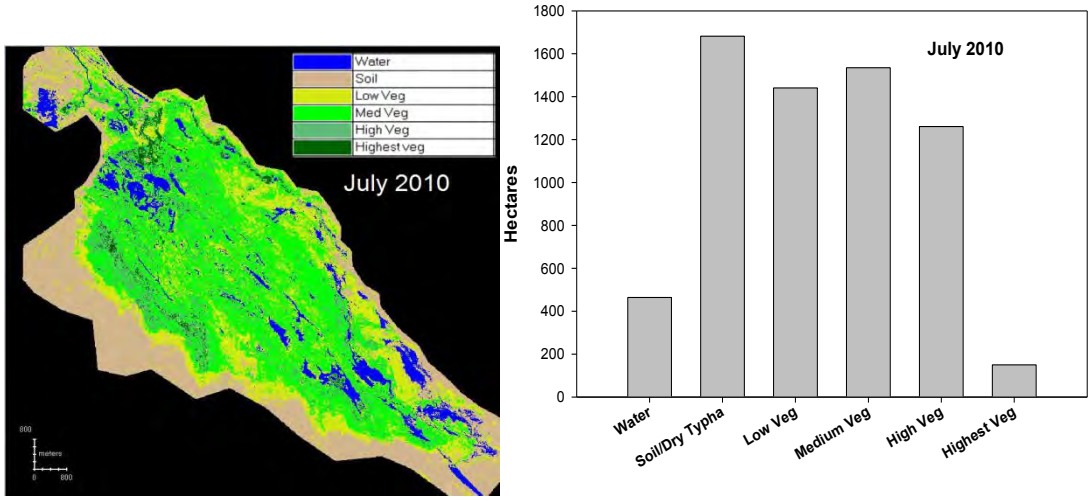

Fig. 56. Imagen clasificada de la Ciénega de Santa Clara e histograma, Julio 2010.

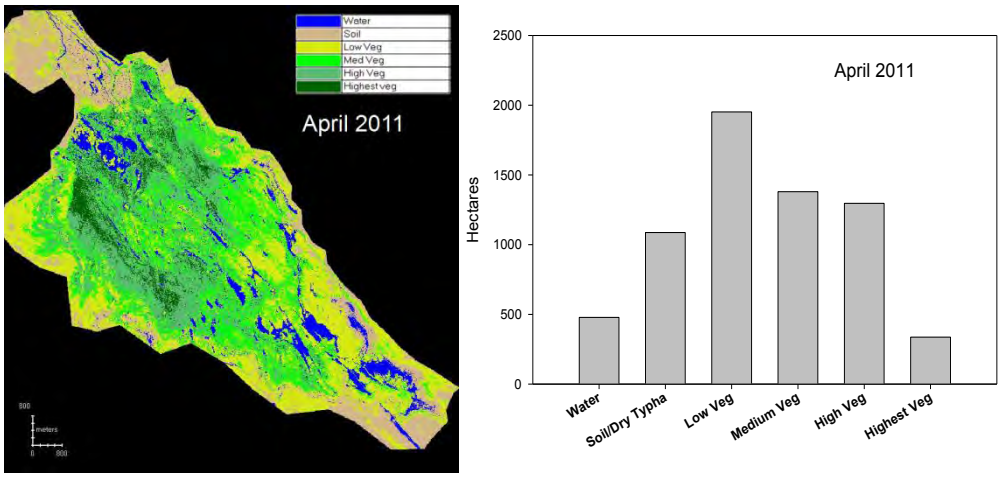

Fig. 57. Imagen clasificada de la Ciénega de Santa Clara e histograma, Abril 2011.

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5.13. Batimetría y topografía de la Ciénega de Santa Clara

Para este proyecto se llevaron a cabo tareas de batimetría y topografía en la Ciénega de Santa Clara. El objetivo de la topografía es documentar las áreas cercanas a la orilla del humedal que pueden inundarse o estar expuestas a cambios en flujo del agua (volumen del agua) a la Ciénega. Se establecieron bancos de nivel monumentados en el perímetro de la Ciénega con el propósito de tener puntos de referencia fijos, en donde se colocaron antenas fijas del GPS. La ubicación de las estaciones base se muestra en la Fig. 58.

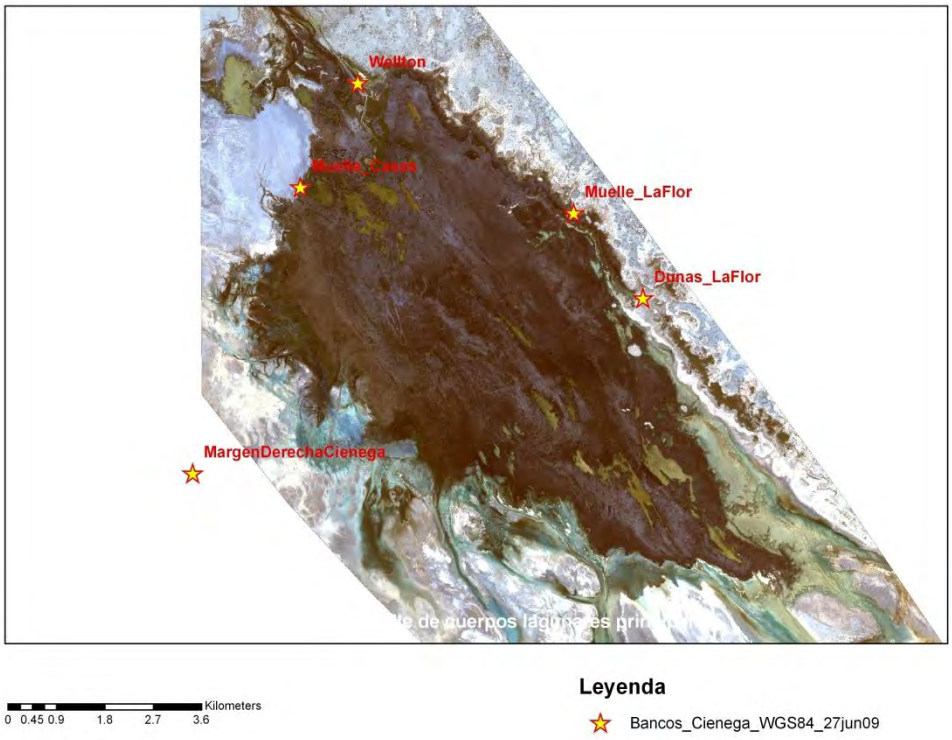

Fig. 58. Ubicación de antenas fijas de GPS para trabajo de topografía de la Ciénega de Santa Clara

A partir de estas estaciones base se obtuvo la elevación del fondo de las lagunas de mayor extensión en la Ciénega haciendo recorridos en lancha y tomando la elevación tanto del fondo de las lagunas como del espejo de agua, con el propósito de definir el tirante de agua. En la figura 58 se muestran los puntos tomados en las lagunas ubicadas al noroeste de la Ciénega cerca del muelle. Se tuvo especial atención en tomar puntos alrededor de las lagunas para establecer con precisión el perímetro de las lagunas, mismo que luego fue utilizado para evaluar la superficie de agua libre dentro de la Ciénega en los cálculos de evaporación.

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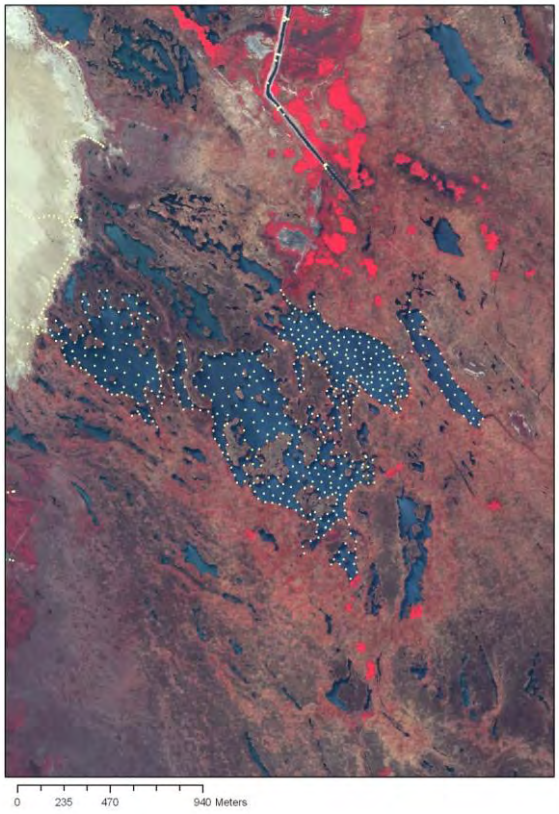

Fig. 59. Detalle de levantamiento topográfico de las lagunas cercanas al muelle en la porción noroeste de la Ciénega. Los puntos indican los sitios en los que se tomaron datos de profundidad de la laguna.

En los sitios donde no fue posible acceder por navegación fluvial se utilizó un aerobote que permitió pasar por zonas de vegetación y alcanzar las áreas lagunares que eran inaccesibles. De esta forma se obtuvo la geometría y profundidad de muchas otras lagunas principalmente ubicadas al sur y sureste de la Ciénega. Desafortunadamente no fue posible acceder a todas las lagunas ya que la vegetación es tan robusta que el aerobote no puede pasar sobre ella. De igual forma que en los casos anteriores se tomaron los puntos sobre el perímetro de las lagunas y algunos en la porción central de las mismas.

En la Figura 60 se muestran las líneas de nivel de lo que podría llamarse el suelo de la Ciénega que está formado en la zona lagunares por el fondo de las mismas y en la zona de vegetación por la zona de enraizamiento más denso de la vegetación como el tule, pino salado, etc. Las zonas en las que no se cuenta con información topográfica se ven como líneas suaves continuas, a diferencia de las zonas en las que se tiene información topográfica en las que se observan contornos circulares, irregulares e influenciados por puntos más bajos producto de las irregularidades del fondo de las lagunas.

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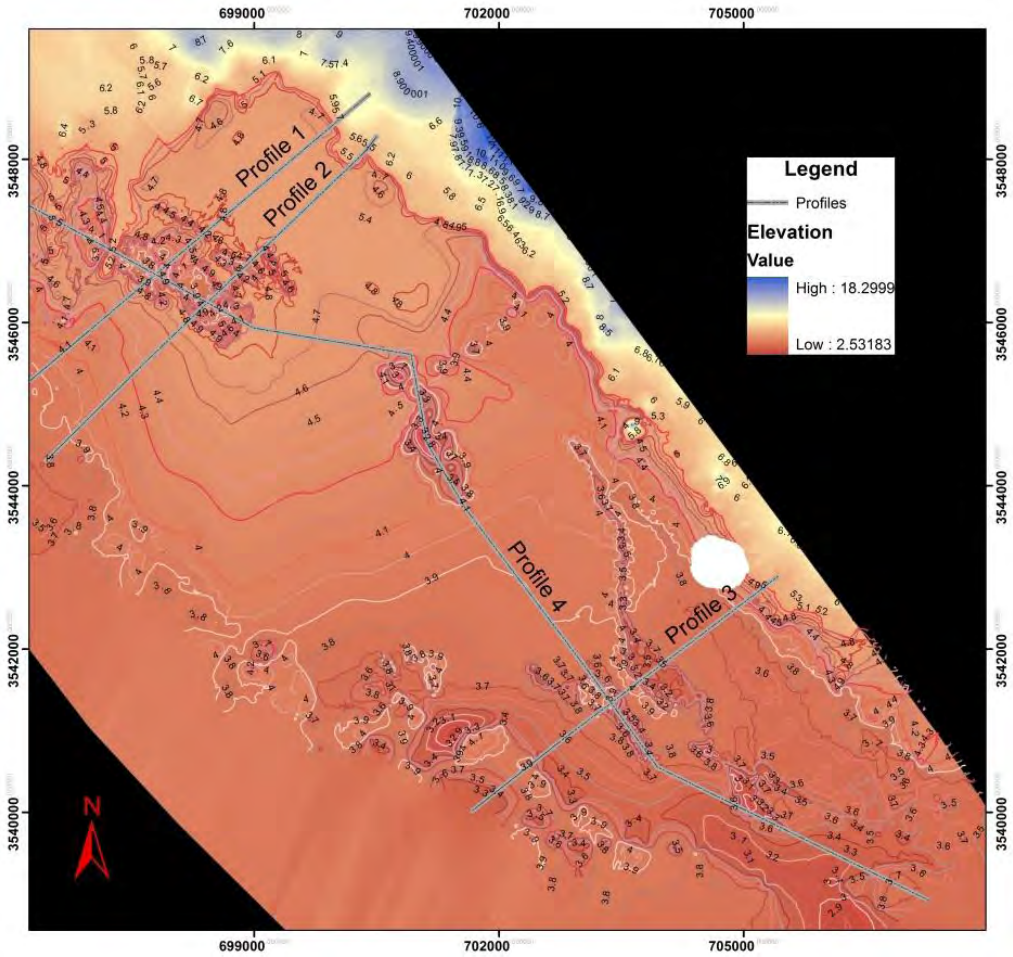

Fig. 60. Levantamiento topográfico y curvas de nivel de la Ciénega obtenidas durante este trabajo. Los contornos están en metros sobre el nivel del mar y poseen un espaciamiento de 0.10 m. Las líneas grises muestran la ubicación de los perfiles.

Con el propósito de analizar las relaciones hidrodinámicas entre lagunas se procedió a obtener cuatro perfiles de la Ciénega tres de ellos con orientación NE-SW. Los perfiles 1 y 2 ubicados en la poción norte de la Ciénega. El perfil No.1 se muestra en la Figura 61. En él se puede observar que el borde Este de la Ciénega constituye una barrera topográfica de más de 3 m de altura que impide la extensión del humedal en este flanco, este aumento en la elevación de la topografía continúa y a menos de un kilómetro del extremo Este del perfil se registraron alturas de 8 msnm. En la primera porción del perfil se mantiene en alrededor de 5 msnm de elevación para luego bajar hasta menos de 4 m en los cuerpos lagunares más importantes por su extensión en la Ciénega en el flanco oeste de estas lagunas se observa una barrera de mayor elevación de hasta casi 5 m que impide el vaciado de estos cuerpos. Después de esta barra se inicia una disminución progresiva de del nivel de la Ciénega hasta alcanzar en el extremo oeste del perfil una altura de 3.85 m.

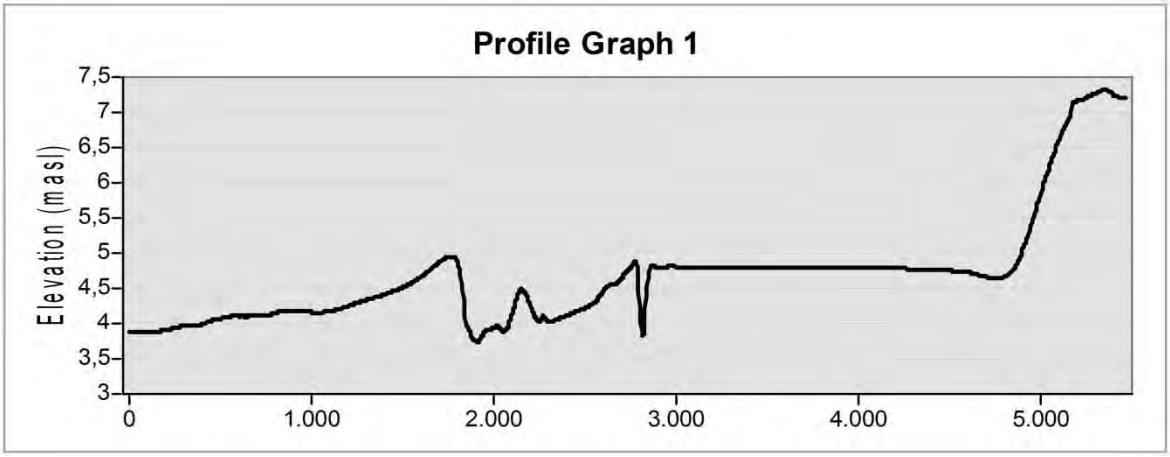

Fig. 61. Perfil No.1 con orientación NE-SW ubicada en la porción Norte del humedal. La porción izquierda del perfil corresponde al NE y la porción derecha al SW. Ver figura 60 para ubicación en el humedal.

El perfil No.2 muestra un comportamiento muy similar al descrito en el perfil No.1 con un incremento en la elevación al Este que de igual forma impide el crecimiento de la zona de humedales en ese flanco (Figura 62). Se observan cuerpos lagunares en la parte central del perfil que se ubican en la misma elevación que los del perfil No.1 y se inicia una disminución gradual de la topografía en dirección oeste alcanzando los 3.78 m en el borde del perfil. En este perfil no se observa la barra que divide las lagunas de este descenso de la topografía.

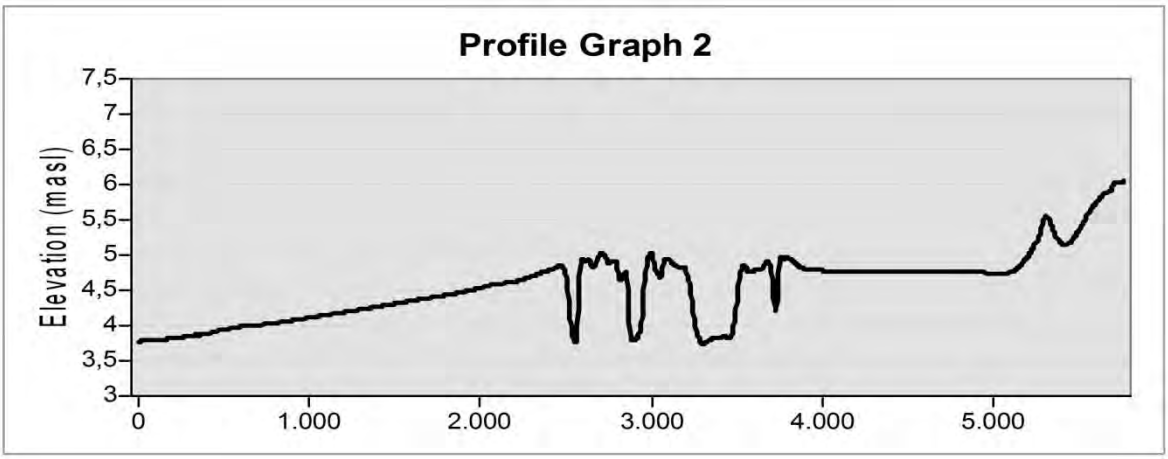

Figura 62. Perfil No.2 con orientación NE-SW ubicada en la porción Norte del humedal. La porción izquierda del perfil corresponde al NE y la porción derecha al SW. Ver figura 60 para ubicación en el humedal.

Perfil No.3 Está ubicado en la porción central sur del humedal tiene la misma orientación que los perfiles anteriores y muestra también al Este un escarpe topográfico que delimita la zona húmeda del resto de la mesa arenosa con elevaciones mayores a 5

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m en el extremo este del perfil. En este perfil se observa que el fondo de las lagunas centrales se encuentran un poco arriba de los 3 m de profundidad y están separadas por zonas de vegetación con elevaciones que alcanzan los 4 msnm, en este caso aunque se observa un gradiente que disminuye el nivel del terreno en dirección SW existe una barra de arena que esta la mayor parte del tiempo seca con una elevación que alcanza los 4 m para después bajar hasta menos de 3.3 msnm. El rasgo más importante de este último perfil es que el fondo de las lagunas es más bajo que el fondo de las lagunas de la porción norte, es decir se observa un cambio en la elevación del fondo que permite el paso del agua entre lagunas.

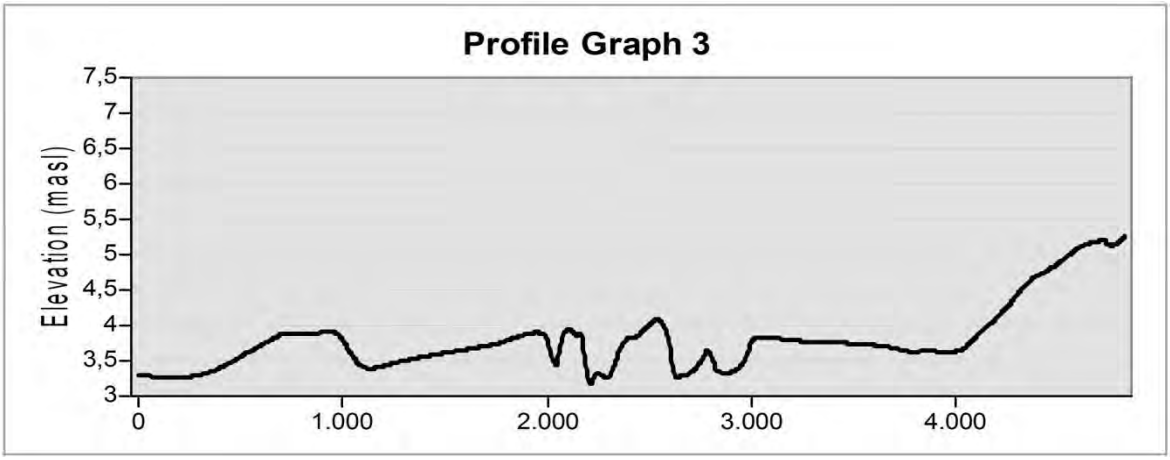

Figura 63. Perfil No.3 con orientación NE-SW ubicada en la porción Central sur del humedal. La porción izquierda del perfil corresponde al NE y la porción derecha al SW. Ver figura 60 para ubicación en el humedal.

El perfil No.4 con orientación NW-SE longitudinal a lo largo de la laguna (Fig. 64) muestra la secuencia en elevación de los diferentes cuerpos lagunares que van bajando en cota a medida que nos aproximamos a la salida o desagüe sur de la Ciénega. Las primeras lagunas ubicadas a partir del km 0+500 tienen el fondo a una elevación de aproximadamente 4.0 msnm, pudiéndose llegar hasta los 4.7 msnm ya que a partir de esta altura (inclusive antes) el agua pasaría de forma directa a las lagunas ubicadas más al sur. Mientras que las lagunas centrales del perfil entre el kilómetro 5+000 y 7+000 son las más profundas con un fondo a casi 2 msnm pero con un llenado máximo de 4 msnm. Las lagunas ubicadas más al sur a partir de los kilómetros 9+600 y hasta 14+200 poseen fondos de laguna entre 3 y 3.4 msnm pero los bordes de las lagunas van bajando progresivamente llenándose hasta un máximo de 3.8 msnm. Esta disminución paulatina de la elevación de los bordes lagunares permite inferir que la Ciénega se va llenando de NW a SE de forma directa cuando superan la altura de los bordes pero de forma indirecta o entre la base de la vegetación de los bordes por filtración o infiltración para descargar en el extremo SE como de hecho se observa con la formación de un canal de desagüe muy bien formado.

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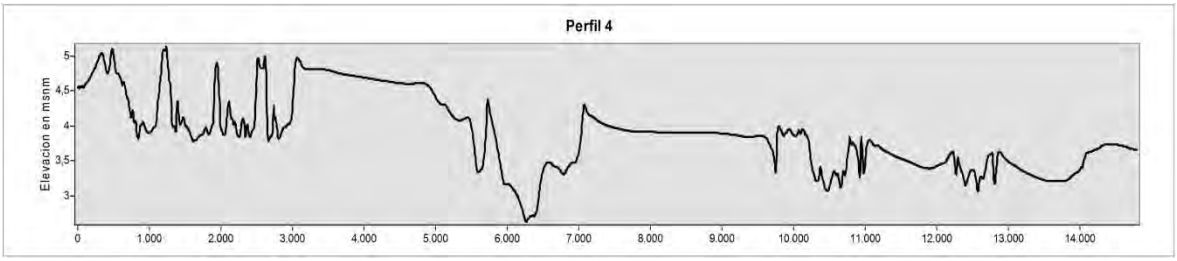

Figura 64. Perfil 4 con orientación NW-SE ubicado longitudinalmente a la Laguna. Ver figura 4 para ubicación en el humedal.

La dirección de flujo en los tres primeros perfiles es claramente en dirección SW y en el perfil longitudinal (perfil 4) la dirección del flujo es en dirección SE por lo que es posible concluir que el flujo de entrada de agua desde el canal de desvío W-M inicia llenando las lagunas que están más cercanas a él para luego llenar progresivamente el grupo de lagunas ubicadas en dirección SE (lagunas ubicadas en los kilómetros 1+800 y 2+900 del perfil 1) luego continúa el llenado al SSW con las lagunas centrales que están representadas en el perfil 3 (kilómetros 2+000 y 3+000). Parte de esta agua sale del sistema lagunar por el borde Oeste de la laguna que es el más bajo y que actualmente tiene influencia directa de la marea sufriendo inundaciones en mareas vivas. No obstante la porción central sur y sur se van llenando por filtración a través de las fronteras vegetales entre lagunas ya que por llenado directo sería imposible dada la cota de los fondos lagunares.

El llenado por filtración o infiltración (llenado indirecto) y el llenado por rebosamiento de los bordes lagunares (llenado directo) tienen dos diferencias fundamentales. Primera, el llenado directo es mucho más rápido y permite ver cambios en los niveles lagunares asociados a cambios en los caudales del canal de desvío W-M, aunque solo ocurre en las lagunas muy próximas al canal; por el contrario el llenado por filtración a través de los bordes o fronteras vegetales es más lento y los cambios en elevación pueden relacionarse solo con cambios estacionales de la tasa de evapotranspiración o bien por cambios sostenidos del caudal de entrada. Segunda diferencia, el llenado directo transporta junto con la transferencia de agua una carga sedimentaria que podría modificar la geometría de las lagunas, esto de observa claramente en la zona de descarga del Bypass después del drenado en las fotografías aéreas dado que el abanico aluvial que se está formando trae consigo una alta carga de sedimentos. Este mismo fenómeno aunque no de forma tan intensa está sucediendo en todas las lagunas que se comunican de forma directa con la laguna de descarga del Bypass. Por su parte las lagunas ubicadas en la porción central y sur alimentadas de forma indirecta no recibirán la carga sedimentaria y la geometría de sus lagunas no se verá modificada.

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5.14. Evaluación de las aves de marisma en la Ciénega de Santa Clara

Cada año desde 1999 se han realizado censos estandarizados utilizando el protocolo para monitoreo de aves de marisma de Norteamérica, éstos censos se hacen dos veces al año, en marzo y en mayo y tienen la capacidad de observar diferencias y tendencias de > del 3%. La Fig. 65 muestra la ubicación de los transectos para 2010. En 2010 se realizaron tres censos: Marzo 20-Abril 10, Abril 20-Mayo 10 y Mayo 20-Junio 10.

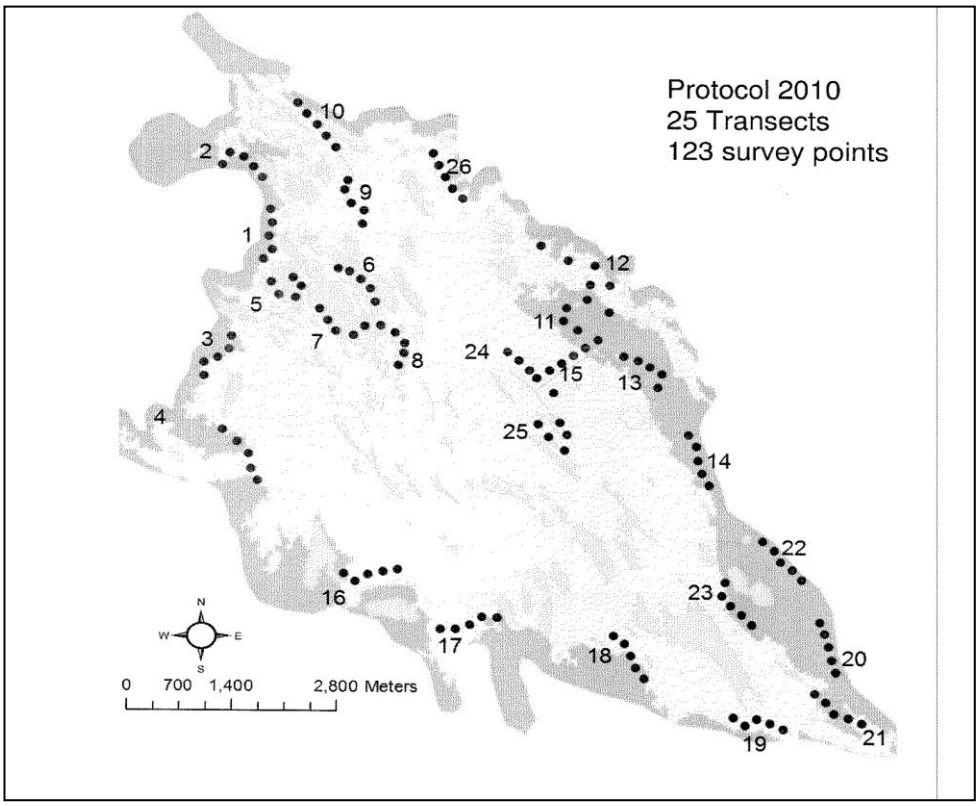

Fig. 65. Protocolo de monitoreo de aves de marisma 2010, con 25 transectos y 123 puntos de monitoreo.

En 2010 se detectaron 1,822 aves de marismas, de los cuales 674 eran Palmoteadores de Yuma (*Rallus longirostris yumanensis*), se detectaron palmoteadores en 72.8% de todos los sitios censados, se detectaron además 23 Polluelas negras (*Laterallus jamaicensis*) en 5.4% de los sitios, generalmente ubicados en las orillas de la Ciénega.

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Tabla 38. Número de detecciones de aves durante el censo del 2010 en la Ciénega de Santa Clara

Especie	Visita			Total	%
	I	II	III		
Avetoro norteño	18	5	1	24	1.32
Polluela negra	11	1	11	23	1.26
Palmoteador de Yuma	224	148	302	674	36.99
Avetoro mínimo	43	99	321	463	25.41
Sora	140	45	1	186	10.21
Rascón limícola	195	88	169	452	24.81
Total	631	386	805	1822	100.00
Puntos sin aves	12	2	1	15	4.57

Con estos valores se obtuvieron las densidades en 2010 utilizando el modelo Distance y se pudieron comparar con años anteriores (Tabla 39 y Fig.66). Se observa que la población no ha variado significativamente en los últimos tres años. Los censos realizados en 2010 fueron justo antes de que iniciara operación la Planta Desaladora de Yuma, por lo que los posibles efectos de la planta se observarán en los resultados de los censos del 2011.

Tabla 39. Densidad de palmoteadores/ha y estimación de la población en toda la Ciénega de Santa Clara.

Año	**Densidades de Palmoteadores/hectárea**	**Estimación de la población**
2006	1.03 (0.81-1.29)	5,974 (4,698-7,482)
2008	0.59 (0.43-0.80)	3,564 (2,623-4,842)
2010	0.94 (0.73-1.21)	5,438 (4,229-6,993)

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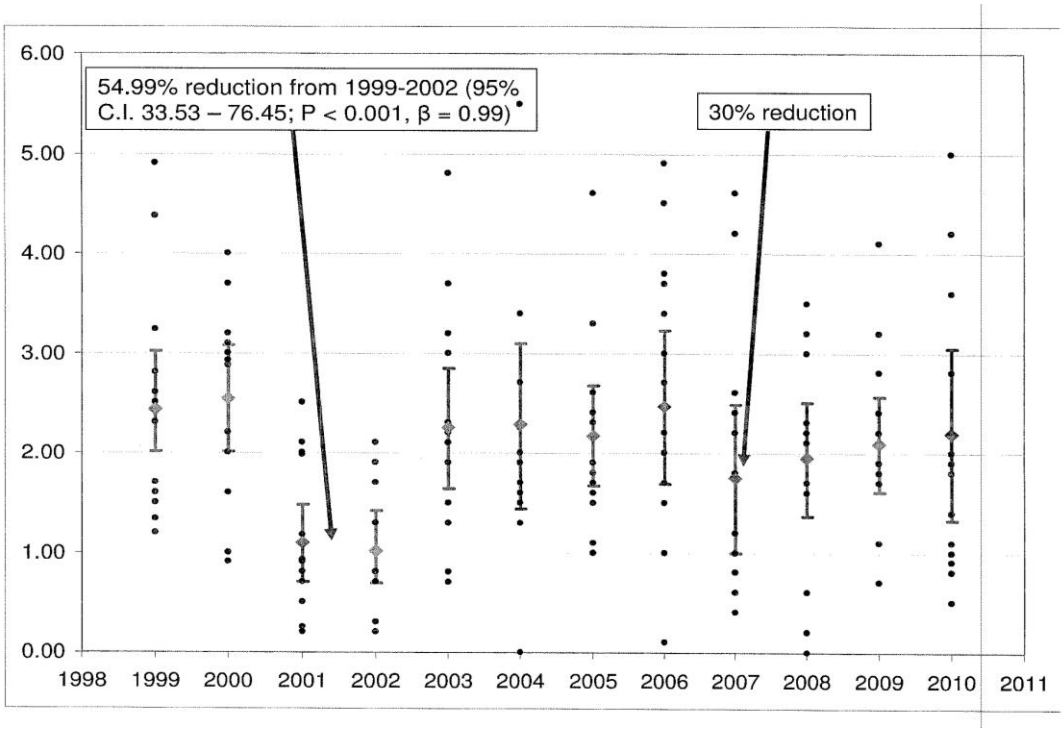

Fig. 66. Variaciones en abundancia de Palmoteador de Yuma de 1999-2010.

6. CONCLUSIONES

Calidad del agua

- Las concentraciones de sólidos disueltos totales (SDT) en la Ciénega fueron diferentes entre los diferentes periodos comprendidos dentro de la operación de la planta desaladora de Yuma al 30%: agua acordada sin operación de la planta, solo operación de la planta y agua acordada con operación de la planta. Sin embargo, no se observaron diferencias significativas entre todo el periodo de línea base comparado con todo el periodo de la operación de la planta. Por lo tanto, la presencia de agua acordada disminuyó las concentraciones de SDT durante la operación de la planta resultando en variaciones normales de SDT.
- La temperatura, pH y oxígeno no se alteraron durante la operación de la planta
- La cantidad de selenio en agua aumentó en 2010 antes de la operación de la planta pero durante la descarga de aguas acordadas y disminuyó en 2011 durante la operación de la planta.
- Las concentraciones de metales pesados analizados en tejido de peces no excedieron los límites para consumo humano.
- Los plaguicidas más frecuentemente detectados fueron los organoclorados, sin embargo, los niveles en tejido de peces estuvieron por debajo de los límites recomendados, no hubo un incremento durante la operación de la planta.
- No se detectó inhibición de la Acetilcolinesterasa en tejido cerebral de peces, lo que indica que no existen efectos en la salud de los peces derivados de contaminantes (plaguicidas y mercurio).
- *E. coli* se detectó en un mes, sin embargo, lo mas probable es que haya sido un hecho aislado ya que no se volvió a repetir durante el monitoreo.
- Las concentraciones de nutrientes disminuyeron del dren Bypass hacia la parte interior de la Ciénega probablemente debido a la presencia de vegetación.
- Los sólidos suspendidos totales (SST) disminuyeron durante la operación de la planta
- Los sulfatos, cloro total, calcio y dureza no mostraron un incremento durante la operación de la planta

Vegetación

- En general, la huella de la vegetación en la Ciénega de Santa Clara no ha variado de 2008 a 2011, sin embargo, si se observaron cambios en la densidad de vegetación durante la operación de la Planta Desaladora de Yuma (en Julio 2010) comparada con imágenes previas de verano.

Batimetría y topografía

- Los perfiles batimétricos de la Ciénega muestran cambios en la elevación del fondo lo que permite el paso del agua entre lagunas, con esta información se

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puede inferir que la Ciénega se va llenando de NW a SE de forma directa cuando superan la altura de los bordes, pero de forma indirecta por filtración o infiltración para descargar en el extremo SE tal como se observa con la formación de un canal de desagüe en esa zona.

Aves de marisma

- En 2010 se estimó una población de 5,438 palmoteadores de Yuma en la Ciénega de Santa Clara, la cual no ha variado significativamente en los últimos 3 años previos.

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Impact of industrial scale solar on avifauna; concern for the Pacific Flyway



3 types of industrial scale solar

- Solar Trough
- Power Tower
- Flat Panel



Solar Trough
(30 foot tall curved mirror)



Flat panel; 300 - +4,000 acres of panels per facility





Power tower









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Besides thousands of acres of panels, solar energy sites have gen-tie and transmission lines, ponds, fences, etc.

Other features (permanent or temporary) present a nuisance attraction to flying birds





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Reflectivity is disorienting; non-reflective flat panels are not commercially available







Mute streams (cloacal evacuation) are found on numerous panels, suggesting many ‘near miss’ of flying birds

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‘Lake Effect’

From a distance, solar facilities have the appearance of an ephemeral or permanent lake



Grebes and other waterfowl have been observed circling low over panel fields looking for places to land



Additional Documentation Attachment to Comment 2-F1
Attachment I-9









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Lake effect photos courtesy of Kevin Emmerich and Jody Fraser

‘Lake effect’ not just with solar panels, but also with heliostats (flat mirrors)



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The result:

> 160 different bird species found dead at just three facilities (caveats discussed later)

What follow, are several clear examples…




Date & Time: Tue Aug 20 10:33:44 PDT 2013
Position: 11 N 685514 3727682
Altitude: 409ft
Azimuth: +159° +2827mils
Elevation Angle: +80.3°
Horizon Angle: +48.2°
Zoom: 1X
bird mortality unit 1 block6 row61 location





Additional Documentation Attachment to Comment 2-F1
Attachment I-9







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(note dust smear on panel)
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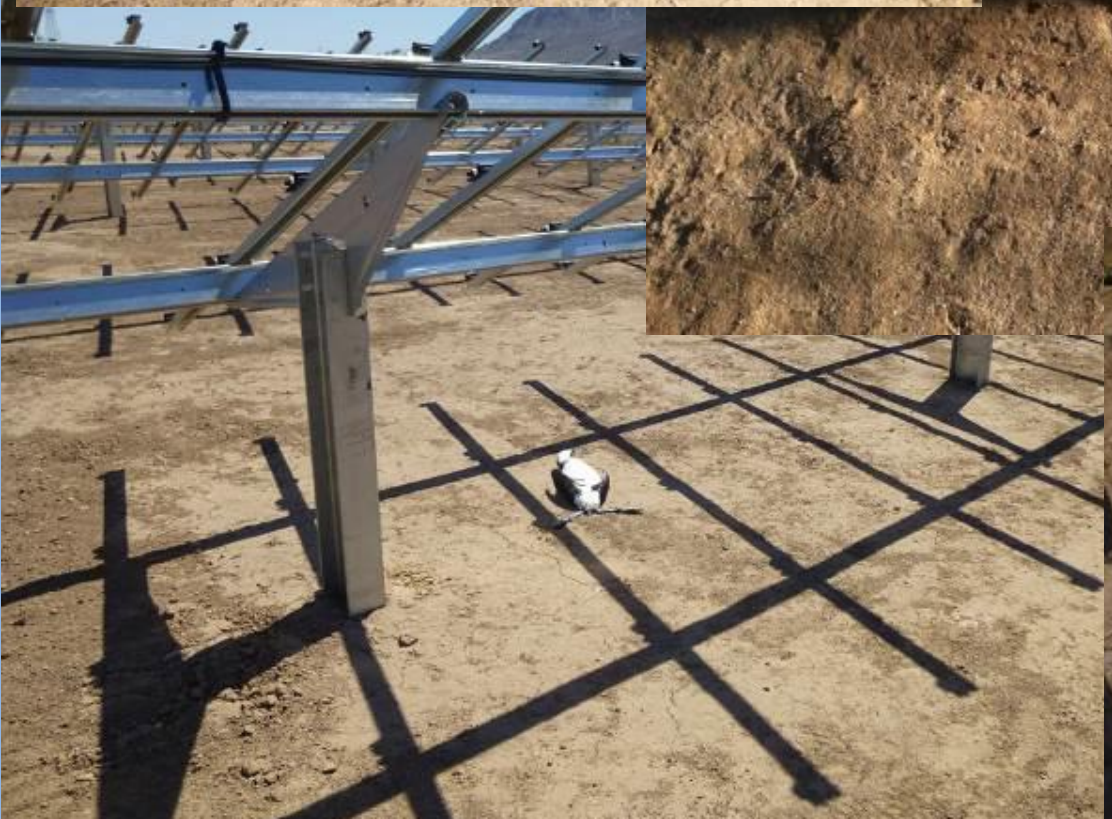
Additional Documentation Attachment to Comment 2-F1
Attachment I-9









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Additional Documentation Attachment to Comment 2-F1
Attachment I-9









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Species list

American Avocet
American Coot
American Kestrel
American Pipit
Anna's Hummingbird
Ardeidae spp.
Ash-throated Flycatcher
Bank Swallow
Barn Owl
Barn Swallow
Bewick's Wren
Black Phoebe
Black-and-white Warbler
Blackbird spp.
Black-chinned Hummingbird
Black-crowned Night-Heron
Black-headed Grosbeak
Black-tailed Gnatcatcher
Black-throated Gray Warbler
Black-Throated Sparrow
Blue Grosbeak
Blue-Gray Gnatcatcher
Blue-winged Teal
Brewer's Blackbird
Brewer's Sparrow
Broad-tailed Hummingbird
Brown Pelican
Brown-headed Cowbird
Bufflehead
Bullock's oriole
Burrowing Owl
Cactus Wren
California Gull
California myotis
Calliope Hummingbird
Caprimulgiforme spp.
Cassin's Vireo
Chipping Sparrow
Clapper Rail
Clark's Grebe
Cliff swallow
Common Gallinule
Common Ground Dove
Common Loon
Common Merganser
Common Poorwill
Common Raven
Common Yellowthroat
Cooper's Hawk
Costa's Hummingbird
Double-crested Cormorant
Dove spp.
Duck spp.
Eared Grebe
Empidonax spp.
Eurasian Collared-Dove
Falconiforme spp.
Finch spp.
Flycatcher spp.
Gadwall
Gnatcatcher spp.
Great Blue Heron
Great Egret
Greater Roadrunner
Great-tailed Grackle
Grebe spp.
Green-tailed Towhee
Green-winged teal
Gull spp.
Hermit Thrush
Hermit Warbler
Herring Gull
Horned Grebe
Horned Lark
House Finch
House wren
Hummingbird spp.
Indian Peafowl
Jaeger spp.
Killdeer
Ladder-backed Woodpecker
Lapland Longspur
Lazuli Bunting
Least Sandpiper
Lesser Goldfinch
Lesser Nighthawk
Lesser Scaup
Lincoln's Sparrow
Loggerhead Shrike
Long-eared Owl
Lucy's Warbler
MacGillivray's Warbler
Mallard
Marsh wren
Mourning Dove
Nashville Warbler
Northern Flicker
Northern Mockingbird
Northern Rough-winged Swallow
Olive-sided Flycatcher
Orange-crowned warbler
Pallid Bat
Passerine spp.
Pelicaniforme species
Peregrine Falcon
Phainopepla
Pied-billed Grebe
Pine Siskin
Prairie Falcon
Rail spp.
Red-breasted Merganser
Redhead
Red-necked Phalarope
Red-tailed hawk
Red-winged Blackbird
Ring-billed gull
Rock Pigeon
Rock Wren
Ruby-Crowned Kinglet
Ruddy duck
Rufous Hummingbird
Sage Sparrow
Sandpiper spp.
Savannah Sparrow
Say's Phoebe
Scott's Oriole
Sora
Sparrow spp.
Spotted sandpiper
Sternidae spp.
Surf Scoter
Swallow spp.
Swift spp.
Townsend's big -eared bat
Townsend's Warbler
Tree swallow
Unidentified Bird
Vaux's Swift
Verdin
Vesper Sparrow
Violet Green Swallow
Virginia Rail
Warbler spp.
Western Grebe
Western Kingbird
Western Mastiff Bat
Western Meadowlark



Western Tanager
Western Wood Pewee
White-crowned Sparrow
White-faced Ibis
White-throated Swift
White-winged Dove
Wilson's Warbler
Wood Duck
Yellow Warbler
Yellow-billed Cuckoo
Yellow-breasted Chat
Yellow-headed Blackbird
Yellow-rumped Warbler

Other species known to have been killed at solar facilities in CA

- Many neotropical insectivore migrants (including mass killing of insects at power tower facilities)
- Ducks, geese and loons
- Double-crested Cormorant
- Blue-footed Booby
- Short-eared Owl
- Yellow-billed Cuckoo
- Willow Flycatcher
- Ridgway's (Yuma clapper)Rail
- Virginia Rail
- Prairie and Peregrine Falcons
- Jaeger spp.



AR073645

As of Aug. 2014

- At least 160 different bird species
- Over 1,000 individuals
- Flat panel facilities kill many species and large numbers of water-associated birds
- Power tower facilities kill considerable #'s of insectivores and raptors
- Solar trough has shown variability in bird mortality; mainly waterbirds



Caveats to 'data':

- The bird fatality data were largely gleaned from incidental observations during monitoring of construction activities,
- Data came from Special Purpose Utility (SPUT) permit reports received from the ISEGS, Desert Sunlight, and Genesis projects in San Bernardino and Riverside counties.
- Incidental data; voluntarily reported
- Three different facilities
- Relatively few fatalities have been reported from projects in Imperial County (little if any monitoring being accomplished)
- Many more facilities have no monitoring or reporting
- Only one facility (Ivanpah; power tower) had systematic monitoring but only for a few months to date (sampling design problems with monitoring plan)
- Limited observations



Numbers not corrected for scavenger bias; numerous kit fox, coyotes, and ravens present at all facilities.





Additional Caveats

The fatality numbers above should not be taken as a comprehensive list of birds killed (either species or total numbers), because much of the reporting on bird mortality is voluntary and incidental to the monitoring of construction activities, and not from systematic mortality monitoring during the operational phase of these projects.



10's of Thousands of acres of new industrial scale solar sites proposed or under construction in CA, AZ, ID, NV, TX, Alberta, etc.



Imperial County, CA (as an example)

23,500 acres (36.7 square miles) of habitat has been constructed, or is under construction or proposed for conversion into industrial scale solar panel fields



Important!!!

- The +1,000 fatality number is non-systematic raw data;
- not corrected for scavenger and searcher efficiency biases,
- from relatively small fractions of these project sites,
- have not all been systematically collected,
- NO third party monitoring occurring,
- not collected during all seasons of the year,
- sample sizes too small to apply accepted statistical methods, and
- numerous fatalities have not been identified to species, depending on the project.

Key point

Likely that these ‘data’ (~ 160 species, and +1,000 individuals) substantially under-estimate the number of species impacted, and total number killed (probably by a significant margin).





From:	Mix, Emily
To:	Wendy Campbell; Ray Bransfield (Ray_Bransfield@fws.gov)
Cc:	Bernhardt, Tricia; Alice E. Karl (heliophile@mindspring.com); Melin, Jess (Jess.Melin@nexteraenergy.com); "Flajole, Andy" (Andy.Flajole@nexteraenergy.com)
Subject:	Joshua Tree Solar Farm Spring 2015 Bio Survey Methods
Date:	Friday, February 13, 2015 6:57:03 AM
Attachments:	Joshua Tree Bio Survey Area Spring 2015.pdf

Wendy and Ray,

Thanks again for your time last week to discuss the Joshua Tree Solar Farm. As requested, I've outlined our survey plan for your review and concurrence.

Comprehensive surveys for biological resources, including desert tortoise and burrowing owl, were conducted on the current Project site in Spring 2012. Due to the time lapse in permitting, we plan to re-survey the Project site in Spring 2015 to determine the presence of special-status species. Surveys will adhere to standardized protocols for desert tortoise and burrowing owl, as well as to biologically sound approaches for other species. The survey area will encompass the 115-acre airport site, which is the same area that was surveyed in Spring 2012 (see attached figure). The linear corridor survey width will be approximately 60 feet, covering the existing utility easement. Surveys will be conducted by qualified biologists and botanists.

Desert Tortoise: Tetra Tech and Alice E. Karl and Associates will follow U.S. Fish and Wildlife Service (2010) recommended protocols for surveying for desert tortoise. The Project site will be surveyed using 10-m wide, contiguous transects to achieve 100% visual coverage. The parcels surrounding the Project are privately owned and therefore no buffer surveys are planned due to access constraints. However, a visual assessment will be made of the habitat and the possibility of tortoises and effects on those animals that may result from the Project. See attached figure showing the 2015 Biological Resources Survey Area.

Burrowing Owl: Previous surveys determined that the Project site and vicinity contain burrowing owl habitat. Tetra Tech and Alice E. Karl and Associates will conduct burrowing owl surveys according to CDFW survey guidelines described in the *Staff Report on Burrowing Owl Mitigation* (CDFG 2012). As we discussed on the phone call on 5 February 2015, all owls and owl sign will be recorded during the rare plant surveys, which will likely take place in March, or desert tortoise surveys, whichever comes first, because these surveys will use, at the widest (depending on vegetation density), 10-m wide transects. Any owl sign detected during this survey will then serve as the focal areas for the three subsequent burrowing owl surveys that will be conducted during the CDFW-recommended dawn and dusk timeframes and spaced throughout the spring and early summer per the CDFW 2012 protocol. The parcels surrounding the Project are privately owned and therefore no buffer surveys are planned due to access constraints. However, a visual assessment will be made of the habitat and the possibility of burrowing owls and effects on those animals that may result from the Project.

Bats: CDFW requested that we investigate the on-site structures and trees for the presence of roosting bats. Therefore, we will survey the on-site buildings and trees for evidence of bats (i.e., guano) and monitor at dusk for bats exiting the structures or trees to evaluate whether there are roosting bats on site. Monitoring will be on the same dates as the burrowing owl surveys (after the

evening burrowing owl survey) for a total of three surveys. If bats are found to be roosting on site, a bat expert would be consulted to determine whether and what type of additional surveys would be necessary; however, they are not planned at this time.

Other Wildlife: All other wildlife will be inventoried and special-status species observations recorded during desert tortoise and burrowing owl surveys. No focused migratory bird surveys are scheduled because of (1) the degraded quality of the habitat, (2) the lack of attractive site features except for the house and associated structures, and (3) the presence of more attractive features (e.g., trees and residences) throughout the valley. Also due to the degraded habitat, no focused surveys for invertebrates or small mammals are scheduled.

Rare Plants: Special-status plant surveys will be conducted in accordance with the CDFW *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities* (CDFG 2009). Transects will be spaced at approximately 10-m intervals, or narrower in areas of dense vegetation, to achieve 100% visual coverage. Surveys will be conducted when plants are in optimum condition for identification (generally with blooms, fruits, and leaves). Surveys will be conducted on the Project site for perennial and for spring-blooming annual special-status plants.

Please let us know if you have any questions.
Thank you,
Emily

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Avian Mortality at Solar Energy Facilities in Southern California: A Preliminary Analysis

Rebecca A. Kagan, Tabitha C. Viner, Pepper W. Trail, and Edgard O. Espinoza
National Fish and Wildlife Forensics Laboratory

PRE-DECISIONAL

Executive Summary

This report summarizes data on bird mortality at three solar energy facilities in southern California: Desert Sunlight, Genesis, and Ivanpah. These facilities use different solar technologies, but avian mortality was documented at each site. Desert Sunlight is a photovoltaic facility, Genesis employs a trough system with parabolic mirrors, and Ivanpah uses a power tower as a focal point for solar flux.

FINDINGS

Trauma was the leading cause of death documented for remains at the Desert Sunlight and Genesis sites. Trauma and solar flux injury were both major causes of mortality at the Ivanpah site. Exposure to solar flux caused singeing of feathers, which resulted in mortality in several ways. Severe singeing of flight feathers caused catastrophic loss of flying ability, leading to death by impact with the ground or other objects. Less severe singeing led to impairment of flight capability, reducing ability to forage and evade predators, leading to starvation or predation. Our examinations did not find evidence for significant tissue burns or eye damage caused by exposure to solar flux.

Cause of Death	Ivanpah	Genesis	Desert Sunlight	Total
Solar Flux	47	0	0	47
Impact trauma	24	6	19	49
Predation trauma	5	2	15	22
Trauma of undetermined cause	14	0	0	14
Electrocution	1	0	0	1
Emaciation	1	0	0	1
Undetermined (remains in poor condition)	46	17	22	85
No evident cause of death	3	6	5	14
Total	141	31	61	233

These solar facilities appear to represent “equal-opportunity” hazards for the bird species that encounter them. The remains of 71 species were identified, representing a broad range of ecological types. In body size, these ranged from hummingbirds to pelicans; in ecological type from strictly aerial feeders

(swallows) to strictly aquatic feeders (grebes) to ground feeders (roadrunners) to raptors (hawks and owls). The species identified were equally divided among resident and non-resident species, and nocturnal as well as diurnal species were represented. Although not analyzed in detail, there was also significant bat and insect mortality at the Ivanpah site, including monarch butterflies. It appears that Ivanpah may act as a **"mega-trap,"** attracting insects which in turn attract insect-eating birds, which are incapacitated by solar flux injury, thus attracting predators and creating an entire food chain vulnerable to injury and death.

			Foraging Zone			**Residency Status**	
SITE	No. Remains	Identifiable Remains	Air	Terr	Water	Resident	Migrant
Ivanpah	141	127	28	85	14	63	64
Genesis	31	30	12	12	6	20	10
Desert Sun	61	56	7	22	27	18	38
TOTALS	233	213	47	119	47	101	112

CONCLUSIONS AND RECOMMENDATIONS

In summary, three main causes of avian mortality were identified at these facilities: impact trauma, solar flux, and predation. Birds at all three types of solar plants were susceptible to impact trauma and predators. Predation was documented mostly at the photovoltaic site, and in many cases appeared to be associated with stranding or nonfatal impact trauma with the panels, leaving birds vulnerable to resident predators. Solar flux injury, resulting from exposures to up to 800º F, was unique to the power tower facility. Our findings demonstrate that a broad ecological variety of birds are vulnerable to morbidity and mortality at solar facilities, though some differential mortality trends were evident, such as waterbirds at Desert Sunlight, where open water sources were present; and insectivores at Ivanpah, where insects are attracted to the solar tower.

Specific hazards were identified, including vertically-oriented mirrors or other smooth reflective panels; water-like reflective or polarizing panels; actively fluxing towers; open bodies of water; aggregations of insects that attracted insectivorous birds; and resident predators. Making towers, ponds and panels less attractive or accessible to birds may mitigate deaths. Specific actions should include:

Monitoring/detection measures*:*

1) Install video cameras sufficient to provide 360 degree coverage around each tower to record birds (and bats) entering and exiting the flux

2) For at least two years (and in addition to planned monitoring protocol), conduct daily surveys for birds (at all three facilities), as well as insects and bats (in the condenser building at Ivanpah) around each tower at the base of and immediately adjacent to the towers in the area cleared of vegetation. Timing of daily surveys can be adjusted to minimize scavenger removal of carcasses as recommended by the TAC. Surveys in the late afternoon might be optimal for bird carcasses, and first light for bat carcasses.

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3) Use dogs for monitoring surveys to detect dead and injured birds that have hidden themselves in the brush, both inside and outside the perimeter of the facility

4) To decrease removal of carcasses, implement appropriate raven deterrent actions

Bird Mortality Avoidance Measures*:*

1) Increase cleared area around tower at Ivanpah to decrease attractive habitat; at least out to fence

2) Retrofit visual cues to existing panels at all three facilities and incorporate into new panel design. These cues should include UV-reflective or solid, contrasting bands spaced no further than 28 cm from each other

3) Suspend power tower operation during peak migration times for indicated species

4) Avoid vertical orientation of mirrors whenever possible, for example tilt mirrors during washing

5) Properly net or otherwise cover ponds

6) Place perch deterrent devices where indicated, eg. on tower railings near the flux field

7) Employ exclusionary measures to prevent bats from roosting in and around the condenser facility at Ivanpah.

It must be emphasized that we currently have a very incomplete knowledge of the scope of avian mortality at these solar facilities. Challenges to data collection include: large facilities which are difficult to efficiently search for carcasses; vegetation and panels obscuring ground visibility; carcass loss due to scavenging; rapid degradation of carcass quality hindering cause of death and species determination; and inconsistent documentation of carcass history.

To rectify this problem, video cameras should be added to the solar towers to record bird mortality and daily surveys of the area at the base of and immediately adjacent to the towers should be conducted. At all the facilities, a protocol for systematic, statistically-rigorous searches for avian remains should be developed, emphasizing those areas where avian mortality is most likely to occur. Investigation into bat and insect mortalities at the power tower site should also be pursued.

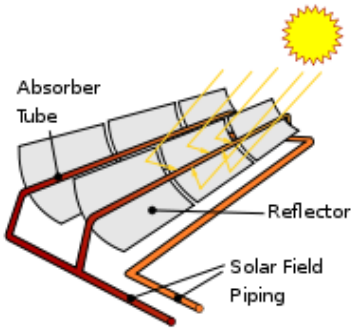
Finally, there are presently little data available on how solar flux affects birds and insects. Studies of the temperatures experienced by objects in the flux; of the effects of high temperatures on feather structure and function; and of the behavior of insects and birds in response to the flux and related phenomena (e.g. “light clouds”) are all essential if we are to understand the scope of solar facility effects on wildlife.

Introduction

The National Fish and Wildlife Forensics Laboratory was requested to determine cause of death for birds found at facilities that generate electricity from solar energy. Solar generating facilities can be classified into three major types: photovoltaic sites, trough systems and solar power towers. There is much written about these systems so this report will not include any technical details, but simply mention the differences and their potential impact on birds.

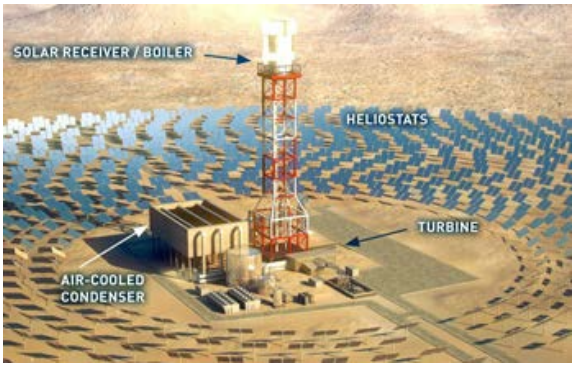
1) **Photovoltaic systems** directly convert the sun's light into electricity. The perceived threat to birds is associated with the presence of water ponds which attract birds and from traumatic impact with the photovoltaic cells. An example of this type of solar power plant is Desert Sunlight Solar Farm (AKA First Solar).





2) **Trough systems** are composed of parabolic mirrors which focus and reflect the sun to a tube that converts the heat from the sun into electricity. The perceived threat to birds is associated with the presence of water ponds which attract birds and from traumatic impact with the trough structures. An example of this type of solar power plant is Genesis Solar Energy Project.

3) **Solar power tower**s use thousands of mirrors to reflect the solar energy to a tower, where water in a boiler is converted to steam, generating the electricity. The perceived threat to birds is associated traumatic impact with the mirrors and the danger associated with the heat produced by the mirrors. An example of this type of solar power plant is Ivanpah Solar Electric Generating System.



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Methods

Carcasses were collected at the different solar power plant sites by either US Fish and Wildlife Service employees or by energy company staff. The collection of the carcasses was opportunistic; that is, not according to a pre-determined sampling schedule or protocol. There was no attempt to quantify the number of carcasses that scavengers or predators removed from the solar facilities' grounds, or to compare the distribution of carcasses inside and outside the boundaries of the solar facility sites.

Additionally, three USFWS/-OLE staff, including two Forensics Lab staff (EOE and RAK), visited the Ivanpah Solar plant from October 21 – 24, 2013. Their on-site observations are included in this report.

A total of 233 birds collected from three different facilities were examined; 141 from a solar thermal power tower site (Ivanpah, Bright Source Inc.), 31 from a parabolic trough site (Genesis, NextEra Energy Inc.) and 61 from a photovoltaic (PV) panel site (Desert Sunlight, First Solar Inc.). Nine of the Ivanpah birds were received fresh; 7 of those were necropsied during a site visit by a Forensics Laboratory pathologist (RAK). The rest of the birds were received frozen and allowed to thaw at room temperature prior to species identification and necropsy. Species determination was made by the Forensics Laboratory ornithologist (PWT) for all birds either prior to necropsy or, for those necropsied on-site, from photos and the formalin-fixed head. All data on carcass history (location of the carcass, date of collection and any additional observations) were transcribed, although these were not available for all carcasses.

As part of the gross pathological examination, whole carcasses were radiographed to help evaluate limb fractures and identify any metal foreign bodies. Alternate light source examination using an Omnichrome Spectrum 9000+ at 570 nm with a red filter helped rule in or out feather burns by highlighting subtle areas of feather charring (Viner et al., 2014). All birds or bird parts from Ivanpah without obvious burns were examined with the alternate light source, as well as any bird reportedly found near a power line and a random sub-sample of the remaining birds from Genesis and Desert Sunlight (Viner, T. C., R. A. Kagan, and J. L. Johnson, 2014, Using an alternate light source to detect electrically singed feathers and hair in a forensic setting. Forensic Science International, v. 234, p. e25-e29).

Carcass quality varied markedly. If carcasses were in good post mortem condition, representative sections of heart, lung, kidney, liver, brain and gastrointestinal tract as well as any tissues with gross lesions were collected and fixed in 10% buffered formalin. Full tissue sets were collected from the fresh specimens. Formalin-fixed tissues were routinely processed for histopathology, paraffin-embedded, cut at 4 µm and stained with hematoxylin and eosin. Tissues from 63 birds were examined microscopically: 41 from Ivanpah, 1 from Genesis and 21 from Desert Sunlight.

Birds with feather burns were graded based on the extent of the lesions. Grade 1 birds had curling of less than 50% of the flight feathers. Grade 2 birds had curling of 50% or more of the flight feathers. Grade 3 birds had curling and visible charring of contour feathers (Figure 1).

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Figure 1: Three grades of flux injury based on extent and severity of burning. Grade 1 (top); Yellow-rumped Warbler with less than 50% of the flight feathers affected (note sparing of the yellow rump feathers). Grade 2 (middle); Northern Rough-winged Swallow initially found alive but unable to fly, with greater than 50% of the flight feathers affected. Grade 3 (bottom); MacGillivray's Warbler with charring of feathers around the head, neck, wings and tail.

Bird Species Recovered at Solar Power Facilities

Tables 1-4 and Appendix 1 summarize 211 identifiable bird remains recovered from the three solar facilities included in this study. These birds constitute a taxonomically diverse assemblage of 71 species, representing a broad range of ecological types. In body size, these species ranged from hummingbirds to pelicans; in ecological type from strictly aerial feeders (e.g. swifts and swallows) to strictly aquatic feeders (pelicans and cormorants) to ground feeders (roadrunners) to raptors (hawks and owls). The species identified were equally divided among resident and non-resident species. Nocturnal as well as diurnal species were represented.

In Tables 1-4 and Appendix 1, bird species are categorized into very general ecological types by foraging zone and residency status. Foraging Zones were "air" (a significant portion of foraging activity performed in the air), "terrestrial" (including foraging both in vegetation and on the ground), and "water" (foraging associated with water, including waders as well as aquatic birds). Residency Status was "resident" (for breeding or year-round residents) and "migrant" (for both passage migrants and non-breeding-season residents). For a number of species, the appropriate classification for residency status was uncertain, due to a lack of detailed knowledge of the sites. The present classification is based on published range maps, and is subject to revision as more information becomes available.

This dataset is not suitable for statistical analysis, due to the opportunistic and unstandardized collection of avian remains at the facilities, and the lack of baseline data on bird diversity and abundance at each site. Nevertheless, a few conclusions can be noted. First, these data do not support the idea that these solar facilities are attracting particular species. Of the 71 bird species identified in remains, only five species were recovered from all three sites. These five were American Coot, Mourning Dove, Lesser Nighthawk, Tree Swallow, and Brown-headed Cowbird, again emphasizing the ecological variety of birds vulnerable to mortality at the solar facilities. Over two-thirds (67%) of the species were found at only a single site

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(Appendix 1). That being said, the Desert Sunlight facility had particularly high mortality among waterbirds, suggesting a need to render the ponds at that site inaccessible or unattractive to these species.

The diversity of birds dying at these solar facilities, and the differences among sites, suggest that there is no simple "fix" to reduce avian mortality. These sites appear to represent "equal-opportunity" mortality hazards for the bird species that encounter them. Actions to reduce or mitigate avian mortality at solar facilities will need to be designed on a site-specific basis, and will require much more data on the bird communities at each site, and on how mortality is occurring. Carefully-designed mortality studies might reveal significant patterns of vulnerability that are not evident in these data.

Table 1. Summary data on avian mortality at the three solar sites included in this study. See summary for discussion of Foraging Zone and Residency Status categories.

				Foraging Zone			Residency Status	
SITE	**No. Species**	**No. Remains**	**Identifiable Remains**	**Air**	**Terr**	**Water**	**Resident**	**Migrant**
Ivanpah	49	141	127	26	85	14	63	64
Genesis	15	31	30	12	12	6	20	10
Desert Sun	33	61	56	7	22	27	18	38
TOTALS	71	233	213	47	119	47	101	112

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Table 2. Species identified from avian remains at the Desert Sunlight photovoltaic solar facility. MNI = minimum number of individuals of each species represented by the identifiable remains. In some cases (e.g. Cinnamon/Blue-winged Teal), closely related species could not be distinguished based on the available remains, but the Foraging Zone and Residency Status could still be coded, due to the ecological similarities of the species involved. Total identified birds = 56.

DESERT SUNLIGHT		Zone	Residency	MNI
Pied-billed Grebe	*Podilymbus podiceps*	water	migrant	1
Eared Grebe	*Podiceps nigricollis*	water	migrant	3
Sora	*Porzana carolina*	water	migrant	1
American Avocet	*Recurvirostra americana*	water	migrant	1
Cinnamon/Blue-winged Teal	*Anas discors/clypeata*	water	migrant	1
Western Grebe	*Aechmophorus occidentalis*	water	migrant	9
Brown Pelican	*Pelecanus occidentalis*	water	migrant	2
Double-crested Cormorant	*Phalacrocorax auritus*	water	migrant	2
Black-crowned Night-Heron	*Nycticorax nycticorax*	water	migrant	1
Yuma Clapper Rail	*Rallus longirostris*	water	resident	1
American Coot	*Fulica americana*	water	migrant	5
Mourning Dove	*Zenaida macroura*	terr	resident	3
White-winged Dove	*Zenaida asiatica*	terr	resident	1
Lesser Nighthawk	*Chordeiles acutipennis*	air	resident	2
Common Poorwill	*Phalaenoptilus nuttallii*	air	resident	1
Costa's Hummingbird	*Calypte costae*	air	resident	1
Ash-throated Flycatcher	*Myiarchus cinerascens*	air	resident	1
Black-throated/Sage Sparrow	*Amphispiza sp.*	terr	resident	1
Black Phoebe	*Sayornis nigricollis*	air	resident	1
Loggerhead Shrike	*Lanius ludovicianus*	terr	resident	2
Common Raven	*Corvus corax*	terr	resident	1
Horned Lark	*Eremophila alpestris*	terr	migrant	1
Tree Swallow	*Tachycineta bicolor*	air	migrant	1
Townsend's Warbler	*Setophaga townsendi*	terr	migrant	2
Common Yellowthroat	*Geothlypis trichas*	terr	migrant	1
Savannah Sparrow	*Passerculus sandwichensis*	terr	migrant	1
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	terr	migrant	1
Wilson's Warbler	*Cardellina pusilla*	terr	migrant	2
Western Tanager	*Piranga ludoviciana*	terr	migrant	2
Black-headed Grosbeak	*Pheucticus melanocephalus*	terr	migrant	1
Great-tailed Grackle	*Quiscalus mexicanus*	terr	resident	2
Brown-headed Cowbird	*Molothrus ater*	terr	resident	1

Table 3. Species identified from avian remains at the Genesis trough system solar facility. Total identified birds = 30.

GENESIS		Zone	Residency	MNI
Eared Grebe	*Podiceps nigricollis*	water	migrant	2
Great Blue Heron	*Ardea herodias*	water	migrant	1
American Kestrel	*Falco sparverius*	air	resident	1
Ring-billed Gull	*Larus delawarensis*	water	migrant	2
California Gull	*Larus californianus*	water	resident	1
White-winged Dove	*Zenaida asiatica*	terr	resident	1
Lesser Nighthawk	*Chordeiles acutipennis*	air	resident	2
Say's Phoebe	*Sayornis saya*	air	resident	2
Tree Swallow	*Tachycineta bicolor*	air	migrant	2
Cliff Swallow	*Petrochelidon pyrrhonota*	air	resident	5
Hermit Warbler	*Setophaga occidentalis*	terr	migrant	1
Black-headed Grosbeak	*Pheucticus melanocephalus*	terr	migrant	1
Chipping Sparrow	*Spizella passerina*	terr	resident	1
Bullock's Oriole	*Icterus bullockii*	terr	resident	2
Brown-headed Cowbird	*Molothrus ater*	terr	resident	6

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Table 4. Species identified from avian remains at the Ivanpah power tower solar facility. Total identified birds = 127

IVANPAH		Zone	Residency	MNI
Cinnamon Teal	*Anas cyanoptera*	water	migrant	4
Cooper's Hawk	*Accipiter cooperii*	air	migrant	1
Red-shouldered Hawk	*Buteo lineatus*	terr	migrant	1
American Kestrel	*Falco sparverius*	air	resident	1
Peregrine Falcon	*Falco peregrinus*	air	resident	1
American Coot	*Fulica americana*	water	migrant	7
Sora	*Porzana carolina*	water	migrant	1
Spotted Sandpiper	*Actitis maculatus*	water	migrant	2
Greater Roadrunner	*Geococcyx californianus*	terr	resident	5
Yellow-billed Cuckoo	*Coccyzus americanus*	terr	migrant	1
Mourning Dove	*Zenaida macroura*	terr	resident	11
Barn Owl	*Tyto alba*	terr	resident	1
Lesser Nighthawk	*Chordeiles acutipennis*	air	resident	3
Common Poorwill	*Phalaenoptilus nuttallii*	air	resident	1
White-throated Swift	*Aeronautes saxatalis*	air	resident	1
Allen's/Rufous Hummingbird	*Selasphorus sp.*	air	migrant	1
Northern Flicker	*Colaptes auratus*	terr	resident	1
Ash-throated Flycatcher	*Myiarchus cinerascens*	air	resident	1
Loggerhead Shrike	*Lanius ludovicianus*	terr	resident	3
Warbling Vireo	*Vireo gilvus*	terr	migrant	1
Common Raven	*Corvus corax*	terr	resident	2
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	air	migrant	2
Tree Swallow	*Tachycineta bicolor*	air	migrant	2
Verdin	*Auriparus flaviceps*	terr	resident	3
Blue-gray Gnatcatcher	*Polioptila caerulea*	terr	resident	1
Northern Mockingbird	*Mimus polyglottos*	terr	resident	1
American Pipit	*Anthus rubescens*	terr	migrant	4
Orange-crowned Warbler	*Oreothlypis celata*	terr	migrant	1
Lucy's Warbler	*Oreothlypis luciae*	terr	resident	1
Black-throated Gray Warbler	*Setophaga nigrescens*	terr	migrant	1
Yellow-rumped Warbler	*Setophaga coronata*	air	migrant	14
Townsend's Warbler	*Setophaga townsendi*	terr	migrant	2
Yellow Warbler	*Setophaga petechia*	terr	migrant	1
Black-and-white Warbler	*Mniotilta varia*	terr	migrant	1
Wilson's Warbler	*Cardellina pusilla*	terr	migrant	2
MacGillivray's Warbler	*Oporornis tolmei*	terr	migrant	1
Western Tanager	*Piranga ludoviciana*	terr	migrant	2
Lazuli Bunting	*Passerina amoena*	terr	migrant	1
Blue Grosbeak	*Passerina caerulea*	terr	resident	1
Green-tailed Towhee	*Pipilo chlorurus*	terr	migrant	1
Brewer's Sparrow	*Spizella breweri*	terr	resident	3
Chipping Sparrow	*Spizella passerina*	terr	resident	3
Black-throated Sparrow	*Amphispiza bilineata*	terr	resident	3
Savannah Sparrow	*Passerculus sandwichensis*	terr	migrant	2
White-crowned Sparrow	*Zonotrichia leucophrys*	terr	migrant	6

IVANPAH		Zone	Residency	MNI
Pine Siskin	*Spinus pinus*	terr	migrant	1
House Finch	*Carpodacus mexicanus*	terr	resident	13
Brown-headed Cowbird	*Molothrus ater*	terr	resident	1
Great-tailed Grackle	*Quiscalus mexicanus*	terr	resident	3

Cause of Death of Birds Found at the Solar Power Plants

Photovoltaic facility (Desert Sunlight):

Sixty-one birds from 33 separate species were represented from Desert Sunlight. Due to desiccation and scavenging, a definitive cause of death could not be established for 22 of the 61 birds (see Table 5). Feathers could be examined in all cases, however, and none of the 61 bird remains submitted from the PV facility had visible evidence of feather singeing, a clear contrast with birds found at Ivanpah.

Blunt force impact trauma was determined to have been the cause of death for 19 Desert Sunlight birds including two Western Grebes (*Aechmophorus occidentalis*) and one each of 16 other species. Impact (blunt force) trauma is diagnosed by the presence of fractures and internal and/or external contusions. In particular, bruising around the legs, wings and chest are consistent with crash-landings while fractures of the head and/or neck are consistent with high-velocity, frontal impact (such as may result from impacting a mirror).





Predation was the immediate cause of death for 15 birds. Lesions supporting the finding of predation included decapitation or missing parts of the body with associated hemorrhage (9/15), and lacerations of the skin and pectoral muscles. Eight of the predated birds from Desert Sunlight were

Figure 2: Predation trauma (top) resulting in traumatic amputation of the head and neck (American Avocet) and impact trauma (bottom) causing bruising of the keel ridge of the sternum (Brown Pelican).

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grebes, which are unable to easily take off from land. This suggests a link between predation and stranding and/or impact resulting from confusion of the solar panels with water (see Discussion).

Parabolic trough facility (Genesis):

Thirty-one birds were collected from this site. There were 15 species represented. Those found in the greatest numbers were Brown-headed Cowbirds and Cliff Swallows, though no more than 6 individuals from any given species were recovered. Overall, carcass quality was poor and precluded definitive cause of death determination in 17/31 birds (Table 5). Identifiable causes of death consisted of impact trauma (6/31) and predation trauma (2/31). Necropsy findings were similar to those at Desert Sunlight with fractures and hemorrhage noted grossly. Predation trauma was diagnosed in two birds, a Cliff Swallow and a Ring-billed Gull.

Power tower facility (Ivanpah):

Ivanpah is the only facility in this study that produces solar flux, which is intense radiant energy focused by the mirror array on the power-generating tower. Objects that pass through this flux, including insects and birds, encounter extreme heat, although the extent of heating depends on many variables, including the duration of exposure and the precise location in the flux beam.

From Ivanpah, 141 birds were collected and examined. Collection dates spanned a period of one year and five months (July 2012 to December 2013) and included at least seven months of construction during which time the towers were not actively fluxing (2013). There were 49 species represented (Table 4). Those found in the greatest numbers were Yellow-rumped Warblers (*Setophaga coronata;* 14), House Finches (*Carpodacus mexicanus*; 13), Mourning Doves (*Zenaida macroura*; 11) and American Coots (*Fulica americana*; 7). Yellow-rumped Warblers and House Finches were found exclusively at the power tower site.

Solar flux injury was identified as the cause of death in 47/141 birds. Solar flux burns manifested as feather curling, charring, melting and/or breakage and loss. Flight feathers of the tail and/or wings were invariably affected. Burns also tended to occur in one or more of the following areas; the sides of the body (axillae to pelvis), the dorsal coverts, the tops and/sides of the head and neck and the dorsal body wall (the back). Overlapping portions of feathers and light-colored feathers were often spared (Figures 3 and 4).

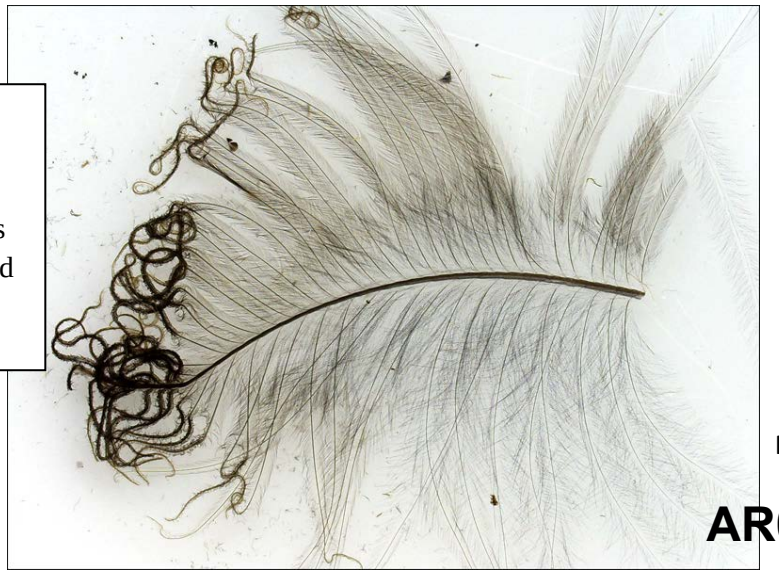

Figure 3: contour feather from the back of a House Finch with Grade 3 solar flux injury. The feather has curling and charring limited to the exposed tip.

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Figure 4: Feather from a Peregrine Falcon with Grade 2 solar flux injury. Note burning of dark feather bands with relative sparing of light bands.

The yellow and red rumps of Yellow-rumped Warblers and House Finches respectively remained strikingly unaffected (See Figure 1). Charring of head feathers, in contrast, was generally diffuse across all color patterns. A pattern of spiraling bands of curled feathers across or around the body and wings was often apparent.

Table 5. Cause of death (COD) data

Cause of Death	Ivanpah	Genesis	Desert Sunlight	Total
Solar Flux	47	0	0	47
Impact trauma	24	6	19	49
Predation trauma	5	2	15	22
Trauma of undetermined cause	14	0	0	14
Electrocution	1	0	0	1
Emaciation	1	0	0	1
Undetermined (remains in poor condition)	46	17	22	85
No evident cause of death	3	6	5	14
Total	141	31	61	233

Eight birds were assigned a feather damage Grade of 1 with curling of less than 50% of the flight feathers. Six of these had other evidence of acute trauma (75%). Five birds were Grade 2, including three birds that were found alive and died shortly afterwards. Of these birds, 2 (the birds found dead) also had evidence of acute trauma. Twenty-eight birds were Grade 3; with charring of body feathers. Of these birds, 21/28

(28%) had other evidence of acute trauma. Remaining carcasses (6) were incomplete and a grade could not be assigned.

Twenty-nine birds with solar flux burns also had evidence of impact trauma. Trauma consisted of skull fractures or indentations (8), sternum fractures (4), one or more rib fractures (4), vertebral fractures (1), leg fracture (3), wing fracture (1) and/or mandible fracture (1). Other signs of trauma included acute macroscopic and/or microscopic internal hemorrhage. Location found was reported for 39 of these birds; most of the intact carcasses were found near or in a tower. One was found in the inner heliostat ring and one was found (alive) on a road between tower sites. The date of carcass collection was provided for 42/47. None were found prior to the reported first flux (2013).



Figure 5: The dorsal aspect of the wing from a Peregrine Falcon (the same bird as shown in Figure 4) with Grade 2 lesions. Note extensive curling of feathers without visible charring. This bird was found alive, unable to fly, emaciated and died shortly thereafter. These findings demonstrate fatal loss of function due to solar flux exposure in the absence of skin or other soft tissue burns.

Among the solar flux cases, a variety of bird species were affected though all but one (a raptor) was a passerine (Appendix 2). House Finches and yellow-rumped Warblers were most often represented (10/47 and 12/47 respectively). For the birds in which species could be determined (41/47), insects were a major

dietary component in all but two species. These were an unidentified hummingbird (*Selasphorus*) species (known to include insects in the diet) and a Peregrine Falcon (a species that feeds on small birds).

Four birds were reportedly found alive and taken to a wildlife rehabilitation center where they died one to a few days later (exact dates were not consistently provided). Three had Grade 2 feather burns and one had Grade 3 feather burns. None had other evidence of trauma. Body condition was reduced in all of the birds (two considered thin and two emaciated) based on a paucity of fat stores and depletion of skeletal muscling. The four birds were of four different species and consisted of three passerines and one raptor.

The second most commonly diagnosed cause of death at the Ivanpah facility was impact (or blunt force) trauma (24/141 birds). Necropsy findings were as previously described at the Desert Sunlight facility. Impact marks were reported on heliostat mirrors adjacent to the carcasses in 5 cases and mirrors were described as being vertically-oriented in 5 cases. Specific carcass locations were reported for 18 of the birds. Those birds were found in a variety of areas; below heliostats (8/18), in or near tower and powerblock buildings (4/18), on roads (2/18), below power lines (2/18), in the open (1/18) and by a desert tortoise pen (1/18).

Predation was determined to be the cause of death for five of the birds. A coot and a Mourning Dove were found with extensive trauma and hemorrhage to the head and upper body consisting of lacerations, crush trauma and/or decapitation. One of the birds (an American Coot) was found near a kit fox shelter site. One bird (Northern Mockingbird) was found near the fence line and the third (a Mourning Dove) in an alley way. Two more birds (an unidentified sparrow and an American Pipit) were observed being eaten by one of the resident Common Ravens.

Discussion of Cause of Death of Birds Found at the Solar Power Plants

Impact trauma:

Sheet glass used in commercial and residential buildings has been well-established as a hazard for birds, especially passerines (Klem 1990, 2004, 2006; Loss et al. 2014). A recent comprehensive review estimated that between 365-988 million birds die annually by impacting glass panels in the United States alone (median estimate 599 million; Loss et al. 2014). Conditions that precipitate window strike events include the positioning of vegetation on either side of the glass and the reflective properties of the window. Glass panels that reflect trees and other attractive habitat are involved in a higher number of bird collisions.

The mirrors and photovoltaic panels used at all three facilities are movable and generally directed upwardly, reflecting the sky. At the Ivanpah facility, when heliostats are oriented vertically (typically for washing or installation, personal communication, RAK) they appear to pose a greater risk for birds. Of the eight birds reported found under a heliostat, heliostats were vertically-oriented in at least 5 cases. (D Klem Jr., DC Keck, KL Marty, AJ Miller Ball, EE Niciu, and CT Platt. 2004. Effects of window angling, feeder placement, and scavengers on avian mortality at plate glass. Wilson Bulletin, 116(1):69-73; D Klem Jr. 2006. Glass: A deadly conservation issue for birds. Bird Observer 34(2):73-81; D Klem Jr. 1990.

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Collisions between birds and windows: mortality and prevention. Journal of Field Ornithology 61:120–128; Loss, S.R., T. Will, S.S.Loss, and P.P. Marra. 2014. Bird-building collisions in the United States: Estimates of annual mortality and species vulnerability. Condor 116: 8-23). Studies with aquatic insects have found that vertically-oriented black glass surfaces (similar to solar panels) produced highly polarized reflected light, making them highly attractive (Kriska, G., P. Makik, I. Szivak, and G. Horvath. 2008. Glass buildings on river banks as "polarized light traps" for mass-swarming polarotactic caddis flies. Naturwissenschaften 95: 461-467).

A desert environment punctuated by a large expanse of reflective, blue panels may be reminiscent of a large body of water. Birds for which the primary habitat is water, including coots, grebes, and cormorants, were over-represented in mortalities at the Desert Sunlight facility (44%) compared to Genesis (19%) and Ivanpah (10%). Several factors may inform these observations. First, the size and continuity of the panels differs between facilities. Mirrors at Ivanpah are individual, 4 x 8' panels that appear from above as stippling in a desert background (Figure 6). Photovoltaic panels at Desert Sunlight are long banks of adjacent 27.72 x 47.25" panels (70 x 120 cm), providing a more continuous, sky/water appearance. Similarly, troughs at Genesis are banks of 5 x 5.5' panels that are up to 49-65 meters long.



Figure 6: The Ivanpah Solar Electric Generating System as seen via satellite. The mirrored panels are 5 x 8 feet.

There is growing concern about "polarized light pollution" as a source of mortality for wildlife, with evidence that photovoltaic panels may be particularly effective sources of polarized light in the environment (see Horvath et al. 2010. Reducing the maladaptive attractiveness of solar panels to polarotactic insects. Conservation Biology 24: 1644-1653, and ParkScience, Vol. 27, Number 1, 2010; available online at: http://www.nature.nps.gov/parkscience/index.cfm?ArticleID=386&ArticleTypeID=5; as well as discussion of this issue in the Desert Sunlight Final Environmental Impact Statement, Chapter 4, pp. 14-15).

Variables that may affect the illusory characteristics of solar panels are structural elements or markings that may break up the reflection. Visual markers spaced at a distance of 28 cm or less have been shown to reduce the number of window strike events on large commercial buildings (City of Toronto Green Development Standard; Bird-friendly development guidelines. March 2007). Mirrors at the Ivanpah facility are unobscured by structures or markings and present a diffuse, reflective surface. Photovoltaic panels at Desert Sunlight are arranged as large banks of small units that are 60 x 90 cm. The visually uninterrupted expanse of both these types of heliostat is larger than that which provides a solid structure visual cue to passerines. Parabolic troughs at Genesis have large, diffusely reflective surfaces between seams that periodically transect the bank of panels at 5.5' intervals. Structures within the near field, including the linear concentrator and support arms, and their reflection in the panels and may provide a visual cue to differentiate the panel as a solid structure.

The paper by Horvath et al cited above provides experimental evidence that placing a white outline and/or white grid lines on solar panels significantly reduced the attractiveness of these panels to aquatic insects, with a loss of only 1.8% in energy-producing surface area (p. 1651). While similar detailed studies have yet to be carried out with birds, this work, combined with the window strike results, suggest that significant reductions in avian mortality at solar facilities could be achieved by relatively minor modifications of panel and mirror design. This should be a priority for further research.

Finally, ponds are present on the property of the Desert Sunlight and Genesis facilities. The pond at Genesis is netted, reducing access by migratory birds, while the pond at Desert Sunlight is open to flighted wildlife. Thus, birds are both attracted to the water feature at Desert Sunlight and habituated to the presence of an accessible aquatic environment in the area. This may translate into the misinterpretation of a diffusely reflected sky or horizonal polarized light source as a body of water.

Stranding and Predation:

Predation is likely linked to panel-related impact trauma and stranding. Water birds were heavily over-represented in predation mortalities at Desert Sunlight. Of the 15 birds that died due to predation, 14 make their primary habitat on water (coots, grebes, a cormorant, and an avocet). A single White-winged Dove was the only terrestrial-based predation mortality in the submitted specimens. This is in contrast to blunt trauma mortalities at Desert Sunlight in which 8 of the 19 birds determined to have died of impact trauma were water species.

Locations of the birds when found dead were noted on several submissions. Of the birds that died of predation for which locations were known, none were located near ponds. The physiology of several of

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these water birds is such that locomotion on land is difficult or impossible. Grebes in particular have very limited mobility on land and require a run across water in order to take off (Jehl, J. R., 1996. Mass mortality events of Eared Grebes in North America. Journal of Field Ornithology 67: 471-476). Thus, these birds likely did not reach their final location intentionally. Ponds at the PV and trough sites are fenced, prohibiting terrestrial access by predators. Birds on the water or banks of the pond are inaccessible to resident predators. Therefore, it is unlikely that the birds were captured at the pond and transported by a predator into the area of the panels. Attempts to land or feed on the panels because of their deceptive appearance may have injured the birds to the point that they could not escape to safety, or inadvertently stranded the birds on a substrate from which they could not take flight. We believe that an inability to quickly flee after striking the panels and stranding on the ground left these birds vulnerable to opportunistic predators. At least two types of predators, kit foxes and ravens, have been observed in residence at the power tower and PV facilities and ravens have been reported at the trough site (personal communication and observation, RAK). Additionally, histories for multiple birds found at the tower site document carcasses found near kit fox shelters or being eaten or carried by a raven.

Solar Flux:

Avian mortality due to exposure to solar flux has been previously explored and documented (McCrary, M. D., McKernan, R. L., Schreiber, R. W., Wagner, W. D., and Sciarrotta, T. C. Avian mortality at a solar energy power plant. Journal of Field Ornithology, 57(2): 135-141). Solar flux injury to the birds of this report, as expected, occurred only at the power tower facility. Flux injury grossly differed from other sources of heat injury, such as electrocution or fire. Electrocution injury requires the bridging of two contact points and is, therefore, seen almost exclusively in larger birds such as raptors. Contact points tend to be on the feet, carpi and/or head and burns are often found in these areas. Electrocution causes deep tissue damage as opposed to the surface damage of fire or solar flux. Other sequelae include amputation of limbs with burn marks on bone, blood vessel tears and pericardial hemorrhage. Burns from fires cause widespread charring and melting of feathers and soft tissues and histopathologic findings of soot inhalation or heat damage to the respiratory mucosa. None of these were characteristics of flux injury. In the flux cases small birds were over-represented, had burns generally limited to the feathers and internal injuries attributable to impact. Flux injury inconsistently resulted in charring, tended to affect feathers along the dorsal aspects of the wings and tail, and formed band-like patterns across the body (Divincenti, F. C., J. A. Moncrief, and B. A. Pruitt. 1969. Electrical injuries: a review of 65 cases. The Journal of Trauma 9: 497-507).

Proposed mechanisms of solar flux-related death follow one or a combination of the following pathways:

- impact trauma following direct heat damage to feathers and subsequent loss of flight ability
- starvation and/or thermoregulatory dysfunction following direct heat damage to feathers
- shock
- soft tissue damage following whole-body exposure to high heat
- ocular damage following exposure to bright light.

Necropsy findings from this study are most supportive of the first three mechanisms.

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Loss of feather integrity has effects on a bird's ability to take off, land, sustain flight and maneuver. Tail feathers are needed for lift production and maneuverability, remiges are needed for thrust and lift and feathers along the propatagium and coverts confer smoothness to the avian airfoil. Shortening of primary flight feathers by as little as 1.6 cm with loss of secondary and tertiary remiges has been shown to eliminate take-off ability in house sparrows further demonstrating the importance of these feathers (Brown, R. E., and A. C. Cogley, 1996. Contributions of the propatagium to avian flight: Journal of Experimental Zoology 276: 112-124). Loss of relatively few flight feathers can, therefore, render a bird unable or poorly-able to fly. Birds encountering the flux field at Ivanpah may fall as far as 400 feet after feather singeing. Signs of impact trauma were often observed in birds with feather burns and are supportive of sudden loss of function (Beaufrere, H., 2009. A review of biomechanic and aerodynamic considerations of the avian thoracic limb. Journal of Avian Medicine and Surgery 23: 173-185).

Birds appear to be able to survive flux burns in the short term, as evidenced by the collection of several live birds with singed feathers. Additionally, Forensic Lab staff observed a falcon or falcon-like bird with a plume of smoke arising from the tail as it passed through the flux field. Immediately after encountering the flux, the bird exhibited a controlled loss of stability and altitude but was able to cross the perimeter fence before landing. The bird could not be further located following a brief search (personal observation, RAK and EOE). Birds that initially survive the flux exposure and are able to glide to the ground or a perch may be disabled to the point that they cannot efficiently acquire food, escape predators or thermoregulate. Observations of emaciation in association with feather burns in birds found alive is supportive of debilitation subsequent to flux exposure. More observational studies and follow-up are required to understand how many birds survive flux exposure and whether survival is always merely short-term. As demonstrated by the falcon, injured birds (particulary larger birds), may be ambulatory enough to glide or walk over the property line indicating a need to include adjacent land in carcass searches.

There was evidence of acute skin burns on the heads of some of the Grade 3 birds that were found dead. But interestingly, tissue burn effects could not be demonstrated in birds known to have survived short periods after being burned. Hyperthermia causing instantaneous death manifests as rapid burning of tissue, but when death occurs a day or later there will be signs of tissue loss, inflammation, proteinic exudate and/or cellular death leading to multisystemic organ failure. The beginnings of an inflammatory response to injury can be microscopically observed within one to a few hours after the insult and would have been expected in any of the four birds found alive. Signs of heat stroke or inhalation of hot air should have been observable a day or more after the incident. Rather, in these cases extensive feather burns on the body largely appeared to be limited to the tips of the feathers with the overlapping portions insulating the body as designed. This, in conjunction with what is likely only a few seconds or less spent in the flux, suggests that skin or internal organ damage from exposure to high temperatures in solar flux may not be a major cause of the observed mortality.

Ocular damage following light exposure was also considered but could not be demonstrated in the submitted birds. In the four birds that initially survived, there were no signs of retinal damage, inflammation or other ocular trauma. Given the small sample size, this does not preclude sight impairment as a possible sequela but clinical monitoring of survivors would be needed to draw more definitive conclusions.

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Other/Undetermined:

Powerline electrocution was the cause of death for one bird (a juvenile Common Raven) at the Ivanpah facility. Electrocution at these solar facilities is a potential hazard but, thus far, appears to be an uncommon cause of death.

Smashed birds (13/233) were found at all three locations. Detailed carcass collection information was provided for 6; all were found on roads. Though poor carcass quality in all cases precluded definitive cause death determination, circumstances and carcass condition suggest vehicle trauma as the cause of deaths. The relatively low numbers of vehicle collisions may be attributed to slow on-site vehicle speeds and light traffic. Vehicle collisions, therefore, do not appear to be a major source of mortality and would be expected to decrease as construction ends.

There was a large number of birds (85/233) for which a cause of death could not be determined due to poor carcass condition. The arid, hot environment at these facilities leads to rapid carcass degradation which greatly hinders pathology examination. Results were especially poor for birds from the Genesis facility, where the cause of death(s) for 23/31 (74%) could not be determined. These results underscore the need for carcasses to be collected soon after death. More frequent, concerted carcass sweeps are advised.

Insect mortality and solar facilities as "mega-traps"

An ecological trap is a situation that results in an animal selecting a habitat that reduces its fitness relative to other available habitats (Robertson, B.A. and R.L. Hutto. 2006. A framework for understanding ecological traps and an evaluation of existing evidence. Ecology 87: 1075-1085; Robertson, B.A., J.S. Rehage, and Sih, A. 2013. Ecological novelty and the emergence of evolutionary traps. Trends in Ecology and Evolution 28: 552-560).

A wide variety of circumstances may create ecological traps, ranging from subtle (songbirds attracted to food resources in city parks, where they are vulnerable to unnaturally high populations of predators) to direct (birds are attracted to oil-filled ponds, believing it to be water, and become trapped). It appears that solar flux facilities may act as "**mega-traps,"** which we define as artificial features that attract and kill species of multiple trophic layers. The strong light emitted by these facilities attract insects, which in turn attract insect-eating birds, which are incapacitated by solar flux injury, thus attracting predators and creating an entire food chain vulnerable to injury and death.

OLE staff observed large numbers of insect carcasses throughout the Ivanpah site during their visit. In some places there were hundreds upon hundreds of butterflies (including monarchs, *Danaus plexippus*) and dragonfly carcasses. Some showed singeing, and many appeared to have just fallen from the sky. Careful observation with binoculars showed the insects were active in the bright area around the boiler at the top of the tower. It was deduced that the solar flux creates such a bright light that it is brighter than the surrounding daylight. Insects were attracted to the light and could be seen actively flying the height of the tower. Birds were also observed feeding on the insects. At times birds flew into the solar flux and ignited. Bird carcasses recovered from the site showed the typical singed feathers. The large populations of insects

may also attract indigenous bat species, which were seen roosting in structures at the base of the power tower.

Monarch butterflies in North America – both east and west of the Rocky Mountains – have been documented to be in decline (see the North American Monarch Conservation Plan, available at: http://www.mlmp.org/Resources/pdf/5431_Monarch_en.pdf). Proposed causes include general habitat loss and specific loss of milkweed, upon which the butterflies feed and reproduce. Considering the numerous monarch butterfly carcasses seen at the Ivanpah facility, it appears that solar power towers could have a significant impact on monarch populations in the desert southwest. Analysis of the insect mortality at Ivanpah, and systematic observations of bird/insect interactions around the power tower, is clearly needed.

Bird species affected by solar flux include both insectivores (e.g. swallows, swifts, flycatchers, and warblers) and raptors that prey on insect-feeding birds. Based on observations of the tower in flux and the finding of large numbers of butterflies, dragonflies and other insects at the base of the tower and in adjacent buildings it is suspected that the bright light generated by solar flux attracts insects, which in turn attracts insectivores and predators of insectivores. Waterbirds and other birds that feed on vegetation were not found to have solar flux burns. Birds were observed perching and feeding on railings at the top of the tower, apparently in response to the insect aggregations there.

Further, dead bats found at the Ivanpah site could be attracted to the large numbers of insects in the area. Nineteen bats from the condenser area of the power tower facility have been submitted to NFWFL for further evaluation. These bats belong to the Vespertilionidae and Molossidae families, which contain species considered by the Bureau of Land Management to be sensitive species in California. Preliminary evaluation revealed no apparent singing of the hair, and analysis is ongoing.

Solar flux and heat associated with solar power tower facilities

Despite repeated requests, we have been unsuccessful in obtaining technical data relating to the temperature associated with solar flux at the Ivanpah facility. The following summarizes the information we have gathered from other sources.



Figure 7 Ivanpah solar power facilities http://ivanpahsolar.com/about

The Ivanpah solar energy generating facility consists of mirrors that reflect sunlight to a tower. In the tower sits a boiler that generates steam which then powers a turbine.

At the top of a 459 foot tall tower sits a boiler (solar receiver) that is heated by the sun rays reflected by 300,000 mirrors, called solar heliostats. When the concentrated sunlight strikes the boiler tubes, it heats the water to create superheated steam. The high temperature steam is then piped from the boiler to a turbine where electricity is generated (http://ivanpahsolar.com/about visited on 01/20/2014).

If all the solar heliostats are focused on the solar tower the beams multiply the strength of sunlight by 5000 times, and this generates temperatures at the solar tower in excess of 3600° Fahrenheit (> 1982° Celsius). Since steel melts at 2750° Fahrenheit (1510° Celsius), only a percentage of heliostats are focused on the solar receiver so that) the optimal temperature at the tower is approximately 900° Fahrenheit (~482° Celsius) ("How do they do it" Wag TV for Discovery Channel, Season 3, Episode 15, "Design Airplane Parachutes, Create Solar Power, Make Sunglasses" Aired August 25, 2009).



Figure 8: Seville solar power facility (http://inhabitat.com/sevilles-solar-power-tower)

A solar steam plant in Coalinga that also uses heliostat technology for extracting oil is on record stating that the steam generator is set to about 500° Celsius. (http://abclocal.go.com/kDSn/story?section=news%2Fbusiness&id=8377469 Viewed Jan 21, 2013)

Temperatures measured by the authors at the edge of the solar complex on the surface of a heliostat were approximately 200° Fahrenheit (~93° Celsius). Therefore, there is a gradient of temperature from the edge of the solar field to the tower that ranges from 200° to 900° Fahrenheit.

There is a phenomenon that occurs when the heliostats are focused on the tower and electricity is being generated. The phenomenon can be described as either a circle of clouds around the tower or, at times, a cloud formed on the side that is receiving the solar reflection. It appears as though the tower is creating clouds. Currently we propose two hypotheses of why this "cloud" is formed. The first hypothesis is simply the presumption that the high heat associated with towers is condensing the air, and forming the



Figure 9: Tower 1 (bright white) is shown under power. Tower 2 (black) is not operating.

clouds. The second hypothesis is that this phenomenon does not represent clouds at all rather it is a place in space where the heliostats that are not being used to generate heat are focused. Under this scenario, it is a place where the mirrors focus the excess energy not being used to generate electricity.

Ivanpah employees and OLE staff noticed that close to the periphery of the tower and within the reflected solar field area, streams of smoke rise when an object crosses the solar flux fields aimed at the tower. Ivanpah employees used the term "streamers" to characterize this occurrence.

When OLE staff visited the Ivanpah Solar plant, we observed many streamer events. It is claimed that these events represent the combustion of loose debris, or insects. Although some of the events are likely that, there were instances in which the amount of smoke produced by the ignition could only be explained by a larger flammable biomass such as a bird. Indeed OLE staff observed birds entering the solar flux and igniting, consequently becoming a streamer.

OLE staff observed an average of one streamer event every two minutes. It appeared that the streamer events occurred more frequently within the "cloud" area adjacent to the tower. Therefore we hypothesize that the "cloud" has a very high temperature that is igniting all material that traverses its field.
One possible explanation of this this phenomenon is that the "cloud" is a convergent location where heliostats are "parked" when not in use. Conversely it undermines the condensation hypothesis, given that birds flying through condensation clouds will not spontaneously ignite.

Temperatures required to burn feathers

Many of the carcasses recovered from the Ivanpah Solar plant after the plant became operational showed singing of feathers as shown in Figure 10.



Figure 10: Singed feathers from a Northern Rough-winged Swallow

In order to investigate at what temperature feathers burn/singe, we exposed feathers to different air temperatures. Each feather was exposed to a stream of helium and air for 30 seconds. The results indicate that at 400° Celsius (752° Fahrenheit) after 30 seconds the feather begins to degrade. But at 450° and



Figure 11: Results of exposing feathers to different temperatures (in degrees Celsius)

500° Celsius (842° and 932° Fahrenheit respectively) the feathers singed as soon as they made contact with the superheated air (Figure 11). Therefore, when singed birds are found, it can be inferred that the temperatures in the solar flux at the time a bird flew through it was at least 400° Celsius (752° Fahrenheit). This inference is consistent with the desired operating temperature of a power tower solar boiler (482° Celsius).

The fact that a bird will catch on fire as it flies through the solar flux has been confirmed by a Chevron engineer who works at the Coalinga Chevron Steam plant, a joint venture of Chevron and BrightSource Solar. (http://abclocal.go.com/kDSn/story?section=news%2Fbusiness&id=8377469 Viewed Jan 21, 2013)

Conclusions and Recommendations

In summary, three main causes of avian mortality were identified at these facilities; impact trauma, predation and solar flux. Birds at all three types of solar plants were susceptible to impact trauma and predators. Solar flux injury was unique to the power tower facility. Solar facilities, in general, do not appear to attract particular species, rather an ecological variety of birds are vulnerable. That said, certain mortality and species trends were evident, such as waterbirds at Desert Sunlight, where open water sources were present.

Specific hazards were identified, including vertically-oriented mirrors or other smooth reflective panels; water-like reflective or polarizing panels; actively fluxing towers; open bodies of water; aggregations of insects that attracted insectivorous birds; and resident predators. Making towers, ponds and panels less attractive or accessible to birds may mitigate deaths. Specific actions include placing perch-guards on power tower railings near the flux field, properly netting or otherwise covering ponds, tilting heliostat mirrors during washing and suspending power tower operation at peak migration times.

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Visual cues should be retrofitted to existing panels and incorporated into new panel design. These cues may include UV-reflective or solid, contrasting bands spaced no further than 28 cm from each other. This arrangement has been shown to significantly reduce the number of passerines hitting expanses of windows on commercial buildings. Spacing of 10 cm eliminates window strikes altogether. Further exploration of panel design and orientation should be undertaken with researchers experienced in the field (Daneil Klem Jr. of Muhlenberg College) to determine causes for the high rate of impact trauma, and designs optimized to reduce these mortalities.

Challenges to data collection included rapid degradation of carcass quality hindering cause of death and species determination; large facilities which are difficult to efficiently search for carcasses; vegetation and panels obscuring ground visibility; carcass loss due to scavenging; and inconsistent documentation of carcass history. Searcher efficiency has been shown to have varying influences on carcass recovery with anywhere from 30% to 90% detection of small birds achieved in studies done at wind plants (Erickson et al., 2005). Scavengers may also remove substantial numbers of carcasses. In studies done on agricultural fields, up to 90% of small bird carcasses were lost within 24 hours (Balcomb, 1986; Wobeser and Wobeser, 1992). OLE staff observed apparently resident ravens at the Ivanpah power tower. Ravens are efficient scavengers, and could remove large numbers of small bird carcasses from the tower vicinity. (Erickson, W. P., G. D. Johnson, and D. P. Young, Jr., 2005, A summary and comparison of bird mortality from anthropogenic causes with an emphasis on collisions: U S Forest Service General Technical Report PSW, v. 191, p. 1029-1042; Balcomb, R., 1986, Songbird carcasses disappear rapidly from agricultural fields: Auk, v. 103, p. 817-820; Wobeser, G., and A. G. Wobeser, 1992, Carcass disappearance and estimation of mortality in a simulated die-off of small birds: Journal of Wildlife Diseases, v. 28, p. 548-554.)

Given these variables it is difficult to know the true scope of avian mortality at these facilities. The numbers of dead birds are likely underrepresented, perhaps vastly so. Observational and statistical studies to account for carcass loss may help us to gain a better sense of how many birds are being killed. Complete histories would help us to identify factors (such as vertical placement of mirrors) leading to mortalities. Continued monitoring is also advised as these facilities transition from construction to full operation. Of especial concern is the Ivanpah facility which was not fully-functioning at the time of the latest carcass submissions. In fact, all but 7 of the carcasses with solar flux injury and reported dates of collection were found at or prior to the USFWS site visit (October 21-24, 2013) and, therefore, represent flux mortality from a facility operating at only 33% capacity. Investigation into bat and insect mortalities at the power tower site should also be pursued.

ACKNOWLEDGMENTS

We wish to acknowledge the invaluable assistance and insights of S.A. Michael Clark and S.A. Ed Nieves.

Appendix 1. List of all 71 species recovered from the three solar energy sites. In this table, remains of closely related taxa that could not be definitively identified (e.g. Cinnamon/Blue-winged Teal and Black-throated/Sage Sparrow) are assigned to the biogeographically more likely taxon. In all such cases, the possible taxa are ecologically similar. All of these species are MBTA-listed.

SPECIES		Zone	Residency	Sites	MNI
Cinnamon Teal	*Anas cyanoptera*	water	migrant	DS,IV	5
Pied-billed Grebe	*Podilymbus podiceps*	water	migrant	DS	1
Western Grebe	*Aechmorphorus occidentalis*	water	migrant	DS	9
Eared Grebe	*Podiceps nigricollis*	water	migrant	DS,GN	5
Brown Pelican	*Pelecanus occidentalis*	water	migrant	DS	2
Double-crested Cormorant	*Phalacrocorax auritus*	water	migrant	DS	2
Great Blue Heron	*Ardea herodias*	water	migrant	GN	1
Black-crowned Night-Heron	*Nycticorax nycticorax*	water	migrant	DS	1
Cooper's Hawk	*Accipiter cooperii*	air	migrant	IV	1
Red-shouldered Hawk	*Buteo lineatus*	terr	migrant	IV	1
American Kestrel	*Falco sparverius*	air	resident	GN,IV	2
Peregrine Falcon	*Falco peregrinus*	air	resident	IV	1
American Coot	*Fulica americana*	water	migrant	DS, IV	12
Yuma Clapper Rail	*Rallus longirostris yumanensis*	water	resident	DS	1
Sora	*Porzana carolina*	water	migrant	DS,IV	2
American Avocet	*Recurvirostra americana*	water	migrant	DS	1
Spotted Sandpiper	*Actitis maculatus*	water	migrant	IV	2
Ring-billed Gull	*Larus delawarensis*	water	migrant	GN	2
California Gull	*Larus californianus*	water	resident	GN	1
Greater Roadrunner	*Geococcyx californianus*	terr	resident	IV	5
Yellow-billed Cuckoo	*Coccyzus americanus*	terr	migrant	IV	1
Mourning Dove	*Zenaida macroura*	terr	resident	DS, IV	14
White-winged Dove	*Zenaida asiatica*	terr	resident	DS,GN	2
Barn Owl	*Tyto alba*	terr	resident	IV	1
Lesser nighthawk	*Chordeiles acutipennis*	air	resident	DS,GN,IV	7
Common Poorwill	*Phalaenoptilus nuttallii*	air	resident	DS,IV	2
White-throated Swift	*Aeronautes saxatalis*	air	resident	IV	1
Costa's Hummingbird	*Calypte costae*	air	resident	DS	1
Allen's/Rufous Hummingbird	*Selasphorus sp.*	air	migrant	IV	1
Northern Flicker	*Colaptes auratus*	terr	resident	IV	1
Ash-throated Flycatcher	*Myiarchus cinerascens*	air	resident	DS,IV	2
Say's Phoebe	*Sayornis saya*	air	resident	GN	2
Black Phoebe	*Sayornis nigricollis*	air	resident	DS	1
Loggerhead shrike	*Lanius ludovicianus*	terr	resident	DS,IV	5
Warbling Vireo	*Vireo gilvus*	terr	migrant	IV	1
Common Raven	*Corvus corax*	terr	resident	DS,IV	3
Horned Lark	*Eremophila alpestris*	terr	migrant	DS	1
Tree Swallow	*Tachycineta bicolor*	air	migrant	DS,GN,IV	5

SPECIES		Zone	Residency	Sites	MNI
Cliff Swallow	*Petrochelidon pyrrhonota*	air	resident	GN	5
No. Rough-winged Swallow	*Stelgidopteryx serripennis*	air	migrant	IV	2
Verdin	*Auriparus flaviceps*	terr	resident	IV	3
Blue-gray Gnatcatcher	*Polioptila caerulea*	terr	resident	IV	1
Northern Mockingbird	*Mimus polyglottos*	terr	resident	IV	1
American Pipit	*Anthus rubescens*	terr	migrant	IV	4
Orange-crowned Warbler	*Oreothlypis celata*	terr	migrant	IV	1
Lucy's Warbler	*Oreothlypis luciae*	terr	resident	IV	1
Yellow-rumped Warbler	*Setophaga coronata*	air	migrant	IV	14
Black-throated Gray Warbler	*Setophaga nigrescens*	terr	migrant	IV	1
Hermit Warbler	*Setophaga occidentalis*	terr	migrant	GN	1
Townsend's warbler	*Setophaga townsendi*	terr	migrant	DS,IV	4
Yellow Warbler	*Setophaga petechia*	terr	migrant	IV	1
Black-and-white Warbler	*Mniotilta varia*	terr	migrant	IV	1
MacGillivray's Warbler	*Oporornis tolmei*	terr	migrant	IV	1
Wilson's Warbler	*Cardellina pusilla*	terr	migrant	DS,IV	4
Common Yellowthroat	*Geothlypis trichas*	terr	migrant	DS	1
Western Tanager	*Piranga ludoviciana*	terr	migrant	DS,IV	4
Black-headed Grosbeak	*Pheucticus melanocephalus*	terr	migrant	DS,GN	2
Lazuli Bunting	*Passerina caerulea*	terr	migrant	IV	1
Blue Grosbeak	*Passerina caerulea*	terr	resident	IV	1
Green-tailed Towhee	*Pipilo chlorurus*	terr	migrant	IV	1
Brewer's Sparrow	*Spizella breweri*	terr	resident	IV	3
Chipping Sparrow	*Spizella passerina*	terr	resident	GN,IV	4
Black-throated Sparrow	*Amphispiza bilineata*	terr	resident	DS,IV	4
Savannah Sparrow	*Passerculus sandwichensis*	terr	migrant	DS,IV	3
White-crowned Sparrow	*Zonotrichia leucophrys*	terr	migrant	IV	6
Pine Siskin	*Spinus pinus*	terr	migrant	IV	1
House Finch	*Carpodacus mexicanus*	terr	resident	IV	13
Great-tailed Grackle	*Quiscalus mexicanus*	terr	resident	DS,IV	5
Brown-headed Cowbird	*Molothrus ater*	terr	resident	DS,GN,IV	8
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	terr	migrant	DS	1
Bullock's Oriole	*Icterus bullockii*	terr	resident	GN	2

Species recovered from one site: 47
two sites: 18
three sites: 5

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Appendix 2. Species with solar flux burns

Common Name	Scientific name	
Yellow-rumped warbler	*Setophaga coronata*	12
House finch	*Carpodacus mexicanus*	10
Chipping sparrow	*Spizella passerina*	2
Unidentified warbler	*Parulidae*	2
Verdin	*Auriparus flaviceps*	2
Great-tailed grackle	*Quiscalus mexicanus*	2
Lucy's warbler	*Oreothlypis luciae*	1
Wilson's warbler	*Cardellina pusilla*	1
MacGillivray's warbler	*Oporornis tolmei*	1
Black-throated gray warbler	*Setophaga nigrescens*	1
Townsend's warbler	*Setophaga townsendi*	1
Orange-crowned warbler	*Oreothlypis celata*	1
Blue-gray gnatcatcher	*Polioptila caerulea*	1
Unidentified swallow	*Hirundinidae*	1
Northern rough-winged swallow	*Stelgidopteryx serripennis*	1
Warbling vireo	*Vireo gilvus*	1
Unidentified hummingbird	*Selasphorus sp.*	1
Unidentified passerine	Passeriformes	1
Unidentified finch	*Carpodacus sp.*	1
Lazuli bunting	*Passerina caerulea*	1
Unidentified sparrow	*Spizella species*	1
Unidentified blackbird	*Icteridae*	1
Peregrine falcon	*Falco peregrinus*	1

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ECOLOGICAL SPECIATION OF KING RAILS (*RALLUS ELEGANS*) AND CLAPPER RAILS (*RALLUS LONGIROSTRIS*)

A Dissertation

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

in

The Department of Biological Sciences

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James Michael Maley
B.S., University of Alaska Fairbanks, 2002
M.S., University of Alaska Fairbanks, 2006
May 2012

ACKNOWLEDGMENTS

I have many people to thank for helping me complete this dissertation. I would first like to thank my advisor Dr. Robb T. Brumfield, who was instrumental in finishing this body of work. Thanks Robb. I would also like to thank my committee, Dr. J. Van Remsen, Dr. Fred Sheldon, Dr. Mike Hellberg, Dr. Fern Galvez, Dr. Al Afton, and Dr. Rick Shaw, for catapulting me forward to a career in ornithology and evolutionary biology.

In the field several people helped with logistics and made collecting possible. No person stands out more than Jacob R. Saucier. His constant enthusiasm and unwavering commitment to this project were instrumental in collecting samples and moving my dissertation forward. Additionally, Brian J. O'Shea, Glenn F. Seeholzer, and Michael G. Harvey helped tremendously to collect birds necessary for this research. I would also like to thank Dr. Matt Carling for providing me with such a tremendous opportunity to join you in Wyoming, you rock.

I would like to thank Tammie Jackson for her tireless help with this project; she is truly a gem. I would also like to thank Donna L. Dittmann and Steve W. Cardiff for help with permits, collecting, and preparing specimens for this project. The staff of the Department of Biological Sciences, in particular Priscilla Milligan, was invaluable.

I am indebted to the Brumfield lab postdocs Dr. Elizabeth Derryberry, Dr. John McCormack, and Dr. Brian Smith. I would like to thank several faculty members that provided me with useful discussion: Dr. Andrew Whitehead, Dr. Chris Austin, Dr. Prosanta Chakrabarty, Dr. Mark Hafner, Dr. Phil Stouffer, and Dr. Sammy King. Also, the graduate students of the Brumfield lab were instrumental in understanding and developing this dissertation. I would like to thank Gustavo Bravo, Dr. Curt Burney, Dr. Zac Cheviron, Dr. Santiago Claramunt, Andres Cuervo, Caroline Duffie, Sarah Hird, John Mittermeier, Luciano Naka, and Dr. Thomas Valqui.

Additionally, several students in other labs helped me with this work, in particular David Anderson, Natalia Aristizábal, Matt Brooks, Vivien Chua, Dr. Ron Eytan, Richard Gibbons, Nathan Jackson, Erik Johnson, Matt Jones, Dan Lane, Haw Chuan Lim, Ben Marks, Verity Mathis, John McVay, Tara Pelletier, Brad Pickens, Carlos Prada, Noah Reid, Eric Rittmeyer.

I would like to thank the following institutions, curators, collections managers, staff, and collectors for providing valuable tissue specimens critical to this study: Academy of Natural Sciences of Philadelphia (N. Rice), Field Museum of Natural History (J. Bates, S. Hackett, D. Willard), Marjorie Barrick Museum of Natural History (J. Klicka), Natural History Museum of Los Angeles County (K. Garrett), San Diego Natural History Museum (K. Burns, P. Unitt), University of Arkansas (D. Krementz), University of Kansas, Natural History Museum (R. Moyle, T. Peterson, M. Robbins), University of Michigan Museum of Zoology (J. Hinshaw), University of Washington, Burke Museum of Natural History and Culture (S. Birks). I would also like to thank S. Houston and the UAF Life Science Informatics Portal for computational support. UAF Life Science Informatics is supported by Grant Number RR016466 from the National Center for Research Resources (NCRR), a component of the National Institutes of Health. Collecting permits in Louisiana were granted by United States Fish and Wildlife Service and the Louisiana Department of Wildlife and Fisheries. I thank J. Huner, L. Richard, Jr., and P. Smith, Jr. for access to private land for collecting. This research was supported by grants DEB-0841729, DEB-0956909, and DEB -1110624.

Finally, I would like to thank my family for their support. Thanks Mom and Dad, Tom and Christy, and Bill and Larissa. I would also like to thank my two dogs for their unconditional love. Thanks Java, you were a great dog, and thanks Fred, you’re pretty good for a short dog.

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ABSTRACT

Ecological speciation is a process involving adaptation to different environments leading to reproductive isolation between populations. Hybridization between Clapper and King rails (*Rallus longirostris* and *R. elegans*) is frequent but restricted to narrow bands of brackish marsh along the Gulf of Mexico and Atlantic coastlines of North America. In the second chapter I used mitochondrial and nuclear sequences to infer phylogenetic relationships in this species complex. The complex falls out into three distinct groups: South America; western North America; and eastern North America and the Caribbean. My results indicate that *R. elegans* as currently recognized is paraphyletic, with birds of highland Mexico sister to *R. longirostris* of California whereas *R. elegans* of eastern North America and Cuba forms a clade with eastern North American and Caribbean *R. longirostris*. My results support splitting the complex into four distinct species. In the third chapter I used morphological data, ecological data, and DNA sequences generated via next-generation methods to investigate the hybrid zone situated along a salinity gradient. Maximum-likelihood clines fitted to the five loci, body weight, salt gland weight, and water salinity revealed that the hybrid zone is narrow (mean genetic cline width = ~8.3 km), and that all clines are coincident and concordant with the water salinity cline. In the fourth chapter, I measured morphological characters on males collected across the hybrid zone to determine differences on opposite ends of the zone and to examine if these differences covaried and were correlated with genotypes from four nuclear markers; I also estimated dispersal distances using these characters. For four hybrid sites I found six of twelve correlations were significant, and ten of twelve estimates of covariance were greater than the expected covariance, suggesting selection against recombinants for the quantitative characters salt gland weight, bill length, and overall size. The estimates of dispersal distances for genetic and morphological characters were more than an order of magnitude lower than the only published estimate from a

banding study. These results suggest that while rails are capable of dispersing across the zone, the hybrid zone constrains dispersal within it.

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CHAPTER 1

INTRODUCTION

Speciation in vertebrates is thought to occur via allopatry, where geographically isolated populations diverge genetically and phenotypically to the point of reproductive isolation (Mayr 1942). Ecological speciation occurs when this process is accelerated by adaptations to different environmental conditions (Nosil et al. 2009). Compelling examples of ecological speciation in non-model organisms are few, primarily because evolutionary mechanisms in allopatric populations are inherently difficult to test (Hendry et al. 2007; Nosil et al. 2009) and because the relevant selective agent acting on natural populations is often difficult to pinpoint. Recently diverged populations distributed along an environmental gradient provide excellent systems in which to investigate the processes associated with adaptive divergence in the context of ecological speciation. Salinity gradients are known to induce adaptive divergence in aquatic organisms (Whitehead and Crawford 2006; Hemmer-Hansen et al. 2007; Fuller 2008), but the extent to which physiological, ecological, or genetic adaptation of terrestrial vertebrates distributed along salinity gradients is involved in speciation has not been investigated. I set out to investigate adaptation in a pair of apparently hybridizing marsh birds found in the eastern United States (Figure 1.1).

To first understand the evolutionary relationship between Clapper and King rails, I reconstructed the phylogeny of the complex (Chapter 2). The genus *Rallus* comprises nine or ten species (Taylor 1996), depending on whether *R. aquaticus* of Eurasia is divided into two species (Tavares et al. 2010). Six of the nine species occur in the New World, with the other three occurring in Africa, Madagascar, and Eurasia. Species and subspecies delimitation in the Clapper Rail (*R. longirostris*) and King Rail (*R. elegans*) complex is difficult due to their weak

phenotypic differentiation. The two species differ primarily in size and subtle plumage color variation from a palette of reds, browns, and grays. There is also considerable morphological variation between and within populations. Clapper Rails include three distinct subspecies groups: a conglomeration of six subspecies in the nominate *longirostris* (Boddaert 1783) group of the Pacific and Atlantic coasts of South America, eleven subspecies in the *crepitans* (Gmelin 1789) group of eastern North America, the Caribbean, and the Yucatan Peninsula, and four subspecies in the *obsoletus* (Ridgway 1874) group of western North America and the Gulf of California (Olson 1997). King Rails currently comprise three subspecies: nominate *elegans* (Audubon 1834) of eastern North America, *ramsdeni* (Riley 1913) of Cuba, and *tenuirostris* (Ridgway 1874) of the highlands of central Mexico.

Species limits in the group are of conservation interest because both species are hunted legally in the southeastern United States despite the endangered status of some migratory populations of King Rails that spend the nonbreeding season in the region. Additionally, the taxonomic status of the *R. l. obsoletus* group of the western United States and western Mexico is of particular interest because these populations are highly endangered (Eddleman and Conway 1998). I used DNA sequence data from the mitochondrion and four nuclear loci to infer a phylogeny of Clapper and King rail subspecies. I developed the nuclear loci using a novel reduced-representation technique with next-generation sequencing (next-gen) to attempt to develop phylogenetically informative markers. For some populations lacking tissues I sampled historic specimens and sequenced mitochondrial DNA (mtDNA). I sought to understand the relationships within the complex to further our understanding of lineage diversification within the complex. Once I determined that Clapper and King rails of eastern North America were sister taxa, I set out to understand hybridization in Louisiana (Chapter 3).

Hybrid zones provide natural systems to investigate processes of speciation and the mechanisms preventing fusion of lineages (Endler 1977; Hewitt 1988; Coyne and Orr 2004). Genetic and morphological investigations of hybrid zones have revealed that these mechanisms can include sexual selection (Brumfield et al. 2001; Jiggins et al. 2001; Saetre et al. 2003; Payseur et al. 2004; Carling and Brumfield 2009), neutral processes (Szymura and Barton 1986; Szymura and Barton 1991), or adaptive divergence to different environmental conditions. I examined the hybrid zone between Clapper and King rails to provide the first genetic and morphological characterization of the hybrid zone, and to assess the role of the salinity gradient in the reproductive isolation of the two species. Whereas Clapper Rails breed at high densities in coastal saltmarshes dominated by *Spartina alterniflora*, King Rails have a patchier distribution that reflects the more localized distribution of inland freshwater marshes (Meanley 1992; Eddleman and Conway 1998). Where these two habitats come into contact Clapper and King rails hybridize (Figure 1.1; Meanley and Wetherbee 1962; Bledsoe 1988; Meanley 1989; Olson 1997; Eddleman and Conway 1998).

Previous studies of King and Clapper rails have demonstrated physical and physiological differences associated with osmoregulation (Conway et al. 1988). Both species have nasal salt glands on the dorsum of the skull, but these are significantly larger in Clapper Rails (Olson 1997). The salt gland is a relatively simple organ composed of mitochondria-rich cells that, by creating a concentration gradient similar to the cells found in fish gills (Peaker 1971), is capable of filtering the blood and concentrating ions into a solution exceeding 20 times the osmolality of blood plasma (Hughes 2003). Salt glands are needed in rails to maintain osmoregulatory equilibrium, because their kidneys are incapable of concentrating inorganic ions

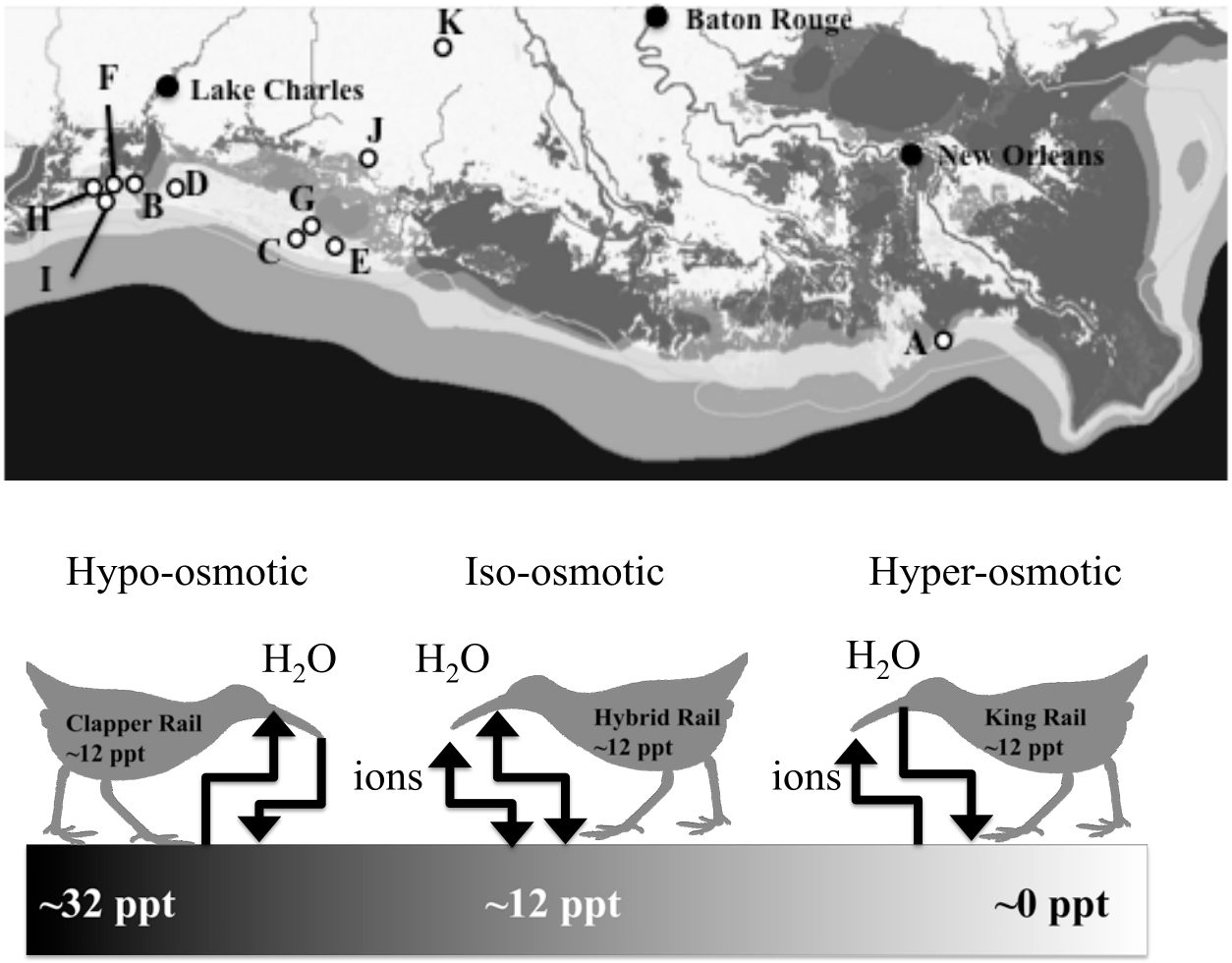

Figure 1.1 The top map shows sampling in south Louisiana along the salinity gradient. Black is ocean water at high salinity and white represents freshwater. Circles show approximate sampling localities. The site codes correspond to Table 3.1: A. GI, B. ML, C. R2, D. CC, E. R1, F. SB, G. R3, H. SN, I. SS, J. LA, and K. CP. The bottom is a schematic of birds distributed along a salinity gradient. Black arrows represent osmoregulatory pressure for water movement and ion movement. All salinity values on birds are approximate estimates of blood osmolality calculated from Conway et al. (1988).

more than three times the concentration found in their blood (Braun 1999). Larger salt glands (relative to body size) are capable of excreting more salt from the blood and at higher concentrations (Peaker 1971). Conway et al. (1988) gave both species high salt loads and found that Clapper Rails were capable of excreting salt more quickly and at higher concentrations. By studying the genetic and morphological change across this ecological gradient, I am attempting to understand if osmoregulatory differences could be responsible for ecological speciation between these two lineages (Figure 1.1). I also studied the morphological differences between the two species in the context of the hybrid zone.

In Chapter 4, I use the hybrid zone structure, linkage disequilibria among loci, and covariance between genes and quantitative traits to make inferences about the strength of selection acting on morphological characters. I also estimated root-mean-square dispersal distance using estimated cline widths, within-site linkage disequilibria between genetic markers, and covariance between the morphological characters. Using the mean dispersal distance I estimated the time since contact between the two lineages, and these estimates are then contrasted to those derived from banding data. Although the number of samples that can reasonably be collected from bird populations limits the strength of inference in some cases, these estimates provide useful insight on the magnitude of important evolutionary parameters, given the paucity of such information that is available for birds (Barrowclough 1978; Moore and Buchanan 1985; Moore and Dolbeer 1989).

In sum, I studied three components of the Clapper and King rail system. First I investigated the phylogeny of the entire genus of *Rallus* rails, with the goal of assessing the evolutionary relationships, taxonomy, and conservation status of North American populations.

Second, I conducted the first genetic, morphological, and ecological characterization of the hybrid zone, with a primary goal of assessing the role of a salinity gradient in the reproductive isolation of Clapper and King rails. Finally I inferred selection on hybrids in the center of the zone by estimating covariances between genetic and morphological characters.

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CHAPTER 2

MITOCHONDRIAL AND NEXT-GENERATION SEQUENCE DATA USED TO INFER PHYLOGENETIC RELATIONSHIPS AND SPECIES LIMITS IN THE CLAPPER/KING RAIL (*RALLUS LONGIROSTRIS* & *ELEGANS*) COMPLEX

INTRODUCTION

The family Rallidae is a distinct, species-rich group of birds, many of which are exceptional at long-distance colonization. The genus *Rallus* comprises nine or ten species (Taylor 1996; Dickinson 2003) depending on whether *R. aquaticus* of Eurasia is divided into two species (Tavares et al. 2010). Six of the nine species occur in the New World, with the other three occurring in Africa, Madagascar, and Eurasia. Species and subspecies delimitation in the *R. longirostris*/*R. elegans* complex is difficult due to their weak phenotypic differentiation. The two species differ primarily in size and subtle plumage color variation from a palette of reds, browns, and grays. Also, morphological variation is considerable between and within populations. Hybridization and introgression may play a role in the variation found in eastern North America. Additionally, occupancy of different habitats and the presence of many phenotypically distinct allopatric populations have confounded defining species limits in the group (Olson 1997). *Rallus longirostris* includes three distinct subspecies groups (Olson 1997): (1) a conglomeration of six subspecies in the nominate *longirostris* group of the Pacific and Atlantic coasts of South America, (2) eleven subspecies in the *crepitans* group of eastern North America, the Caribbean, and the Yucatan Peninsula, and (3) four subspecies in the *obsoletus* group of western North America and the Gulf of California . *Rallus elegans* currently comprises three subspecies (Figure 2.1): nominate *elegans* of eastern North America, *ramsdeni* of Cuba, and *tenuirostris* of the highlands of central Mexico (Dickinson 2003).

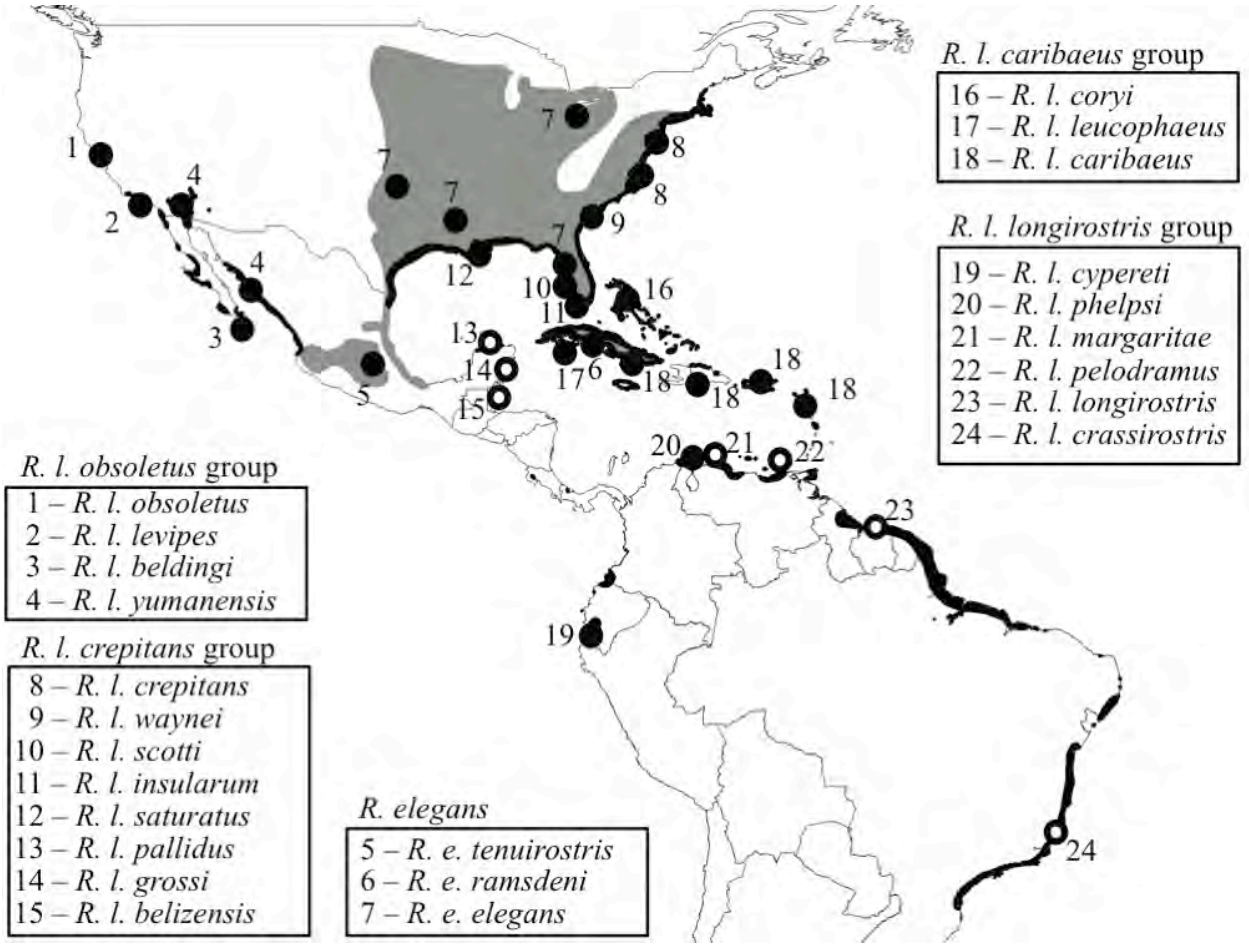

Figure 2.1 A map showing the distribution of sampling sites and approximate geographic distribution of *Rallus elegans* (gray) and *R. longirostris* (black), with points denoting subspecies (Taylor 1996). The gray and black distribution underlying the samples was downloaded from InfoNatura (Ridgely et al. 2005). White-filled circles represent random points along the distribution of subspecies that I were unable to sample, while black-filled circles represent approximate sampling locations. Subspecific identifiers are organized by group within the complex.

Typical *R. longirostris* breed in saltmarsh and mangrove habitats. Their breast plumage ranges from dull silvery to dull rufous, and they are generally smaller than *R. elegans*. Some *R. longirostris* occur in freshwater habitats seasonally, and some *R. elegans* occur in saltwater habitats seasonally. For example, the subspecies *R. l. yumanensis* breeds in freshwater marshes along the Colorado River (Figure 2.1), but inhabits saltmarshes of the Gulf of California during nonbreeding seasons (Tomlinson and Todd 1973; Banks and Tomlinson 1974). In contrast, *R. elegans* breeds in freshwater marshes, is brighter rufescent on the breast, and is larger than *R. longirostris* (Olson 1997). *Rallus elegans* can be found in saltmarshes during migration and boreal winter, but apparently do not breed in saltmarshes (Meanley 1992).

Species limits in the group are of conservation interest because both species are hunted legally in the southeastern United States despite the endangered status of some migratory populations of *R. elegans* that spend the nonbreeding season in the region. Additionally, the taxonomic status of the *R. l. obsoletus* group of the western United States and western Mexico is of particular interest because these populations are highly endangered (Eddleman and Conway 1998). The taxonomic affinity of this subspecies group has long been questioned because it is bright rufous ventrally like *R. elegans*, but primarily inhabit saltwater marshes like *R. longirostris* (Olson 1997). Genetic relationships of *R. elegans* breeding in the eastern United States are of interest because migratory populations in the northern portion of their range are considered endangered due to habitat loss (Perkins et al. 2009). These birds also experience light hunting pressure during the nonbreeding season in southeastern North America, but no genetic studies have been conducted to determine if migratory and nonmigratory populations are distinct, or where migratory populations spend the nonbreeding season. A review of the literature on the complex resulted in the lumping of both species into *R. longirostris* (Ripley 1977), primarily

based on reports of extensive hybridization between the two rails in brackish marshes of the eastern U. S. (Meanley and Wetherbee 1962). Here I use DNA sequence data from the mitochondrion and four nuclear loci to infer a phylogeny of *R. longirostris* and *R. elegans* subspecies. I developed the nuclear loci using a novel reduced-representation library and next-generation sequencing to attempt to develop phylogenetically informative markers. For some populations lacking tissues I sampled historic specimens and sequenced mitochondrial DNA (mtDNA).

METHODS

Sampling

Through collecting and loans from other institutions I were able to include samples from throughout the distribution of the species complex (Table 2.1). I were unable to include samples from three of the six species of *Rallus* in the Americas (*R. antarcticus, wetmorei,* and *semiplumbeus*), due to unavailability of any recent specimens or tissues and because they are highly restricted or critically endangered. In total, I sampled 14 of the 21 recognized subspecies of *R. longirostris* and the three subspecies of *R. elegans* (Figure 2.1, Table 2.1). For populations lacking fresh tissue samples I scraped toe-pads from older specimens housed at the Louisiana State University Museum of Natural Science (LSUMNS). These 16 samples ranged in collection date from 1937 to 1967 (Table 2.1). Each sample was cut using a new, sterile scalpel blade and sterilized scissors and forceps. I included two samples of *R. limicola* as an outgroup. All future references to the abbreviation *R. l.* in this chapter indicate *Rallus longirostris,* not *Rallus limicola*.

Table 2.1 Samples of *Rallus* used in this study. Groups refer to those pictured in Fig. 1. Voucher numbers are provided when available. Abbreviated IDs correspond to the tips on Fig. 2.

Species	Subspecies	Group	Voucher Number[a]	Locality	Date	ID	Type	Museum[b]
longirostris	*obsoletus*	*obsoletus*	UWBM 87934	CALIFORNIA: Marin Co.; Santa Venetia Marsh Open Space Preserve	7-Feb-2007	CALO6	Toe Pad	BMUW
longirostris	*levipes*	*obsoletus*	SDNHM 50948	CALIFORNIA: San Diego Co.; San Diego, Mission Valley	29-Sep-2004	CALO2	Tissue	SDNHM
longirostris	*levipes*	*obsoletus*	SDNHM 50958	CALIFORNIA: San Diego Co.; Carlsbad	10-Jul-2004	CALO3	Tissue	SDNHM
longirostris	*levipes*	*obsoletus*	SDNHM 51596	CALIFORNIA: San Diego Co.; San Elijo Lagoon	14-Nov-2006	CALO4	Tissue	SDNHM
longirostris	*levipes*	*obsoletus*	SDNHM 51955	CALIFORNIA: San Diego Co.; San Elijo Lagoon	10-Mar-2008	CALO5	Tissue	SDNHM
longirostris	*beldingi*	*obsoletus*	UWBM 82691	MEXICO: Baja California Sur; Municipio La Paz, La Paz	2-Sep-2006	MXLO2	Tissue	BMUW

table continued

longirostris	*rhizophorae*	*obsoletus*	71222	MEXICO: Sonora; Agiabampo	16-May-1937	MXLO1	Toe Pad	LSUMZ
longirostris	*yumanensis*	*obsoletus*	LACM 107400	CALIFORNIA: Imperial Co.	19-Apr-1993	CALO1	Tissue	LACM
longirostris	*crepitans*	*crepitans*	ANSP 22095	NEW JERSEY: Cape May Co.; Dennis Township	9-Sep-1999	NJLO1	Tissue	ANSP
longirostris	*crepitans*	*crepitans*	ANSP 22479	NEW JERSEY: Ocean Co.; Tuckerton Marsh	7-Oct-2000	NJLO2	Tissue	ANSP
longirostris	*crepitans*	*crepitans*	ANSP 25897	NEW JERSEY: Cape May Co.; Nummy Island	26-May-2002	NJLO3	Tissue	ANSP
longirostris	*crepitans*	*crepitans*	ANSP 25898	NEW JERSEY: Cape May Co.; Nummy Island	26-May-2002	NJLO4	Tissue	ANSP
longirostris	*crepitans*	*crepitans*	MBM 6009	NORTH CAROLINA: Carteret Co.; Atlantic Beach	2-Nov-1998	NCLO1	Tissue	MBM

table continued

longirostris	*crepitans*	*crepitans*	MBM 6010	NORTH CAROLINA: Carteret Co.; Atlantic Beach	7-Sep-1998	NCLO2	Tissue	MBM
longirostris	*waynei*	*crepitans*	KU 94320	GEORGIA: Glynn Co.; Brunswick, Blythe Island	12-Dec-2000	GALO1	Tissue	KU
longirostris	*waynei*	*crepitans*	KU 94322	GEORGIA: Glynn Co.; Brunswick, Blythe Island	12-Dec-2000	GALO2	Tissue	KU
longirostris	*waynei*	*crepitans*	KU 94324	GEORGIA: Glynn Co.; Brunswick, Blythe Island	12-Dec-2000	GALO3	Tissue	KU
longirostris	*waynei*	*crepitans*	KU 94323	GEORGIA: Glynn Co.; Brunswick, Blythe Island	12-Dec-2000	GALO4	Tissue	KU
longirostris	*waynei*	*crepitans*	KU 94321	GEORGIA: Glynn Co.; Brunswick, Blythe Island	12-Dec-2000	GALO5	Tissue	KU
longirostris	*scottii*	*crepitans*	KU 112081	FLORIDA: Lee Co.; Sanibel	9-Mar-2007	FLLO2	Tissue	KU

table continued

longirostris	*insularum*	*crepitans*	FMNH 385736	FLORIDA; Monroe Co.; Upper Keys	20-Nov-1994	FLLO1	Tissue	FMNH
longirostris	*saturatus*	*crepitans*	63400	LOUISIANA: Jefferson Par.; Grand Isle, ca 1 mi. W Grand Isle	9-Apr-2009	LALO1	Tissue	LSUMZ
longirostris	*saturatus*	*crepitans*	63401	LOUISIANA: Jefferson Par.; Grand Isle, ca 1 mi. W Grand Isle	9-Apr-2009	LALO2	Tissue	LSUMZ
longirostris	*saturatus*	*crepitans*	63402	LOUISIANA: Jefferson Par.; Grand Isle, ca 1 mi. W Grand Isle	3-Jun-2009	LALO3	Tissue	LSUMZ
longirostris	*saturatus*	*crepitans*	63403	LOUISIANA: Jefferson Par.; Grand Isle, ca 1 mi. W Grand Isle	3-Jun-2009	LALO4	Tissue	LSUMZ
longirostris	*saturatus*	*crepitans*	63404	LOUISIANA: Jefferson Par.; Grand Isle, ca 1 mi. W Grand Isle	4-Jun-2009	LALO5	Tissue	LSUMZ
longirostris	*saturatus*	*crepitans*	63405	LOUISIANA: Jefferson Par.; Grand Isle, ca 1 mi. W Grand Isle	4-Jun-2009	LALO6	Tissue	LSUMZ

table continued

longirostris	*saturatus*	*crepitans*	63406	LOUISIANA: Jefferson Par.; Grand Isle, ca 1 mi. W Grand Isle	4-Jun-2009	LALO7	Tissue	LSUMZ
longirostris	*saturatus*	*crepitans*	63407	LOUISIANA: Jefferson Par.; Grand Isle, ca 1 mi. W Grand Isle	4-Jun-2009	LALO8	Tissue	LSUMZ
longirostris	*saturatus*	*crepitans*	63474	LOUISIANA: Lafourche Par.; 5.5 mi. E Port Fourchon	25-Jun-2009	LALO9	Tissue	LSUMZ
longirostris	*saturatus*	*crepitans*	63475	LOUISIANA: Lafourche Par.; 5.5 mi. E Port Fourchon	25-Jun-2009	LALO10	Tissue	LSUMZ
longirostris	*caribaeus*	*caribaeus*	71223	PUERTO RICO: Mayagüez; Guanajibo, Caño Corazones	18-Dec-1942	CBLO1	Toe Pad	LSUMZ
longirostris	*caribaeus*	*caribaeus*	71224	CUBA: Las Villas; Cayo Baíia de Cádiz	27-Jun-1958	CULO1	Toe Pad	LSUMZ
longirostris	*caribaeus*	*caribaeus*	71225	CUBA: Las Villas; Laguna de San Mateo	8-Jul-1960	CULO2	Toe Pad	LSUMZ

table continued

longirostris	*caribaeus*	*caribaeus*	71226	CUBA: Las Villas; Laguna de San Mateo	8-Jul-1960	CULO3	Toe Pad	LSUMZ
longirostris	*coryi*	*caribaeus*	71227	BAHAMAS: San Salvador; lake 1 mi. E Cockburn Town	29-Dec-1963	CBLO2	Toe Pad	LSUMZ
longirostris	*leucophaeus*	*caribaeus*	71228	CUBA: Isle of Pines; Siguanea Bay	9-Jul-1958	CULO4	Toe Pad	LSUMZ
longirostris	*caribaeus*	*caribaeus*	71230	BRITISH VIRGIN ISLANDS: Beef Island; western end	12-Aug-1964	CBLO3	Toe Pad	LSUMZ
longirostris	*caribaeus*	*caribaeus*	71231	ANTIGUA: St. John Par.; The Flashes	24-Mar-1962	CBLO4	Toe Pad	LSUMZ
longirostris	*caribaeus*	*caribaeus*	KU 95142	DOMINICAN REPUBLIC: Monte Cristi National Park	28-Mar-2003	CBLO5	Tissue	KU
longirostris	*cypereti*	*longirostris*	66005	PERU: Depto. Tumbes; ca 29 km NE Tumbes	1-Jun-2009	PELO1	Tissue	LSUMZ

table continued

longirostris	*cypereti*	*longirostris*	66008	PERU: Depto. Tumbes; ca 29 km NE Tumbes	1-Jun-2009	PELO2	Tissue	LSUMZ
longirostris	*cypereti*	*longirostris*	67817	PERU: Depto. Tumbes; ca 2 km S Santuario Nacional los Manglares de Tumbes	26-Jul-2009	PELO3	Tissue	LSUMZ
longirostris	*cypereti*	*longirostris*	67818	PERU: Depto. Tumbes; ca 2 km S Santuario Nacional los Manglares de Tumbes	26-Jul-2009	PELO4	Tissue	LSUMZ
longirostris	*cypereti*	*longirostris*	67819	PERU: Depto. Tumbes; ca 2 km S Santuario Nacional los Manglares de Tumbes	26-Jul-2009	PELO5	Tissue	LSUMZ
longirostris	*cypereti*	*longirostris*	67820	PERU: Depto. Tumbes; ca 2 km S Santuario Nacional los Manglares de Tumbes	26-Jul-2009	PELO6	Tissue	LSUMZ
longirostris	*phelpsi*	*longirostris*	UMMZ 620	VENEZUELA: Zulia; Ancon de Iturre, ca. 1 km NE of town	11-Feb-1989	VZLO1	Tissue	UMMZ
elegans	*elegans*	*elegans*	49394	FLORIDA: Lee Co.; Fort Meyers	9-Jul-2002	FLEL1	Tissue	LSUMZ

table continued

elegans	*elegans*	*elegans*	63464	LOUISIANA: St. Landry Par.; 4 mi. NNW Church Point, Dusty Rd.	23-Jun-2009	LAEL1	Tissue	LSUMZ
elegans	*elegans*	*elegans*	63465	LOUISIANA: St. Landry Par.; 4 mi. NNW Church Point, Dusty Rd.	23-Jun-2009	LAEL2	Tissue	LSUMZ
elegans	*elegans*	*elegans*	63466	LOUISIANA: St. Landry Par.; 4 mi. NNW Church Point, Dusty Rd.	23-Jun-2009	LAEL3	Tissue	LSUMZ
elegans	*elegans*	*elegans*	63467	LOUISIANA: St. Landry Par.; 4 mi. NNW Church Point, Dusty Rd.	23-Jun-2009	LAEL4	Tissue	LSUMZ
elegans	*elegans*	*elegans*	63468	LOUISIANA: St. Landry Par.; 4 mi. NNW Church Point, Dusty Rd.	23-Jun-2009	LAEL5	Tissue	LSUMZ
elegans	*elegans*	*elegans*	63469	LOUISIANA: St. Landry Par.; 4 mi. NNW Church Point, Dusty Rd.	23-Jun-2009	LAEL6	Tissue	LSUMZ
elegans	*elegans*	*elegans*	63470	LOUISIANA: St. Landry Par.; 4 mi. NNW Church Point, Dusty Rd.	24-Jun-2009	LAEL7	Tissue	LSUMZ

table continued

elegans	*elegans*	*elegans*	63471	LOUISIANA: St. Landry Par.; 4 mi. NNW Church Point, Dusty Rd.	24-Jun-2009	LAEL8	Tissue	LSUMZ
elegans	*elegans*	*elegans*	63472	LOUISIANA: St. Landry Par.; 4 mi. NNW Church Point, Dusty Rd.	24-Jun-2009	LAEL9	Tissue	LSUMZ
elegans	*elegans*	*elegans*	63473	LOUISIANA: St. Landry Par.; 4 mi. NNW Church Point, Dusty Rd.	24-Jun-2009	LAEL10	Tissue	LSUMZ
elegans	*ramsdeni*	*elegans*	71232	CUBA: Las Villas; El Jibaro, Sancti Spiritus	14-May-1967	CUEL1	Toe Pad	LSUMZ
elegans	*tenuirostris*	*elegans*	71233	MEXICO; San Luis Potosi; Media Luna	28-Jun-1952	MXEL1	Toe Pad	LSUMZ
elegans	*tenuirostris*	*elegans*	71234	MEXICO; San Luis Potosi; Villa de Reyes Reg, Laguna de las Rusias, 6000'	6-Aug-1947	MXEL2	Toe Pad	LSUMZ
elegans	*tenuirostris*	*elegans*	71235	MEXICO: Michoacán, near Cumuato	21-Nov-1959	MXEL3	Toe Pad	LSUMZ

table continued

elegans	*tenuirostris*	*elegans*	71236	MEXICO: Michoacán, near Cumuato	10-Nov-1959	MXEL4	Toe Pad	LSUMZ
elegans	*tenuirostris*	*elegans*	71237	MEXICO: Michoacán, near Cumuato	21-Nov-1959	MXEL5	Toe Pad	LSUMZ
elegans	*elegans*	*elegans*	71305	OHIO: Ottawa Co.; Ottawa National Wildlife Refuge	3-May-2010	OHEL1	Feather	LSUMZ
elegans	*elegans*	*elegans*	71308	OKLAHOMA: McCurtain Co.; Red Slough Wildlife Management Area	11-Apr-2010	OKEL1	Feather	AR
elegans	*elegans*	*elegans*	71309	OKLAHOMA: McCurtain Co.; Red Slough Wildlife Management Area	23-Mar-2010	OKEL2	Feather	AR
elegans	*elegans*	*elegans*	FMNH 461050	ILLINOIS: Cook Co.; Evanston	5-Jun-2008	ILEL1	Tissue	FMNH
limicola	*limicola*	NA	25122	LOUISIANA: Lafayette Par.; Potter's Road, 1.5 mi. W Hwy. 719	2-Jan-1995	limicola	Tissue	LSUMZ

table continued

limicola	*limicola*	NA	46858	LOUISIANA: Iberia Par.; 7.8 km S Lydia, Hwy. 83	26-Oct-2005	limicola	Tissue	LSUMZ

[a] Voucher number if one is available.

[b] LSUMZ = Louisiana Museum of Natural Science; FMNH = The Field Museum of Natural History; AR = University of Arkansas; BMUW = The Burke Museum of Natural History and Culture; KU = University of Kansas Natural History Museum; ANSP = Academy of Natural Sciences of Philadelphia; MBM = Marjorie Barrick Museum of Natural History; SDNHM = San Diego Natural History Museum; UMMZ = University of Michigan Museum of Zoology; LACM = Natural History Museum of Los Angeles County

We extracted total DNA from fresh tissue samples using a DNEasy Tissue Kit (Qiagen) following manufacturer protocols. DNA concentration was quantified using a NanoDrop spectrophotometer. Because of low yield, extractions from feather samples were concentrated using a heated Speedvac (Savant). For the toe pad samples, I lysed a portion of each sample for three weeks in an ancient DNA facility in the Taylor lab at LSU. These samples were extracted with two positive and two negative controls. Following lysis, extraction of ancient DNA using a DNEasy Tissue Kit (Qiagen) was carried out using instructions provided by the manufacturer. These extractions were then concentrated using a heated Speedvac in the ancient DNA facility.

Mitochondrial Sequences

We sequenced eight samples of Louisiana birds (four of each species) for the mtDNA protein-coding NADH subunit 2 (ND2) using PCR amplicons from the primers L5215 (Hackett 1996) and H6313 (Johnson and Sorenson 1998). From these sequences I used the online resource Primer3 (Rozen and Skaletsky 2000) to design primers for a 787 base pair (bp) portion of the ND2 gene (RallusND2F & RallusND2R, Table 2.2). For the toe pad samples I used Primer3 to design 15 internal primers that allowed us to sequence eight small, overlapping portions (87 – 108 bp) of ND2 totaling 681 bp when concatenated.

All PCR amplifications were 10 μL in volume and contained ~50 ng of DNA, 1X Standard Taq Buffer, 0.13 mM $MgCl_2$, 0.5 μM of each primer, 0.1 mM dNTPs, 0.1 mg/mL BSA, 0.25 U Taq DNA Polymerase (New England Biolabs), and 4.95 µL water. All PCRs were performed using the following cycle parameters: 2 min at 94°C, followed by 35 cycles of 94°C for 30s, 51°C for 30s (for ND2) or 60°C (for nuDNA), and 72°C for 1 min, followed by 72°C for 10 min. After confirming amplification by running PCR products on 1% agarose gels, they were

Table 2.2 Primers used to amplify mitochondrial and nuclear loci in *Rallus*, and in the AFLP method to reduce the genome. All primers were designed using Primer3 (Rozen and Skaletsky 2000), except AFLP primers (Vos et al. 1995).

Primer Name	Locus	Sequence (5' to 3')
RallusND2F	ND2 - external	CCCACATGCAAGCCTAATCT
RallusND2IF2	ND2 - internal	CCTTATCTCAAAATCCCACCA
RallusND2IF3	ND2 - internal	TCCACACTCCTACTATTTTCCAG
RallusND2IF4	ND2 - internal	CCAACAGCCTCCATCCTACT
RallusND2IF5	ND2 - internal	CAGAAGTACTACAGGGCACATCC
RallusND2IF6	ND2 - internal	CCCATTCACTTAACCCAACC
RallusND2IF7	ND2 - internal	CCAGACTCAACTCCGAAAAA
RallusND2IF8	ND2 - internal	GCCTTTTACCTCTACTGCTTAACAA
RallusND2IR1	ND2 - internal	ATTTGATTGCTGCTTCGGTAG
RallusND2IR2	ND2 - internal	CCCATTGTCCTGTGTGTCAG
RallusND2IR3	ND2 - internal	GGGAATCAAAAGTGGAATGG
RallusND2IR4	ND2 - internal	TGGAGGGAGTTTTATTATTGTGG
RallusND2IR5	ND2 - internal	TGCTGAAAGGATGGCTAGTG
RallusND2IR6	ND2 - internal	TCCCAGGTGAGAAATAGACGA
RallusND2IR7	ND2 - internal	TGTTGATGGTGAGGAAAATGG
RallusND2IR8	ND2 - internal	CCTGCAAGGGATAGCAGTGT
RallusND2R	ND2 - external	GGTTGGGTGGAAGTGTGATT
F*139*	*139* - external	CTGGGAGTGAGGGCAGAG
R*139*	*139* - external	CCTTGCAAGTTGATGGATGA
F*472*	*472* - external	GGTATGCAGCTCACCACAGA
R*472*	*472* - external	GCAAGAAAGAGGCTGTGTCC
F*1166*	*1166* - external	CCTGTGCTCCTGCTGATGTA
R*1166*	*1166* - external	CAACCAGATGTTGCAGGAGA
F*1766*	*1766* - external	GCAGCAAACTAGGAGCAGTACA
R*1766*	*1766* - external	CTTCAGCCTCCCATCAAGG
EcoRI-F adaptor	N/A	CTCGTAGACTGCGTACC
EcoRI-R adaptor	N/A	AATTGGTACGCAGTCTAC
MseI-F adaptor	N/A	GACGATGAGTCCTGAG
MseI-R adaptor	N/A	TACTCAGGACTCAT
EcoRI primer	N/A	GACTGCGTACCAATTC
MseI primer	N/A	GATGAGTCCTGAGTAA
EcoRI fusion primer[a]	N/A	CGTATCGCCTCCCTCGCGCCATCAGXXXXXXXXXXG ACTGCGTACCAATTC
MseI fusion primer[b]	N/A	CTATGCGCCTTGCCAGCCCGCTCAGGATGAGTCCTGA GTAAN

[a] X denotes different barcode sequence per individual.

[b] N indicates selective base, primer is biotinylated on the 5' end.

AR073714

cleaned with 10 μL EXOSAP reactions containing 5 μL of PCR product, 4.25 μL water, 1.25 U Antarctic Phosphatase, 5 U ExoI, and 1X Antarctic Phosphatase Buffer. Ancient DNA amplifications were performed with the above protocol except that BSA was substituted with 0.1 mg/mL RSA (Rabbit Serum Albumin) and Taq was substituted with 0.25 U HotStarTaq (Qiagen). I then conducted cycle-sequencing reactions using Big Dye Terminator Cycle-Sequencing Kit v3.1 (Applied Biosystems Inc., Foster City, CA). All cycle-sequencing reactions included 1 μL of cleaned PCR product, 0.93 X Sequencing Buffer, 0.3 μL of 1X Big Dye 3.1, 2 X 10^{-5} μmoles of forward or reverse primer, and combined with distilled water to make a final volume of 7 μL. These reactions were run using the following thermal profile: 2 cycles of 96°C for 20s, 50°C for 15s, and 60°C for 4 min, followed by 24 cycles of 96°C for 12s, 50°C for 15s, and 60°C for 4 min. Cycle-sequence products were then purified using a Sephadex G-50 Fine (Sigma-Aldrich Co., St. Louis, MO) matrix in a 96-well filter plate. Cleaned products were run on an ABI 3130 Genetic Analyzer and sequences were aligned and checked for quality using Sequencher v4.7 (Gene Codes Corp., Ann Arbor, MI).

Nuclear DNA Sequences

Using four Louisiana samples of each species (LALO1 – LALO4; LAEL1 – LAEL4; Table 2.1) I amplified and sequenced 11 nuclear (nuDNA) markers *ADAMTS6, SLC30A5* (Backström et al. 2006); *ALDOB4* (Saetre et al. 2003); *ARNTL, PER2, VIM* (Kimball et al. 2009), *BF5* (Weissbach et al. 1991), *BF7* (Prychitko 1997); *G3PDH* (Fjeldså et al. 2003); *MYO2* (Slade et al. 1993); and *VLDLR9* (Borge et al. 2005), and attempted to amplify an additional nine nuDNA markers: *AQP5, ARVPA, BRM15, CLTC, CRYAA, IPOII, MSHR, PPWDI,* and *RHO1* (Consortium 2004). I found no informative single nucleotide polymorphisms (SNPs) among the 11 loci. Some loci

were completely homogeneous, while others had one to three unique SNPs found only in one individual. To develop informative nuDNA markers with SNPs that showed strong frequency differences (greater than 0.7) between the two species I used an AFLP-based genome reduction technique combined with 454 pyrosequencing (McCormack et al. 2012). Because I used this method to develop markers for analysis of the hybrid zone in Louisiana, next-gen data were only collected from members of the *R. l. crepitans* group and nominate *R. elegans* from Louisiana.

We prepared samples from 20 individuals, 10 of each species collected in Louisiana (LALO1 – LALO10; LAEL1 – LAEL10; Table 2.1), on a quarter plate of a 454 pyrosequencing run. I standardized initial DNA concentrations at 100 ng/uL. Then, in a single step, 250 ng DNA was digested and adaptors (Table 2.2; Vos et al. 1995) were ligated on the resulting sticky ends for 2 hr at 37°C in an 11 μL volume reaction containing 3.47 μL water, 2.5 μL DNA template, 1.1 μL T4 ligase buffer, 0.05 M NaCl, 5 U EcoRI, 1 U MseI, 0.05 mg/mL BSA, 5 U T4 ligase (New England Biolabs), and 0.91 μM adaptor for both MseI and EcoRI (all concentrations are final). Each adaptor was made beforehand by heating equal volumes of two complementary pieces of DNA to 95°C and allowing them to cool slowly to room temperature. I then conducted a round of PCR in a 20 μL reaction containing 4 μL of a 10-fold dilution of the digest-ligation product, 10.08 μL water, 1.5 mM $MgCl_2$, 1X Phusion buffer, 0.2 mM dNTPs, 0.3 μM of each adaptor-specific primer (Table 2.2; Vos et al. 1995), and 0.4 U Phusion High-fidelity DNA Polymerase (Finnzymes, Woburn, MA). The PCR protocol was 2 min at 72°C, followed by 15 cycles of 98°C for 30s, 56°C for 30s, and 72°C for 2 min, followed by 72°C for 10 min. For each individual, resulting PCR products were visualized on a 0.8% SeaKem GTG Agarose (Lonza, Rockland, ME) gel. A section of the resulting smear of DNA fragments (400-550 bp) was excised. During this step DNA from each individual was separated by a well containing Quick-

Load 100bp DNA ladder (New England Biolabs) to insure alignment and to avoid cross-contamination. These samples were column purified using a QIAquick gel extraction kit (Valencia, CA), eluted with 50 μL volume, and then subjected to another round of PCR, this time with longer "fusion primers" (Table 2.2). These primers include the complementary adaptor priming sites and overhanging DNA sequence containing the necessary binding sites for emulsion PCR and individual-identifying barcodes (20 different primers, each with a different barcode sequence). The MseI fusion primer is biotinylated on the 5' end, and includes one selective base to reduce the genome further. The primer was biotinylated to aid in removing non-targeted short fragments and to remove any EcoRI-EcoRI fragments. This PCR was 10 μL in volume and contained 2.5 μL of eluted PCR product, 3.94 μL water, 1.5 mM $MgCl_2$, 1X Phusion buffer, 0.2 mM dNTPs, 0.3 μM of MseI reverse fusion primer (Table 2.2), and 0.2 U Phusion Polymerase. To each reaction, I separately added 0.3 μM of EcoRI forward fusion primer with indexes (Table 2.2). For this PCR, I used a touchdown profile beginning with 98°C for 2 min, then 12 cycles of 98°C for 30s, 65°C for 30s (reducing temperature by 0.7°C in each cycle), 72°C for 2 min, then 10 cycles of 98°C for 30s, 56°C for 30s, and 72°C for 2 min, followed by 10 min at 72°C.

Conversion of the raw 454 output into loci and allele calls for each individual was performed using the computer pipeline PRGmatic v1.4 (Hird et al. 2011). The data were processed and screened for fixed or nearly fixed polymorphic sites. I identified 35 loci containing SNPs with high allele frequency differences between the two species (frequency difference > 0.70; Mean = 0.90, SD = 0.08). Four loci that contained between one and four fixed or nearly fixed SNPs (Frequency > 0.94; Mean = 0.96) between *R. elegans* and *R. longirostris* were chosen for Sanger sequencing. I found no evidence of paralogous gene copies in that there

were no variable positions with more than two nucleotides and all of the loci aligned with avian autosomal intron sequences when searched using BLAST (Consortium 2004; Warren et al. 2010). I also assessed paralogy by using PRGmatic v1.4 to calculate within-species observed and expected heterozygosities. Paralogous loci should have a much higher observed than expected heterozygosity, but I found that all four loci had an equal or slightly higher observed heterozygosity than expected. I used Primer3 to design primers directly from 454 reads (Rozen and Skaletsky 2000); the loci are named for the contig order from the data assembly process (*139*, *472*, *1166*, *1766*; Table 2.2). See above for PCR conditions for nuclear loci.

DNA sequences were aligned using Sequencher 4.7 (GeneCodes). No indels were detected in any sequences. Heterozygous sites in the nuDNA sequences were coded using standard IUPAC ambiguity codes.

Phylogenetic Analysis

We phased nuDNA haplotypes in each of the four datasets (see below) using PHASE 2.1.1 (Stephens et al. 2001; Stephens and Donnelly 2003; Stephens and Scheet 2005) after preparing the datasets using the online tool SeqPHASE (Flot 2010). The PHASE runs included a threshold of 0.9 probabilities for acceptance. I constructed median-joining haplotype networks for each locus (including mtDNA) using the program Network v4.6 (Bandelt et al. 1999).

We first identified the best-fit finite-sites model of sequence evolution for each of the loci using MrModelTest (Nylander 2004) with PAUP* v4.0b10 (Swofford 1998) under the Akaike Information Criterion (AIC). Using these optimal models I then estimated gene trees and species trees using BEAST v1.6.1 (Drummond and Rambaut 2007) and *BEAST (Heled and Drummond 2010), respectively. I estimated a gene tree and a species tree for the full mtDNA dataset, and

estimated species trees for the mtDNA and nuDNA datasets and the nuDNA datasets alone. I define the first dataset as the full mtDNA dataset, which includes all of the samples sequenced from fresh tissue and feathers, as well as those sequenced from toe pads. The second dataset is hereafter referred to as mtDNA and nuDNA, and consists of the mtDNA sequences from all samples excluding the samples from toe pads, and the nuDNA sequences from all four loci from the same samples. The third dataset, nuDNA only, is just the four nuDNA loci sequences from all samples with fresh tissue. I estimated clock rates for each locus in each dataset, used a strict clock, and kept the substitution rates at 1. The three analyses were run three times for ten million generations, successively optimizing scaling factors with each run. Following optimization I ran each analysis for 200 million generations to ensure effective sample sizes were at least 200 for each parameter. I checked for convergence of parameters in Tracer v1.5 (Rambaut and Drummond 2007) and found the Maximum Clade Credibility tree using TreeAnnotater v1.6.1 (Drummond and Rambaut 2007), discarding the first 10% of trees. Species tree delimitations were based on the major lineages recovered in the mtDNA gene tree.

We estimated the maximum-likelihood tree for the full mtDNA dataset using Garli v1.0 (Zwickl 2006). I also performed a maximum-likelihood bootstrap analysis with 100 replicates for the full mtDNA dataset using the program Garli v0.951 (Zwickl 2006). I conducted partition-homogeneity tests for all possible combinations of the five loci, treating each as a separate partition, with 100 replicates using PAUP* v4.0b10 (Swofford 1998). I found significant heterogeneity for all tests excluding one or two loci ($P = 0.01$ or 0.02), and significant heterogeneity for seven out ten pairs of loci ($P = 0.01 – 0.04$). Because I found significant heterogeneity for the majority of locus combinations, I did not run any analyses using concatenations.

RESULTS

The final mtDNA alignment included 787 bp of ND2 for the 54 DNA samples extracted from fresh tissue or feathers (Table 2.1), and 681 bp for 15 of the 16 toe pad samples. I was able to sequence only 656 bp from one individual (CBLO2, Table 2.1). For the 54 samples extracted from fresh tissue I aligned 817 bp of nuDNA sequences (n = 216; 2 alleles per individual for four loci from 54 individuals) from the four autosomal introns. The mtDNA data showed relatively low levels of uncorrected divergence within the complex, ranging from 0.3% to 2.1% (Table 2.3). Jukes-Cantor corrected distances for synonymous sites only calculated using DnaSP v5 (Librado and Rozas 2009) showed higher levels of divergence, ranging from 0.6% to 6.0% (Table 2.3).

The nuDNA sequences aligned to autosomal intron sequences in either chicken or Zebra Finch (Table 2.4), of the 216 sequences generated, most were homozygotes (n = 167). With the exception of one SNP in one individual I were able to phase most (n =93) nuDNA haplotypes with a probability of 1.0 and the rest (n = 4) with a probability equal to or greater than 0.93. Only one SNP was called below the 0.9 threshold, an allele with a phase probability of 0.67 that was detected in one individual. Networks constructed including or excluding this allele were essentially identical; therefore the allele with a probability of 0.67 was used in all subsequent analyses.

The optimal model of sequence evolution for the full mtDNA dataset was GTR + G. The full mtDNA dataset refers to sequences from all extracted samples, including samples from toe pads. I found the same model of sequence evolution using AIC when the sequences from toe pads were included or excluded. Different models were selected for each of the nuDNA loci using AIC (*139*, JC+I; *472*, K80; *1166*, F81; *1766*, K80+I).

Table 2.3 Mitochondrial genetic distances between groups. Jukes-Cantor corrected distances for synonymous sites only are above the diagonal. Below the diagonal are uncorrected (p) distances. *DR refers to a sample from the Dominican Republic.

	R. e. elegans	*R. e. ramsdeni*	*R. l. crepitans*	*R. l. caribaeus* Cuba	*R. l. caribaeus* *DR	*R. l. cypereti*	*R. l. phelpsi*	*R. l. obsoletus*	*R. e. tenuirostris*
R. e. elegans	-	0.012	0.035	0.029	0.017	0.035	0.035	0.054	0.047
R. e. ramsdeni	0.006	-	0.023	0.017	0.006	0.023	0.035	0.041	0.035
R. l. crepitans	0.01	0.012	-	0.006	0.017	0.035	0.035	0.053	0.047
R. l. caribaeus Cuba	0.01	0.01	0.001	-	0.012	0.029	0.029	0.06	0.054
R. l. caribaeus DR	0.006	0.007	0.006	0.006	-	0.029	0.029	0.047	0.041
R. l. cypereti	0.01	0.01	0.013	0.012	0.011	-	0.012	0.041	0.035
R. l. phelpsi	0.009	0.01	0.011	0.012	0.01	0.004	-	0.041	0.035
R. l. obsoletus	0.015	0.016	0.018	0.021	0.017	0.013	0.011	-	0.006
R. e. tenuirostris	0.013	0.013	0.016	0.018	0.015	0.012	0.012	0.003	-
R. limicola	0.156	0.155	0.161	0.163	0.16	0.152	0.155	0.156	0.157

Table 2.4 BLAST results for the four nuclear genes used in this study. Sequences were compared to the two available avian genomic reference sequences (Hillier et al. 2004; Warren et al. 2010). All four align to intron sequences and do not align closely to anything but bird sequence. Only alignments with E values lower than 1.00E-05 are shown.

	Gallus gallus			*Taeniopygia guttata*		
locus	chromosome	feature	E value	chromosome	feature	E value
139	26	54845 bp at 3' side: green sensitive cone opsin	1.0E-08	none	none	none
472	13	similar to macrophage colony stimulating factor I receptor	1.0E-62	13	similar to colony stimulating factor 1	2.0E-61
1166	none	none	none	19	237690 bp at 5' side: ligase III, DNA, ATP-dependent, 68044 bp at 3' side: transmembrane protein 132E	1E-24
1766	24	centromere/kinetochore protein zw10	2.0E-21	24	centromere/kinetochore protein zw10	1.0E-21

AR073722

Bayesian phylogenetic analyses of the full mtDNA data set using BEAST v1.6.1 (Drummond and Rambaut 2007) resulted in several well-supported nodes in the gene tree (Figure 2.2). Maximum-likelihood analyses resulted in a very similar topology. However, bootstrap support was low for many clades (Figure 2.2). I used *BEAST (Heled and Drummond 2010) as implemented in BEAST v1.6.1 (Drummond and Rambaut 2007) to estimate a species tree for the full mtDNA dataset (Figure 2.2), for the mtDNA and nuDNA datasets combined, and the nuDNA datasets combined. Both trees including nuDNA data had the same topology, which differed from the full mtDNA species tree. Nodal probability values were low (< 0.70) throughout the trees, with the exception of a sister relationship between *R. l. caribaeus* and the *R. l. crepitans* group (posterior probability = 0.99) so these trees are not presented here.

The entire species complex is well supported as distinct from *R. limicola* (Figure 2.2). This was not surprising given the deep mtDNA divergence between the complex and *R. limicola* (15.2% - 16.3%). There are three main lineages in the mtDNA topology consisting of a South American clade, a western North American clade, and an eastern North American and Caribbean clade (Figure 2.2). A clade including only the South American birds (*R. l. cypereti* and *R. l. phelpsi*, both members of the *R. l. longirostris* group) was well supported in Bayesian analyses (posterior probability = 1.0), and received moderate bootstrap support (69%). A clade including members of the *R. l. obsoletus* group and *R. e. tenuirostris* was well supported in both Bayesian and likelihood analyses (Figure 2.2). Also, a clade comprising *R. e. elegans*, *ramsdeni*, and members of the *R. l. caribaeus* and *crepitans* groups was well supported. Within this clade, a subset of *R. e. elegans* had high support as a distinct clade, as did a clade including members of the *R. l. caribaeus* and *crepitans* groups. A clade comprised solely of members of the *R. l. crepitans* group also had high support (Figure 2.2).

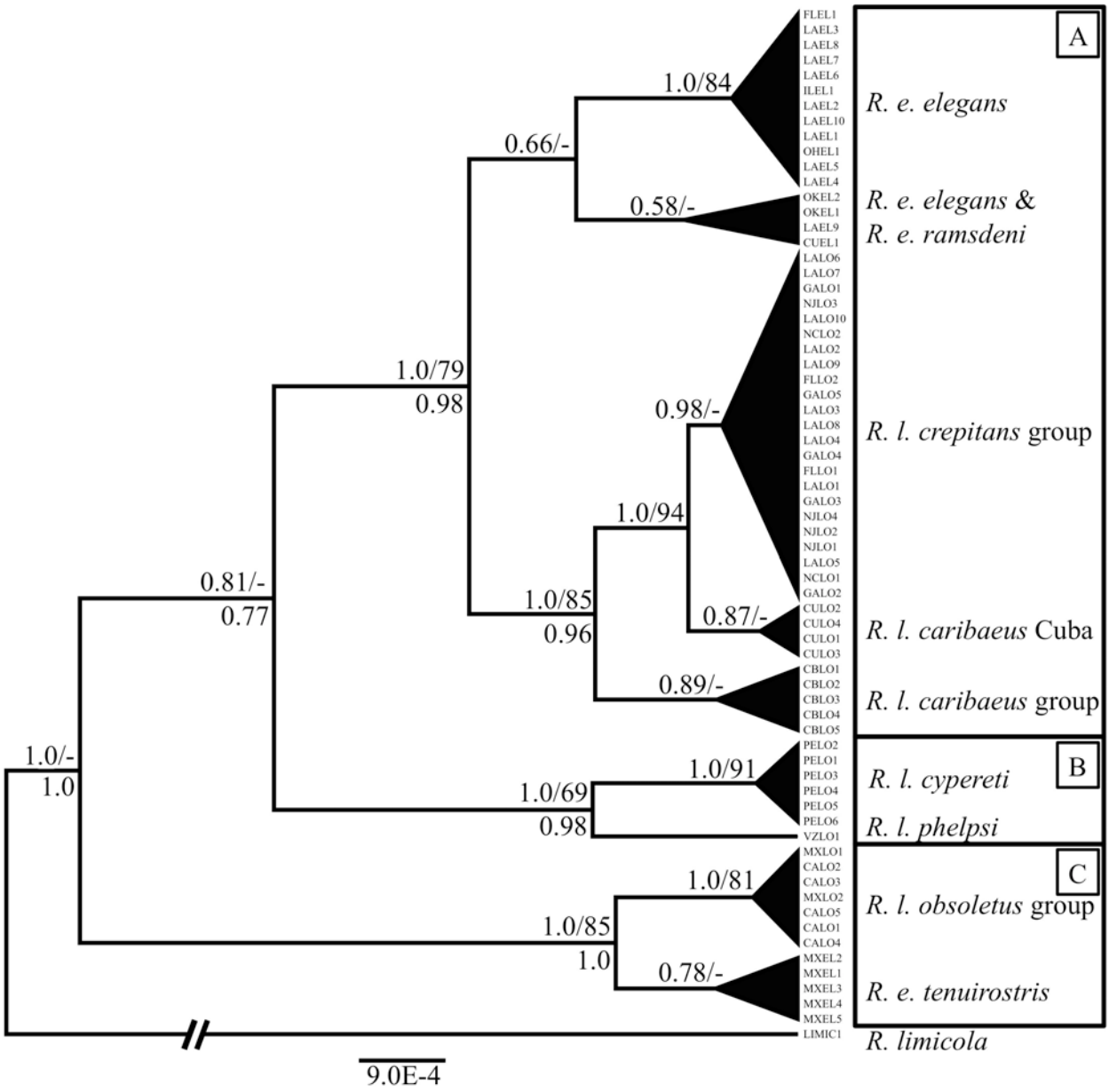

Figure 2.2 Maximum Clade Credibility gene tree of ND2 inferred in BEAST (Drummond and Rambaut 2007). The labels above nodes are the posterior probability followed by the bootstrap support value (if greater than 65) for that node. The labels below nodes are the posterior probability for that node in the species tree estimate of the phylogeny, this label is not included if the value was below 0.95. The individuals in clade B are in the *longirostris* group.

AR073724

The nuDNA provided limited phylogenetic information, with little, if any, divergence between subspecies or species groups. The two eastern North American mtDNA lineages, *R. l. crepitans* group and *R. e. elegans*, generally had two or more distinct haplotypes from one another, with some haplotype sharing (Figure 2.3). This is expected because I chose the nuclear markers based on distinctiveness between these two groups. The sole member of the *R. l. caribaeus* group for which I had fresh tissue always shared nuclear haplotypes with members of the *R. l. crepitans* group (Figure 2.3), consistent with the close relationship observed in the mtDNA data (Figure 2.2). Members of the *R. l. obsoletus* group shared haplotypes with either *R. e. elegans* (Figure 2.3.2, 2.3.4) or the *R. l. crepitans* group (Figure 2.3.1, 2.3.3). The South American birds either had distinct haplotypes (Figure 2.3.1, 2.3.2), or shared them with either *R. e. elegans* (Figure 2.3.4) or the *R. l. crepitans* group (Figure 2.3.3). Haplotypes from *R. limicola* were distinct from the complex for three loci, but unexpectedly they shared a haplotype with several members of the complex (Figure 2.3.3).

DISCUSSION

Our primary finding is that *R. elegans*, as currently recognized, is paraphyletic with respect to *R. longirostris*. Species limits in the group correspond roughly to geography instead of current species designations. For example, the *R. longirostris obsoletus* subspecies group endemic to California and northwestern Mexico is sister to *R. elegans tenuirostris* of the highlands of Mexico, instead of to either *R. longirostris* or *R. elegans* of eastern North America as previously suggested in taxonomic treatments (Hellmayr and Conover 1942; Ripley 1977; Olson 1997). Additionally, the lineages of the *R. l. crepitans* group and nominate *R. elegans*, which are known to hybridize in eastern North America (Olson 1997), are in the same clade. This pattern of hybridization also apparently occurs on Cuba (Olson 1997) between members of

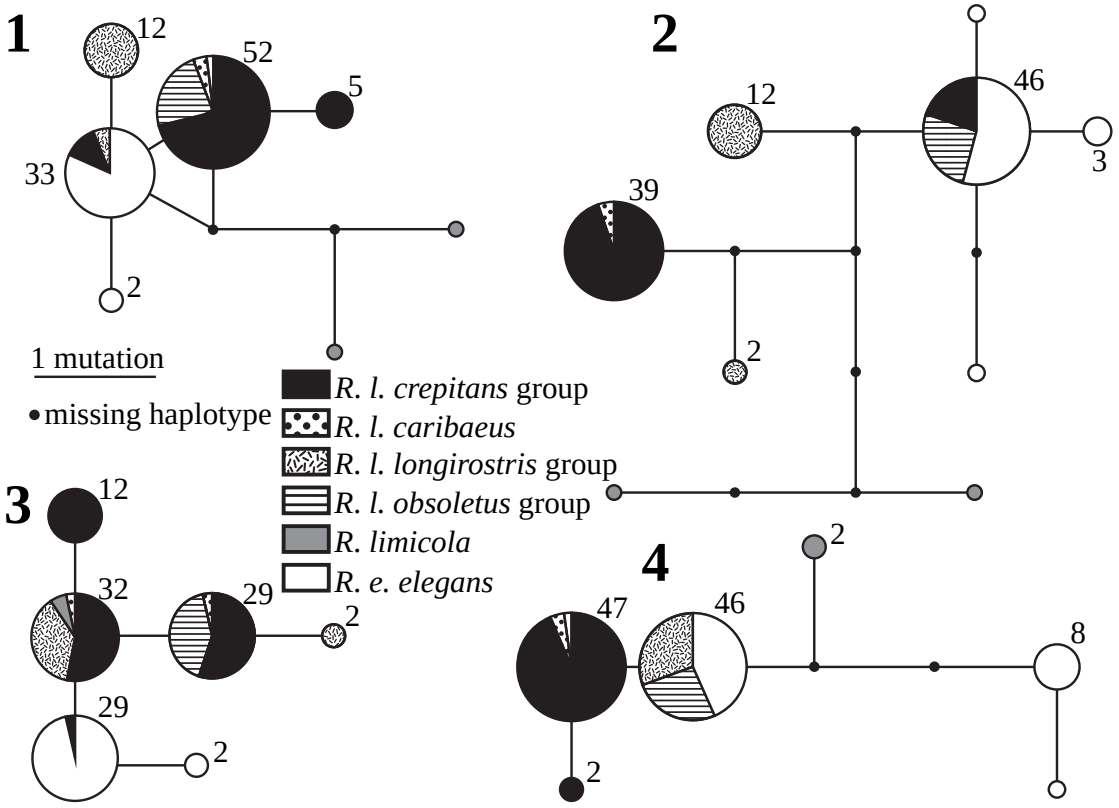

Figure 2.3 Median-joining haplotype networks inferred using Network v4.6 (Bandelt et al. 1999) for each of the four nuclear loci generated using next-generation sequencing. Circles are sized proportionally to the number of alleles tallied for each haplotype. Numbers indicate the tally for a given haplotype, except when the tally was one. (1) Locus *139*, (2) locus *472*, (3) locus *1166*, (4) locus *1766*.

these same two lineages. This clade also includes birds of the Caribbean, including some with intermediate haplotypes (Figure 2.3). Despite the shallow mtDNA divergence between the *R. l. crepitans* group and nominate *R. elegans*, I were able to find nearly fixed nuclear differences using next-generation sequencing. These results do not reflect an overall pattern across the genome because, for future hybrid zone analyses, I biased the selection of nuclear loci to those that were most divergent between *R. elegans* and *R. l. crepitans*. Ideally, researchers would include all divergent mtDNA lineages for next-generation sequencing in a search for informative loci rather than searching for informative population-level loci (McCormack et al. *In Press*). I analyzed these loci here because they were more variable and divergent relative to anonymous loci screened at a population level, leading us to believe that they may also be useful to address phylogenetic questions within the complex. The lack of phylogenetic resolution that these loci provide should be carefully considered by researchers attempting to develop markers using this same technique in recently diverged species complexes.

There are two separate taxonomic possibilities for the complex. First, both species could be combined under *R. longirostris* following a previous taxonomic evaluation of the group (Ripley 1977). This view obscures the fact that two members of the complex are in secondary contact in eastern North America and Cuba but have not fused despite hybridizing (Olson 1997). My morphological and genetic characterization (Chapter 3) of the hybrid zone in Louisiana found that it is very narrow (~ 4.2 km wide), with selection against hybrids acting to maintain it (Chapter 4). These data suggest there is strong, albeit incomplete, reproductive isolation between these species in Louisiana. Extending these results to the remaining taxa and considering the differential level of morphological and genetic divergence between previously identified subspecies groups; my results suggest at least four species could be recognized in this complex.

This treatment would also be consistent with recent genetic analyses of other members of the family showing similar levels of divergence (Tavares et al. 2010; Goodman et al. 2011). The most divergent clade within the complex, according to mtDNA data, represents a pair of subspecies groups from both currently recognized species (*R. l. obsoletus* group and *R. e. tenuirostris*). This pair shares the same pattern observed in the birds of eastern North America, in that individuals of one group are relatively smaller than those of the other and are found primarily in saltmarshes, whereas the other is relatively larger, brighter, and found in freshwater habitats (Olson 1997).

Given that *R. elegans* and *R. longirostris* behave as species in secondary contact, I propose species rank for four members of the complex described below. Because I did not attempt to assess subspecies limits I recommend keeping all subspecific taxonomic designations within groups. These taxonomic recommendations are based on two factors: 1) that each of the species represent a morphologically distinct group within the complex; and 2), that the species is a unique clade in the mtDNA gene tree with one exception discussed below. I propose recognizing as a species the nominate form of *R. longirostris* Boddaert, 1783 found in South America and adjacent islands, and which includes the subspecies *phelpsi* Wetmore, 1941, *margaritae* Zimmer and Phelps, 1944, *pelodramus* Oberholser, 1937, *cypereti* Taczanowski, 1877, and *crassirostris* Lawrence, 1871. These birds are relatively small, dull-breasted, robust-billed, and restricted to mangroves (Figure 2.4; Eddleman and Conway 1998). The second species I propose would be the population of birds inhabiting the highland freshwater marshes of Mexico, *R. e. tenuirostris* Ridgway, 1874 and the critically endangered populations that occur along the Pacific Coast of North America, with *R. l. obsoletus* Ridgway, 1874 taking priority, and including the subspecies *levipes* Bangs, 1899, *beldingi* Ridgway, 1882, and, inland,

yumanensis Dickey, 1923. In their highland distribution, individuals are very bright rufous ventrally, and have diffuse flank banding (Figure 2.4; Meanley 1992). In the Pacific Coast populations this group is characterized by also having a bright rufous breast, and by their occurrence in saltmarshes (Eddleman and Conway 1998). The third species I propose consists of two subspecies, *R. elegans elegans* Audubon, 1834 and *R. e. ramsdeni* Riley, 1913. Four of the individuals from this group had intermediate haplotypes and were not a part of the main clade, but they had a lower genetic distance to *R. e. elegans* haplotypes (0.006) than to any *R. longirostris* haplotypes (Table 2.3). These birds breed in freshwater marshes of eastern North America and Cuba, are rufous-breasted, and relatively large (Figure 2.4; Meanley 1992). The fourth species consists of the eastern North America group of *R. l. crepitans* Gmelin, 1789, including the subspecies *waynei* Brewster, 1899, *scottii* Sennett, 1888, *insularum* Brooks, 1920, and *saturatus* Ridgway, 1880, as well as the birds of the Caribbean and Yucatan, including *R. l. caribaeus* Ridgway, 1880, *pallidus* Nelson, 1905, *grossi* Paynter, 1950, *belizensis* Oberholser, 1937, *leucophaeus* Todd, 1913, and *coryi* Maynard, 1887. These birds are intermediate in size, and the breast spans a range of colors from very dull, silvery-gray, to dull rufous (Figure 2.4). They breed in *Spartina* spp. saltmarshes and saltmeadows of the Atlantic and Gulf Coasts of North America, as well as mangroves in the Yucatan, extreme southern United States, and Caribbean (Eddleman and Conway 1998).

The taxonomy of this complex has been complicated by the morphological and ecological variation found within the group, as well as evidence of hybridization between the two eastern North American lineages (Olson 1997). Understanding the degree of hybridization and mechanisms preventing fusion of these two lineages is part of my ongoing research. My genetic results suggest that the morphologically distinct groups represent good species relative to



Figure 2.4 Two photographs showing specimens of members from each major group ventrally and in profile. The birds, from left to right, are as follows: *R. e. tenuirostris* (LSUMZ 39438; *R. elegans* group), *R. l. yumanensis* (LSUMZ 39435; *R. l. obsoletus* group), *R. l. cypereti* (B-67819; *R. l. longirostris* group), *R. l. coryi* (LSUMZ 141611 *R. l. caribaeus* group), *R. l. saturatus* (B-63400; *R. l. crepitans* group), and *R. e. elegans* (B-63513; *R. elegans* group). All specimens are males in adult plumage. Photographs provided courtesy of R. E. Gibbons.

subspecific designations. The California and northwestern Mexico birds of the *R. l. obsoletus* group should be considered a distinct species, elevating them from endangered subspecies status to endangered species in the United States. I found little evidence of divergence between migratory and nonmigratory populations of King Rails in the eastern United States. However,two samples from migratory birds breeding in Oklahoma did have a unique mtDNA haplotype (Figure 2.2), which was also found in one bird from Louisiana, suggesting some structure within *R. e. elegans* in the U. S. may exist, warranting further study. The results of this study suggest that current taxonomy in the complex warrants revision, and this may have management and conservation implications.

CHAPTER 3

ECOLOGICAL SPECIATION IN *RALLUS* RAILS ALONG A SALINITY GRADIENT

INTRODUCTION

Speciation in vertebrates is thought to occur almost exclusively via allopatry, such that geographically isolated populations diverge genetically and phenotypically to the point of reproductive isolation (Mayr 1942). Ecological speciation occurs when this process is accelerated by adaptations to different environmental conditions (Nosil et al. 2009). Compelling examples of ecological speciation in non-model organisms are few, primarily because evolutionary mechanisms in allopatric populations are inherently difficult to test (Hendry et al. 2007; Nosil et al. 2009) and the relevant selective agent acting on natural populations is often difficult to pinpoint. Recently diverged populations distributed along an environmental gradient provide excellent systems in which to investigate the processes associated with adaptive divergence in the context of ecological speciation. Salinity gradients are known to induce adaptive divergence in aquatic organisms (Whitehead and Crawford 2006; Hemmer-Hansen et al. 2007; Fuller 2008), but the extent to which physiological, ecological, or genetic adaptation of terrestrial vertebrates distributed along salinity gradients is involved in speciation has not been investigated.

Adaptation to saline environments in terrestrial birds can lead to substantial morphological changes (Greenberg and Olsen 2010; Luther and Greenberg 2011) and physiological adaptations (Sabat *et al.* 2006). Whether these changes have pleiotropic effects on reproductive isolation remains unexplored. In this regard, hybrid zones situated along salinity gradients provide a natural experiment to investigate the interplay between environmental change along a gradient and the reproductive isolation of organisms distributed along it (Endler

1977; Hewitt 1988; Coyne and Orr 2004). Genetic and morphological investigations of hybrid zones have revealed that the strength of selection acting against hybrids can be sufficient to maintain reproductive isolation in the face of the dispersal of unrecombined parentals across the gradient (Moore and Buchanan 1985; Ross and Harrison 2002; Mullen and Hoekstra 2008).

Here, I investigate a hybrid zone between two recently diverged (~1% divergent in mtDNA) avian sister species that replace one another along a salinity gradient. King Rails (*Rallus elegans*) and Clapper Rails (*R. longirostris*) are wetland birds that are morphologically, behaviorally, and vocally similar. The two have long been considered ecological replacements of one another (Meanley 1992; Olson 1997). Whereas Clapper Rails breed at high densities in coastal saltmarshes dominated by *Spartina alterniflora*, King Rails have a patchier distribution that reflects the more localized distribution of inland freshwater marshes (Fig. 1A; Meanley 1992; Eddleman and Conway 1998). Where these two habitats come into contact along the Gulf and Atlantic coasts of the southeastern United States, King and Clapper rails hybridize (Meanley and Wetherbee 1962; Bledsoe 1988; Meanley 1989; Olson 1997; Eddleman and Conway 1998).

Previous studies of King and Clapper rails have demonstrated physical and physiological differences associated with osmoregulation (Conway et al. 1988). Both species have nasal salt glands on the dorsum of the skull, but these are significantly larger in Clapper Rails (Olson 1997). The salt gland is a relatively simple organ composed of mitochondria-rich cells that, by creating a concentration gradient similar to the cells found in fish gills (Peaker 1971), is capable of filtering the blood and concentrating ions into a solution exceeding 20 times the osmolality of

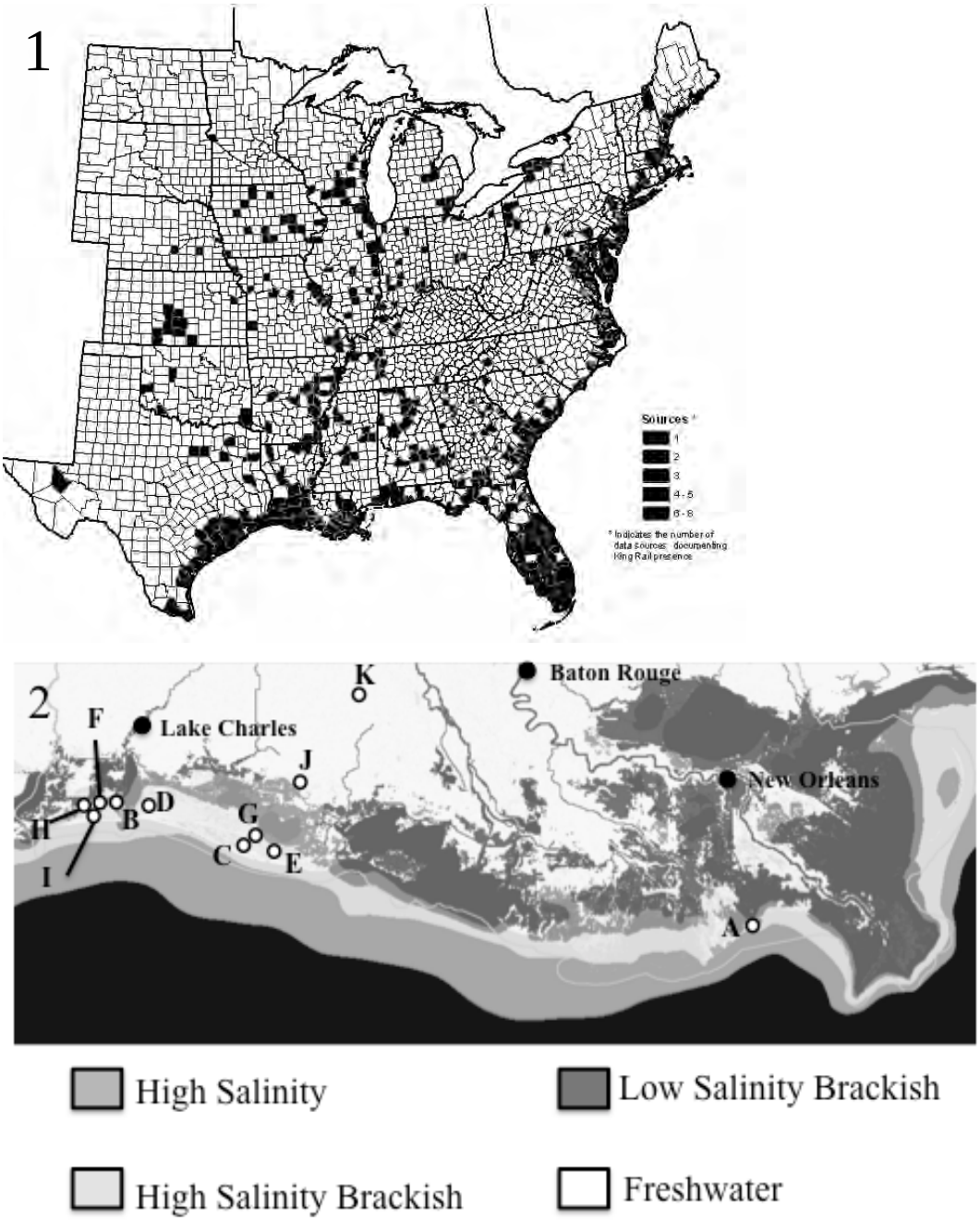

Figure 3.1 1) The distributions of King and Clapper rails in the eastern United States. Counties where King Rails have been recorded are shown in black, Clapper Rails are distributed in saltmarshes along a narrow band of the coast from New England to south Texas.
2) Sampling in south Louisiana along the salinity gradient. Circles show approximate sampling localities. Site codes correspond to Table 3.1: A. GI, B. ML, C. R2, D. CC, E. R1, F. SB, G. R3, H. SN, I. SS, J. LA, and K. CP. These

blood plasma (Hughes 2003). Salt glands are needed in rails to maintain osmoregulatory equilibrium, because their kidneys are incapable of concentrating inorganic ions more than three times the concentration found in their blood (Braun 1999). Larger salt glands (relative to body size) are capable of excreting more salt from the blood and at higher concentrations (Peaker 1971). Conway et al. (1988) gave both species high salt loads and found that Clapper Rails were capable of excreting salt more quickly and at higher concentrations. By studying the genetic and morphological change across this ecological gradient, I am attempting to understand if osmoregulatory differences could be responsible for ecological speciation between these two lineages.

METHODS AND MATERIALS

Sample Collection

We sampled 139 rails from 11 different marshes spanning the transition from pure, parental King Rails at inland freshwater marsh localities to parental Clapper Rails at coastal saltmarsh localities (Figure 3.1B, Table 3.1). Birds were collected during the breeding season (April – July) by shotgun or mist net.

Ecological and Morphological Data

We collected water samples from open water sources at specimen collection sites. At each site, I collected at least four water samples. Samples were kept at a constant temperature for a month, shaken vigorously, and then measured for salinity level in parts per thousand (ppt) using a calibrated refractometer (MarineDepot.com). I used measurements from at least four samples to calculate a mean salinity per site on the day or days of rail collection.

Table 3.1 Site code, sampling localities, number of collected bird samples (N), distance from the nearest saltwater source (km), mean salinity (ppt), mean salt gland weight (g), and voucher numbers.

Code	Locality	*N*	Distance (km)	Voucher Numbers
GI	Jefferson Parish; Grand Isle, 1.6 km W Grand Isle, 29° 14.245' N, 90° 0.283' W	19	0.0	63400 - 63407, 63474 - 63478, 63536 - 63541
ML	Cameron Parish; Sabine NWR, E Mud Lake Road, 7.6 km NNE Holly Beach, 29° 50.079' N 93° 25.673' W	10	1.6	63518 - 63527
R2	Cameron Parish; Rockefeller SWR, 15.3 km SE Grand Chenier, 29° 41.203' N 92° 50.678' W	10	2.2	63434 - 63443
CC	Cameron Parish; 3.2 km NNE Cameron, Amoco Road, 29° 49.347'N 93° 18.421' W	25	3.0	63454 - 63463, 63491 - 63505
R3	Cameron Parish; Rockefeller SWR, 4 km W North Island, 29° 42.451' N 92° 46.491' W	10	6.9	63444 - 63453
SB	Cameron Parish; Sabine NWR, Second Bayou, 7.2 km N Holly Beach, 29° 50.133' N 93° 28.165' W	10	7.3	63408 - 63417
R1	Vermilion Parish; Rockefeller SWR, 11.3 km W Pecan Island, 29° 38.776' N 92° 34.207' W	10	7.6	63418 - 63427
SN	Cameron Parish; Second Bayou, 5.6 km NNW Holly Beach, 29° 48.260' N 93° 29.075' W	10	8.0	63515 - 63517, 63528 - 63534
SS	Cameron Parish; Second Bayou, 4.3 km WNW Holly Beach, 29° 47.771' N, 93° 29.871' W	10	8.8	63506 - 63514, 63535
LA	Cameron Parish; Lacassine NWR, 10.5 km SW Lowry, 29° 58.723'N 92° 51.737' W	10	30.0	63433, 63479 - 63487
CP	St. Landry Parish; 6.4 km NNW Church Point, Dusty Road, 30° 27.724' N 92° 14.037' W	10	75.0	63464 - 63473

We measured total body weight immediately after collecting each bird. Salt glands of adult or fully-fledged (not accompanied by a parent) birds were weighed in the lab because the salt glands are small (10 – 30 mg), and bringing a highly sensitive scale in the field was not feasible.

Molecular Data

Mitochondrial sequences – Total DNA was extracted from ~25 mg fresh pectoral muscle using a DNeasy Tissue Kit (Qiagen Sciences Inc., Germantown, MD) following manufacturer's protocols. I used primers RallusND2F and RallusND2R (Chapter 2) to amplify and sequence 789 bp of NADH subunit 2 (ND2) for all samples.

All PCR amplifications were 10 μL in volume and contained ~50 ng of DNA, 1X Standard Taq Buffer, 0.13 mM $MgCl_2$, 0.5 μM of each primer, 0.1 mM dNTPs, 0.1 mg/mL BSA, 0.25 U Taq DNA Polymerase (New England Biolabs Inc., Ipswich, MA), and 4.95 µL water. All mtDNA PCRs were performed using the following cycle parameters: 2 min at 94°C, followed by 35 cycles of 94°C for 30s, 51°C for 30s, and 72°C for 1 min, followed by 72°C for 10 min. For nuDNA I used 60°C for the annealing temperature instead of 51°C. I confirmed amplification by running PCR products on 1% agarose gels. PCR products were then cleaned with 10 μL EXOSAP reactions containing 5 μL of PCR product, 4.25 μL water, 1.25 U Antarctic Phosphatase, 5 U ExoI, and 1X Antarctic Phosphatase Buffer. I then conducted cycle-sequencing reactions using Big Dye Terminator Cycle-Sequencing Kit v3.1 (Applied Biosystems Inc., Foster City, CA). All cycle-sequencing reactions included 1 μL of cleaned PCR product, 0.93 X Sequencing Buffer, 0.3 μL of 1X Big Dye 3.1, 2 X 10^{-5} μmoles of forward or reverse primer, and combined with distilled water to make a final volume of 7 μL. These reactions were run using the

following thermal profile: 2 cycles of 96°C for 20s, 50°C for 15s, and 60°C for 4 min, followed by 24 cycles of 96°C for 12s, 50°C for 15s, and 60°C for 4 min. Cycle-sequence products were then purified using a Sephadex G-50 Fine (Sigma-Aldrich Co., St. Louis, MO) matrix in a 96-well filter plate. Cleaned products were run on an ABI 3130 Genetic Analyzer and sequences were aligned and checked for quality using Sequencher v4.7 (Gene Codes Corp., Ann Arbor, MI).

Nuclear sequences – To find nuclear genetic markers that distinguish the two species I used an AFLP genome-reduction method (Vos et al. 1995) and then ran this product on a quarter plate of a 454 pyrosequencing run. The methods I used to generate the next-gen sequences are described in detail elsewhere (McCormack et al. 2012). I conducted the pyrosequencing run on 20 individuals collected outside of the transition zone – 10 Clapper Rails collected on a barrier island and 10 King Rails from the sampling location farthest from the coast (Figure 3.1B).

Conversion of the raw 454 output into loci and allele calls for each individual was performed using the computational pipeline PRGmatic v1.6 (Hird et al. 2011). After processing the data were screened for loci having fixed or nearly fixed differences between the species. Of 474 loci screened I identified 35 loci having high allelic frequency differences between the two species (frequency difference > 0.7; Mean = 0.9, SD = 0.08). Four loci that had between one and four fixed or nearly fixed SNPs (Frequency > 0.94; Mean = 0.96) that sorted between King and Clapper rails were Sanger sequenced (see below) in all 139 individuals from the hybrid zone transect. I did not find evidence of paralogous gene copies in that there were no variable positions with more than two nucleotides and all of the loci aligned with single avian autosomal intron sequences when searched using BLAST. I designed PCR primers for the four loci using

Primer3 directly from 454 reads (Rozen and Skaletsky 2000); I named the loci for the contig order from the data assembly process (*139, 472, 1166, 1766*). I then sequenced these four loci for all 139 samples. See above for PCR conditions and Chapter 2 for primers used to sequence nuclear loci.

Hybrid Zone Analyses

The marshes of southwest Louisiana are large, but suitable habitat is patchily distributed; therefore, a straight-line transect is not the best characterization of the ecological gradient along which Clapper and King rail populations occur. Based on initial scouting observations, in which I examined phenotypic variation at different sites, salinity appeared to be the most important factor in predicting the taxonomic composition of each population. Therefore, I sampled marshes of varying salinities and distances to saltwater sources (Figure 3.1.2). To approximate the transition from saltmarsh to freshwater marsh, I measured the distance from the center of each sampling site to the nearest source of high salinity (salinity > 20 parts per thousand) by tracing along open canals using Google Earth v6.0.3.2197 (Google Inc., Mountain View, CA). These distances were used for all cline analyses (Table 3.1).

We fit clines using the R statistical package (R Foundation for Statistical Computing, Vienna, Austria) for three sets of data: molecular, morphological and ecological. For the molecular data, I fit clines to King Rail ND2 haplotype frequency and to King Rail allele frequencies at each of the four nuclear loci. Nuclear allele frequencies were based on the frequency of a single SNP per locus rather than considering all SNPs at a given locus. For morphological data, I fit clines to total body weight and to the recorded salt gland weight divided by total body weight. Because salt gland data were missing for some individuals the overall

sample size (N = 99) was lower than that for other characters. For the ecological cline, I used the salinity data taken at each collection site.

To apply the frequency likelihood function developed for the molecular data to the morphological and environmental data (neither of which are inherently frequency data), I had to first conduct a Bernoulli transformation of the data. I transformed morphological and ecological data into frequencies per site by transforming each sample into a Bernoulli trial (e.g., 0 or 1) in which 1 means that the sample is less than a constant and 0 means the sample is greater than or equal to that constant. To determine the constant for each trait, I created a vector of the midpoints between all the sample values. I then iteratively treated each midpoint as the constant, generating a frequency per site and calculating the information content of that distribution. I then chose as the constant the midpoint that yielded the maximum information.

The structure of the hybrid zone was analyzed by modeling the shape of clines for organismal (i.e., molecular, morphological) and environmental (i.e., salinity) traits. These clines estimate changes in the population frequency along the geographical transect. Cline shape was modeled by combining three equations (Szymura and Barton 1986; Szymura and Barton 1991) that describe a sigmoid shape at the center of a cline and two exponential decay curves (tails) on either side of the central cline. The sigmoid shape is described by two parameters, width (*w*) and center (*c*). The decay curves are each described by two parameters, delta (*d*; distance between the tail and the center) and tau (t; slope of the tail/slope of the sigmoid; Gay et al. 2008). The whole cline can be scaled using *Pmin* and *Pmax*, which are the minimum and maximum frequencies for the cline. I fit clines using a new software package (HZAR) that provides functions for fitting genetic, ecological and morphological data from hybrid zones to these classic equilibrium cline models using the Metropolis-Hasting algorithm in the R platform (Derryberry et al in prep).

We fit a series of 15 cline models to each data set. These models can be grouped into three sets: set 1 has no scaling (*Pmin* = 0, *Pmax* = 1), set 2 has fixed scaling (*Pmin* = observed minimum frequency, *Pmax* = observed maximum frequency), and set 3 fits *Pmin* and *Pmax*. Within each set, there are five variations, each of which includes the sigmoid cline but (A) has no tails, (B) has only a left tail, (C) has only a right tail, (D) has mirrored tails (same *d* and *t*) and (E) has independent tails (different *d* and *t*). For each data set, I ran each model for 1.0×10^6 generations to set up the covariance matrix. I then ran three independent chains of three runs each for a total of 9.0×10^6 generations and assessed the stability and convergence of the MCMC trace, the posterior distribution, and the cline parameters (for an example, see Figure 3.2). Because some models displayed anomalies, I ran all models for an additional eight independent runs each with a different covariance matrix to ensure adequate exploration of the likelihood space. These runs added a total of 8.0×10^6 generations. After these runs, all traces showed stability and convergence. I identified and discarded the burn-in and concatenated independent runs for each model. I used corrected Akaike Information Criterion (AICc) to perform model selection. To visualize the best model for each trait, I plotted the maximum likelihood cline and the 95 percent credible cline region from the posterior distribution.

Parameters estimated in the process of fitting cline models can be used to determine concordance between clines from different traits as well as the strength of selection against hybrids. For each trait, I generated 95 percent credible intervals for cline center and width from the posterior distribution for the selected model. To assess significant differences between estimates of *w* and *c* for each locus, I used two log-likelihood score confidence intervals (Edwards 1992). If these confidence intervals did not overlap, then I considered the parameters to differ significantly.

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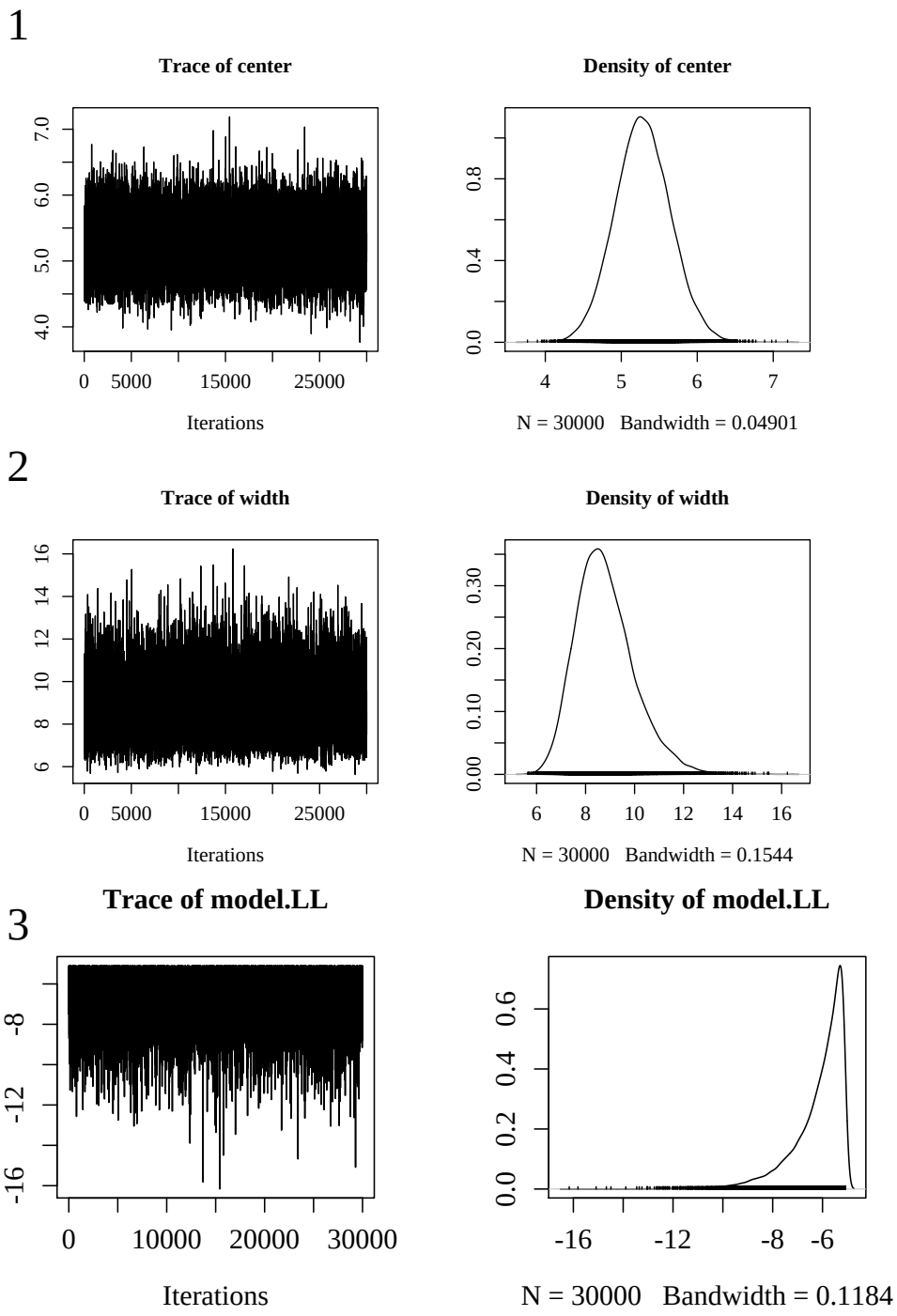

Figure 3.2. An example showing MCMC traces demonstrating convergence and stability of cline parameter estimates using HZAR. 1. Two graphs showing the MCMC trace and probability distribution of the estimate of cline center. 2. Two graphs showing the trace and distribution for width. 3. Two graphs showing the trace and distribution for the overall model.

We used the cline width estimates to determine the potential effects of selection acting on hybrids. Assuming neutral diffusion after secondary contact I modeled the hybrid zone's structure assuming an absence of selection by using the equation $w = 2.51\sigma\sqrt{t}$, where w is the width of the hybrid zone, σ is the root mean square dispersal distance, and t is the time since contact (Barton and Gale 1993). An estimate of natal dispersal distance in Clapper Rails (~55 km) is based on a study in which multiple flightless juveniles were banded and recovered after dispersing (Hon et al. 1977). I solved for t and calculated it using my estimates of the other parameters, and also solved for w using two estimates of t (45 and 250 years). I also estimated the strength of selection that favors different alleles on opposite ends of a sharp ecological gradient, where s^* represents the mean fitness difference between populations at the center versus the edges (Barton and Gale 1993). I used the equation $w = 1.732\sigma\sqrt{s^*}$ assuming no dominance, and substituted 1.732 with 1.782 for dominance, and solved for s^* (Barton and Gale 1993). I also calculated a standardized linkage disequilibrium metric (R) between all pairs of polymorphic loci within sites using DnaSP v5 (Rozas et al. 2003). To determine the population assignment for each individual sampled across the hybrid zone, I analyzed the mitochondrial and four autosomal loci using the program Structure v2.3.2 (Pritchard et al. 2000). I set the population number to k = 2, and used the POPINFO flag to indicate that individuals sampled away from the contact zone were of known origin. For individuals without prior population information I ran the admixture model for cluster assignment multiple times with a burnin of 1.0 X 10^5 steps and 1.0 X 10^6 iterations. I then modified the figure for publication using distruct v1.1 (Rosenberg 2004) and Adobe Illustrator CS5 (Adobe Systems Inc., San Jose, CA).

Coalescent Analyses

To prepare a larger dataset for a divergence population genetics analysis of the two species using the 454 data, I conducted a series of conversions from raw reads to final infiles. I used PRGmatic v1.6 (Hird et al. 2011) to obtain two allele calls per individual. The initial step in this pipeline uses the publicly available pyrosequencing tools found on the online Ribosomal Database Project to filter out short (length < 100bp) and low-quality reads (Q < 20), to remove primer and barcode sequences, and to identify and separate reads from barcoded individuals into fasta files. The pipeline then takes the fasta and quality files for each individual and uses a portion of the reads to concatenate a pseudo-reference genome from loci with a sufficient depth of coverage to call high confidence alleles and a minimum percent identity within an individual. The pipeline then aligns the remainder of the reads to the pseudo-reference genome with additional user-defined settings (Hird et al. 2011). Consensus sequence calls are determined by setting the minimum level of coverage within an individual. SNP calls use a minimum coverage threshold and the minimum percent of reads with a particular SNP for making calls for each individual at that nucleotide position (Hird et al. 2011). I ran the pipeline several times under various conditions and compared results to determine the optimal parameter settings for high-confidence allele and SNP calls (McCormack et al. 2012). I used the following settings: minimum coverage of reads to call high confidence alleles = 4; minimum percent identity to call a locus = 90; minimum coverage for calling consensus sequence in an individual = 3; minimum coverage for calling a SNP = 2; minimum percent of reads for calling a SNP = 20. The SNP calls were then compared to Sanger sequences from the same individuals for four loci to determine the accuracy of the pipeline under these settings (McCormack et al. 2012).

We removed all loci that included fewer than ten individuals with allele calls. I then filtered potentially paralogous gene copies using observed and expected heterozygosities calculated by PRGmatic. I removed any locus with an observed and expected heterozygosity difference greater than 0.06. I made this determination based on the observation that most or all individuals were heterozygotes for these loci. To further remove potentially paralogous gene copies, I conducted a BLAST search of consensus sequences of each locus against the chicken and Zebra Finch genomes using Geneious v5.0.3 (Biomatters Inc., Auckland, New Zealand). Loci that aligned with an E-value less than 1.0E-04 were retained and I discarded any locus that aligned with high confidence to multiple locations within a genome.

We used the coalescent-based program Isolation with Migration analytic 2 (IMa2; Hey and Nielsen 2007; Hey 2010) to estimate a series of parameters describing the population genetic history of these two species. I selected 200 loci that aligned to avian genomes and had allele calls for the highest number of individuals (N > 10) for analysis under the Isolation with Migration model of divergence. I chose 200 loci because this is the maximum number allowed by the program. I then used a custom perl script to convert the fasta files into a single infile. I used IMa2 to estimate divergence time (t), effective population size (θ_0, θ_1, and θ_A), and migration rate (m_1, and m_2) parameters for each of four datasets from individuals collected away from the contact zone (Figure 3.1.2). We also included substitution rates to convert parameters into demographic estimates of divergence time (T), effective population sizes (N_C, N_K, and N_A), the migration rate from Clapper Rails into King Rails ($M_{C>K}$), and the migration rate from King Rails into Clapper Rails ($M_{K>C}$). I initially ran each of the four datasets with very large priors to determine the optimal priors that encompass the distribution of each parameter estimate. For each dataset I ran three replicates set to generate outfiles every hour until I determined that the

runs had reached convergence (ESS for $t > 50$). For the mtDNA dataset I used the following priors and substitution rate: $q = 200$, $t = 10$, $m = 0$, substitution rate = 1.125 X 10-8 substitutions/site/year (Klicka et al. 2011). I set the migration rate to zero based on the initial runs with large priors and because the two populations do not share mtDNA haplotypes. I used the substitution rate of 1.35 X 10-9 substitutions/site/year (Ellegren 2007) for autosomal loci and 1.45 X 10-9 substitutions/site/year (Axelsson et al. 2004; Ellegren 2007) for Z loci. For the auto and autoZ datasets I used the following priors: $q = 5$, $t = 0.5$, $m = 5$. For the Z dataset I used the following priors: $q = 30$, $t = 2$, $m = 20$. After a burnin of 100,000 steps I ran each dataset for a minimum of $1 \text{ X } 10^6$ generations.

RESULTS

Ecological and Morphological Results

The highest mean salinity (30.5 ppt) was observed on a barrier island off the coast of Louisiana (GI; Table 3.2). I found the lowest salinities at the two sites farthest from the coast (1.0 ppt, LA; 0.0 ppt, CP; Table 3.2). All other localities had intermediate salinities, ranging from 3.0 ppt (SS, SN; Table 3.2) to 23.8 ppt (R2; Table 3.2). One site, R3, had unusually high salinity relative to the distance from the nearest saltwater source (Table 3.2). Reasons for this abnormally high salinity are discussed below.

We conducted an Analysis of Variance (ANOVA) and found a significant difference in total body weight ($F = 34.85$, $Pr(>F) = 2.38 \times 10^{-6}$) and nasal salt gland weight ($F = 30.57$, $Pr(>F) = 2.38 \times 10^{-6}$) between parental Clapper Rails on the barrier island (GI; Table 3.2) and parental King Rails at two combined inland sites (LA, CP; Table 3.2). I found that these traits varied across the hybrid zone; body weights generally increased with decreasing salinity, and salt

Table 3.2 Site code, distance from the nearest saltwater source (km), mean salinity (ppt), number of water samples (N_{SAL}), mean total body weight (g), number of birds weighed (N_W) mean salt gland (SG) weight (g), and number of salt gland pairs weighed (N_{SGW}). Standard deviations are in parentheses.

Code	Distance (km)	Mean Salinity (ppt)	N_{SAL}	Mean Body Weight (g)	N_W	Mean SG Weight (g)	N_{SGW}
GI	0.0	30.5 (2.4)	4	335.67 (24.85)	15	0.16 (0.042)	9
ML	1.6	17.3 (1.2)	10	345.43 (30.34)	7	0.15 (0.033)	6
R2	2.2	23.8 (0.5)	4	328.13 (27.89)	8	0.22 (0.043)	6
CC	3.0	10.6 (4.0)	19	349.50 (32.98)	22	0.15 (0.039)	22
R3	6.9	20.8 (3.7)	6	375.50 (32.95)	10	0.17 (0.033)	10
SB	7.3	7.2 (2.2)	5	372.78 (28.96)	9	0.12 (0.036)	9
R1	7.6	4.0 (1.2)	5	387.40 (37.80)	10	0.11 (0.040)	8
SN	8.0	3.0 (1.7)	10	380.50 (24.99)	6	0.10 (0.043)	6
SS	8.8	3.0 (0.7)	10	382.44 (18.45)	9	0.092 (0.030)	9
LA	30.0	1.0 (1.0)	5	378.75 (22.95)	8	0.031 (0.020)	7
CP	75.0	0.0 (0.0)	4	392.86 (17.29)	7	0.073 (0.057)	7

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gland weights generally decreased with decreasing salinity (Table 3.2). Relative weight of the nasal salt gland in these two species has been shown to be plastic depending on duration of exposure to high saline environments (Conway et al. 1988), and this is discussed below.

Molecular Results

King and Clapper rails are fixed for alternate ND2 mitochondrial haplotypes at opposite ends of the salinity gradient (sites GI and CP in Figure 3.1.2), but these are only weakly (~1% sequence divergence) differentiated. I filtered the 454 sequencing data collected from these two sites, resulting in 474 loci that included at least seven individuals and aligned to either nothing or a single genomic location in Zebra Finch or chicken (Table 3.3). The 474 loci averaged 325 bp in length (minimum 268 bp; maximum 405 bp), with an average of 7X coverage per individual (minimum 4.2X; maximum 25X). I found substantial frequency differences for at least one SNP (Frequency > 0.7) between the two species for 35 of these loci (Table 3.3). When I used the BLAST function in Geneious v5.0.3 on these 35 loci I found that 11 of them aligned with nothing in either chicken or Zebra Finch genomes, 11 of them aligned with various housekeeping genes, and 13 with them aligned to genes possibly involved in osmoregulation (Table 3.3). I Sanger-sequenced four of the 35 loci for all individuals collected at sites GI and CP and found that one was fixed (*1166*), whereas the other three exhibited strong frequency differences (*139* = 0.92; *472* = 0.67; *1766* = 0.92). Sanger sequencing of the four loci confirmed a very low bp call error rate of < 0.05% for the 454 data with the settings I used in PRGmatic v1.6 (Hird et al. 2011; McCormack et al. 2012).

Table 3.3 Frequency differences (F) for the 35 loci with strong differences between the two populations for SNPs compared to the chicken and Zebra Finch genomes. Difference score is calculated as the absolute value of the number of individuals with one base in one population minus the number of individuals with a different base pair in the other population, taking into account the number in each population that has the other population-specific SNP. The number of SNPs indicates the number of population specific SNPs that sort together. Also shown are the BLAST results comparing the loci to the chicken and Zebra Finch genomes. Function is the purported gene function of the gene that locus is within or adjacent to based on the gene annotations from GENBANK.

Contig	Diff. Score	# inds	freq	# SNPs	Chicken	Zebra Finch	Potential Function
38	18	18	1.000	2	Nothing	Nothing	Unknown
42	15	20	0.750	1	Nothing	Nothing	Unknown
50	17	19	0.895	2	Chr. 20 - similar to long type PB-cadherin	Chr. 17 - 5' similar to ribosomal protein L35; 3' similar to Chr. 9 open reading frame 126	Tight Junction - Osmoregulation
54	17	18	0.944	1	Nothing	Chr. 13 - 5' hypothetical protein; 3' DnaJ (Hsp40) homolog, subfamily C, member 18	Protein Folding
86	14	19	0.737	4	Chr. 10 - similar to secretory carrier membrane protein	Chr. 10 - similar to secretory carrier membrane protein 2	Regulation of Sodium, Potassium Exchangers - Osmoregulation

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table continued

139	19	20	0.950	1	Nothing	Nothing	Unknown
173	15	16	0.938	1	Chr. 19 - 5' similar to nuclear receptor co-repressor 1; 3' similar to PIG-L	Chr. 19 - 5' nuclear receptor co-repressor 1 isoform 2; 3' similar to phosphatidylinositol glycan anchor biosynthesis	Possibly Osmoregulation
220	16	17	0.941	3	Nothing	Nothing	Unknown
248	14	18	0.778	3	Nothing	Chr. 17 - euChromatic histone-lysine N-methyltransferase 1	Potentially Osmoregulation
285	15	19	0.789	1	Nothing	Nothing	Unknown
329	19	20	0.950	4	Chr. 21 - 5' similar to RNDEu-2; 3' similar to guanylin	Chr. 21 - 5' transitional epithelia response protein; 3' patched domain containing 2	Guanylin Induces Chloride Secretion and Decreases Intestinal Fluid Absorption - Osmoregulation
403	15	19	0.789	8	Nothing	Nothing	Unknown

table continued

430	16	18	0.889	3	Nothing	Chr. 13 - 5' follistatin-like 4; 3' folliculin interacting protein 1	Tumor Suppression - Possibly Osmoregulation (Salt Gland Growth)
431	17	19	0.895	1	Nothing	Chr. 23 - 5' similar to gap junction protein, connexin 31; 3' similar to CSMD2 protein	Vasopressin Receptor Activity - Osmoregulation
437	20	20	1.000	2	Nothing	Nothing	Unknown
472	16	17	0.941	4	Chr. 13 - similar to macrophage colony stimulating factor I receptor	Chr. 13 - similar to colony stimulating factor 1	Immune Function
565	14	17	0.824	2	Chr. 19 - hypothetical protein - ATP binding	Chr. 19 - similar to probable ATP-dependent RNA helicase DHX40	ATP-binding - Possibly Osmoregulation
656	18	18	1.000	2	the end is a repetitive element found on most other chicken Chr.s	Chr. 13 - 5' similar to KIAA0837 protein; 3' prolyl 4-hydroxylase, alpha II subunit	Not Osmoregulation
755	17	17	1.000	2	Chr. 17 - 5' LIM homeobox 3; 3' NIMA (never in mitosis gene a)-related kinase 6	Chr. 17 - 5' LIM homeobox 2; 3' NIMA (never in mitosis gene a)-related kinase 6	Cell Division - Possibly Osmoregulation

table continued

863	15	18	0.833	1	Chr. 25 - hypothetical protein, unknown function	Nothing	Unknown
866	17	18	0.94	1	Chr. 23 - similar to GluR7	Chr. 23 - similar to Glutamate receptor, ionotropic kainate 3	Ion Channel Receptor - Osmoregulation
917	19	19	1.00	1	Chr. 19 - 5' similar to Williams Beuren syndrome Chr. region 27; 3' LIM domain kinase 1	Chr. 19 - 5' similar to transmembrane tight junction protein claudin; 3' hypothetical protein	Controls Organization of Actin Filaments - Osmoregulation
1166	18	19	0.95	3	Nothing	Chr. 19 - 5' ligase III, DNA, ATP-dependent; 3' transmembrane protein 132E	Ion Channels - Osmoregulation
1179	14	16	0.88	1	Nothing	Nothing	Unknown
1469	16	16	1.00	5	Nothing	Nothing	Unknown
1535	16	16	1.00	3	Nothing	Nothing	Unknown

table continued

1563	15	17	0.88	2	Nothing	Chr. 25 - 5' hypothetical protein; 3' similar to keratin	Unknown
1618	17	18	0.94	1	Nothing	Chr. 20 - 5' similar to Gpr7; 3' myelin transcription factor 1	Nervous System
1702	15	15	1.00	1	Chr. 13 - similar to neuralized-2	Nothing	Unknown
1766	18	18	1.00	4	Chr. 24 - centromere/kinetochore protein zw10	Chr. 24 - centromere/kinetochore protein zw10	Cell Division - Possibly Osmoregulation
1865	14	17	0.82	1	Chr. 4 - 5' hypothetical protein; 3' hypothetical protein spermatogenesis associated 5	Chr. 4 - 5' sprouty homolog 1, antagonist of FGF signaling; 3' ankyrin repeat domain 50	Spermatogenesis
2379	15	19	0.79	1	Chr. 23 - 5' hypothetical protein; 3' syndecan 3 (N-syndecan)	Nothing	Actin Cytoskeleton - Osmoregulation
2778	14	17	0.82	1	Nothing	Nothing	Unknown

table continued

9661	17	20	0.85	1	Chr. 17 - 5' ribosomal protein L35; 3' hypothetical protein	Chr. 17 - 5' ribosomal protein L35; 3' hypothetical protein	Not Osmoregulation

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Hybrid Zone Results

We sequenced mtDNA and the four nuclear markers developed using next-gen sequencing for all individuals collected in the hybrid zone. I found a mixture of haplotypes at all sites of intermediate salinity, with the highest admixture in the middle of the hybrid zone. I fit the fifteen cline models described in the methods to each marker and checked all parameter traces for convergence (Figure 3.2). I found that the simplest cline models (model 1) fit the molecular markers, body weight, and salinity (Table 3.4). Only corrected salt gland weight had a more parameter-rich best-fit model (model 3A, Table 3.4). All genetic markers exhibited sharp transitions (Figure 3.3.1 – 3.3.5), as did salinity, total body weight, and corrected salt gland weight (Figure 3.3.6 – 3.3.8). The transitions in genetic markers were centered from ~4.0 km to ~6.8 km from the nearest saltwater source (Table 3.4). The width of these transitions was very narrow, from ~4.0 km for mtDNA, and ranging from ~6.7 to ~17.3 km for nuDNA (Table 3.4). The center for salt gland weight (~7.2 km from the nearest saltwater source, Table 3.4) was significantly offset from ND2, *139*, *472*, weight, and salinity. However, all other estimated centers were coincident (Table 3.4). Salt gland weight had a significantly narrower width than the other estimated widths, and marker *472* showed a significantly wider transition than all other clines (Table 3.4).

Based on a neutral diffusion model assuming a dispersal distance of ~55 km and a time since secondary contact of 45 years, the expected width of the clines should be ~838 km. Using a time since contact of 200 years, the expected width should be ~3723 km., whereas the mtDNA width was ~4.0 km. My estimates of the time since contact based on a neutral diffusion model using the width of each cline suggest very recent contact of less than one year for all characters

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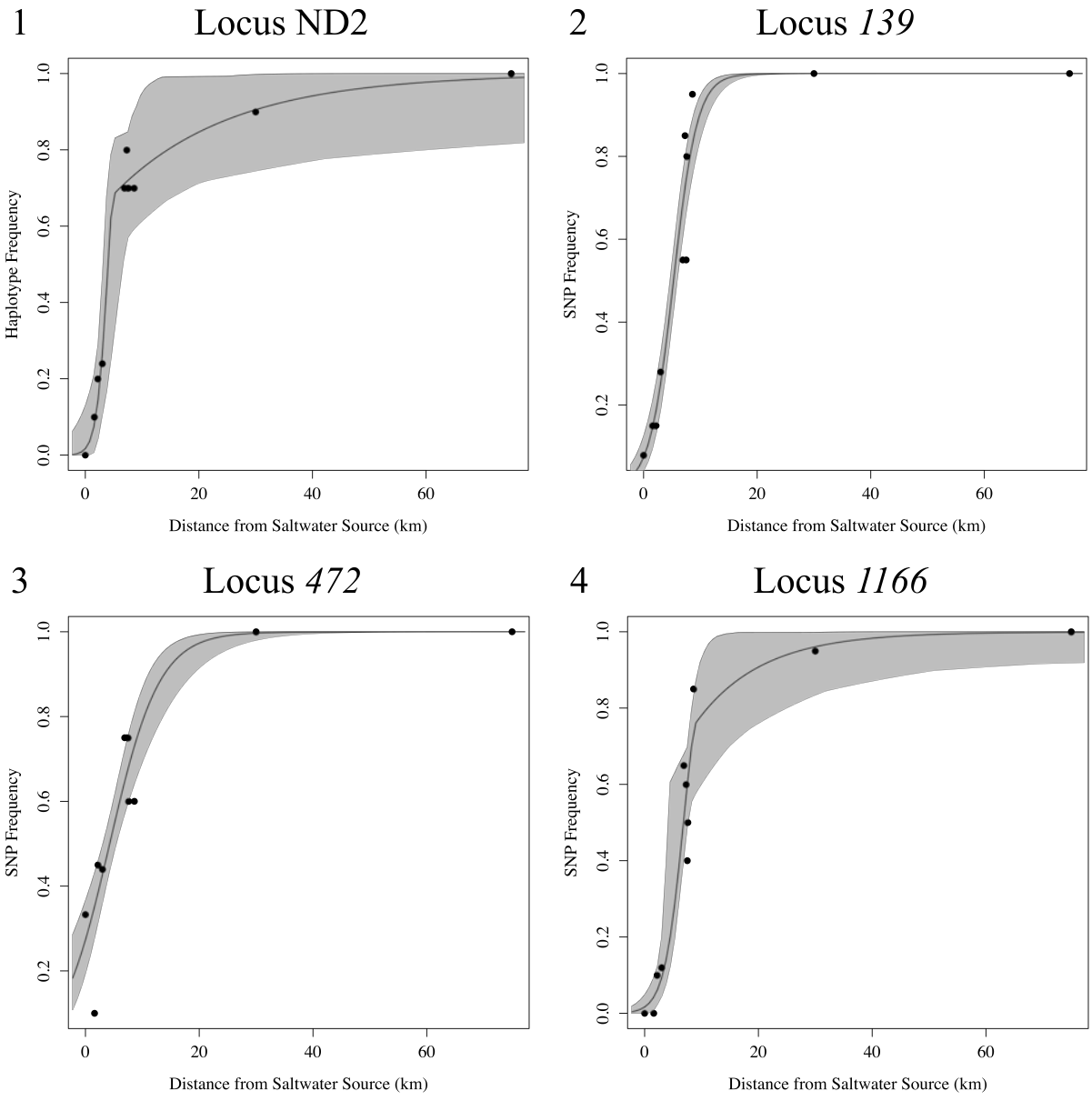

Figure 3.3 Cline shape estimates of genetic, morphological, and ecological datasets generated using HZAR. Points represent specific locality frequencies, black lines represent maximum likelihood estimates of the cline, and gray shaded areas represent credible cline regions. The right side of each graph is truncated to 40 km to show detail within the transition zone. 1. Locus ND2. 2. Locus *139*. 3. Locus *472*. 4. Locus *1166*. Four additional graphs are on the next page

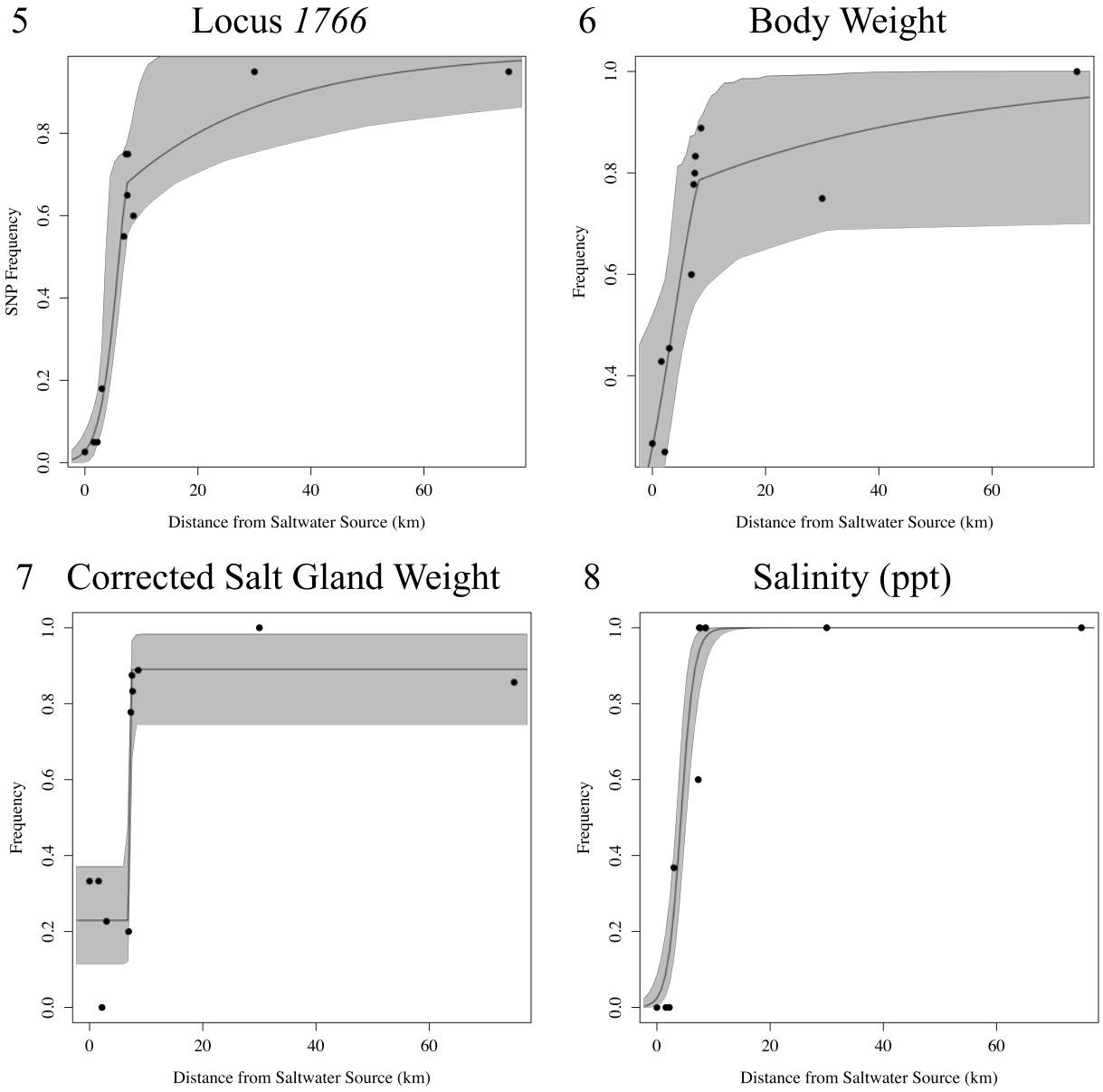

Figure 3.3 continued. 5. Locus *1766*. 6. Weight. 7. Corrected Salt Gland Weight. 8. Salinity (ppt).

Table 3.4 Models selected and cline shape parameters estimated with 2-unit log likelihood confidence intervals for center and width in parentheses.

Dataset	N[1]	Model	c (km from saltwater source)	w (km)	d_r	t_R	*Pmin*	*Pmax*
ND2	134	1C	4.0 (3.2 - 6.3)	4.0 (2.0 - 10.0)	0.7	0.1	0	1
139	268	1A	5.3 (4.6 - 6.0)	8.3 (6.6 - 11.0)	1	0	0	1
472	268	1A	4.3 (3.0 - 5.5)	17.4 (12.4 - 27.7)	1	0	0	1
1166	268	1C	6.8 (4.0 - 7.5)	6.7 (2.1 - 9.0)	1.9	0.2	0	1
1766	268	1C	6.0 (3.8 - 6.9)	6.8 (2.6 - 9.6)	1.3	0.1	0	1
weight	99	1C	3.6 (1.9 - 5.2)	13.8 (7.0 - 25.7)	4.5	0.1	0	1
sg.corrected	99	3A	7.2 (6.9 - 7.4)	0.2 (0 - 1.3)	1	0	0.2	0.9
sal	82	1A	4.3 (3.4 - 5.3)	4.6 (3.0 - 7.3)	1	0	0	1

[1]Number of alleles (genetic data), number of salt gland pairs, or number of water samples.

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Table 3.5 Time-since-contact calculations based on a neutral diffusion model and a selection coefficient representing fitness differences between the center and edges across the salinity gradient (Barton and Gale 1993). See methods for equations used in making these calculations.

Locus	*t* (years)	*s**[1]	*s**[2]
ND2	0.0008	579	613
139	0.0036	130	138
472	0.016	30	32
1166	0.0024	200	212
1766	0.0025	193	205
weight	0.010	47	50
sg	0.000002	280076	296480
mean	0.0051	227	240

[1]Assuming no dominance.

[2]Assuming dominance.

(Table 3.5). My estimates of selection coefficients were all 30 or greater, with the highest coefficients found for salt glands (Table 3.5).

We found significant differences in between-locus standardized linkage disequilibrium (*R*) for genetic markers, with a higher number of significant linkage disequilibrium estimates in the center of the hybrid zone than at the edges (Table 3.6). My results assigning known parental populations on opposite ends of the gradient and then using Structure to assign individual ancestry for all individuals within the gradient showed effectively "pure" populations for sites on the edges of the gradient (ML, R2, LA), but substantial admixture at all intermediate sites (Figure 3.4).

Coalescent Results

For the mtDNA dataset, I conducted three runs of IMa2 for 1×10^9 steps following the burnin, which resulted in very high effective sample sizes (ESS > 7×10^5). The parameter estimates from each run were very similar, so I only present the results from a single run. Time since divergence for the mtDNA dataset was found to be ~ 280,000 years before present (ybp), with wide confidence intervals (Figure 3.5.1 and Table 3.7). For the mtDNA dataset the female effective population size of King Rails was found to be higher than for Clapper Rails however, the confidence intervals broadly overlapped (Table 3.7).

We conducted similar runs for three nuclear datasets: autosomal loci only (auto, N = 191), Z loci only (Z, N = 9), and autosomal and Z loci combined (autoZ, N = 200), but with fewer steps following the burnin because running the much larger datasets was more computationally intensive. Loci selected for the autoZ dataset were distributed across the genome according to the BLAST results (Figure 3.6). I ran each dataset three times for at least 9

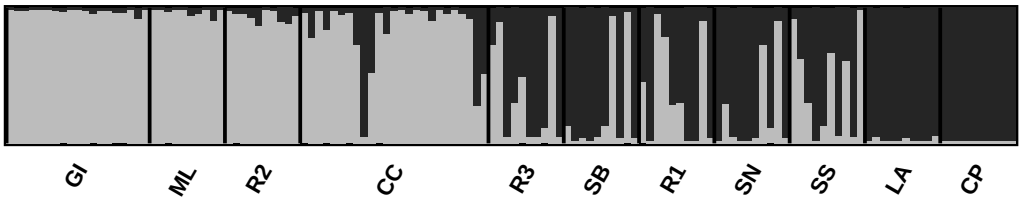

Figure 3.4 Structure results showing proportion of membership of each individual sampled across the hybrid zone. Boxed portions indicate populations with labels referring to locations in Table 3.1 and within each box bars represent individuals, with light gray representing Clapper Rail genotypes and dark gray representing King Rail genotypes. The y-axis represents the proportion of each genotype for each individual.

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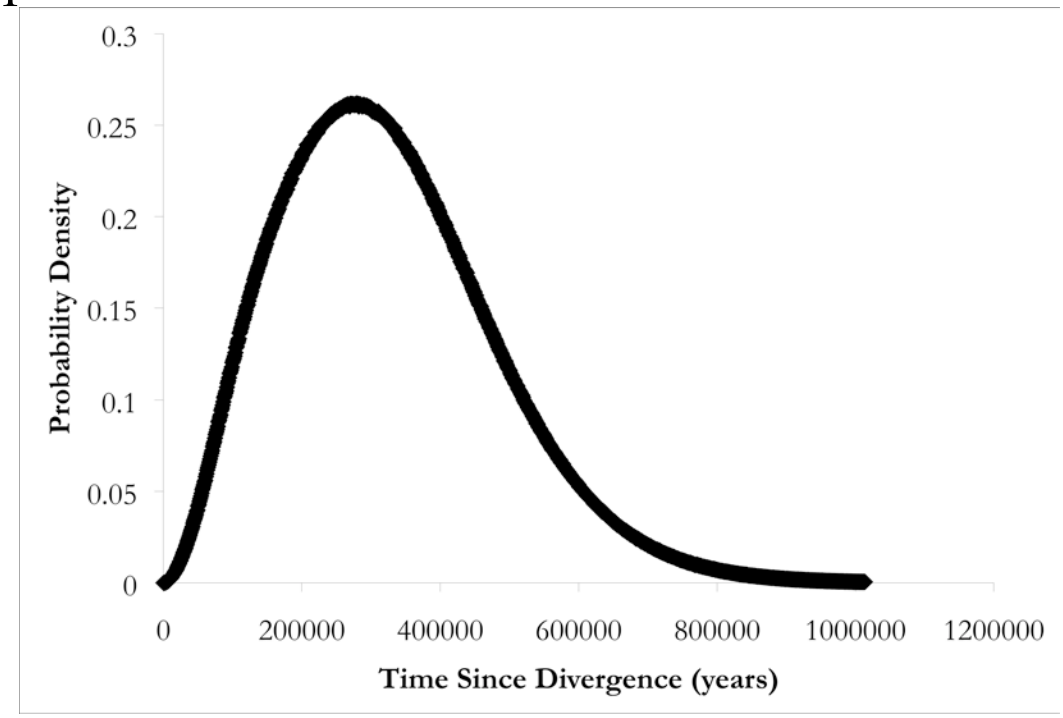

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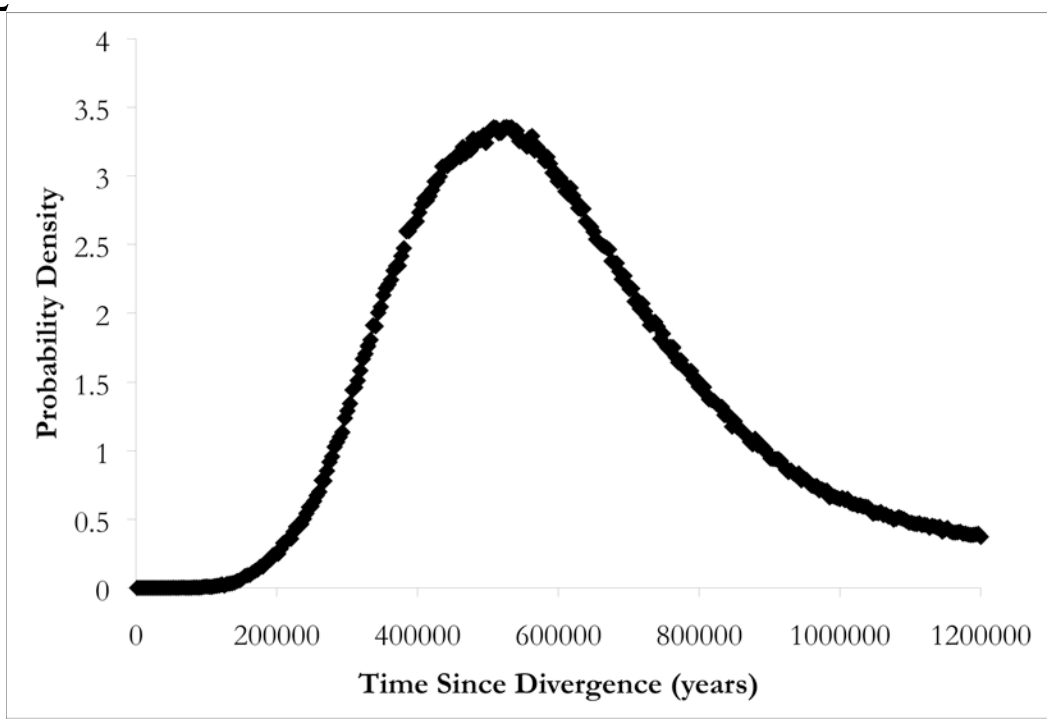

Figure 3.5 Probability distributions of time since divergence estimated with IMa2 (Hey 2010) using mitochondrial (Klicka et al. 2011), autosomal (Ellegren 2007), Z (Ellegren 2007), or autosomal and Z substitution rates (Ellegren 2007). 1. mtDNA 2. Z loci only. Two additional graphs are shown on the next page.

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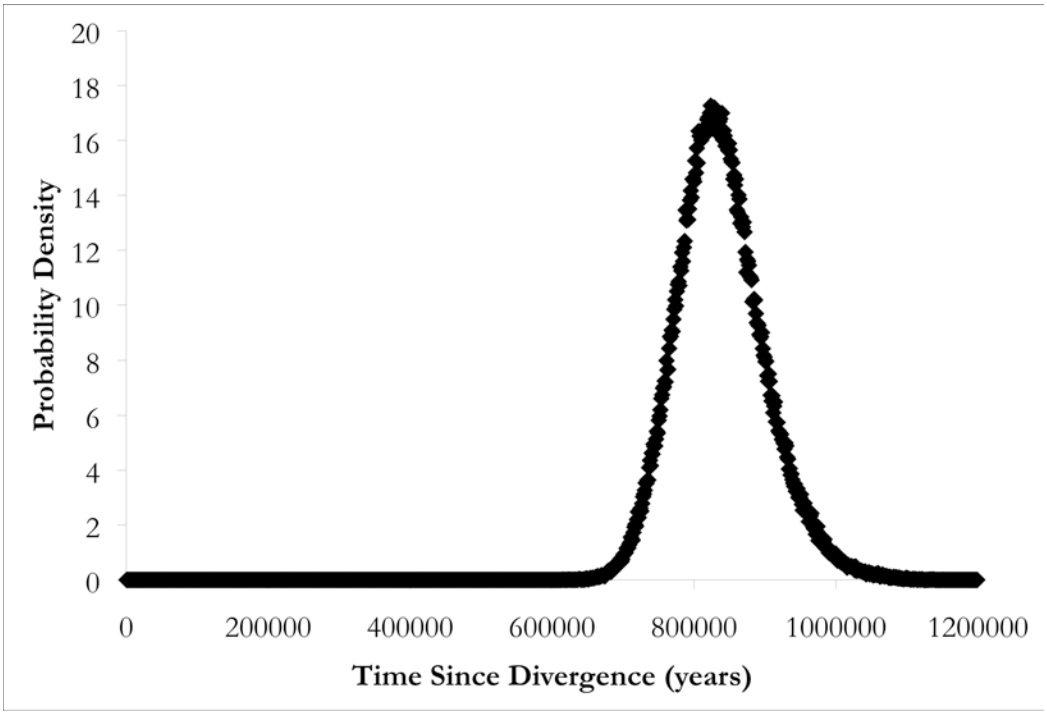

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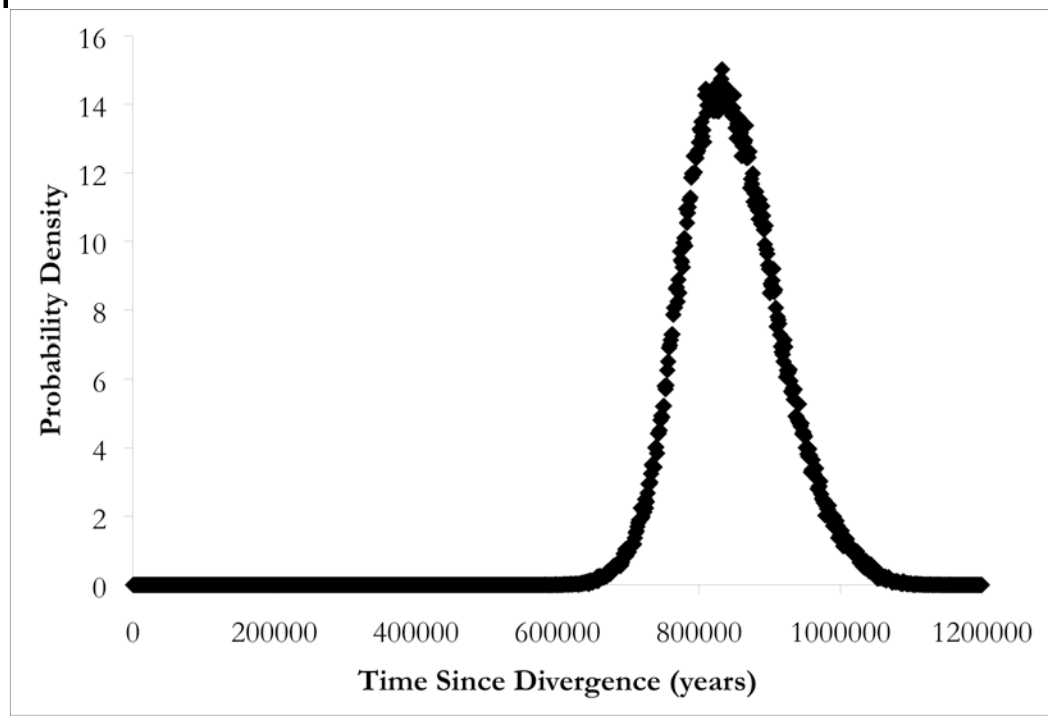

Figure 3.5 continued. 3. Autosomal loci only. 4. Autosomal and Z loci combined.

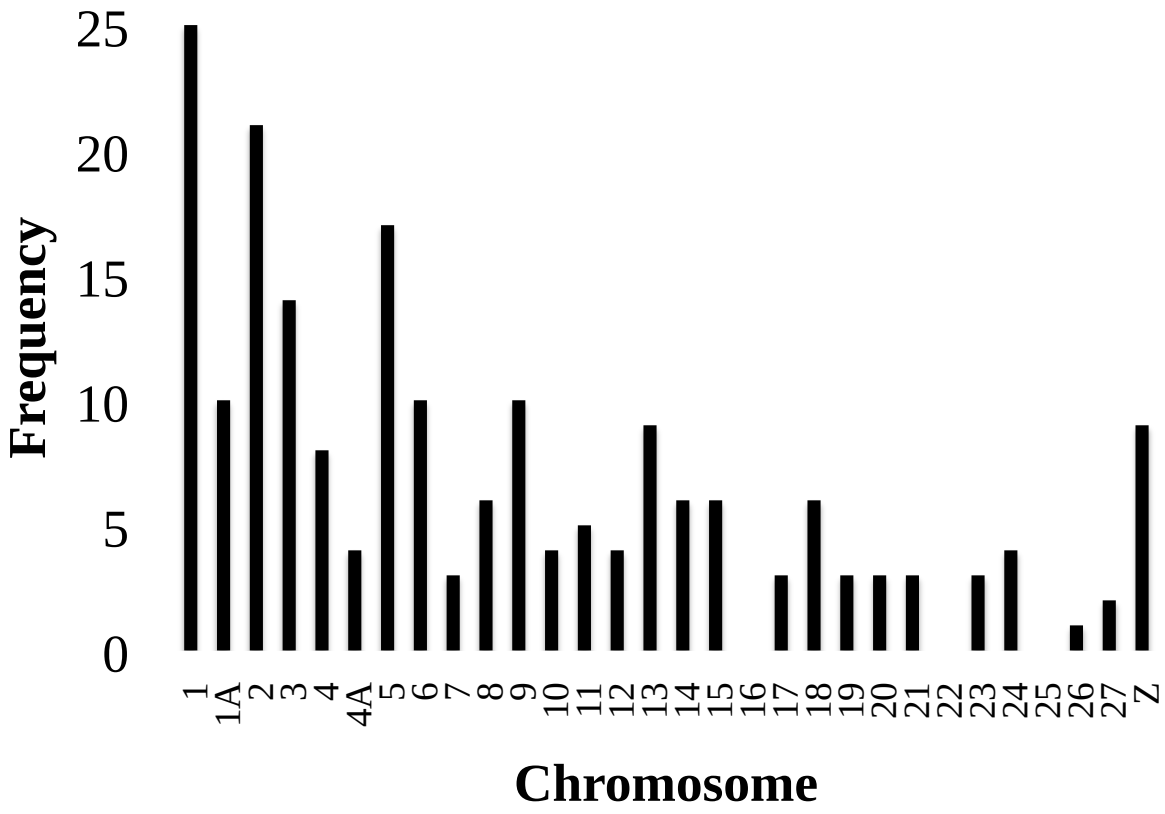

Figure 3.6 Distribution of 200 loci selected to analyze in IMa2 across the chicken or Zebra Finch genomes.

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Table 3.6 Standardized linkage disequilibrium (R) estimates for all sampling localities, estimated using DNAsp. Site codes refer to Table 1. Bold values are significant under Fisher's exact test. Only polymorphic loci are included (N/A signifies monomorphic comparisons): therefore, CP was not included because there is only one polymorphic locus.

		Site Code									
Locus 1	Locus 2	GI	ML	R2	CC	R3	SB	R1	SN	SS	LA
ND2	139	N/A	-0.14	0.33	0.13	0.29	0.14	0.22	0.35	0.07	N/A
ND2	472	N/A	0.44	0.03	0.08	0.38	**0.87**	0.21	0.36	0.13	N/A
ND2	1166	N/A	N/A	-0.11	0.28	0.21	**0.61**	**-0.66**	**0.64**	-0.09	-0.076
ND2	1766	N/A	-0.076	-0.08	0.29	0.29	**0.87**	0.21	**0.63**	0.36	-0.076
139	472	0.20	0.33	0.46	**0.46**	0.17	0.08	**0.68**	0.28	**0.64**	N/A
139	1166	N/A	N/A	-0.14	**0.46**	**0.60**	0.23	-0.50	0.55	-0.33	N/A
139	1766	-0.048	0.55	-0.10	**0.40**	**0.60**	**0.08**	**0.68**	0.40	0.29	N/A
472	1166	N/A	N/A	0.03	0.31	**0.55**	0.47	-0.52	0.23	-0.47	N/A
472	1766	-0.12	-0.076	0.25	0.23	0.17	**1.00**	**0.56**	0.24	0.47	N/A
1166	1766	N/A	N/A	-0.08	**0.47**	**0.60**	0.47	-0.31	**0.73**	**-0.67**	-0.053
mean[1]	all	0.011	0.27	0.16	0.31	0.38	0.48	0.45	0.44	0.35	0.068
mean[2]	nuc	0.011	0.32	0.18	0.39	0.45	0.39	0.54	0.40	0.48	0.053

[1]Mean absolute value of R for all loci.

[2]Mean absolute value of R for nuclear comparisons only.

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Table 3.7 Demographic parameters estimated using IMa2 for multiple datasets. Estimates use substitution rates for mtDNA, Z loci, and autosomal loci. High points are given with 95 highest posterior density in parentheses.

	Dataset			
	mtDNA[1]	Z	Auto	AutoZ
t (years)	279,341 (52,218 - 622,053)	522,593 (183,909 - 1,269,153)	834,478 (716,397 - 970,819)	826,331 (705,080 - 958,496)
Ne_K (individuals)	58,302 (7605 - 316,857)	2,970,311 (1,440,771 - 13,089,852)	1,197,546 (944,951 - 1,547,528)	1,341,349 (1,007,906 - 1,696,010)
Ne_C (individuals)	38,023 (0 - 291,508)	1,905,096 (402,870 - 10,399,502)	2,074,022 (1,696,651 - 2,506,174)	2,041,5778 (1,659,635 - 2,596,305)
Ne_A (individuals)	N/A	594,062 (170,708 - 1,181,296)	406,283 (327,157 - 494,539)	422,866 (337,990 - 510,773)
$m_{K>C}$ (individuals)	0	0.75 (0 - 203.1)	2 (0.942 - 2.935)	1.727 (0.64 - 3.218)
$m_{C>K}$ (individuals)	0	2.85 (0 - 125.8)	2.62 (1.17 - 4.24)	3.276 (0.976 - 4.894)

[1]Migration set to zero, ancestral effective population size not estimated because populations reciprocally monophyletic.

$\times 10^6$ steps following the burnin, which yielded effective sample sizes of 10 or higher. For each of the three nuclear datasets the parameter estimates were very similar across runs, so I only present the results of a single run. For the nuclear datasets the time since divergence was consistently older (~523,000 ybp – 826,000 ybp; Table 3.7) than the mitochondrial estimate, and with much narrower confidence intervals (Figure 3.5). The time since divergence according to the Z dataset (Figure 3.5.2 and Table 3.7) was twice that of the mtDNA dataset (Figure 3.5.1), and was even older for the auto (Figure 3.5.3) and autoZ datasets (Figure 3.5.4). Effective population size estimates for each of the three nuclear datasets were consistently several orders of magnitude higher than those for the mtDNA dataset. For the Z dataset I found, as with the mitochondrial estimate, that King Rails had a higher effective population size (~3×10^6) than Clapper Rails (~2×10^6), but confidence intervals broadly overlapped (Table 3.7). I found the opposite pattern for auto and autoZ, with King Rails having a lower effective population size (~1.2 - ~1.3×10^6) compared to Clapper Rails (~2×10^6). Confidence intervals of effective population size did not overlap between the two species for the auto dataset, but they did for the autoZ dataset (Table 3.7). Ancestral effective population sizes for each of the three nuclear datasets were consistently lower than the estimates for each species (Table 3.7). Migration estimates were inconsistent across datasets, with very broad confidence intervals for the Z dataset. The auto and autoZ datasets showed higher migration from Clapper into King rails, but confidence intervals overlapped for both datasets (Table 3.7).

DISCUSSION

This first morphological and genetic characterization of the King Rail/Clapper Rail hybrid zone suggests that an environmental salinity gradient is contributing to their reproductive isolation,

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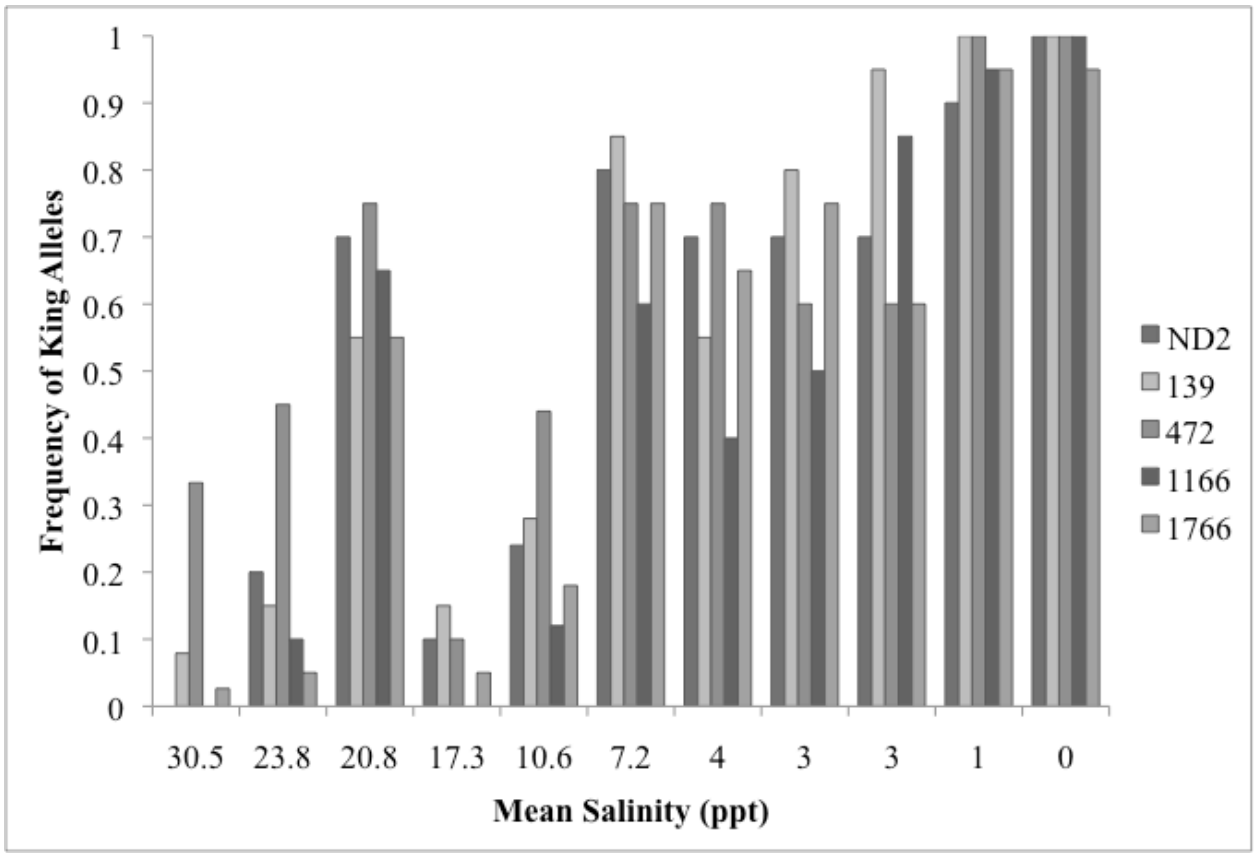

Figure 3.7 A histogram showing the relationship between King Rail allele frequencies and mean salinity. Allele frequencies are shown as columns, with each shade representing a different locus. A value of zero means that all individuals were fixed for the Clapper Rail allele at that locus, while a value of one means that all individuals were fixed for the King Rail allele.

and may have been instrumental in their ecological speciation. The relationship is striking between allele frequencies and mean salinity per site (Figure 3.7). The hybrid zone would have to be improbably young, on the order of less than one year, to explain the narrow widths of the genetic and morphological clines (Figure 3.3, Table 3.4) solely by neutral diffusion after secondary contact. This is especially true given the high dispersal capabilities of rails. Although brackish marsh that would facilitate secondary contact has likely always existed in Louisiana estuarine systems, recent human influence has had a significant effect on the marshes. These effects may have resulted in more opportunities for hybridization. Several of the sites where I collected are around Calcasieu Lake, including CC, ML, SB, SN, and SS (Figure 3.1.2). This formerly freshwater lake was first dredged in 1874, but deep dredging, flooding the lake with high salinity Gulf of Mexico water, was not completed until 1941 (LCW Conservation 2002). On a finer scale the occurrence of breeding King Rails in newly created freshwater impoundments in the middle of coastal saltmarsh illustrates their dispersal and colonization abilities.

The coincidence and concordance of the rail hybrid zone with the salinity gradient provides a terrestrial counterpart to a similar pattern found in Chesapeake Bay killifish (*Fundulus heteroclitus*). The killifish are distributed more or less continuously along a salinity gradient from the Atlantic coast, upstream into the streams and rivers that feed the Chesapeake. A cryptic hybrid zone was identified via microsatellite data between a freshwater genetic lineage and a saltwater lineage, centered at a salinity of approximately 0.5 ppt (Whitehead et al. 2011). Genetically encoded gene expression differences partially explain the adaptive differences in salt tolerance between the fish populations (Whitehead and Crawford 2006; Whitehead 2009; Whitehead et al. 2011). Similar processes might account for differences in salt tolerance between the rail species.

The interdigitation of salt and freshwater marshes near the coast make the rail hybrid zone reminiscent of the mosaic hybrid zones described for *Gryllus* crickets (Ross and Harrison 2002) in the northeastern United States, where species are partitioned by habitat across a patchy mosaic, with narrow hybrid zones occurring wherever these two habitats meet. On a large geographic scale, the salinity gradient in Louisiana represents a linear change from inland freshwater marshes to coastal saltmarshes. But near the coast, the marshes of southwest Louisiana are patchy with respect to salinity, and transitions from freshwater marsh to brackish marsh to saltmarsh across the landscape can occur abruptly. For example, the saltmarsh and an artificial freshwater impoundment are separated by a small beach ridge (< 5m high) at one coastal locality (Willow Island). I collected and sequenced four Clapper Rails from this saltmarsh, and individuals had similar genotypes to those found at a pure Clapper Rail population (GI, Figure 3.1B). Less than 300 meters away in the freshwater impoundment I collected and sequenced a “pure” King Rail and observed several others that appeared phenotypically pure. Birds could be heard calling from the other side of the ridge, but did not appear to be hybridizing in the absence of brackish habitat where the two could occur syntopically. Thus, availability of brackish marshes of intermediate salinity is apparently a prerequisite for hybridization.

Signatures of ecological speciation due to adaptive divergence for different salinities have been found in a number of taxa, including killifish (Whitehead and Crawford 2006; Fuller et al. 2007), amphipods (Seidel et al. 2010), and sunflowers (Karrenberg et al. 2006). The genome scan I performed by using next-gen sequencing to search for differentiated loci suggests a role for osmoregulation across the gradient in the ecological speciation of the rails.

Approximately one third of the divergent autosomal markers I found have been implicated in osmoregulation (Table 3.3).

The rapid transition in the size of the salt glands relative to total body weight is also consistent with adaptive osmoregulatory divergence, because the size of this organ is directly related to the ability to excrete excess inorganic ions from the blood (Peaker 1971). Disruptive osmoregulatory forces should be similar for all euryhaline osmoregulators inhabiting a salinity gradient, whether aquatic or terrestrial, provided the organisms are obtaining water by drinking or through osmosis. At the freshwater end of the gradient, the animal's blood plasma is hyper-osmotic relative to the water; thus there is pressure to shed excess water and retain inorganic ions. At the saline end of the gradient, the organism's blood plasma is hypo-osmotic relative to the water, thus there is pressure to retain water and shed excess inorganic ions. At an intermediate salinity in the gradient the organism's blood plasma is iso-osmotic relative to the water and the organism should be at osmoregulatory equilibrium. Therefore, an individual in the middle of the hybrid zone may not be as well adapted for osmoregulatory challenges as individuals closer to the extremes and could potentially have reduced fitness relative to individuals further from the center of the zone.

Several lines of evidence point to differences in osmoregulatory ability between these two species. First, experimental evidence indicates that Clapper Rails are better able to handle a salt load than unacclimated King Rails (Conway et al. 1988). Second, Clapper Rails have significantly larger nasal salt glands than King Rails. Third, birds that are primarily King Rails genotypically appear to have developmental difficulties in a high salinity environment. Evidence for this exists from my third collecting site on Rockefeller State Wildlife Refuge (R3). I collected ten birds from the marshes at this site, and found a high salinity (~20.8 ppt) relative to other sites

at approximately the same distance from a saltwater source (Table 3.2). This high salinity was a direct result of human influence because the refuge manages a large section of the marsh for waterfowl hunting. This management involves artificially flooding the marsh with saltwater to kill the freshwater vegetation, resulting in a large pool of open water. This practice had been completed two years prior to my collecting efforts (Rockefeller SWR staff, pers. comm.). Seven of the ten birds collected at this site have majority King Rail genotypes (Figure 3.4), and three of these birds appeared to have developmental problems. Two of them had large white patches of feathers missing pigmentation on the breast and belly and another had a small, deformed testis that appeared to have an abnormal growth. These abnormalities were not observed at any other collecting locality.

One important consideration in the discussion of osmoregulatory adaptations between the two species is the intake of water and inorganic ions. Water can be taken from the environment directly by drinking in both saline and freshwater environments, or indirectly by diet. Inorganic ions can be taken from drinking in saline environments, or through diet in freshwater environments. I observed birds drinking directly from open water on multiple occasions during fieldwork. I also saved stomach contents for most specimens and found low variability in diet across the gradient. Stomachs with identifiable remains from birds collected from salt or brackish marshes almost exclusively contained fiddler crab exoskeletons (*Uca* sp.), whereas those collected in freshwater (LA and CP) contained a variety of organisms, including frogs, crayfish, and snails. This suggests that diet does not change within the brackish portion of the gradient, at least during the time of year I was sampling (April and June).

A unique component of this system is the narrow distribution of one of the parental species, Clapper Rails. The width of their distribution is narrower than the hybrid zone itself.

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Despite this narrow width, I found fixed differences in mtDNA and nuDNA markers between inland and saltwater populations. This may be a result of very high breeding densities in saltmarshes, thereby limiting breeding site potential for hybrids or King Rails (Eddleman and Conway 1998). Additionally, there is no evidence that the two lineages are in direct competition for resources. Clapper Rails that breed in saltmarshes adjacent to freshwater marshes in which King Rails have been extirpated do not breed in these freshwater marshes (Eddleman and Conway 1998). Some King Rails spend a portion of the nonbreeding season in saltmarshes, but have never been recorded breeding in them (Meanley 1992). These birds are physically capable of dispersing across the gradient. The average natal dispersal distance of ~55 km from a banding study supports this conclusion (Hon et al. 1977). Additionally, I collected and sequenced a juvenile "pure" Clapper Rail from a rice field ~50 km from the coast in November of 2010 and another Clapper Rail was found under a bridge in the mountains of eastern North Carolina in fall 2011 (BJO-1997, North Carolina Museum of Natural Sciences). This dispersal evidence is also supported by a study conducted in fall 2000 of offshore juvenile tiger shark feeding behavior, which found that a large number (23 out of 72) of them contained Clapper Rail remains (Carlson et al. 2002).

Overall, my results suggest that reproductive isolation of the rails, which are sister species, is at least partly due to ecological speciation. The genetic and morphological clines are strikingly coincident with the salinity gradient, there is genomic evidence for adaptive divergence in osmoregulatory genes, and rails are fully capable of dispersing across the gradient, yet the hybrid zone is narrow. Finally, there is evidence that an organ directly involved in osmoregulation is functionally divergent between the two lineages. Regardless of whether hybrids suffer reduced fitness because of osmoregulation factors, genetic incompatibilities, or

something else, it is clear that natural selection against hybrids plays an important role in the maintenance of this hybrid zone. The width of the rail zone is much narrower than the width of the *Passerina* bunting Great Plains hybrid zone (Carling and Brumfield 2008), which is maintained, at least in part, by reduced fertility in heterogametic female hybrids. That the mitochondrial cline in the rail hybrid zone is narrower than the four nuclear clines suggests a potential role for Haldane's Rule, but I note that the confidence limits overlap broadly between the mitochondrial and nuclear width estimates. The rail hybrid zone is similar to the *Peromyscus* hybrid zone in the southeastern USA (Mullen and Hoekstra 2008), where phenotype and genotype are partitioned by habitat across a soil gradient. That the selection coefficients for the rail hybrid zone are several orders of magnitude higher than those estimated for the mouse zone (Table 3.5) suggests the salinity gradient is a stronger selective force against hybridization than are predators selecting against hybrid mouse phenotypes. Future studies of the rail hybrid zone should examine, at a finer scale, the selective factors acting against hybrids.

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CHAPTER 4

INFERENCES ON NATURAL SELECTION AND DISPERSAL DISTANCE FROM GENOTYPIC DISEQUILIBRIA AND QUANTITATIVE CHARACTER COVARIANCE IN A RAIL HYBRID ZONE

INTRODUCTION

Efforts to understand the evolutionary processes involved in speciation have benefited from the unique perspective provided by hybrid zones. The genetic and phenotypic patterns observed in hybrid zones represent the outcome of hundreds of generations of admixture, combined with the action of evolutionary forces such as selection, recombination, gene flow and genetic drift. The extensively crossed and backcrossed populations found in hybrid zones offer the possibility of measuring some of these forces in nature (Barton and Gale 1993). A comparable hybridization experiment in the lab would be difficult, if not impossible, to perform with many organisms.

Renewed interest in hybrid zones has been spawned by the relative ease with which multi-locus molecular genetic data can now be acquired. This has catalyzed the development of analytical tools, particularly in the inference of evolutionary parameters from nonrandom associations among traits. These include genotypic disequilibria, cytonuclear disequilibria, and covariance among quantitative characters (Barton 1983; Asmussen et al. 1989). One can also take advantage of the matrilineal inheritance of mitochondria to make inferences about the directionality of crosses in hybridizing populations (Arnold 1993).

In a panmictic population without selection, genotypic disequilibria among unlinked loci will arise only through genetic drift or epistasis. In subdivided populations, however, there can be significant disequilibria overall, despite an equilibrium state in all subpopulations (Nei and Li 1973). The disequilibria, which would quickly decay to zero via recombination, are maintained

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by the flux of immigrant gametes among subpopulations that differ in gene frequency. This same phenomenon operates in many hybrid zone centers, where disequilibria result from the presence of parental, or advanced backcross, gametes amongst the admixed gametes. These disequilibria would normally decay at a rate proportional to the rate of recombination, but the constant dispersal of parentals into the zone maintains the disequilibria (Barton and Gale 1993).

Selection against hybrids will also tend to create genotypic disequilibria in hybrid zones by removing recombinant genotypes. Because the strength of the disequilibria is proportional to both the rate of parental migration and to the amount of selection against hybridization, inferences about both of these parameters can be made from the level of disequilibria (Barton and Gale 1993). The role of selection, dispersal, and recombination in maintaining disequilibria is exemplified in the simplest case where selection acts only against heterozygotes (Nürnberger et al. 1995). If selection against hybrids is strong, hybrids are removed from the population before recombination can break up parental gene combinations. If selection is weak, a proportion of recombinant hybrids are maintained in the population with a concomitant reduction in the strength of the disequilibria.

Here, I present an analysis of genetic disequilibria and quantitative character covariance at the center of a hybrid zone between King and Clapper Rails in Louisiana. These measures are used to estimate the amount of selection on the quantitative traits relative to that experienced by the genetic markers. I make indirect estimates of dispersal distance from both genotypic disequilibria and character covariances. Although the number of samples that can reasonably be collected from bird populations limits the strength of inference in some cases, these estimates provide useful insight on the magnitude of important evolutionary parameters, given the paucity

of such information that has been available for birds (Barrowclough 1978; Moore and Buchanan 1985; Moore and Dolbeer 1989).

King Rails (*Rallus elegans*) and Clapper Rails (*R. longirostris*) are wetland birds that form a hybrid zone situated on a salinity gradient that extends from inland freshwater marshes to coastal saltmarsh (Chapter 3; Figure 4.1). The two species are behaviorally and vocally similar and have long been considered ecological replacements of one another (Meanley 1992; Olson 1997). Clapper Rails breed in *Spartina alterniflora* dominated saltmarshes at very high densities, and King Rails have a patchy breeding distribution in freshwater marshes with highest densities found in marshes near the coast in the southeastern portion of their range (Meanley 1992; Eddleman and Conway 1998). No geographic barriers are known between the current distributions of the two species, and they occupy two different habitats with opposing physiological effects. They come into contact and hybridize in brackish transition zones along the length of their distribution (Meanley and Wetherbee 1962; Bledsoe 1988; Meanley 1989; Olson 1997; Eddleman and Conway 1998).

Previous studies of King and Clapper rails have demonstrated physical and physiological differences associated with osmoregulation (Conway et al. 1988). Both species have nasal salt glands on the dorsum of the skull, and these are significantly larger in Clapper Rails (Olson 1997). The salt gland is a relatively simple organ composed of mitochondria-rich cells that, by creating a concentration gradient similar to the cells found in fish gills (Peaker 1971), is capable of filtering the blood and concentrating ions into a solution exceeding 20 times the osmolality of blood plasma (Hughes 2003). Salt glands are needed in rails to maintain osmoregulatory equilibrium, because their kidneys are incapable of concentrating inorganic ions more than three times the concentration found in their blood (Braun 1999). Larger salt glands (relative to body

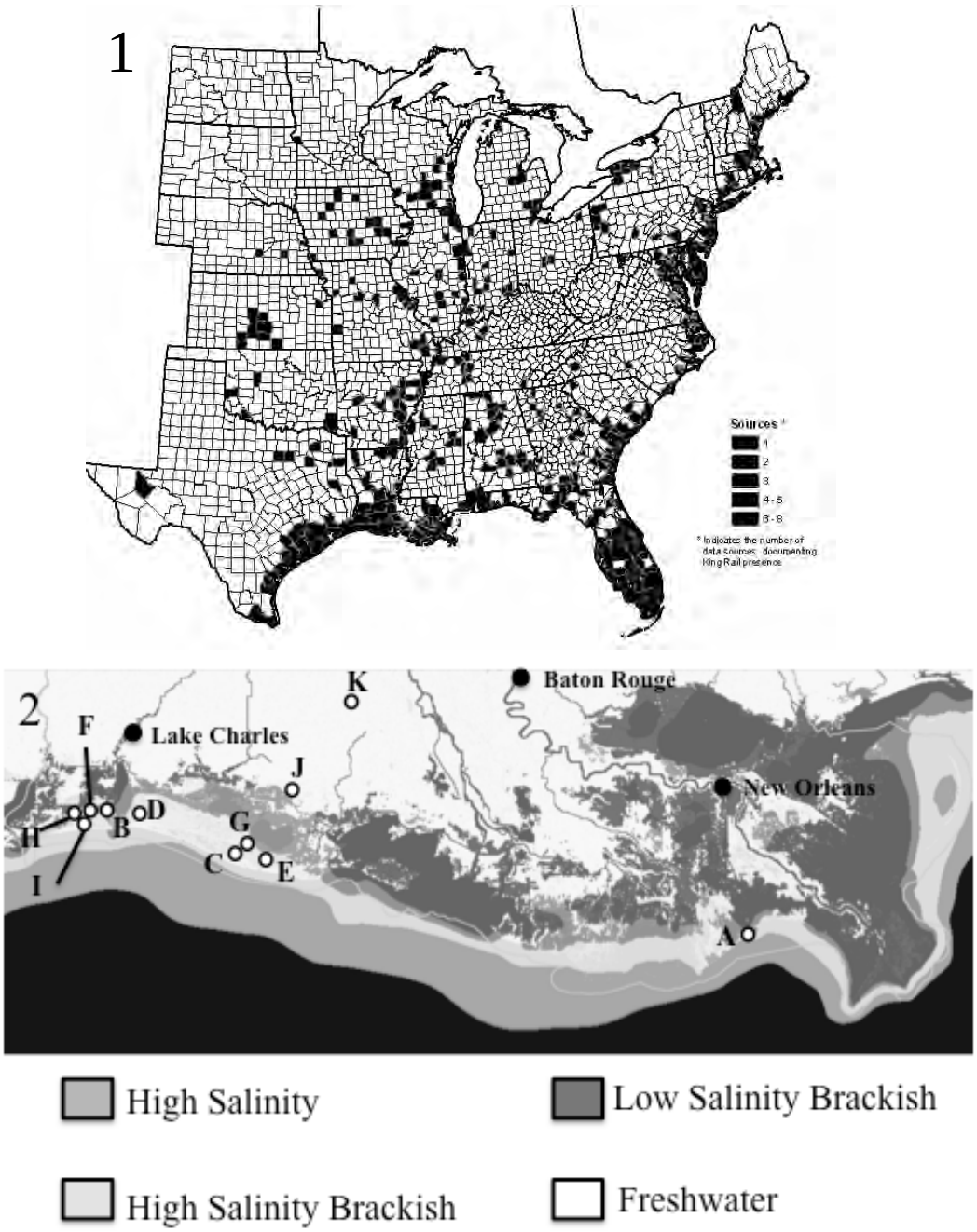

Figure 4.1 1) The distributions of King and Clapper rails in the eastern United States. Counties where King Rails have been recorded are shown in black, Clapper Rails are distributed in saltmarshes along a narrow band of the coast from New England to south Texas.
2) Sampling in south Louisiana along the salinity gradient. Circles show approximate sampling localities. These site codes correspond to Table 4.1: A. GI, B. ML, C. R2, D. CC, E. R1, F. SB, G. R3, H. SN, I. SS, J. LA, and K. CP.

size) are capable of excreting more salt from the blood and at higher concentrations (Peaker 1971). Conway et al. (1988) gave both species high salt loads and found that Clapper Rails were capable of excreting salt more quickly and at higher concentrations. By studying the genetic and morphological change across this ecological gradient, I seek to understand if osmoregulatory differences could be responsible for ecological speciation between these two lineages.

Morphological differentiation has been observed in a variety of taxa between populations that live in freshwater and saltwater environments (Greenberg and Droege 1990; Greenberg and Olsen 2010; Luther and Greenberg 2011). Larger bill size in mangrove and saltmarsh passerines relative to freshwater or non-tidal dwelling sister lineages has been called an ecological rule (Luther and Greenberg 2011). This is typically attributed to an island effect in these different habitats, whereby interspecific competition is lower because of lower diversity, but high abundance and densities of the species that do occur in these saline environments results in higher intraspecific competition (Greenberg and Olsen 2010). Saltmarsh passerines have longer bills with a narrower width, which has been attributed to a dietary change to arthropods from a primarily seed-based diet of their closest relatives (Grenier and Greenberg 2005). These morphological differences have not been studied in the context of a hybrid zone, or in a nonpasserine, where populations at either end of a salinity gradient hybridize along the salinity gradient.

METHODS

We collected and prepared 95 adult and 4 fully-fledged male specimens of Clapper Rails (*Rallus longirostris*) and King Rails (*R. elegans*) from eleven different marshes in southern Louisiana (Figure 4.1) spanning the salinity gradient from a barrier island with salinities typical of oceanic

water to interior freshwater marshes and rice plantations (Table 4.1). I collected an additional 40 females or juveniles not included in the morphological analyses. The barrier island habitat consisted of a matrix of Saltmarsh Cordgrass (*Spartina alterniflora*) and Black Mangrove (*Avicennia germinans*). Brackish marsh intermediate sites consisted of a mix of Saltmarsh Cordgrass, Saltmeadow Cordgrass (*S. patens*), and Common Reed (*Phragmites australis*), and my two freshwater sites were dominated by either cattails (*Typha* sp.) or cultivated rice (*Oryza sativa*). Birds were lured out of dense marsh vegetation using two territorial audio recordings (one or each species) that were played through a small speaker and set to order them randomly on repeat using an iPod (Apple, Inc., Cupertino, CA). Birds were then collected using either a shotgun or mist-nets. Specimens were weighed immediately and then frozen for preparation at Louisiana State University Museum of Natural Science. All birds were prepared as traditional museum round skins with a spread wing saved. After sufficiently drying each bird, I took a series of standard morphological measurements intended to capture the overall morphological variation (Figure 4.2). These measurements included salt gland weight, bill length, bill width, bill depth (all bill measurements from the anterior end of the nares), tarsus length, middle toe length, wing length, and wing depth (measured from the base of the alula). All bill and foot measurements were taken to the nearest 0.01 mm with a Mitutoyo Digimatic Point Caliper and wing measurements were made using a standard chord ruler by a well-trained undergraduate volunteer, Sydney N. Pierce.

All statistical analyses were conducted using the R package (R Foundation for Statistical Computing, Vienna, Austria). I ran ANOVAs on all morphological characters from specimens collected on opposite ends of the salinity gradient (GI, LA, CP; Table 4.1). I also ran ANOVAs

Table 4.1 Site code, sampling localities, number of collected adult and fully-fledged males (N), distance from the nearest saltwater source (km), and voucher numbers.

Distance (km)	Locality	N	Code	Salinity (ppt)	Voucher Numbers
0.0	Jefferson Parish; Grand Isle, 1.6 km W Grand Isle, 29° 14.245' N, 90° 0.283' W	15	GI	30.5	63400, 63403, 63404, 63406, 63407, 63474 - 63478, 63536, 63538 - 63541
1.6	Cameron Parish; Sabine NWR, E Mud Lake Road, 7.6 km NNE Holly Beach, 29° 50.079' N 93° 25.673' W	7	ML	17.3	63519 - 63525
2.2	Cameron Parish; Rockefeller SWR, 15.3 km SE Grand Chenier, 29° 41.203' N 92° 50.678' W	8	R2	23.8	63434, 63436 - 63442
3.0	Cameron Parish; 3.2 km NNE Cameron, Amoco Road, 29° 49.347'N 93° 18.421' W	22	CC	13.5	63454 - 63462, 63491 - 63493, 63495 - 63499, 63501 - 63505
6.9	Cameron Parish; Rockefeller SWR, 4 km W North Island, 29° 42.451' N 92° 46.491' W	10	R3	20.8	63444 - 63453
7.3	Cameron Parish; Sabine NWR, Second Bayou, 7.2 km N Holly Beach, 29° 50.133' N 93° 28.165' W	9	SB	7.2	63409, 63411 - 63417
7.6	Vermilion Parish; Rockefeller SWR, 11.3 km W Pecan Island, 29° 38.776' N 92° 34.207' W	10	R1	4	63418 - 63427
8.0	Cameron Parish; Second Bayou, 5.6 km NNW Holly Beach, 29° 48.260' N 93° 29.075' W	6	SN	3	63515, 63517, 63528, 63532 - 63534
8.8	Cameron Parish; Second Bayou, 4.3 km WNW Holly Beach, 29° 47.771' N, 93° 29.871' W	9	SS	3	63506 - 63514
30.0	Cameron Parish; Lacassine NWR, 10.5 km SW Lowry, 29° 58.723'N 92° 51.737' W	8	LA	1	63480 - 63487
75.0	St. Landry Parish; 6.4 km NNW Church Point, Dusty Road, 30° 27.724' N 92° 14.037' W	7	CP	0	63465, 63466, 63468, 63469, 63471 - 63473

on the same characters divided by tarsus length to account for allometric scaling (except for tarsus length). The only characters that showed significant differences after correction for body size were salt gland weight and bill length; therefore, I do not discuss the other measurements further except for tarsus length as a proxy for differences in body size (Table 4.2).

The marshes of southwest Louisiana are large, but suitable habitat is patchily distributed; therefore, a straight-line transect is not the best characterization of the ecological gradient along which Clapper and King rail populations occur. Based on initial scouting observations, in which I examined phenotypic variation at different sites, salinity appeared to be the most important factor in predicting the phenotypic make-up of each population. Therefore, I sampled marshes of varying salinities and distances to saltwater sources (Figure 4.1.2). To approximate the transition from saltmarsh to freshwater marsh, I measured the distance from the center of each sampling site to the nearest source of high salinity (salinity > 25 parts per thousand) by tracing along open canals using Google Earth v6.0.3.2197 (Google Inc., Mountain View, CA). These distances were used for all cline analyses (Table 4.1).

I fit maximum-likelihood clines to salt gland weight/tarsus length, bill length/tarsus length, and tarsus length. To apply the frequency likelihood function developed for the molecular data to the morphological and environmental data (neither of which are inherently frequency data), I had to first conduct a Bernoulli transformation of the data. I transformed morphological data into frequencies per site by transforming each sample into a Bernoulli trial (e.g. 0 or 1), where 1 means that the sample is less than a constant and 0 means the sample is greater than or equal to that constant. To determine the constant for each trait, I created a vector of the midpoints between all the sample values. I then iteratively treated each midpoint as the constant,

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Table 4.2 Means, Standard Deviations, and ANOVA results comparing Clapper Rails and King Rails collected away from the hybrid zone for each morphological character and each character corrected by dividing by tarsus length. Significant values ($P < 0.05$) are in bold. All measurements are in millimeters except salt gland weight and body weight, which are in grams.

	GI		LA & CP		Uncorrected		Corrected	
Character	Mean	SD	Mean	SD	F Value	Pr(>F)	F Value	Pr(>F)
Salt Gland Weight	0.16	0.04	0.05	0.05	**30.57**	**1.74E-05**	**42.26**	**1.93E-06**
Bill Length	43.29	2.17	41.18	2.49	**6.10**	**1.99E-02**	**49.15**	**1.27E-07**
Bill Depth	8.24	0.30	9.39	0.45	**66.45**	**7.12E-09**	0.03	0.87
Bill Width	4.90	0.48	5.40	0.45	**8.68**	**6.40E-03**	0.81	0.38
Tarsus Length	52.99	1.72	60.15	3.46	**51.54**	**8.20E-08**	-	-
Middle Toe Length	55.94	2.28	61.66	2.52	**42.36**	**4.71E-07**	2.76	0.11
Wing Length	148.20	3.57	165.53	6.05	**91.42**	**2.57E-10**	0.71	0.41
Wing Depth	112.80	5.97	121.47	4.61	**19.81**	**1.24E-04**	3.99	0.06
Body Weight	335.67	24.85	385.33	21.08	**34.85**	**2.38E-06**	0.30	0.59

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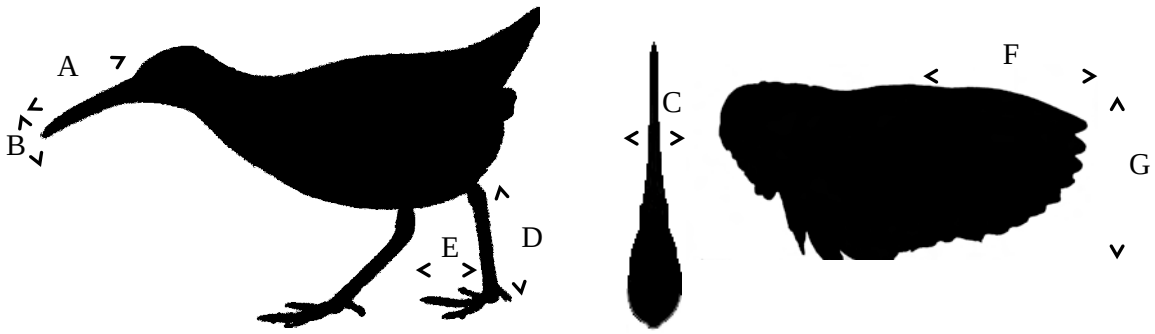

Figure 4.2 Three silhouettes from left to right of a whole rail, a rail head from above, and a spread wing showing approximations of the measurements taken. A. bill length, B. bill depth, C. bill width, D. tarsus length, E. middle toe length, F. wing length, and G. wing depth.

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generating a frequency per site and calculating the information content of that distribution. I then chose as the constant the midpoint that yielded the maximum information.

Cline shape was modeled by combining three equations (Szymura and Barton 1986; Szymura and Barton 1991) that describe a sigmoid shape at the center of a cline and two exponential decay curves (tails) on either side of the central cline. The sigmoid shape is described by two parameters, width (*w*) and center (*c*). The decay curves are each described by two parameters, delta (*d*; distance between the tail and the center) and tau (t; slope of the tail/slope of the sigmoid; Gay et al. 2008). The whole cline can be scaled using *Pmin* and *Pmax*, which are the minimum and maximum frequencies for the cline. I fit clines using a new software package (HZAR) that provides functions for fitting genetic, ecological and morphological data from hybrid zones to these classic equilibrium cline models using the Metropolis-Hasting algorithm in the R platform (Derryberry et al in prep).

We fit a series of 15 cline models to each data set. These models can be grouped into three sets: set 1 has no scaling (*Pmin* = 0, *Pmax* = 1), set 2 has fixed scaling (*Pmin* = observed minimum frequency, *Pmax* = observed maximum frequency), and set 3 fits *Pmin* and *Pmax*. Within each set, there are five variations, each of which includes the sigmoid cline but (A) has no tails, (B) has only a left tail, (C) has only a right tail, (D) has mirrored tails (same *d* and *t*) and (E) has independent tails (different *d* and *t*). For each data set, I ran each model for 1.0×10^6 generations to set up the covariance matrix. I then ran three independent chains of three runs each for a total of 9.0×10^6 generations and assessed the stability and convergence of the MCMC trace, the posterior distribution, and the cline parameters (for an example, see Figure 3.3.2). As some models displayed anomalies, I ran all models for an additional eight independent runs each with a different covariance matrix to ensure adequate exploration of the likelihood space. These

runs added a total of 8.0 x 10^6 generations. After these runs, all traces showed stability and convergence. I identified and discarded the burn-in and concatenated independent runs for each model. I used corrected Akaike Information Criterion (AICc) to perform model selection. To visualize the best model for each trait, I plotted the maximum likelihood cline and the 95 percent credible cline region from the posterior distribution.

Parameters estimated in the process of fitting cline models can be used to determine concordance between clines from different traits as well as the strength of selection against hybrids. For each trait, I generated 95 percent credible intervals for cline center and width from the posterior distribution for the selected model. To test for significant differences between estimates of *w* and *c* for each locus, I used two log-likelihood score confidence intervals (Edwards 1992). If these confidence intervals did not overlap then I considered the parameters to differ significantly.

Covariance and Dispersal Estimates

We scored all individuals for the four nuclear loci from Chapter 3 (*139*, *472*, *1166*, and *1766*) to generate a mean hybrid index for each locality. The hybrid index for each individual was calculated by scoring each diagnostic Clapper Rail single nucleotide polymorphism (SNP) as a zero and each King Rail SNP as a 1. For the four biallelic loci a score for a pure King Rail would be eight, and a score for a pure Clapper Rail would be zero. I then estimated the mean hybrid index for each locality and calculated a linkage disequilibrium metric (D) between all pairs of polymorphic loci within sites using the program DnaSP v5 (Rozas et al. 2003).

To examine the relative strength of selection acting on morphological characters, I conducted an indirect test on the covariance between unlinked genetic characters and morphological characters (Sanderson et al. 1992). I used the average linkage disequilibrium

across the four loci within the four sites as a null model to calculate the expected covariance to compare with the covariance between the genetic and morphological characters. When the estimated covariance is greater than the expected covariance, I can infer that there was more selection on the morphological character (Sanderson et al. 1992). I used the following equation to calculate expected covariance between a morphological trait and hybrid index: $\text{cov}(z, z') = \frac{1}{2}\Delta\bar{z}\,\Delta\bar{z}'D'$. Where $\Delta\bar{z}$ is the difference in diagnostic alleles between parental populations, for the four loci I used this equals 8, D' is the average linkage disequilibrium calculated within a site between loci, and $\Delta\bar{z}'$ is the mean difference of the morphological character between parental sites (Sanderson et al. 1992). For localities at the center of the hybrid zone I also calculated the standardized linkage disequilibrium ($R_{ij} = D_{ij}/\sqrt{p_i q_i\, p_j q_j}$) to facilitate comparisons to published values in other hybrid zone studies (Szymura and Barton 1991).

The equilibrium balance between recombination rate and dispersal distance is dependent on the amount of covariance between characters. Therefore, I can calculate the root-mean-square dispersal distance (σ) between offspring and parents using the following equation: $\sigma = \sqrt{Drw_1w_2}$ where D is the linkage disequilibrium between two genetic loci, r is the intergenic recombination rate (we assume $r = 0.5$), and w_1 and w_2 are the two estimated cline widths. To estimate the dispersal distance using morphological characters, I converted the previous equation to the following: $\sigma = \sqrt{((2r(\text{cov}\, z_1', z_2'))/(\Delta z_1'/w_1)(\Delta z_2'/w_2))}$. Here, $\Delta z_1'$, and $\Delta z_2'$ are the mean differences between parental samples for each character (Sanderson et al. 1992; Brumfield 1999).

We used these dispersal estimates additionally to determine the potential effects of selection acting on hybrids. Assuming neutral diffusion after secondary contact, I modeled the hybrid zone's structure assuming an absence of selection by using the equation $w = 2.51\sigma\sqrt{t}$,

where *w* is the width of the hybrid zone, σ is the root mean square dispersal distance, and *t* is the time since contact (Barton and Gale 1993). I solved for *t* and calculated it using my estimates of the other parameters, and also solved for *w* using two estimates of *t* (45 and 250 years). I estimated the strength of selection that favors different alleles on opposite ends of a sharp ecological gradient, where *s** represents the mean fitness difference between populations at the center versus the edges (Barton and Gale 1993). I used the equation $w = 1.732\sigma\sqrt{s^*}$ assuming no dominance, and also substituted 1.732 with 1.782 for dominance and solved for *s** (Barton and Gale 1993).

RESULTS

As in Chapter 3 I fit clines to salt gland weight (mg)/tarsus length (mm, Figure 4.3.1), bill length (mm)/tarsus length (mm, Figure 4.3.2), and tarsus length (mm, Figure 4.3.3). Estimates of cline width and center were concordant and coincident between the three morphological characters (Table 4.3). These estimates were also concordant and coincident with the centers and widths of genetic clines, except for locus *472*, which had a significantly greater width than bill length (Table 4.3). The hybrid index I calculated per site showed that all intermediate sites except ML had a value between 1 and 7 (Table 4.4).

We found significant linkage disequilibrium (*D*) values between loci within sites for CC, R3, SB, R1, SN, and SS (Table 4.5). Two localities (CC and R3) had four significant estimates of *D* out of six pairwise comparisons. The other sites had a range from one to three out of six comparisons (Table 4.5). R1 had the highest mean value of *D* (0.115), and the mean value decreased away from the center of the zone. I chose the four populations in the center of the zone, CC, R3, SB, and R1, to estimate covariance and expected covariance. I also calculated

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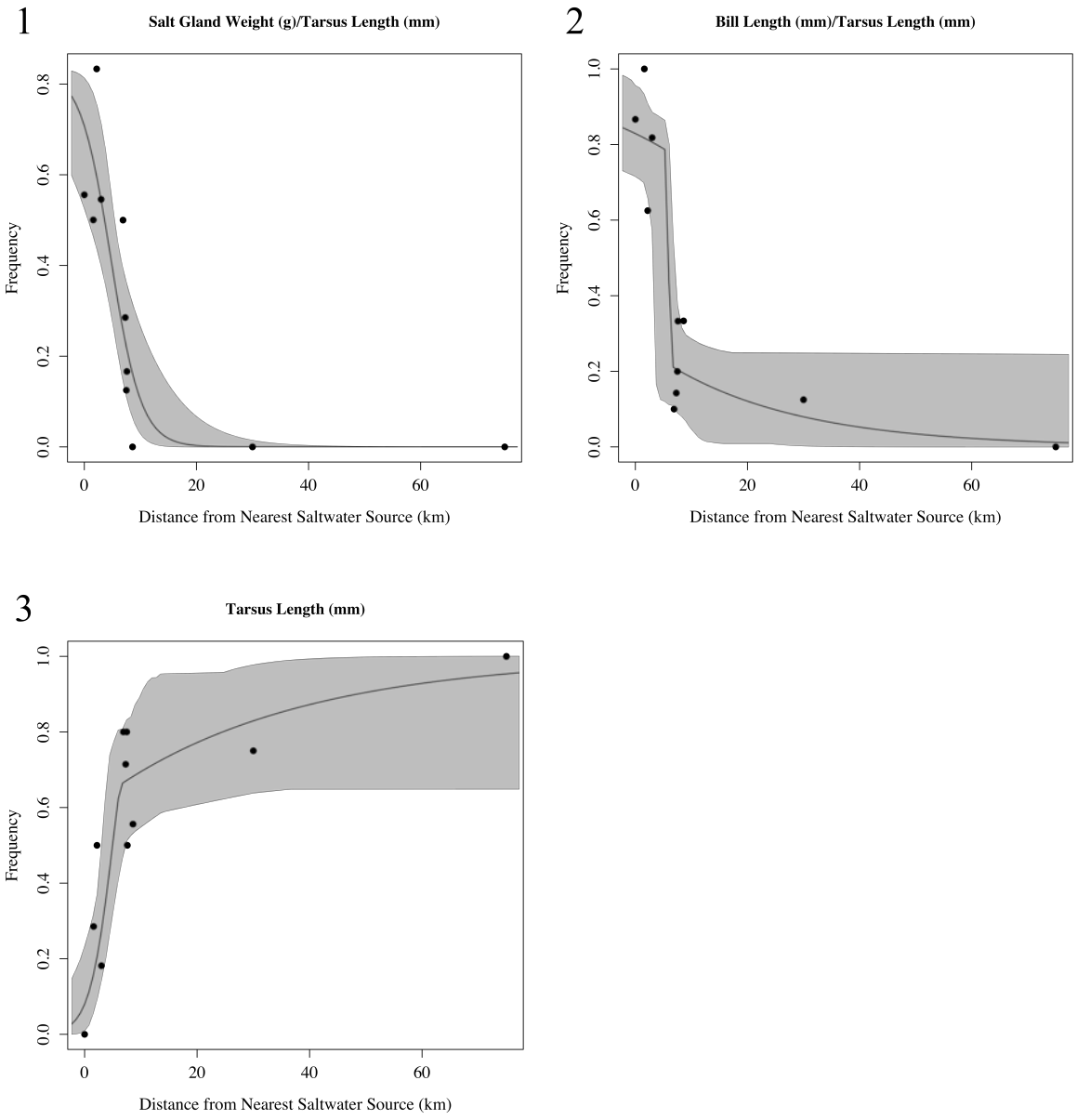

Figure 4.3 Clines fit to each character, with gray shading representing the confidence intervals around the cline. 1. salt gland weight (mg)/tarsus length (mm) 2. bill length (mm)/tarsus length (mm), and 3. tarsus length. Each black dot represents the frequency at a collecting locality.

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Table 4.3 Best fit models and cline parameter estimates (center and width) generated using the R program HZAR for the three morphological characters and four nuclear markers across the hybrid zone between Clapper and King rails. In parentheses for center and width are the 2 LL estimates.

Character	Model	Center (km)	Width (km)
Salt Gland Weight (g)/Tarsus Length (mm)	2A	4.7 (2.6 - 6.5)	10.9 (6.1 - 25.6)
Bill Length (mm)/Tarsus Length (mm)	1D	5.9 (3.4 - 6.7)	1.7 (0.6 - 10.4)
Tarsus Length (mm)	1C	5.0 (3.2 - 6.6)	8.1 (3.5 - 15.1)
139	1A	5.3 (4.6 - 6.0)	8.3 (6.6 - 11.0)
472	1A	4.3 (2.9 - 5.5)	17.4 (12.4 - 27.7)
1166	1C	6.8 (4.0 - 7.5)	6.7 (2.1 - 9.0)
1766	1C	6.0 (3.8 - 6.9)	6.8 (2.6 - 9.6)

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Table 4.4 Hybrid Index, Means and Standard Deviations of characters, and locus frequencies per site.

		Salt Gland Weight (g)/Tarsus Length (mm)		Bill Length (mm)/Tarsus Length (mm)		Tarsus Length (mm)		Frequency (K)			
Code	Hybrid Index	Mean	SD	Mean	SD	Mean	SD	*139*	*472*	*1166*	*1766*
GI	0.89	0.0030	0.00083	0.82	0.042	52.99	1.72	0.08	0.33	0	0.03
ML	0.6	0.0028	0.00058	0.83	0.026	54.46	2.17	0.15	0.10	0	0.05
R2	1.5	0.0040	0.00091	0.79	0.036	56.87	3.16	0.15	0.45	0.10	0.05
CC	1.92	0.0028	0.00074	0.81	0.045	54.31	3.38	0.28	0.44	0.12	0.18
R3	5	0.0029	0.00056	0.71	0.043	59.32	2.65	0.55	0.75	0.65	0.55
SB	5.9	0.0021	0.00071	0.71	0.053	58.14	1.59	0.85	0.75	0.60	0.75
R1	5.2	0.0018	0.00065	0.74	0.055	58.10	2.17	0.55	0.75	0.40	0.65
SN	6.3	0.0018	0.00075	0.72	0.049	56.85	4.33	0.80	0.60	0.50	0.75
SS	5	0.0016	0.00057	0.71	0.062	57.80	3.88	0.95	0.60	0.85	0.60
LA	7.9	0.0005	0.00033	0.73	0.033	58.46	3.62	1.00	1.00	0.95	0.95
CP	7.9	0.0012	0.00092	0.64	0.049	62.08	2.11	1.00	1.00	1.00	0.95

AR073791

Table 4.5 Linkage disequilibrium (*D*) pairwise estimates between all loci within sampling localities estimated using DNAsp. Site codes refer to Table 1. Bold values are significant under Fisher's exact test. Only polymorphic loci are included (N/A signifies monomorphic comparisons). CP was not included because there is only one polymorphic locus.

		Site Codes and Distance from Saltwater (km)									
		0.0	1.6	2.2	3.0	6.9	7.3	7.6	8.0	8.8	30.0
Locus 1	Locus 2	GI	ML	R2	CC	R3	SB	R1	SN	SS	LA
139	*472*	0.026	0.035	0.083	**0.102**	0.038	0.013	**0.130**	0.030	**0.138**	N/A
139	*1166*	N/A	N/A	0.015	**0.066**	**0.143**	0.040	0.100	0.043	0.080	N/A
139	*1766*	0.002	0.043	0.008	**0.070**	**0.148**	**0.013**	**0.130**	0.038	0.070	N/A
472	*1166*	N/A	N/A	0.005	0.050	**0.113**	0.100	0.125	0.040	0.100	N/A
472	*1766*	0.009	0.005	0.028	0.044	0.038	**0.188**	**0.128**	0.050	0.100	N/A
1166	*1766*	N/A	N/A	0.005	**0.058**	**0.143**	0.100	0.075	**0.113**	**0.160**	0.003
	mean	0.005	0.028	0.024	0.065	0.104	0.076	0.115	0.052	0.108	0.003

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Pearson's correlation coefficients between hybrid index and morphological characters and found six of twelve correlations were significant after correcting for multiple comparisons (Table 4.6). Corrected salt gland weight showed significant correlations with hybrid index at site CC and the absolute value of the estimated covariance was greater than the absolute value of the expected covariance at sites CC, R3, and SB. Corrected bill length was significantly correlated with hybrid index at sites CC, R3, and R1 and the covariance was greater than expected at all four sites. Tarsus length was significantly correlated with hybrid index at sites R3 and R1, and the covariance was greater than expected at all sites except SB (Table 4.6).

We estimated the root-mean-square dispersal distances for genetic markers and morphological characters using the two equations described in the Methods and found a range from 0.6 to 3.3 km for the genetic characters and 0.6 to 2.0 km for the morphological characters (Table 4.7). Means for all characters per site fell between 1.5 and 1.9 km (Table 4.7), with an overall average dispersal distance in the hybrid zone of 1.7 km. I used that dispersal distance and my estimated cline widths to calculate time since contact under a neutral diffusion model and selection coefficients for each of my characters. I found very recent values for time since contact for all characters, ranging from 0.2 to 17.3 years (Table 4.8). The selection coefficients fell within a range from 0.03 to 0.2 for all characters except corrected bill length, which had selection coefficients that were an order of magnitude higher (3.0 and 3.2) than estimated for any other character (Table 4.8). I also used two estimates of time since contact and of my estimate of dispersal to calculate the predicted width of the zone in the absence of selection. For a time since contact of 45 years I would expect the width to be 28.1 km and for a time since contact of 250 years I would expect the width to be 66.3 km.

Table 4.6 Estimates of covariance (*cov*), expected covariance (*covE*), and Pearson's correlation coefficients (*r*) between three morphological characters and hybrid index calculated from four nuclear loci for sites CC, R3, SB, and R1. Significant correlations with a P-value < 0.017 are shown in bold.

		Character		
Site	Parameter	Salt Gland Weight (mg)/Tarsus Length (mm)	Bill Length (mm)/Tarsus Length (mm)	Tarsus Length (mm)
CC	*cov*	-7.56E-04	-0.06	2.48
	covE	-5.62E-04	-0.03	1.86
	r	**-0.57**	**-0.73**	0.41
R3	*cov*	-1.37E-04	-0.07	4.67
	covE	-8.99E-05	-0.05	2.98
	r	-0.11	**-0.74**	**0.78**
SB	*cov*	-8.98E-04	-0.08	1.82
	covE	-6.57E-04	-0.04	2.17
	r	-0.62	-0.71	0.56
R1	*cov*	-5.87E-05	-0.12	4.60
	covE	-9.94E-04	-0.06	3.29
	r	-0.04	**-0.84**	**0.82**

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Table 4.7 Estimates of Root Mean Square Dispersal Distance (km) per site from pairwise comparisons between genetic loci using estimated cline widths and linkage disequilibrium. I also present estimates of dispersal distance using cline widths and covariance between morphological characters. Site labels refer to Table 1.

		Site			
Locus 1	Locus 2	CC	R3	SB	R1
139	472	2.72	1.66	0.97	3.07
139	1166	1.36	2.00	1.06	1.68
139	1766	1.41	2.06	0.61	1.93
472	1166	1.71	2.57	2.42	2.71
472	1766	1.62	1.51	3.35	2.76
1166	1766	1.16	1.82	1.52	1.31
salt gland weight	bill length	0.95	0.63	1.33	0.57
salt gland weight	tarsus length	1.92	1.27	2.01	1.80
bill length	tarsus length	1.23	1.09	1.01	1.22
	mean	1.56	1.62	1.59	1.89

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Table 4.8 Time since contact calculations based on a neutral diffusion model and a selection coefficient representing fitness differences between the center and edges across the salinity gradient (Barton and Gale 1993). See methods for equations used in making these calculations.

Locus	*t* (years)	s^{*1}	s^{*2}
sg/tl	6.76	0.07	0.05
bl/tl	0.16	3.04	3.21
tl	3.76	0.13	0.13
139	3.96	0.12	0.13
472	17.29	0.03	0.03
1166	2.58	0.18	0.20
1766	2.67	0.18	0.19
mean	6.62	0.13	0.14

[1]Assuming no dominance.

[2]Assuming dominance.

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DISCUSSION

At the center of the rail hybrid zone, I found nonrandom associations among the nuclear genetic markers and between these genetic markers and the quantitative characters. These associations are likely due to the presence of pure and advanced backcross alleles in the hybrid zone center brought by dispersal, and are accentuated by reduced fitness experienced by hybrids. Because the strength of the non-random associations depends on the average dispersal distance and the amount of selection acting against hybrids, one can make inferences about both factors. The largest assumptions in these inferences are that the hybrid zone is a stable equilibrium structure maintained by the opposing forces of dispersal and selection, so it is appropriate to examine these assumptions.

Pure and advanced backcross rails observed near the center of the hybrid zone are consistent with dispersal of parentals into the zone (Szymura and Barton 1986), as is the high vagility of birds in general (Barrowclough 1978; Moore and Dolbeer 1989) and rails in particular (Hon et al. 1977). Assortative mating could contribute to the observed disequilibria, but the ubiquity of backcrossed hybrids suggests a lack of strong premating reproductive isolation.

Natural selection acting against hybrids is more difficult to assess. Direct tests of selection against hybrids would be desirable, but are difficult to perform in this system. However, consideration of the detailed structure of the zone yields useful insight. Given the dispersal capabilities of these birds (see below), the narrow and coincident nature of the genetic and quantitative character clines in this zone indicates that hybrids suffer at least some reduction in fitness that counteracts introgression. The only viable alternative explanation is that the zone has been formed very recently through secondary contact, and introgression is just beginning (Chapter 3). Heterogeneity of cline structure suggests that the zone cannot be very recent. The cline for locus *472* is much broader than the other coincident clines in this zone, indicating that it

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may be undergoing neutral diffusion, while the narrow clines are constrained by selection against hybrids (Chapter 3). Whether the rail hybrid zone is at equilibrium remains unclear, but the probable age of the zone and the narrow and coincident structure of the clines used in the disequilibria and covariance analyses, suggest that those clines are close enough to equilibrium for the purposes of the analyses.

One of the most fascinating effects of these nonrandom associations between character states for distinct traits is their tendency to strengthen the barrier to gene flow imposed by the hybrid zone. The effect of selection on a particular gene extends beyond the locus and adjacent linked regions to the unlinked mitochondrion as well as to genes underlying diverse quantitative traits. Direct estimates of selection are not available from the *Rallus* hybrid zone, but the strength of the genotypic disequilibria at the center of the hybrid zone (locality R1; average standardized linkage disequilibrium = 0.52) is, to the best of my knowledge, the highest reported from any hybrid zone study. Estimates at the hybrid zone center were 0.22 in *Bombina* toads (Szymura and Barton 1991), 0.29 in *Sceloporus* lizards (Sites et al. 1995), 0.40 in *Gryllus* crickets (Harrison and Bogdanowicz 1997), and 0.42 in *Manacus* manakins (Brumfield 1999). Premating and postmating barriers are known to limit gene exchange between hybridizing *Bombina* species (Nürnberger et al. 1995) and between hybridizing *Gryllus* species (Harrison 1983). Assuming the values of *R* across studies result from similar hybrid zone processes (Lewontin 1988), the disequilibria observed in *Rallus* may reflect similar barriers to gene movements.

The significant associations between the molecular markers and the quantitative traits are likely due to the same processes that create disequilibria between molecular loci. Pleiotropy could produce similar associations, but it is unlikely to impact such a diversity of traits (Nürnberger et al. 1995). From these associations, indirect tests of selection indicate that bill

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length and overall size (tarsus length) are under greater negative selection in recombinants than are salt gland size and the genetic markers. Such estimates of selection are useful, because they are made independently of cline width measurements. In fact, based on estimated cline widths alone (Table 4.3), one would suspect that salt gland weight is experiencing the strongest negative selection of the quantitative traits because its cline is narrowest. Although traits under stronger selection may tend to have narrower clines, the polygenic nature of quantitative traits can produce variation in the widths of their clines that reveal little about selective pressure (Nürnberger et al. 1995). Thus, the indirect test from character covariances provides valuable corroboration of the intensity of selection on these markers.

Why quantitative characters would differ in the strength of selection against them in recombinants is unclear. Whereas salt gland size is thought to be relatively plastic and can adapt to fluxes in salinity, bill length and overall size are not. This could explain why salt gland size is under weaker selection. Rapid shifts in the environment for these birds occur regularly in southwest Louisiana. Hurricanes inundate the freshwater marshes with high salinity ocean water, and bring with them Clapper Rails from the coast. Birds have been observed riding the storm surge inland on floating mats of vegetation (Meanley 1985), although this is in the nonbreeding season and may not play a significant role if birds fly right back to the coast after a storm. Although brackish marsh has likely always existed in Louisiana estuarine systems, human influence has had a significant influence on the marshes. Several of the sites where I collected are around Calcasieu Lake, including CC, ML, SB, SN, and SS (Figure 4.1.2). This formerly freshwater lake was first dredged in 1874, but deep dredging that flooded the lake with high salinity water from the Gulf of Mexico was not completed until 1941 (LCW Conservation 2002). There has been substantial documentation of the changes to the marshes surrounding the lake

(and formerly in what is now open water) by various government agencies. One of my collecting localities ML, or East Mud Lake Road, looked very similar to a saltmarsh on the barrier island of Grand Isle. Birds collected there actually had a lower hybrid index than birds on Grand Isle (Table 4.5), yet this was likely a freshwater marsh in 1940. If the dramatic environmental change of saltwater inundation occurs, it appears that the rail composition can quickly change. In the absence of human-related inundation, in stable brackish marshes surrounding the Mississippi River Delta, there is no reason for expansion of the zone other than during natural contractions in marsh salinity.

We found that dispersal distances estimated from the covariance structure of the hybrid zone (Table 4.7) were markedly lower than natal dispersal values reported from the literature (~55 km), a value that spans well beyond the hybrid zone itself. The contrasting distances highlight the barrier to gene flow imposed by the hybrid zone itself. For example, King Rails are adept at long-distance colonization of freshwater impoundments in the middle of coastal saltmarsh, where they can exist as an ‘island’ population. But individuals that disperse into saltmarsh and brackish coastal marshes will be subjected to ‘hybrid zone’ dynamics, in which the persistence, mating, and movements of individuals are governed by endogenous and exogenous natural selection (Moore and Price 1993). Interestingly, Clapper Rails are occasionally recorded from inland freshwater localities, but to the best of my knowledge, never establish inland populations, presumably because of the presence of King Rails. In sum, although rails are clearly capable of long natal dispersal distances, these are only relevant when the dispersal occurs to their appropriate habitat. In the case of King Rails, this could be to a freshwater impoundment surrounded by saltmarsh and Clapper Rails. But the effective dispersal distance of individuals dispersing into the hybrid zone is much shorter, on the order of a few kilometers.

It is important to note that all inferences from disequilibria are made with the assumption that the processes responsible for creating those disequilibria are equivalent throughout the entire genome. For dispersal distance and recombination rate this may be true, but for selection, it is probably not. It seems clear that the nuclear markers examined herein are under selection against introgression. Their clines are all remarkably narrow given the dispersal capabilities of the birds. But whether the level of selection experienced by these loci should serve as a proxy for the entire genome remains unclear. Hybrid zone research typically focuses on those loci fixed for alternate alleles. This marker bias leads, however, to an overestimation of the selection against hybridization, because these are the markers experiencing the strongest divergent selection (Yuri et al. 2009). Neutral loci or those under weaker selection will have much shallower clines, but these types of markers are typically culled from hybrid zone studies. To gain a clearer picture of the processes involved in hybrid zone maintenance will require an unbiased examination of markers from throughout the hybridizing genomes (Machado et al. 2002).

CHAPTER 5

CONCLUSIONS

Ecological speciation is difficult to explicitly demonstrate, but adaptive divergence is prevalent in nature and was one of the primary mechanisms used to develop the theory of evolution (Darwin 1859). Understanding the mechanisms involved in generating reproductive isolation through adaptation to different environments is a central goal of evolutionary biologists (Coyne and Orr 2004). One of the most difficult tasks is teasing apart adaptive divergence from genetic drift and sexually selected isolating mechanisms. Birds provide an excellent system to test these various hypotheses, because they often have flamboyant sexual displays (Brumfield et al. 2001), they are adapted to thrive in most environments on Earth (Price 2008), and many lineages that hybridize are easy to identify and examine in the field (Moore and Buchanan 1985; Barnes and Nudds 1991; Rohwer et al. 2001; Gee 2004; Gill 2004; Carling and Brumfield 2009). Unfortunately, they are difficult to work with in captivity, which hinders uncovering reproductive isolating mechanisms between recently diverged species. Hybrid zones are excellent natural experiments in which two lineages that have not completed reproductive isolation come in to contact and breed. These systems provide unique laboratories to study the processes which may be responsible for preventing the fusion of the lineages in contact, and thus to infer the mechanisms of speciation in the system.

I began my research trying to understand the phylogenetic relationships within a complex of morphologically similar but ecologically divergent birds: the Clapper Rail (*Rallus longirostris*) and King Rail (*R. elegans*) species group. These two species are distributed in coastal and freshwater marshes throughout the Americas and are split in to a large number of subspecies. I was able to obtain and sequence samples from throughout their respective ranges. I

was also able to sequence geographically unique specimens using ancient DNA techniques on samples of toe pads from skins collected prior to the advent of tissue collections. I found that the taxonomy of this complex has been complicated by the morphological and ecological variation found within the group, as well as evidence of hybridization between the two eastern North American lineages (Olson 1997). Understanding the degree of hybridization and mechanisms preventing fusion of these two lineages is part of my ongoing research. My genetic results suggest that the morphologically distinct groups represent good species relative to subspecific designations. The California and northwestern Mexico birds of the *R. l. obsoletus* group should be considered a distinct species, elevating them from endangered subspecies status to endangered species in the United States. I found little evidence of divergence between migratory and nonmigratory populations of King Rails in the eastern United States. However, two samples from migratory birds breeding in Oklahoma did have a unique mtDNA haplotype, which was found in one bird from Louisiana, suggesting some structure within *R. e. elegans* in the U. S. may exist, warranting further study. The results of this study suggest that current taxonomy in the complex warrants revision, and this may have management and conservation implications.

I also characterized the hybrid zone in Louisiana between the two species using genetic, morphological, and ecological data. I sampled a transect in southern Louisiana that spanned the transition from saltwater to freshwater. I sequenced one mitochondrial and four nuclear markers for *139* individuals. I also took body weight and salt gland weights. I fit clines to each of these characters and found sharp transitions from one species to the other for all characters. These transitions were concordant and coincident with the transition in salinity and salt gland weight, suggesting an adaptive role in preventing these two species from fusing.

I also prepared museum skins and measured a suite of morphological characters for specimens spanning the hybrid zone. I used these in conjunction with the genetic data from Chapter 3 to infer selection against recombinant hybrids. I found selection against hybrids using several methods, including covariance between hybrid index and morphological characters, the estimates of linkage disequilibrium between loci within sites, and estimates of the time since contact and width under a neutral diffusion model in the absence of selection, as well as selection coefficients.

In sum, I found that the species limits in this group require modification to mirror evolutionary relationships within the group. I also found that there is a very narrow hybrid zone between the two species in Louisiana. The markers that showed this rapid transition coincided with rapid transitions in salinity and salt gland size, suggesting that adaptive divergence to different environments is likely playing a role in keeping these two lineages from reticulating. I estimated covariances between morphological measurements and hybrid index and found that there was a greater relative selection against morphological characters in recombinant hybrids than genotypic characters. This result suggests that adaptive divergence for phenotypic differences plays a role in preventing fusion in this system.

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VITA

James Michael Maley was born in September of 1979 in Rochester, New York, to James Francis Maley and Mary Elizabeth Maley. He grew up with two brothers, Thomas James Maley and William Edward Maley. He became interested in the outdoors and birds at a very young age, primarily through the interest of his father. He began hunting at the age of twelve and spent a considerable amount of his youth in the woods of New York. He became a Boy Scout at a young age and spent a summer in the Adirondacks. He earned the rank of Eagle Scout, graduated from high school, and spent a year as a chemistry major at the State University of New York at Geneseo. Finding his studies there to be unfulfilling, at the age of 18 he moved to Alaska to pursue a degree in fisheries at the University of Alaska Fairbanks. While there he developed his love of the outdoors even further. He took ornithology from Dr. Kevin Winker and immediately fell in love with birds, birding, and trying to understand the diversity of birds. He began collecting in the summer of 2001 and has been on over 20 trips since that time. He graduated with a Bachelor of Science in May 2002 and started his Master of Science that Fall. He studied McKay's Buntings (*Plectrophenax hyperboreus*) and Snow Buntings (*Plectrophenax nivalis*). He graduated in 2006 and moved to Baton Rouge to begin his Doctor of Philosophy. Before finishing his dissertation he accepted a job offer at the University of Wyoming to be the Vertebrate Collections Manager, starting in December of 2011. He moved to Laramie and has been enjoying his new job and life prior to returning to Baton Rouge to defend his dissertation in March of 2012.

From: Mix, Emily
To: Ray Bransfield
Cc: Flajole, Andy; Bernhardt, Tricia
Subject: RE: Joshua Tree Solar Project
Date: Friday, January 16, 2015 9:44:57 AM
Attachments: 2_Vicinity_USGS.pdf

Ray,
That's good to hear that you're still our contact despite the shuffle. Thanks for the quick response. We'd like to have a conference call with you (and CDFW if possible – I'm waiting to hear back on who our contact on their end will be) within the next week or two. At that point we can introduce you to the new development team, go over the project in more detail, and discuss our survey approach. Until then, here's a little more info on the project to jog your memory:

The Joshua Tree Solar Project, which we discussed with you in 2012, has resurfaced after permitting was put on hold due to a change in ownership. BP sold the project to NextEra Solar Energy, who is now moving forward with the Project. The CUP application was filed with San Bernardino County in November 2014. The project is on private land and will be 20 MW on approximately 115 acres (see attached figure for the location).

The project's location changed slightly since we discussed the project with you, and in spring of 2012 we conducted biological resources surveys of the current project area (referred to as the airport site, as shown in the figure). Due to the delay in permitting, we plan to re-survey the current project area for tortoise and other wildlife, burrowing owl, and rare plants (depending on sufficient rainfall and germination) this coming spring 2015. On our call we'd like to discuss our survey approach with you.

Once I hear back from CDFW I'll throw out some dates and times for a conference call.

Thanks much!
Emily

Emily F. Mix | **Biologist**
Direct: 303.980.3509 | Main: 303.988.2202 | Fax: 303.980.3539 | Cell: 714.478.7171
Emily.Mix@tetratech.com

Tetra Tech, Inc. | **Natural Resources**
350 Indiana St. Suite 500 | Golden, CO 80401 | www.tetratech.com

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From: Ray Bransfield [mailto:ray_bransfield@fws.gov]
Sent: Friday, January 16, 2015 10:25 AM

To: Mix, Emily
Cc: Flajole, Andy; Bernhardt, Tricia
Subject: RE: Joshua Tree Solar Project

Emily,
A lot can change. Amy moved on. The Ventura, Reno, and Palm Springs Fish and Wildlife Offices changed their boundaries and Ventura no longer deals with anything in the desert; Palm Springs has everything south of the Owens Valley (roughly) and Reno everything to the north. I work for Palm Springs now.

Some things never change. I am still your contact.
Ray

From: Mix, Emily [mailto:Emily.Mix@tetratech.com]
Sent: Friday, January 16, 2015 9:09 AM
To: Ray Bransfield (Ray_Bransfield@fws.gov); Amy_Torres@fws.gov
Cc: 'Flajole, Andy' (Andy.Flajole@nexteraenergy.com); Bernhardt, Tricia
Subject: Joshua Tree Solar Project

Hi Ray and Amy,
In 2012 we discussed a small (20 MW) solar PV project near the town of Joshua Tree. After we completed the bio surveys the Project was put on hold, but now it's being revived. I know a lot can change in three years, so can you confirm that you would still be our contacts on this project? If not, will you please let us know who will take over?

Have a great weekend and thank you in advance!
Emily

Emily F. Mix | **Biologist**
Direct: 303.980.3509 | Main: 303.988.2202 | Fax: 303.980.3539 | Cell: 714.478.7171
Emily.Mix@tetratech.com

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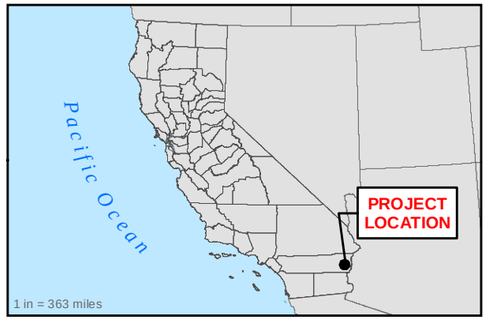

Legend

- MSEP Solar Plant Site Boundary
- BSPP ROW Boundary
- Shared Access Road with BSPP
- Linear Corridor
- Colorado River Substation (SCE)
- Switchyard
- USGS 1:24,00 Quadrangle

0 2.5 5 10
Miles

Notes:
(a) UTM Zone 11, NAD 1983 Projection.
(b) Source data: ESRI, BLM, USGS, TTEC

FIGURE 1
REGIONAL VICINITY MAP

TETRA TECH

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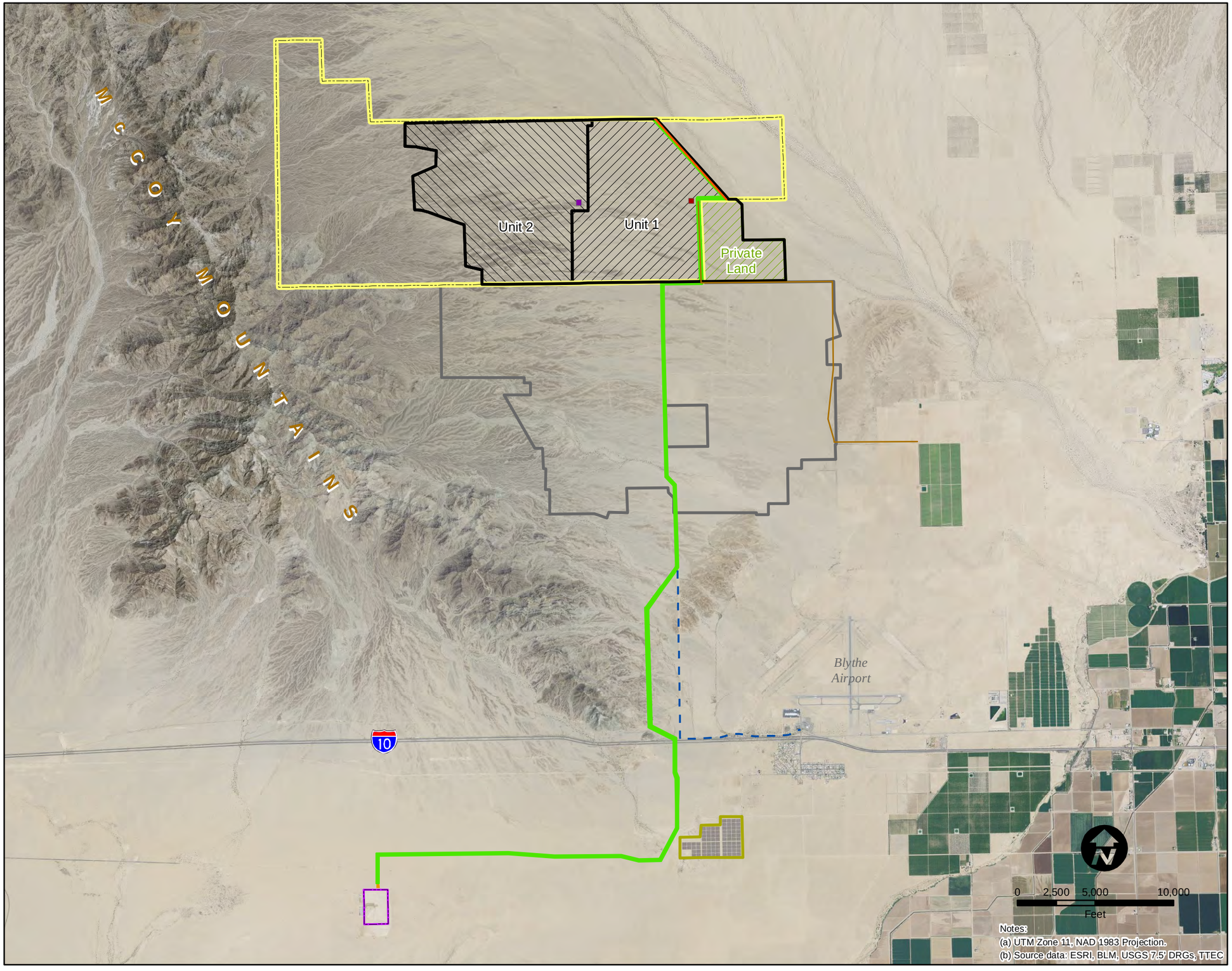
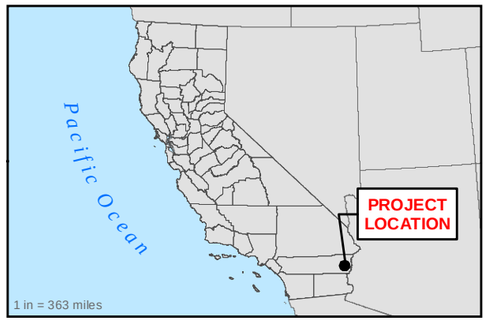


McCOY SOLAR ENERGY PROJECT RIVERSIDE COUNTY, CA



Legend

Project Features

- MSEP BLM ROW Grant Application Boundary (7,700 acres)
- MSEP Solar Plant Site Unit 1 - 2,259 acres
  - 1,782 acres BLM Land
  - 477 acres Private Land
- MSEP Solar Plant Site Unit 2 - 2,178 acres
  - 2,178 acres BLM Land
- BSPP ROW Boundary
- PV Solar Facility
- Linear Corridor
- Distribution Line and Secondary Emergency Access
- MSEP Access Road Shared with Other Solar Projects
- Designated Linear Corridor for Potential Future Solar Projects to the North
- Switchyard
- SCE Colorado River Substation
- Unit 1 Substation
- Unit 2 Substation

FIGURE 2
OVERALL PROJECT LOCATION MAP

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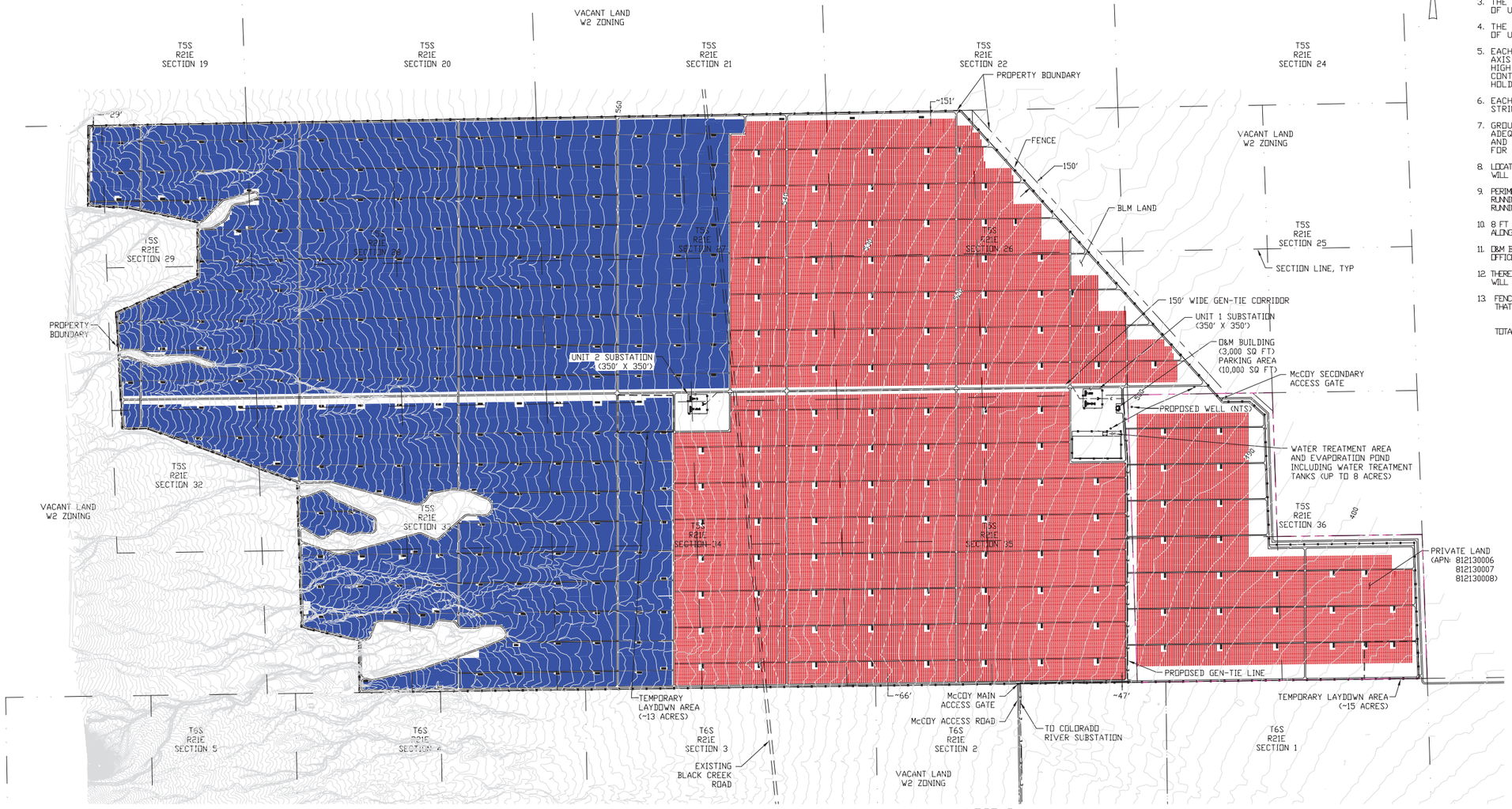

PRELIMINARY PLAN

1,000 0 1,000 2,000 3,000

SCALE: 1" = 1,000'

LEGEND:

- UNIT 1
- UNIT 2
- WELL (NOT DRAWN TO SCALE)
- PRIVATE LAND BOUNDARY
- SECTION LINES
- PROJECT BOUNDARY LINE
- PROPOSED 230KV SINGLE CIRCUIT (GEN-TIE LINE)
- PROPOSED 230KV DOUBLE CIRCUIT (GEN-TIE LINE)
- PROPOSED FENCE

PRELIMINARY
NOT FOR CONSTRUCTION

NOTES:

1. THIS DRAWING IS CONCEPTUAL IN NATURE AND IS NOT FOR DETAILED DESIGN. LAYOUT IS MAXIMIZED FOR CIVIL DESIGN PURPOSES OF PERMITTING ONLY AND DOES NOT REPRESENT AN OPTIMIZED ELECTRICAL DESIGN.
2. THIS DRAWING IS REPRESENTATIVE AND BASED ON SPECIFIC TECHNOLOGY AND SPACING. THESE SPECIFICATIONS ARE SUBJECT TO CHANGE AND AFFECT THE TOTAL POWER OUTPUT AND DC/AC RATIO.
3. THE DC CAPACITY OF UNIT 1 IS 299 MW. THE DC CAPACITY OF UNIT 2 IS UP TO 598 MW.
4. THE AC CAPACITY OF UNIT 1 IS 250 MW. THE AC CAPACITY OF UNIT 2 IS UP TO 500 MW.
5. EACH TWO MW AC BLOCK IN UNIT 1 CONTAINS 294 SINGLE AXIS TRACKERS. EACH TRACKER HOLDS 84 PANELS THREE HIGH IN PORTRAIT. EACH TWO MW AC BLOCK IN UNIT 2 CONTAINS 549 FIXED TILT RACKS AT 30 DEGREES. EACH RACK HOLDS 45 PANELS FIVE HIGH IN LANDSCAPE.
6. EACH TWO MW AC BLOCK CONTAINS 24,696 97 W PANELS IN STRINGS OF 12 FOR A DC/AC RATIO OF 1.2.
7. GROUND COVER RATIO TO MINIMIZE SHADING AND PROVIDE ADEQUATE ACCESSIBILITY IS DEPENDANT ON THE RACK TYPE AND SIZE. FOR UNIT 1, THE GROUND COVERAGE RATIO IS 35%. FOR UNIT 2, THE GROUND COVERAGE RATIO IS 46%.
8. LOCATIONS OF ALL EXISTING AND PROPOSED ITEMS ARE APPROXIMATE AND WILL NEED TO BE VERIFIED IN THE FIELD PRIOR TO CONSTRUCTION.
9. PERIMETER ROADS, INVERTER ACCESS ROADS AND MAINTENANCE ROADS RUNNING NORTH-SOUTH ARE 24 FT WIDE (TYPICAL). ALL MAINTENANCE ROADS RUNNING EAST-WEST ARE 16 FT WIDE (TYPICAL).
10. 8 FT CHAIN LINK FENCING WITH THREE STRAND BARB WIRE IS PROPOSED ALONG ALL PROPERTY LINES. 10 FT OFFSET TYPICAL WHERE ALLOWED.
11. O&M BUILDING IS FOR STORAGE OF SPARE PARTS AND CONTAINS A 500 SF OFFICE.
12. THERE WILL NOT BE REMOVAL OF NATURAL VEGETATION ALL VEGETATION WILL BE MOWED.
13. FENCING SETBACKS WILL BE DETERMINED DURING DETAILED DESIGN SO THAT ANY PONDING WILL BE WITHIN PROJECT BOUNDARY.

TOTAL ACREAGE: ±4,376 ACRES

REV	DATE	DESCRIPTION	DRAWN	CHECKED	LEAD DESIGNER	LEAD TECH SPEC	PROJ ENGR	PROJECT MANAGER
E	11/14/12	ISSUED FOR FEIS	PM	AZ	PM	KD	AZ	RH	AZ
D	11/13/12	ISSUED FOR FEIS	PM	AZ	PM	KD	AZ	RH	AZ
C	10/23/12	ISSUED FOR REVIEW	PM	AZ	PM	KD	AZ	RH	AZ
B	10/08/12	ISSUED FOR REVIEW	PM	AZ	PM	KD	AZ	RH	AZ
A	09/28/12	ISSUED FOR REVIEW	PM	AZ	PM	KD	AZ	RH	AZ

PRELIMINARY STATUS — DATE — LDE — REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.

APPROVED STATUS — DATE — LDE — REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.

ORIGINATING PERSONNEL	PROFESSIONAL ENGINEER'S SEAL
DRAWN BY: P. McKENNA	ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF PE: _____ STATE: _____ LIC. NO.: _____ DATE: _____
CHECKED BY: A. ZIMMERMAN	
LEAD DESIGNER: P. McKENNA	
ENGINEER/TECH SPECIALIST: K. DEASON	
PROJECT ENGINEERING MANAGER: R. HILL	
PROJECT MANAGER: A. ZIMMERMAN	

Zero Harm — Leadership No incidents Safe Behavior

WorleyParsons
resources & energy

CLIENT/PROJECT TITLE
McCOY SOLAR, LLC
McCOY SOLAR ENERGY PROJECT

Figure 3
SOLAR PLANT LAYOUT

SCALE: 1"=1000' | DRAWING SIZE: ARCH D (36" x 24")

WORLEYPARSONS DWG. NO.: MSEP-1-DWG-111-002-001 | REV: E

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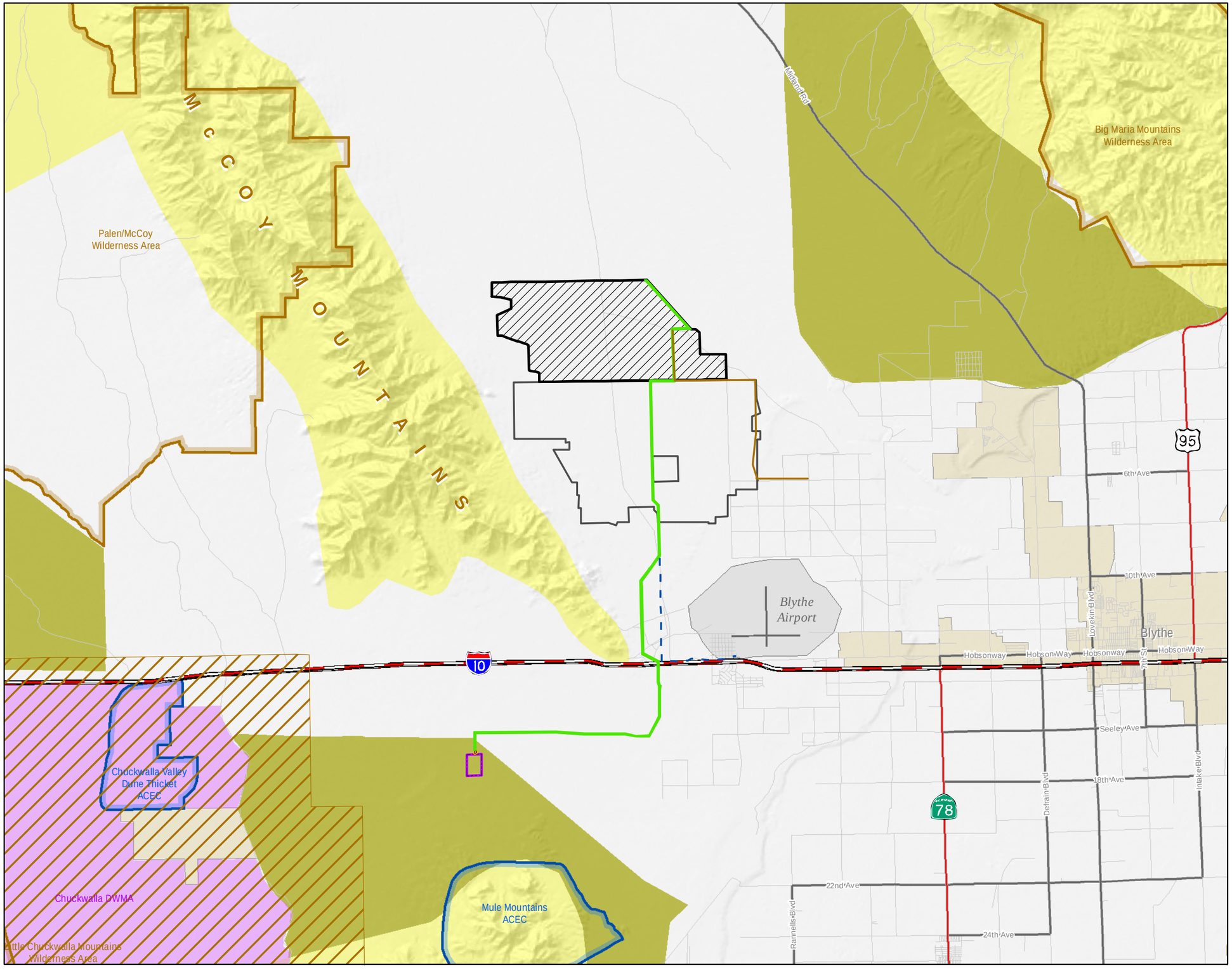
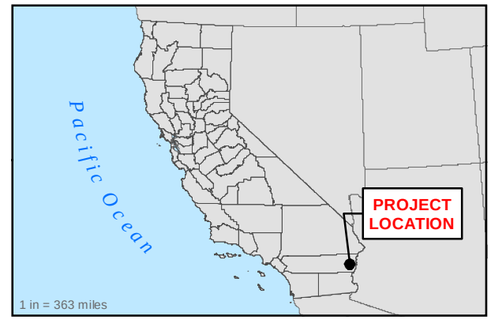


McCOY SOLAR ENERGY PROJECT
RIVERSIDE COUNTY, CA



Special Management Areas
- FWS Desert Tortoise Critical Habitat
- BLM Multi Species Wildlife Habitat Management Area (WHMA)
- BLM Big Horn Sheep WHMA
- BLM Area of Critical Environmental Concern (ACEC)
- BLM Desert Wildlife Management Area (DWMA)
- BLM Wilderness Area

Project Features
- MSEP Solar Plant Site Boundary
- Linear Corridor
- Shared Access Road with BSPP
- Distribution Line
- Colorado River Substation (SCE)
- Switchyard
- BSPP ROW Boundary

0 5,000 10,000 20,000
Feet

Notes:
(a) UTM Zone 11, NAD 1983 Projection.
(b) Source data: ESRI, BLM, USGS, FWS, TTEC

FIGURE 4
SPECIAL MANAGEMENT AREAS
WITHIN PROJECT VICINITY

TETRA TECH

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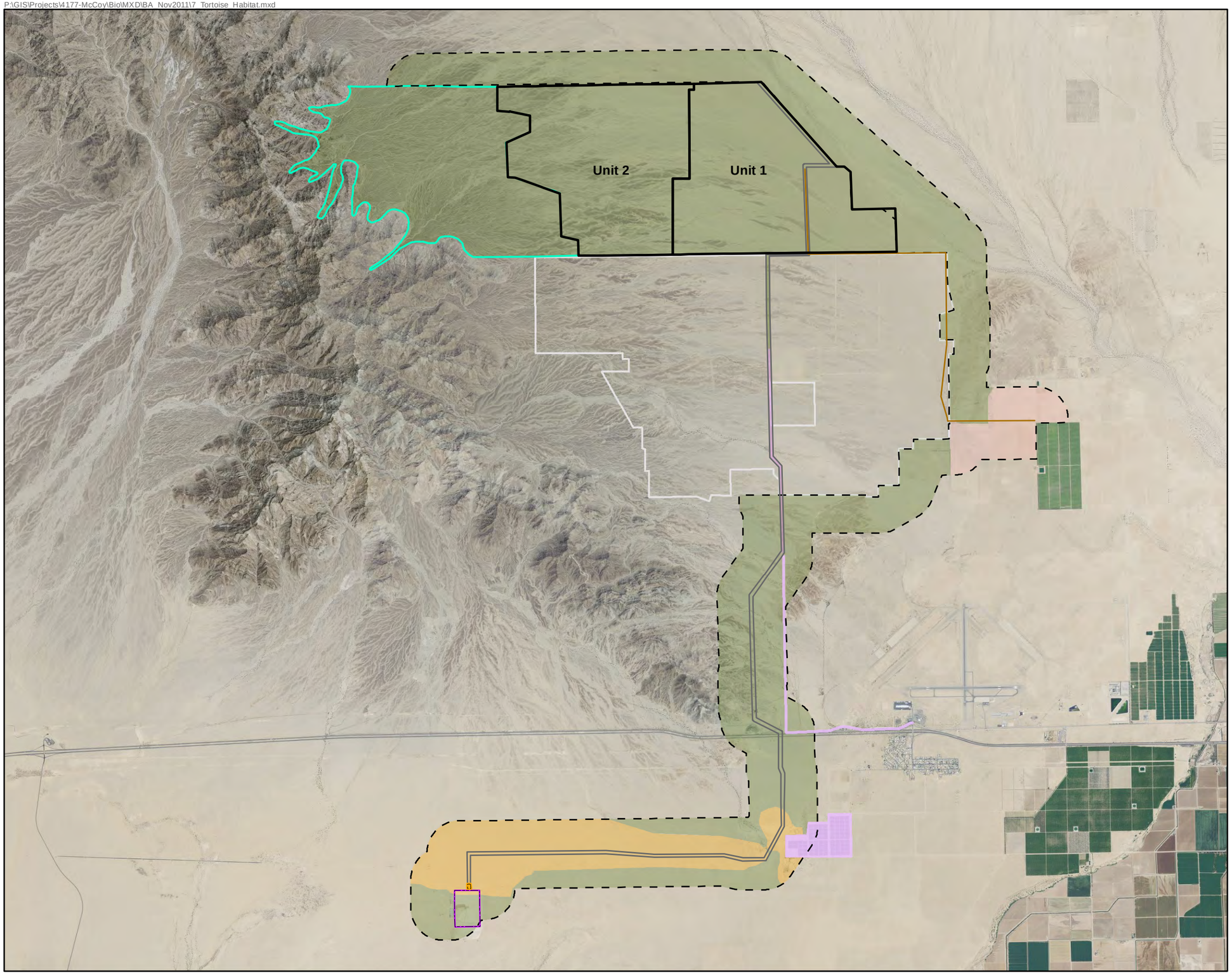

McCOY SOLAR ENERGY PROJECT RIVERSIDE COUNTY, CA

Legend

- MSEP Solar Plant Site Boundary
- Linear Corridor
- Colorado River Substation (SCE)
- Switchyard
- BSPP ROW Boundary
- Distribution Line
- Extent of Area Surveyed
- Potential Primary Recipient Area

Habitat

- Sonoran Creosote Bush Scrub (Creosote Bush-White Burr Sage Scrub Alliance)
- Stabilized and Partially Stabilized Desert Dunes (Sand Sheets and Dunes: Creosote Bush-White Burr Sage-Galleta Grass)
- Agricultural (Crops, Ruderal Vegetation, or Bare Ground)
- Developed (No Vegetation)

Habitat data for the portions of the Linear Corridor that falls outside of the extent of the area surveyed were taken from AECOM 2010.

Desert tortoise could occur within the swales of the Intermittent Low Sand Dunes and Swales habitat; however, compensation for impacts to this area will be covered under that required for sand dunes.

Estimated Project disturbance acres:
Desert Tortoise Habitat: 4,898
Mojave fringe-toed lizard habitat (Stablilized and Partially Stabilized Desert Dunes): 38
Agricultural: 2.3
Developed: 22.7

N

0 0.5 1 2
Miles

Notes:
(a) UTM Zone 11, NAD 1983 Projection.
(b) Source data: A. Karl, USDA.

FIGURE 7
DESERT TORTOISE HABITAT
FOR THE PURPOSE OF
COMPENSATORY MITIGATION

TETRA TECH

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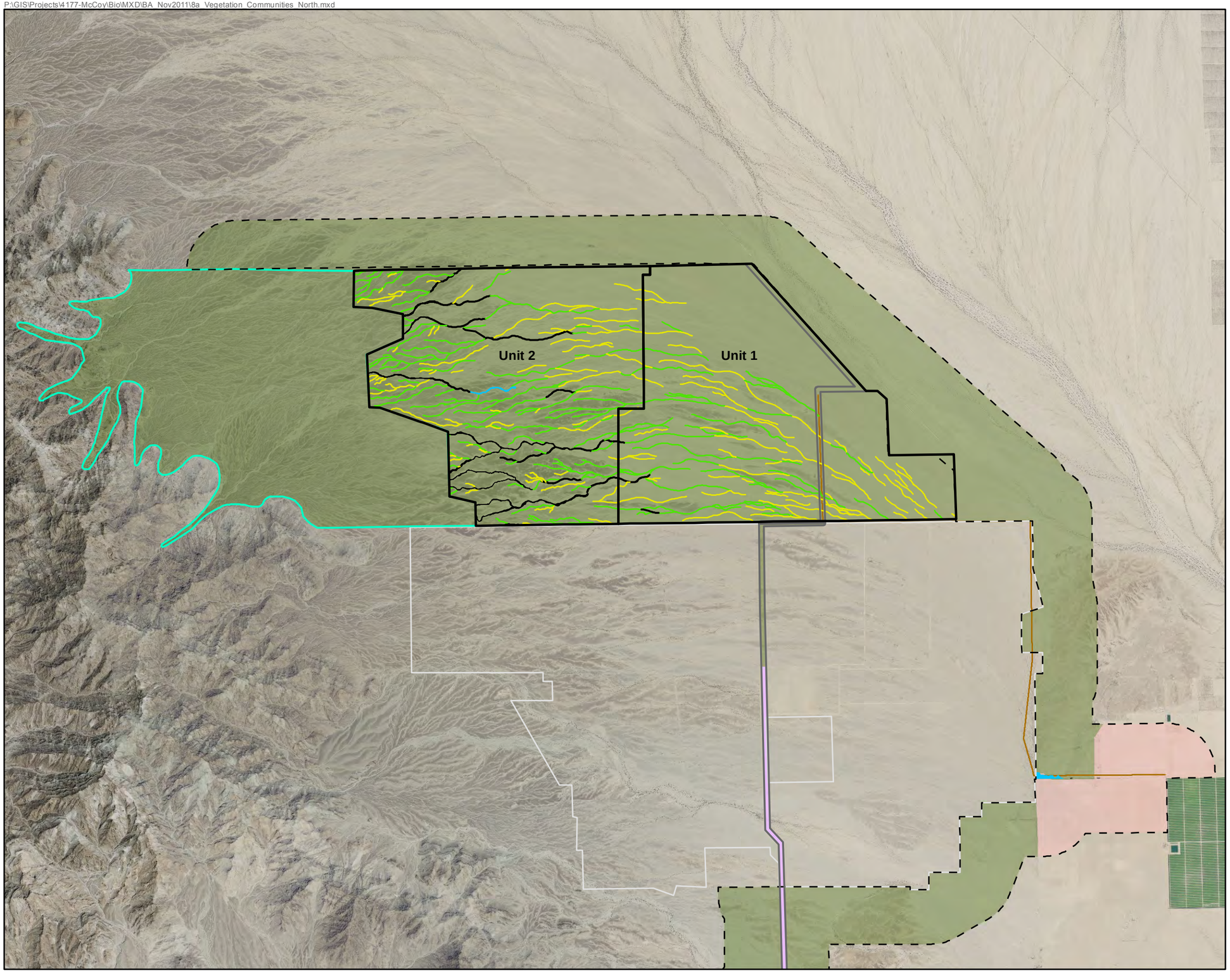

McCOY SOLAR ENERGY PROJECT RIVERSIDE COUNTY, CA

Legend

- MSEP Solar Plant Site Boundary
- Linear Corridor
- Colorado River Substation (SCE)
- Switchyard
- Extent of Area Surveyed for Habitat
- Potential Primary Tortoise Recipient Area
- BSPP ROW Boundary
- Distribution Line

Ephemeral "Riparian" Drainages

- Desert Dry Wash Woodland (Blue Palo Verde-Ironwood Woodland Alliance)
- Mesquite Bosque
- Vegetated Ephemeral Channels (Wash-dependent Vegetation with Sparsely Scattered Trees)
- Vegetated Ephemeral Channels (Vegetated with No Trees)
- Unvegetated (approximately less than or equal to 5% cover)

Upland Vegetation

- Sonoran Creosote Bush Scrub (Creosote Bush-White Burr Sage Scrub Alliance)
- Stabilized and Partially Stabilized Desert Dunes (Sand Sheets and Dunes: Creosote Bush-White Burr Sage-Galleta Grass)

Other Cover Types

- Agricultural (Crops, Ruderal Vegetation, or Bare Ground)
- Developed (No Vegetation)

Categories follow NECO and other BLM-requested terminology.

Data for the portions of the Linear Corridor that falls outside of the extent of the area surveyed were taken from AECOM 2010.

N

0 0.25 0.5 1
Miles

Notes:
(a) UTM Zone 11, NAD 1983 Projection.
(b) Source data: A. Karl, USDA.

FIGURE 8A
VEGETATION AND COVER TYPES

TETRA TECH

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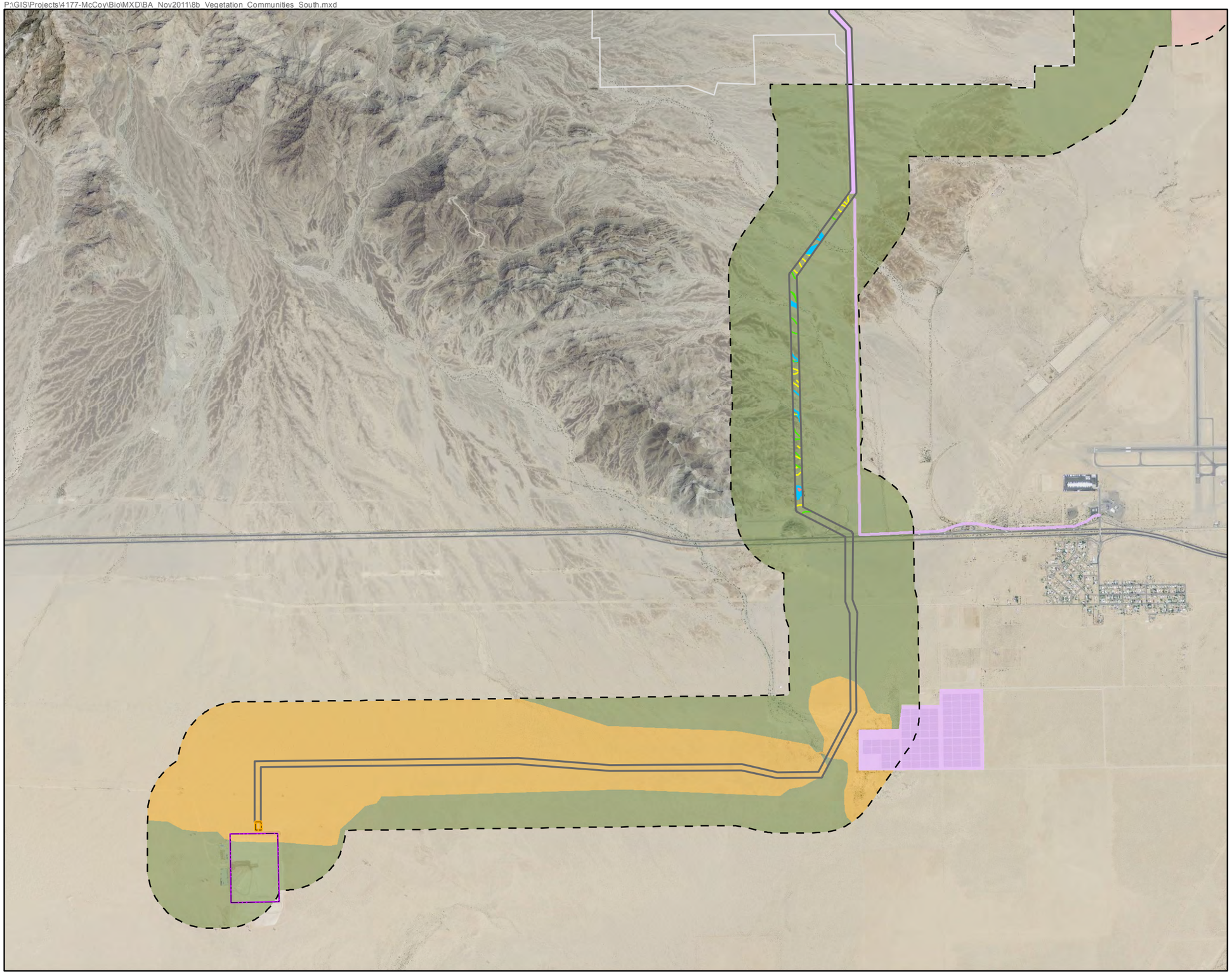

McCOY SOLAR ENERGY PROJECT RIVERSIDE COUNTY, CA

Legend

- MSEP Solar Plant Site Boundary
- Linear Corridor
- Colorado River Substation (SCE)
- Switchyard
- Extent of Area Surveyed for Habitat
- Potential Primary Tortoise Recipient Area
- BSPP ROW Boundary
- Distribution Line

Ephemeral "Riparian" Drainages

- Desert Dry Wash Woodland (Blue Palo Verde-Ironwood Woodland Alliance)
- Mesquite Bosque
- Vegetated Ephemeral Channels (Wash-dependent Vegetation with Sparsely Scattered Trees)
- Vegetated Ephemeral Channels (Vegetated with No Trees)
- Unvegetated (approximately less than or equal to 5% cover)

Upland Vegetation

- Sonoran Creosote Bush Scrub (Creosote Bush-White Burr Sage Scrub Alliance)
- Stabilized and Partially Stabilized Desert Dunes (Sand Sheets and Dunes: Creosote Bush-White Burr Sage-Galleta Grass)

Other Cover Types

- Agricultural (Crops, Ruderal Vegetation, or Bare Ground)
- Developed (No Vegetation)

Categories follow NECO and other BLM-requested terminology.

Data for the portions of the Linear Corridor that falls outside of the extent of the area surveyed were taken from AECOM 2010.

N

0 0.25 0.5 1
Miles

Notes:
(a) UTM Zone 11, NAD 1983 Projection.
(b) Source data: A. Karl, USDA.

FIGURE 8B
VEGETATION AND COVER TYPES

TETRA TECH

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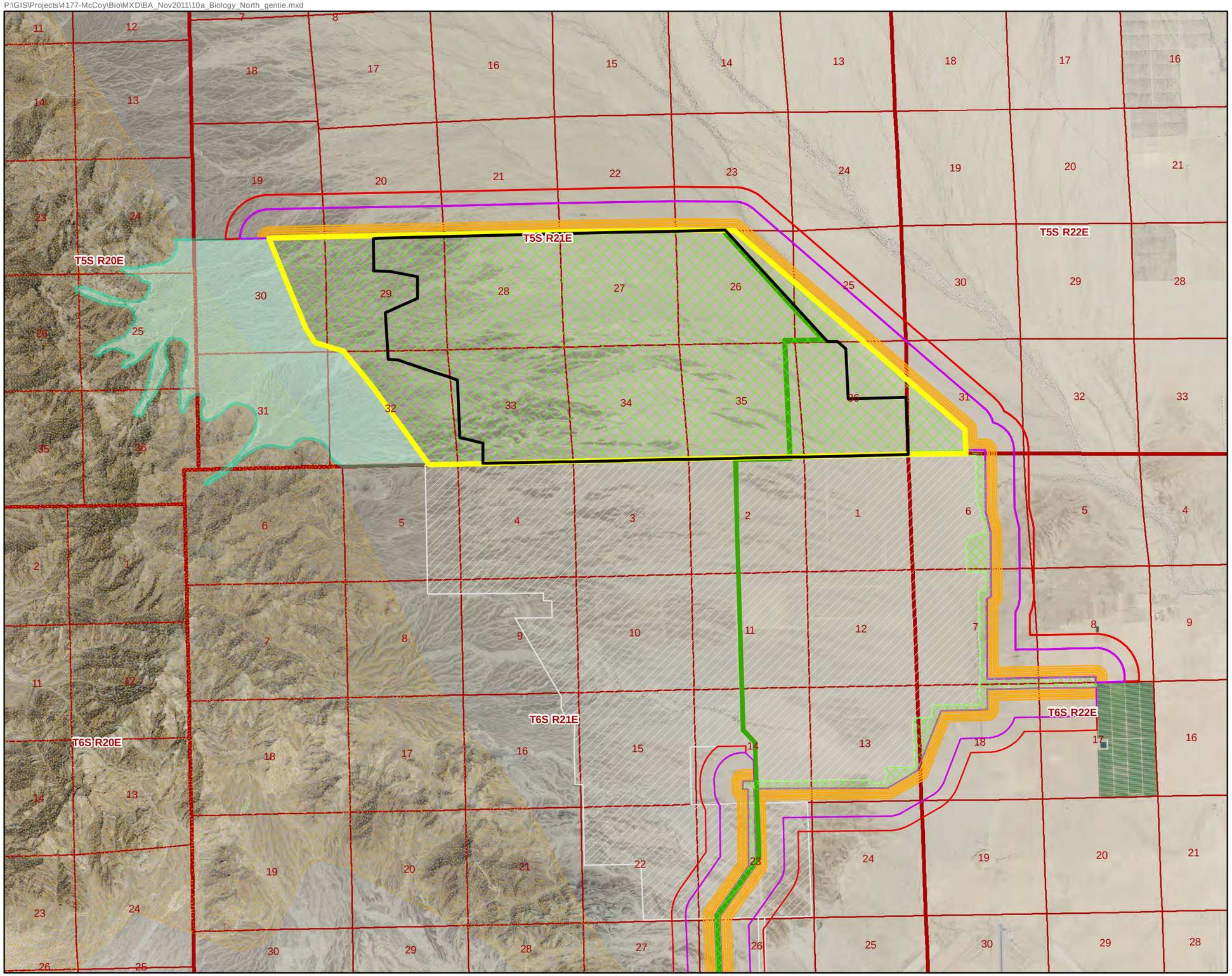

McCOY SOLAR ENERGY PROJECT RIVERSIDE COUNTY, CA

Legend

- Solar Plant Site Survey Area
- MSEP Solar Plant Site Boundary
- Proposed Linear Corridor

Spring 2011 Survey Area

- 100% Survey Coverage
- 100 to 500 ft Buffer and Burrowing Owl Transects
- 1,312 ft (400 m) Buffer Transect
- 1,969 ft (600 m) Buffer Transect
- BSPP 100% Survey Coverage (AECOM 2010)
- Big Horn Sheep WHMA
- Potential Primary Tortoise Recipient (Translocation) Area (100% coverage)
- Township/Range
- Sections

N

0 2,500 5,000 10,000
Feet

Notes:
(a) UTM Zone 11, NAD 1983 Projection.
(b) Source data: ESRI, BLM, USDA, TTEC

FIGURE 10A
2011 BIOLOGICAL RESOURCES SURVEY AREA

TETRA TECH

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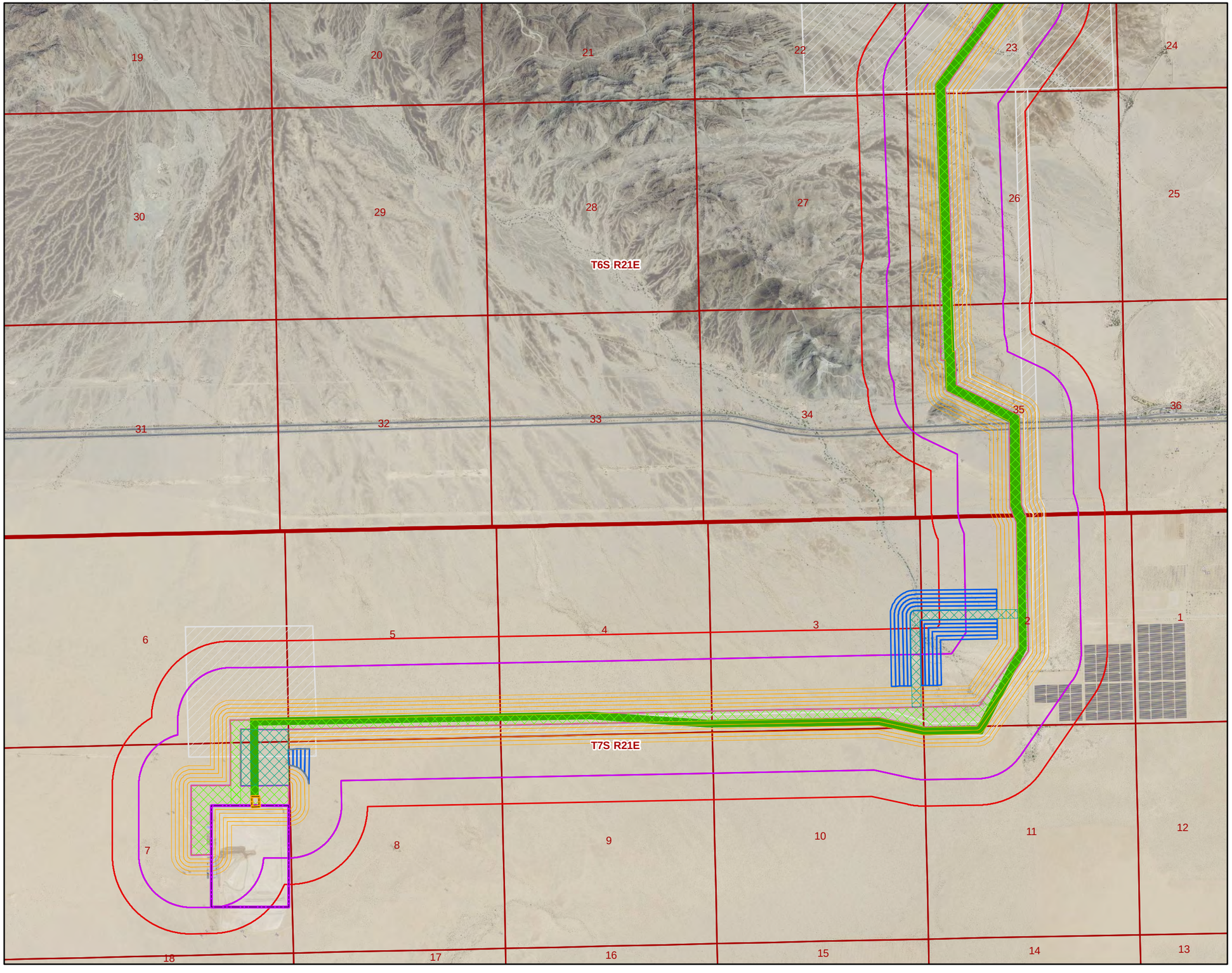

McCOY SOLAR ENERGY PROJECT RIVERSIDE COUNTY, CA

Legend

- Colorado River Substation (SCE)
- Switchyard
- Proposed Linear Corridor

Fall 2011 Survey Area

- Supplemental 100% Survey Coverage
- Supplemental 100 to 500 ft Buffer and Burrowing Owl Transects

Spring 2011 Survey Area

- 100% Survey Coverage
- 100 to 500 ft Buffer and Burrowing Owl Transects
- 1,312 ft (400 m) Buffer Transect
- 1,969 ft (600 m) Buffer Transect

- BSPP 100% Survey Coverage (AECOM 2010)
- Township/Range
- Sections

0 1,250 2,500 5,000
Feet

Notes:
(a) UTM Zone 11, NAD 1983 Projection.
(b) Source data: ESRI, BLM, USDA, TTEC

FIGURE 10B
2011 BIOLOGICAL RESOURCES SURVEY AREA

TETRA TECH

AR073827

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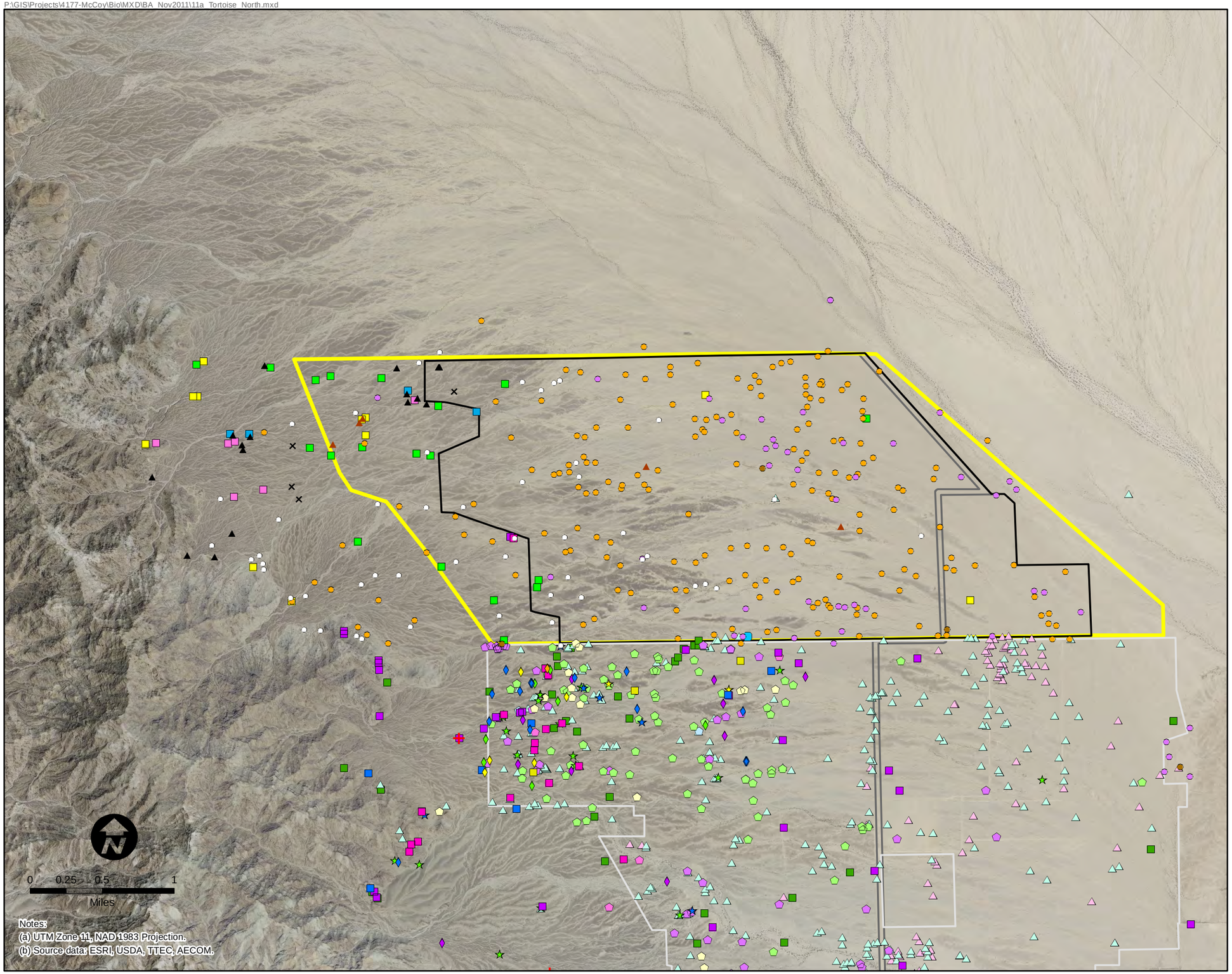
McCOY SOLAR ENERGY PROJECT RIVERSIDE COUNTY, CA



Legend

Tortoise Sign (Tetra Tech and Karl 2011)
- Tortoise
- Burrow - Class 1
- Burrow - Class 2
- Burrow - Class 3
- Burrow - Class 4
- Scat (Spring 2011)
- Scat (Fall 2011)
- Carcass
- Egg Shells
- Shell fragment < 4 years old
- Shell fragment > 4 years old
- Shell fragment (permineralized)

Tortoise Sign (AECOM 2009-2010)
- Tortoise
- Tortoise Burrow - Class 1
- Tortoise Burrow - Class 2
- Tortoise Burrow - Class 3
- Tortoise Burrow - Class 4
- Tortoise Burrow - Class 5
- Tortoise Pallet
- Tortoise Pallet - Class 1
- Tortoise Pallet - Class 2
- Tortoise Pallet - Class 3
- Tortoise Pallet - Class 4
- Tortoise Pallet - Class 5
- Tortoise Scat - Class 1
- Tortoise Scat - Class 2
- Tortoise Scat - Class 3
- Tortoise Scat - Class 4
- Tortoise Scat - Class 5
- Tortoise Carcass - Class 2
- Tortoise Carcass - Class 3
- Tortoise Carcass - Class 4
- Tortoise Bone Fragment - Mineralized
- Tortoise Bone Fragment - Not Mineralized
- Tortoise Egg Shell Fragment
- Tortoise Drinking Depression
- Tortoise Tracks

- Solar Plant Site Survey Area
- MSEP Solar Plant Site Boundary
- Linear Corridor
- BSPP ROW Boundary

FIGURE 11A
DESERT TORTOISE SIGN
OBSERVED DURING FIELD SURVEYS

TETRA TECH

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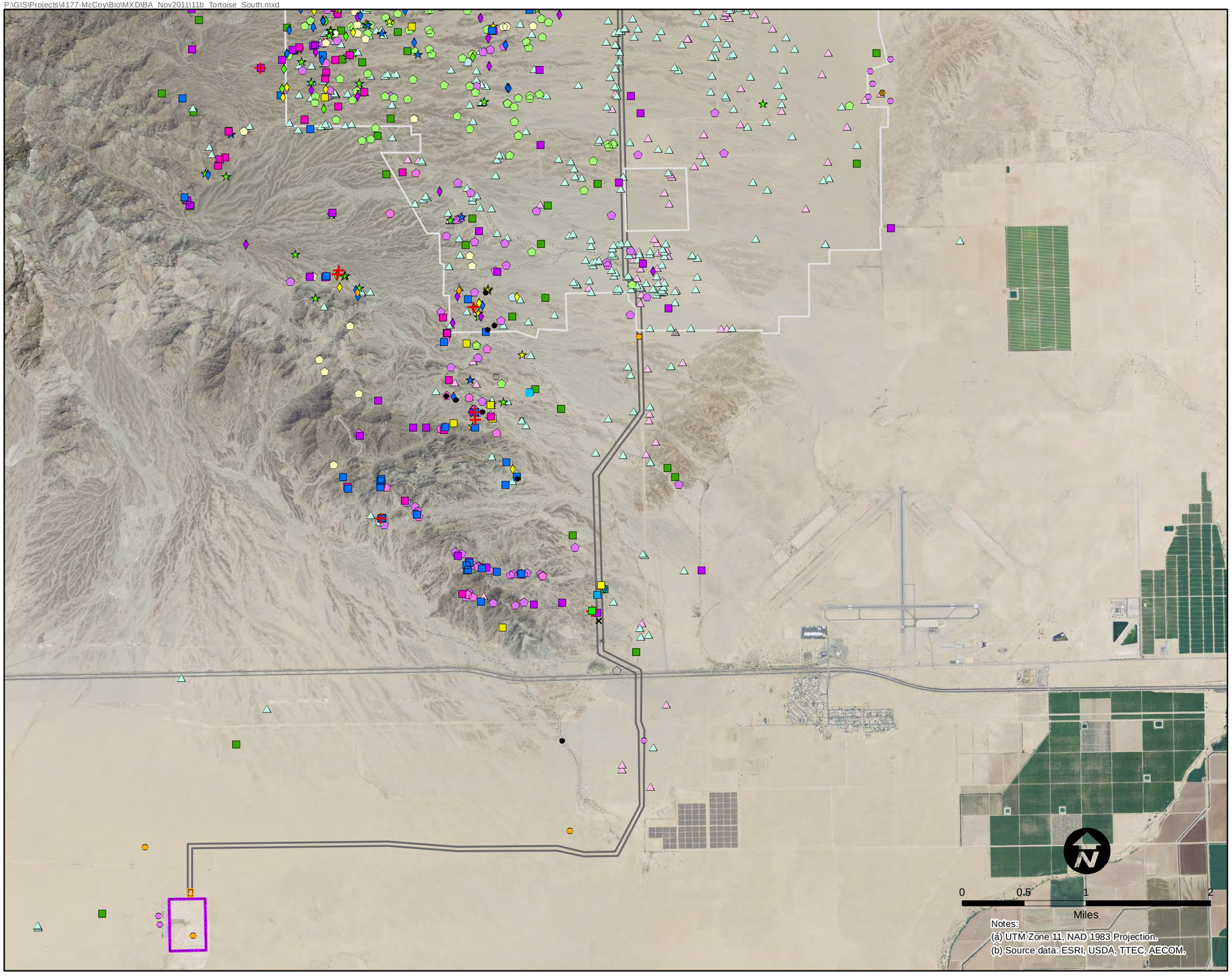


McCOY SOLAR
ENERGY PROJECT
RIVERSIDE COUNTY, CA

Legend

Tortoise Sign (Tetra Tech and Karl 2011)
- Tortoise
- Burrow - Class 1
- Burrow - Class 3
- Burrow - Class 4
- Shell fragment < 4 years old
- Shell fragment > 4 years old
- Shell fragment (permineralized)

Tortoise Sign (AECOM 2009-2010)
- Tortoise
- Tortoise Burrow - Class 1
- Tortoise Burrow - Class 2
- Tortoise Burrow - Class 3
- Tortoise Burrow - Class 4
- Tortoise Burrow - Class 5
- Tortoise Pallet
- Tortoise Pallet - Class 1
- Tortoise Pallet - Class 2
- Tortoise Pallet - Class 3
- Tortoise Pallet - Class 4
- Tortoise Pallet - Class 5
- Tortoise Scat - Class 1
- Tortoise Scat - Class 2
- Tortoise Scat - Class 3
- Tortoise Scat - Class 4
- Tortoise Scat - Class 5
- Tortoise Carcass - Class 2
- Tortoise Carcass - Class 3
- Tortoise Carcass - Class 4
- Tortoise Bone Fragment - Mineralized
- Tortoise Bone Fragment - Not Mineralized
- Tortoise Egg Shell Fragment
- Tortoise Drinking Depression
- Tortoise Tracks
- Linear Corridor
- Colorado River Substation (SCE)
- Switchyard
- BSPP ROW Boundary

FIGURE 11B
DESERT TORTOISE SIGN
OBSERVED DURING FIELD SURVEYS

TETRA TECH

Renewable Energy Development

What's in it for the Birds?

Construction Impacts to Birds

- loss of habitat quantity and quality
- potential impairment within movement corridors
- mortality

Mitigation

- pre-construction clearing and grading outside of breeding seasons
- enforceable timing restrictions and identification of permissible activities within a prescribed distance from active nests
- survey protocols for raptors and MBTA species
- buffer zones around active nests
- monitoring and reporting requirements.

"The MBTA Conservation Agreement may also require monetary compensation or land acquisition."

- None developed to date
- Land acquisition for the desert tortoise - does it compensate for impacts to bird habitat?

What is at Stake?

California BLM only

- 21,616 acres approved
- Processing 20 applications - 113,648 acres







What to do?

- Permitting agencies need to connect impacts to compensation
- I.e., collecting money for later compensation does not work
- Current thinking is traditional
  - acquire habitat
  - isolated habitat improvement

Can we do better for birds than this?



Proposal

Work with permitting agencies to:

- Better assess effects to birds and their habitat in the planning documents
- Include measures in the planning documents to compensate for impacts to birds on a regional basis

Proposal (part 2)

Work with regional partners to identify conservation projects that would result in measurable benefits to birds and their habitats

Where do joint ventures come in?

- Develop strategic mitigation plans to address bird needs
- Provide a list of priority projects within the target region that would benefit from a conservation or restoration effort and contribute to the overall health of the larger landscape
- Facilitate the process (i.e. write plan, implement, bank/hold funds, identify appropriate parties to conduct the mitigation, insure reports are produced and distributed to partners)

Response to Date

- California Department of Fish and Game
- California Energy Commission
- Bureau of Land Management
- Fish and Wildlife Service

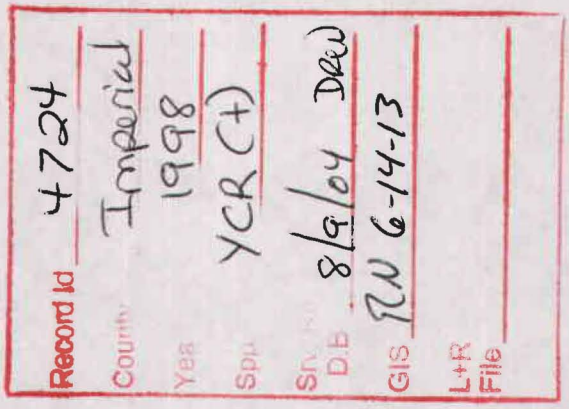
Questions?



SJM BIOLOGICAL CONSULTANTS
General and Focused Biological Surveys
Endangered/Threatened Species Studies
Project Impact Analyses

10 June 1998

SJMBC.476



Attention: Elyssa Robertson
REC Environmental
2650 Jamacha Road
Suite 147-202
San Diego, CA 92019

SUBJECT: Results of a field survey for Yuma clapper rail (*Rallus longirostris yumanensis* - **YCR**) along the 1.4-mile stretch of the Alamo River lying immediately north of the USA-Mexico border and south of State Highway 98. This site occurs in the western ½ of Sections 7 and 18, Township 17 South, Range 16 East, on the Calexico 7.5' USGS Quadrangle map. A specific plan development encompassing a large commercial gateway community is proposed for the lands adjacent to the survey area (Figures 1 and 2).

Dear Ms. Robertson:

Following is a letter-report of the results of a field survey for Yuma clapper rails on the above-described property.

INTRODUCTION AND BACKGROUND

At the request of REC Environmental, SJM Biological Consultants conducted a field survey for YCR along the Alamo River, between State Highway 98 and the USA-Mexico border.

The Yuma clapper is one of 24 known races of clapper rail and one of three races residing in California (Ripley 1977). Within California, the YCR occurs along the lower Colorado river and in the region of the Salton Sea. Populations of the YCR also are known from tributaries and historical areas of overflow along the Colorado River in Arizona, from isolated localities outside of the Colorado River system (e.g. Tavasci Marsh near the Verde Valley), and from overwintering sites in Mexico (Banks and Tomlinson 1974; Tomlinson and Todd 1973; Todd 1986). In response to field observations indicating limited numbers of Yuma clapper rails in the United States, the species was declared endangered in 1967 by the U.S. Department of Interior (U.S. Dept. of Interior 1968), and threatened in 1971 by the California Department of Fish and Game (California Department of Fish and Game 1992).

Yuma clapper rail habitat in known United States breeding areas has been generally characterized as dense emergent freshwater marsh vegetation. Within such freshwater marsh habitats, relatively

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CARLSBAD FIELD OFFICE, CA

Stephen J. Montgomery
4907 Morena Boulevard, Suite 1414 • San Diego, CA 92117 • Ph: (619) 274-6511 • Fax: (619) 274-[illegible]

shallow water depths, the interface between dry ground and the water's edge, the presence of dead fallen emergent vegetation (e.g. cat-tail), and a supply of suitable prey items (primarily crayfish, beetles and snails) were additional elements considered important in the life history of the YCR (Anderson and Ohmart 1978; Bennett and Ohmart 1978; Eddleman 1989; Smith 1975). Recent field work at the CDFG Wister Unit at the Salton Sea indicate that the preferred vegetation type used by YCR in these areas consists of more mature stands of southern cat-tails (*Typha domingensis*) with or without bulrush (*Scirpus spp.*). Areas exhibiting the widespread common reed (*Phragmites australis*) or tamarisk (*Tamarix sp.*), and probably other species common to the region, may occasionally be used but most likely only when they occur near stands of cat-tail or bulrush habitat. Ken Sturm, wildlife biologist at the Salton Sea National Wildlife Refuge, has detected YCR apparently foraging in fields cultivated for cotton and asparagus, at locations at least 50 meters from marsh habitat (Ken Sturm, pers. comm.). At studied sites, the primary item in the YCR diet is crayfish, although beetles and other invertebrates, as well as small vertebrates (i.e. small fish, tadpoles, etc.) also are consumed (Eddleman 1989; Todd 1986).

Eddleman (1989), from radio telemetry studies, reported home ranges of 0.77-20.48 hectares, for YCR in May-July in habitats on or adjacent to the Colorado River. Other investigators (Tomlinson and Todd 1973; Smith 1975; Bennett and Ohmart 1978; Todd 1986) reported YCR home ranges from 0.2 to 3.59 acres in size; however, these studies were based on vocalization counts, which may grossly underestimate home range size.

For many years, a large population of YCR has inhabited the freshwater marsh habitats at the California Department of Fish and Game Wister Unit of the Imperial Wildlife Area (Montgomery 1989-1998) and at the Salton Sea National Wildlife Refuge, both of which occur along the southeastern portion of the Salton Sea. This general habitat area occurs approximately 35 miles northwest of the current southern Alamo River project study area. Scattered populations of this species also have been confirmed for a variety of sites with appropriate habitat along canals and rivers to the south and east of the Salton Sea, including the vicinity of Bonds Corner approximately two miles east of the Alamo River study site (e.g. Jurek 1975; Montgomery 1998). In summary, Yuma clapper rails are known to occur in the area of the Alamo River study site and would be expected to inhabit significant stands of suitable cat-tail and/or bulrush habitat in this region.

SITE DESCRIPTION

The study area encompasses the Alamo River and the immediately adjacent slopes of the river channel. The dominant vegetation type along the banks of the river in the study area is arrow weed scrub, a phase of the more generalized Colorado riparian scrub. This community is simplified in the study area and consists of the following species: arrow weed (*Pluchea sericea*), tamarisk, seep weed (*Suaeda moquinii*), saltbush (*Atriplex sp.*) and a few individuals of creosote bush (*Larrea tridentata*). A nearly 100% cover of vegetation occurs throughout most of both east

and west river channel banks. Along the edge of the river itself, common reed is a dominant species.

Within the river itself, the dominant plant species is southern cat-tail, the primary representative of freshwater marsh vegetation in the study area. This vegetation type occurs in three locations in the study area. The largest stand of cat-tails is continuous and very dense and occurs in the southern one-third of the area; the approximate total area of this stand is 0.15 hectares (approx. 0.35 acre). A second much smaller, open stand occurs immediately north of the border, while the third is extremely small and occurs in the approximately northern one-third of the study area (Figure 2).

Human disturbance is common throughout the banks of the river channel. Numerous well worn trails and tunnels are present in the often total cover of vegetation. Discarded items of clothing are present in all areas, indicating intense and regular use of the river banks by illegal aliens presumably traveling northward through the area. A number of dirt roads occur along the edge of the river channel and are regularly used by U.S. Border Patrol agents. Lands to the east and west of the study area are entirely cultivated, thus no YCR habitat is present outside of the river channel. Habitats in and along the Alamo River immediately north of Highway 98 are similar to those in the study area.

METHODS

The survey for Yuma clapper rails entailed playing taped recordings of the vocalizations of this species at intervals of approximately 100 meters along the entire stretch of the Alamo River south of Highway 98. The roads along the eastern boundary of the study area provided ample access to the river channel and its habitats. A bull horn was used to project recorded calls into the study area, and field observations confirmed that these calls could be heard at a distance greater than 100 meters. This survey procedure was followed on two days, 6 (0600-0800 hrs) May and 18 May (0625-0820 hrs) 1998.

The current protocol for YCR surveys (McKinstry 1995) requires that call count surveys be conducted no earlier than 30 minutes before sunrise and no later than 0900, between 15 April and 15 May. Two or three replicates of the survey are required during this time period. The current survey generally conformed to the survey protocol described above, although the second survey occurred three days after the 15 May deadline. The survey was conducted by Stephen J. Montgomery, who is currently listed on and therefore authorized to conduct YCR surveys by a blanket endangered species permit issued to the Carlsbad Field Office of the United States Fish and Wildlife Service, Carlsbad, California.

Vocalization counts are the standard method for conducting surveys for YCR. In most habitats occupied by YCR, the species typically emits single or double (i.e. duet) "clatter" calls in response to broadcasted vocalizations. Kek, kek-burr or other types of calls also are occasionally emitted. YCR also occasionally respond to taped vocalization broadcasts by leaving the cover of marsh

vegetation and approaching the field investigator on the ground in plain view.

RESULTS AND DISCUSSION

A single pair of Yuma clapper rails, indicated by a "duet clatter" call, was detected on both survey days in the larger central stand of cat-tails in the study area (Figure 2). Duets typically indicate mated pairs that presently are or will be breeding; thus, the detected YCR pair probably either is presently nesting or recently finished nesting. These rails were not responsive to taped vocalizations broadcast into the marsh. Instead, they vocalized spontaneously during each of the field surveys. Weather on the two survey days were as follows.

-- 6 May 0% cloud cover, wind speeds 1-5mph, 58F at 0600

-- 18 May high thin 100% cover of clouds, no wind, 65F at 0625

The second field survey occurred three days later than the 15 May survey deadline specified in the YCR protocol (McKinstry 1995). Nonetheless, there is no reason to think that this 3-day delay made any difference in the results of the call count, since the apparently same pair of YCR was detected in the same cat-tail habitat patch on both survey days. Furthermore, since the 1998 spring weather has been relatively mild, it is likely that the spring breeding season has been extended to some degree due to generally cooler than normal weather conditions..

The very limited area of cat-tail habitat in the study area - that is, approximately 0.2 hectares - is at the lower limit of home ranges reported for YCR and would, therefore, directly limit the number of YCR potentially present. Although home ranges in narrow canals and smaller rivers such as the Alamo could vary from those reported for more expansive habitat stands elsewhere, it is clear that the amount of habitat available for YCR in the study area is extremely limited. It is logical that the central cat-tail patch in the study area is the primary nesting habitat, and probably the primary home range, available to this species. However, the resident rails very likely forage to some degree along the banks of the study area outside of this main cat-tail stand. They also may periodically spend time foraging in the southernmost cat-tail stand. It follows that the low number of YCR detected in the main cat-tail patch, i.e. a single pair, would exhibit limited responsiveness to taped calls, since rail populations with lower densities appear to have lower response rates (Zembal and Massey 1981).

The development of a large commercial center immediately adjacent to the Alamo River could result in the abandonment of the extant cat-tail habitat by the identified pair of YCR. However, this pair of YCR has continued to occupy the extant central cat-tail stand in spite of regular and intense nightly human (illegal alien) activity in the adjacent river bank scrub habitat. In addition, daytime farming activity has occurred on both sides of the Alamo River habitat area for years. This suggests that these birds are somewhat habituated to at least nighttime human activity in the

river banks immediately adjacent to their cat-tail habitat. Since YCR appear to be largely diurnal birds, daytime activity associated with the proposed development could be more detrimental. Any increase in domestic predators (e.g. cats, dogs) resulting from the development could also be very detrimental to the resident YCR.

If the proposed development remains 150 feet away from the top of the river bank, it is likely that YCR will continue to inhabit the identified cat-tail stand, assuming all other factors (including predation pressures) remain in their current state.

Please contact me if you have any questions regarding the preceding report.

Sincerely,

Stephen J. Montgomery
Permitted Yuma Clapper Rail Biologist

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FIGURE 1

VICINITY MAP FOR THE ALAMO RIVER PROJECT SITE

FIGURE 2

LOCATION OF CAT-TAIL STANDS WITHIN THE ALAMO RIVER PROJECT SITE - TWO YUMA CLAPPER RAILS WERE DETECTED (VOCALIZATION) IN THE LARGER CENTRAL CAT-TAIL STAND

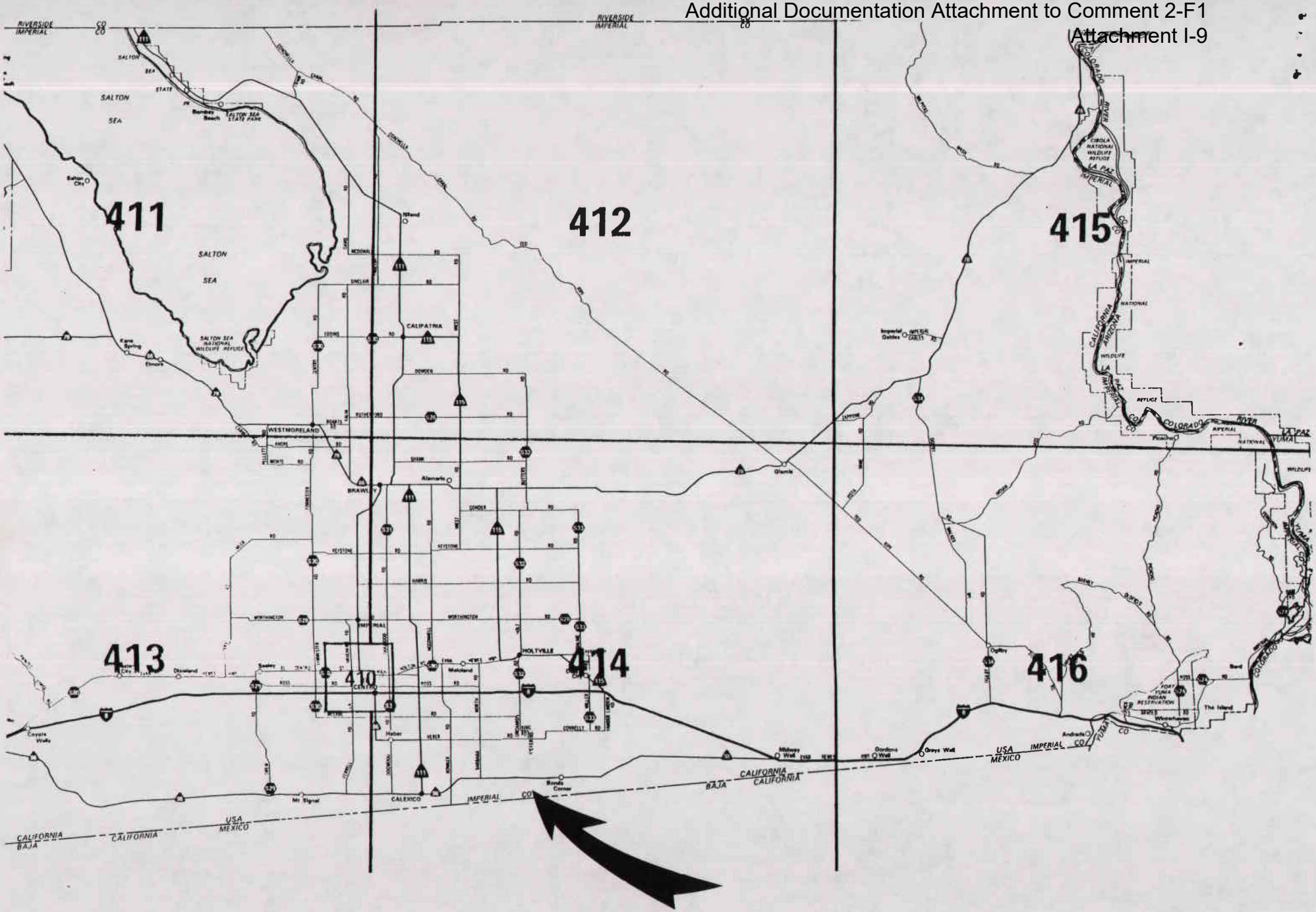

FIGURE 1

VICINITY MAP FOR THE ALAMO RIVER PROJECT SITE

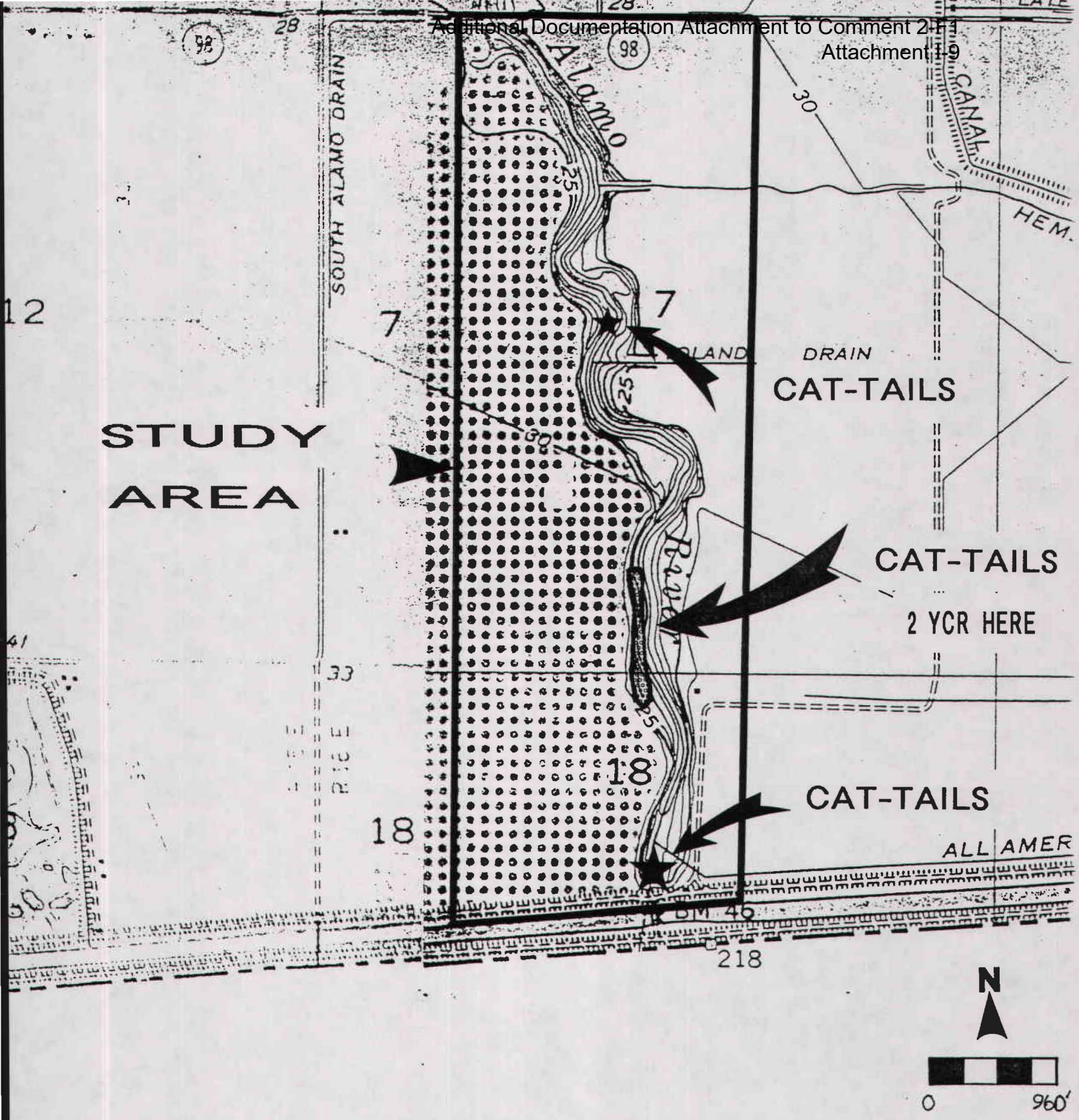

FIGURE 2

LOCATION OF CAT-TAIL STANDS WITHIN THE ALAMO RIVER PROJECT SITE - TWO YUMA CLAPPER RAILS WERE DETECTED (VOCALIZATION) IN THE LARGER CENTRAL CAT-TAIL STAND

Yuma Clapper Rail Survey along Lower Colorado River at Topock Gorge, 2004, Final Report

Record Id 6838
County San Bernardino
Year 2004
Spp YCR ⊕
Srv. Rpt. D.B. D.M. 7/26/05
GIS RN 6-17-13
L+R File

U.S. Bureau of Reclamation, Lower Colorado Region, Natural Resources Office

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Introduction

The Yuma clapper rail (*Rallus longirostris yumanensis*) was listed endangered on 11 March 1967 by the Secretary of Interior pursuant to the Endangered species Act of 1966 (US Dept. of Interior 1968). California listed the Yuma clapper rail rare in 1971 (Leach and Fisk 1972). In 1978, Arizona classified the Yuma clapper rail as group 3, similar to the federal status of endangered (AZ Dept. of Game and Fish Commission 1978).

In 1996, personnel from the Resources Management Office of the Lower Colorado Region, U. S. Bureau of Reclamation (Reclamation) began to conduct surveys for the presence of the Yuma clapper rail in Topock Gorge within the U.S. Fish and Wildlife Service's (USFWS) Havasu National Wildlife Refuge (HNWR), along the lower Colorado River. Surveys were conducted at the request of staff at HNWR. In 2001 and 2002, Reclamation conducted Yuma clapper rail surveys in Topock Marsh, just upstream of Topock Gorge, within HNWR. The USFWS resumed surveys at Topock Marsh in 2003. Reclamation conducts these surveys in accordance with the Biological and Conference Opinion on Lower Colorado River Operations and Maintenance – Lake Mead to Southerly International Border (USFWS 1997), which required that surveys be performed to continually track the population of Yuma clapper rails in order to maintain a minimum breeding population of 700-1000 on the lower Colorado River (USFWS 1983).

Background

The Yuma clapper rail is a large gray brown rail with a slightly decurved bill, very narrow laterally with long legs and toes relative to the body. This very secretive rail feeds mostly on abundant crustaceans found in marsh habitats (Ohmart and Tomlinson 1977). Unlike other subspecies of the clapper rail, *yumanensis* is not restricted to salt water marshes (Eddleman and Conway 1998). It has been found in fresh water marshes along the Virgin and Muddy Rivers and Las Vegas Wash in southern Nevada , the lower Colorado River from Laughlin Bay, Nevada to the Colorado River Delta in Mexico and near the Salton Sea in southern California (Rathbun and Braden 2003, SWCA 1998, Eddleman and Conway 1998). Historically researchers did not believe that the Yuma clapper rail was distributed along the lower Colorado River in the United States (Grinnell 1914, Ohmart and Smith 1973, Rosenberg et al. 1991). Not until the building of dams, which led to the creation of marsh habitats, was the Yuma clapper rail recorded along the lower Colorado River. Dickey recorded the first Yuma clapper rail in 1921, near Laguna Dam, north of Yuma, Arizona, 12 years after Reclamation constructed Laguna dam (Dickey 1923). Naturalists sighted Yuma clapper rails further north of Laguna Dam after Parker, Imperial, and Headgate Rock Dams were built in 1938, 1939, and 1942, respectively (USFWS 1983). The construction of dams created Yuma clapper rail habitat by blocking the flow of sediments which precipitated outward from the river channel, forming sandbars, thus providing suitable substrate for marsh vegetation such as cattails, bulrush, and sedges (Ohmart and Smith 1973).

Radiotelemetry studies of Yuma clapper rail indicate that greater than 75% of the breeding population overwinters along the lower Colorado River (Eddleman 1989, Conway 1990). Eddleman and Conway believe that the Yuma clapper rails migrate locally to search for food and are less vocal in the winter months. Yuma clapper rail males start advertising in February with pair formation beginning shortly afterward (Eddleman and Conway 1998).

Description of Survey Area

The area of study, Topock Gorge, is located along the lower Colorado River between Needles, California and Lake Havasu City, Arizona in Havasu NWR (map1). The predominant vegetation at Topock Gorge consists of bullwhip bulrush (*Juncus californicus*), three-square bulrush (*Scirpus olneyi*), southern cattail (*Typha angustata*) and common reed (*Phragmites communis*). There are also stands of salt cedar (*Tamarix sp.*) and coyote willow (*Salix exigua*) mixed in. There are 52 survey sites with the majority of them located on the eastern side of the Colorado River (Maps 2-4, Fig. 1). A list of other survey areas and the agencies responsible for them (Attachment 1) is included. Reclamation did not survey the Mohave Division in 2003.

Methods

We employed survey protocol and data sheets developed by the USFWS in 1983 and revised in 2000 and again in 2003 (Attachments 2, 3, 4). On current data sheets, we record date, start time, end time, weather, location, route, observers, and other comments as well as rails encountered, their responses and direction and distance from the survey point. This latest version of the data sheet is an optional form more in accordance with established rail survey protocol. From 2000 -2004, the surveys were performed three times between 15 March and 31 May of each year with at least one week between each survey period. Surveys from 1996 through 1999 were done twice during the months of April and May. Each survey period, we attempted to visit each of the 52 sites. Surveys periods were conducted at the same time each year. Flat bottomed lightweight power boats provided access to the survey areas. Surveys commenced 30 minutes before sunrise and continued no later than 3 hours after sunrise. Official surveys ceased when winds reached greater than 16 kilometers per hour due to difficulty in hearing the rails over the rustling of the vegetation. We surveyed for the rails using playback recordings of Yuma clapper rail vocalizations provided by the USFWS to elicit responses. Johnny Stewart Bird and Animal game callers were used. The surveyors arrived at the survey site, waited and listened for 1 minute, played clapper rail "kek" and "clatter" call tape for 2 minutes, listened for 2 minutes, play tape for 2 minutes, listened for 1 minute then moved to the next survey site for a total of 8 minutes of survey time at each location. All responses and sightings of Yuma clapper rail were recorded as well as those of the least bittern, Virginia, sora and black rail. General area maps were marked with the location of the birds observed also. All data forms and maps were sent to the Yuma clapper rail coordinator, USFWS-AESO in Phoenix, AZ.

Results

In 2004, surveys were conducted on March 23-24, April 20-21 and May 18-21. One complete survey was done each month and the average used to obtain a yearly detection number. The number of Yuma clapper rails encountered for the months surveyed was 57, 48 and 72, respectively, with the yearly average of 59. Of the 177 Yuma clapper rails that were encountered only 4 were seen. That is a visual encounter rate of 2.3 %. Rails were detected at 4 survey points where they hadn't been found during all of Reclamation's surveys from 1996 to 2004 (Figure 2).

Discussion

Conway et al. (1993) used radiotelemetry in conjunction with playback recordings of Yuma clapper rail along the lower Colorado River at Mittry Lake, north of Yuma, Arizona to determine detection rates for the USFWS protocol. They determined a year-round response rate of 19.2% of the marked birds responding to the recorded calls. During the breeding season (the same time we performed our surveys), the response rate jumped to 40%. Additionally, the use of taped recordings on several visits may cause the birds to alter their behavior and may provide a reason for the decrease of responses (Robbins 1978). The birds may become habituated to the tape recordings and not respond as frequently. Conway et al. and Robbins data suggest that our survey results may show a number less than half the actual number of Yuma Clapper rail that inhabit the gorge.

Although Yuma clapper rail responses at Topock Gorge have fluctuated both during the survey periods and between the years, there has not been a downward trend throughout those years (Fig. 3). It appears to be more of a rollercoaster ride with the car on a steady climb at the present. The highest response in 9 years of Reclamation surveys was during May 2004 with 72 rails. The lowest was in March of 2002 with 17, a difference of 55 rails encountered in a little over 2 years time. These numbers show that the number of rails encountered can vary greatly over a relatively short period of time and the reason or more likely, reasons for these fluctuations are unknown at this time.

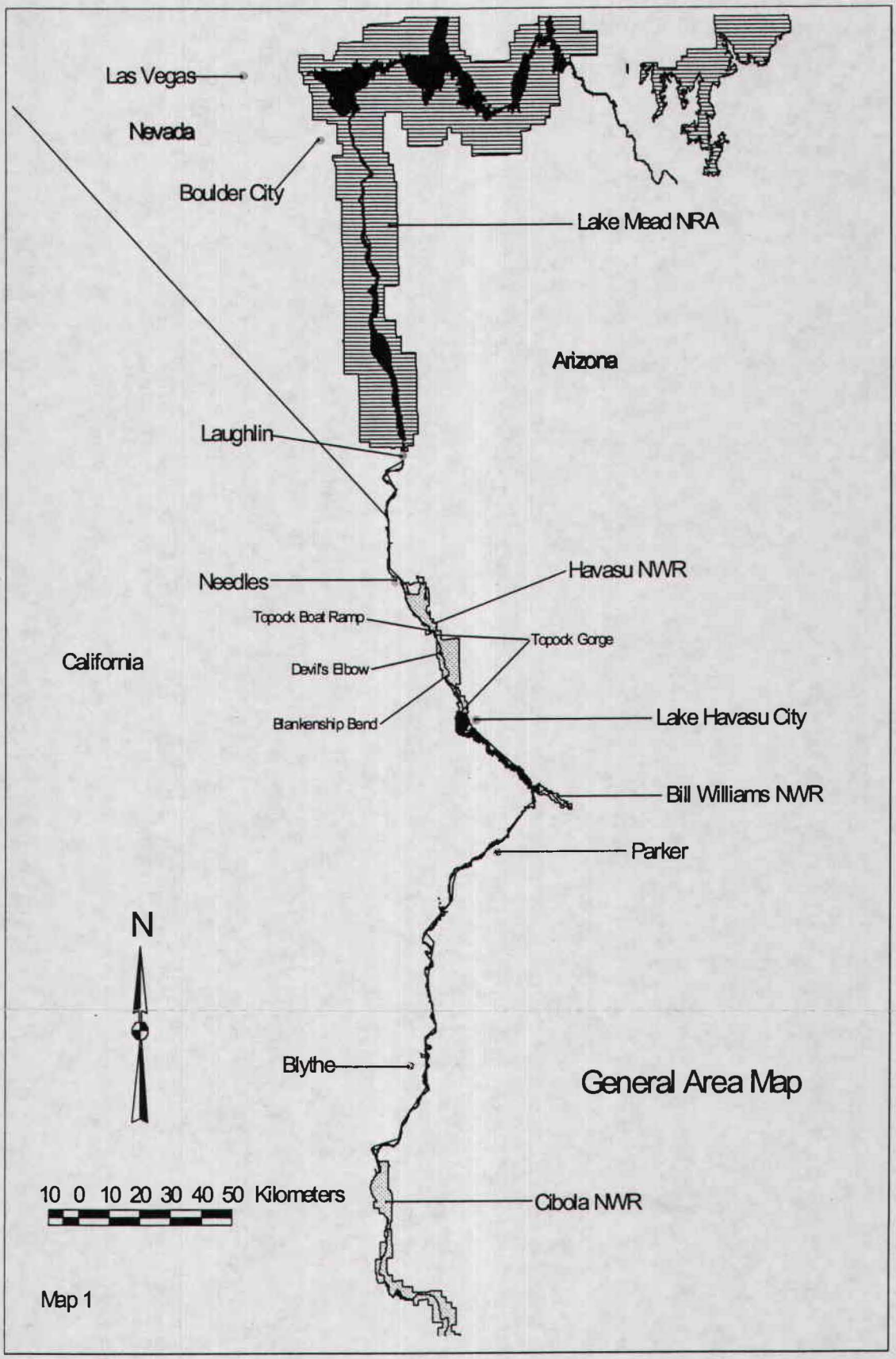
Reservoir levels throughout the survey years have remained fairly constant but there are fluctuations of several feet in the water level during the nesting season. One of the principle causes of nest failure is flooding (Eddleman and Conway 1998). We do not know of an optimum water level in Topock Gorge for Yuma clapper rails.

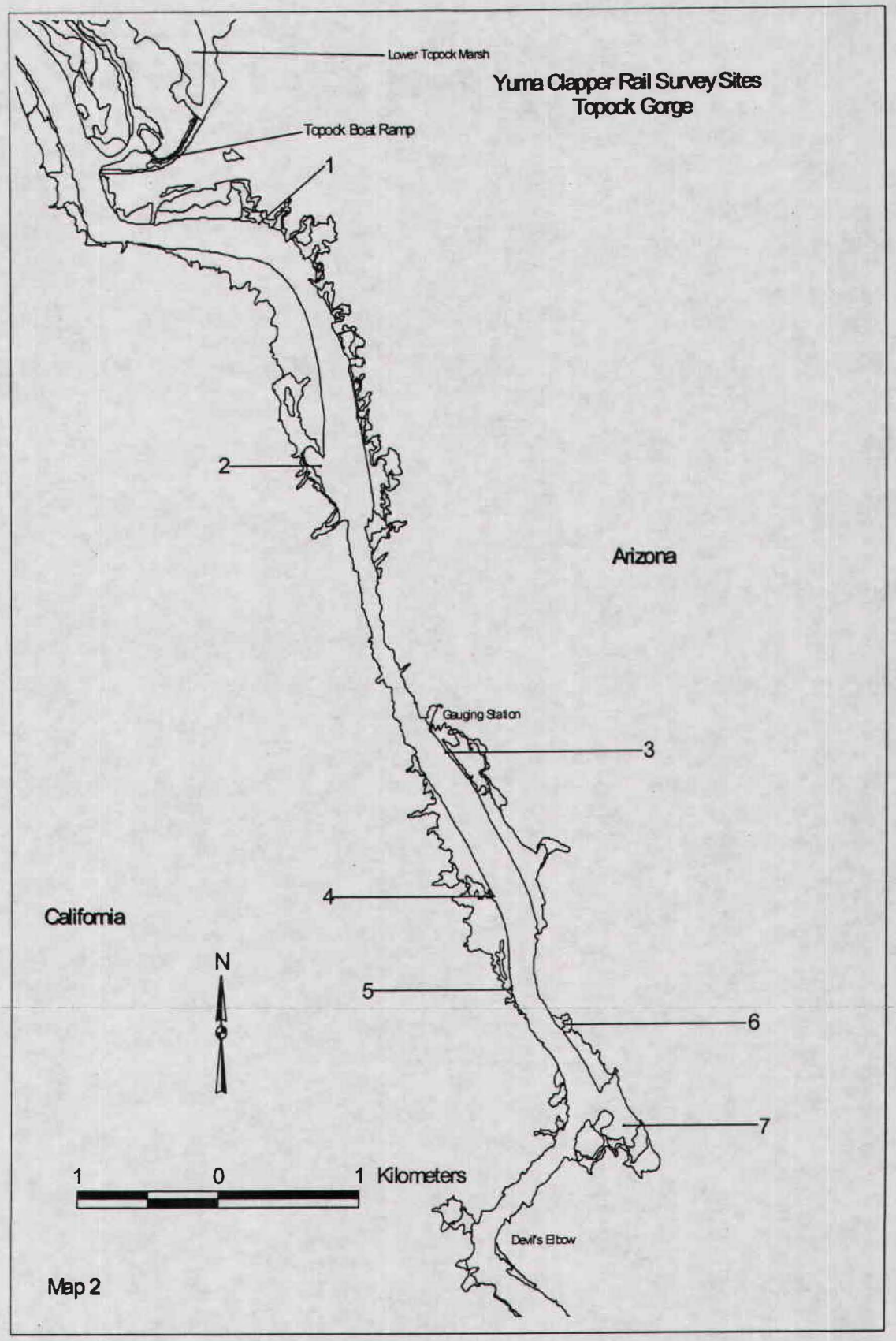
Changes in habitat could also account for the differences in the response levels of Yuma clapper rail between years. Habitat analysis of the survey sites, however, was not performed. If there were any changes of habitat quality during the surveys it is not known. Surveyors have noted minor changes with increases in open water and filling in

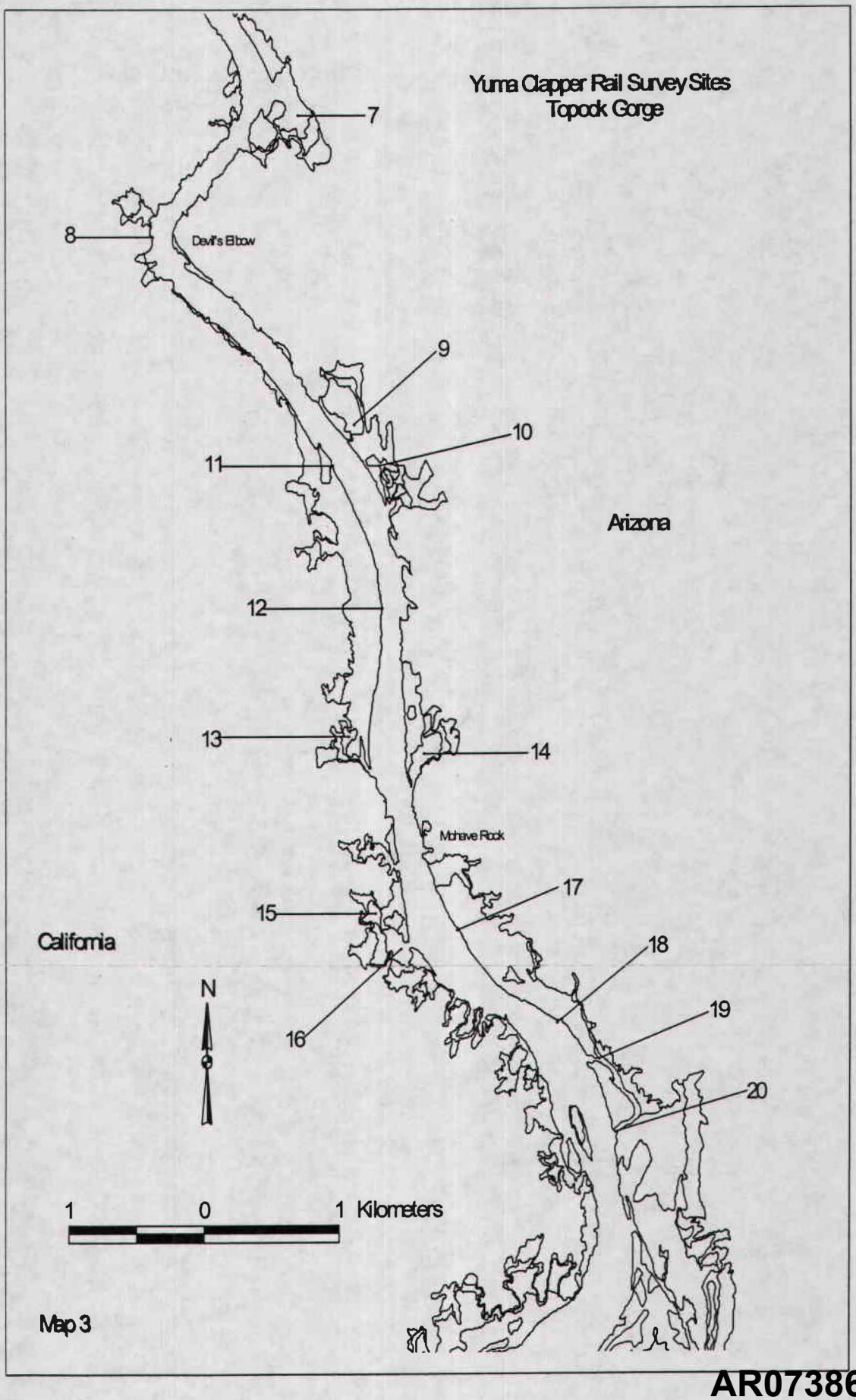
of open water and channels with vegetation (J. Swett, per. comm.). Increases or decreases of habitat quality may account for the differences in the yearly response rates but shouldn't account for the response rate changes experienced between months.

Recommendations

1. Continue survey efforts at Topock Gorge.
2. Look at the significance of water fluctuations and the number of rails encountered. Is there an ideal water level?
3. Perform a more thorough analysis of vegetation composition where Yuma clapper rails are heard and seen including species composition, percentage and distance to shore and open waters and depth of water.
4. Revaluate areas in Topock Gorge that may potentially provide Yuma clapper rail habitat.


Las Vegas
Nevada
Boulder City
Lake Mead NRA
Arizona
Laughlin
Needles
Havasu NWR
Topock Boat Ramp
Topock Gorge
California
Devil's Elbow
Blankenship Bend
Lake Havasu City
Bill Williams NWR
Parker
N
Blythe
General Area Map
10 0 10 20 30 40 50 Kilometers
Cibola NWR
Map 1


Lower Topock Marsh
Yuma Clapper Rail Survey Sites
Topock Gorge
Topock Boat Ramp
1
2
Arizona
Gauging Station
3
4
California
N
5
6
7
1 0 1 Kilometers
Devil's Elbow
Map 2


Yuma Clapper Rail Survey Sites
Topock Gorge
7
8
Devil's Elbow
9
10
11
Arizona
12
13
14
Mohave Rock
17
15
California
18
N
16
19
20
1 0 1 Kilometers
Map 3

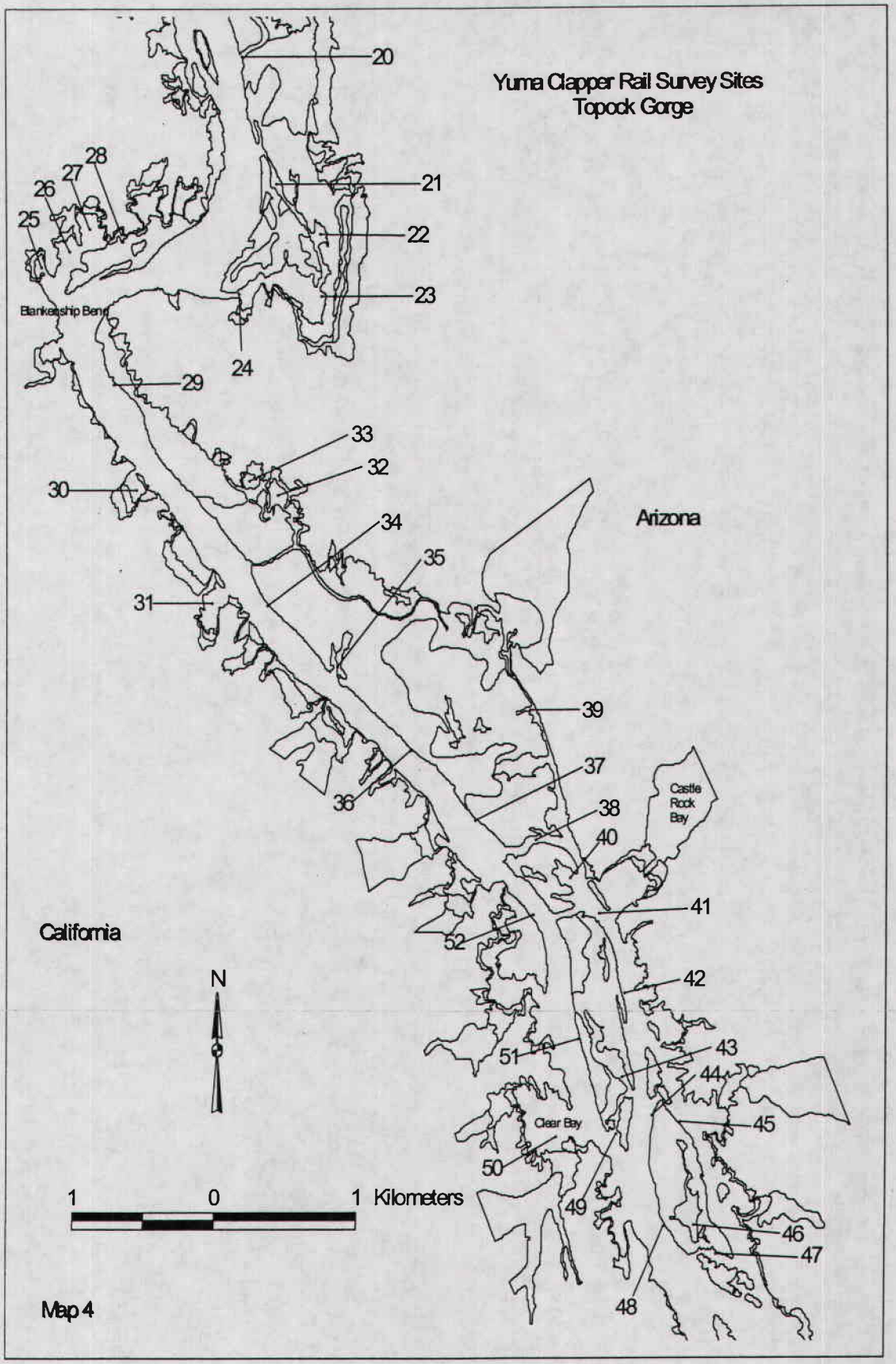
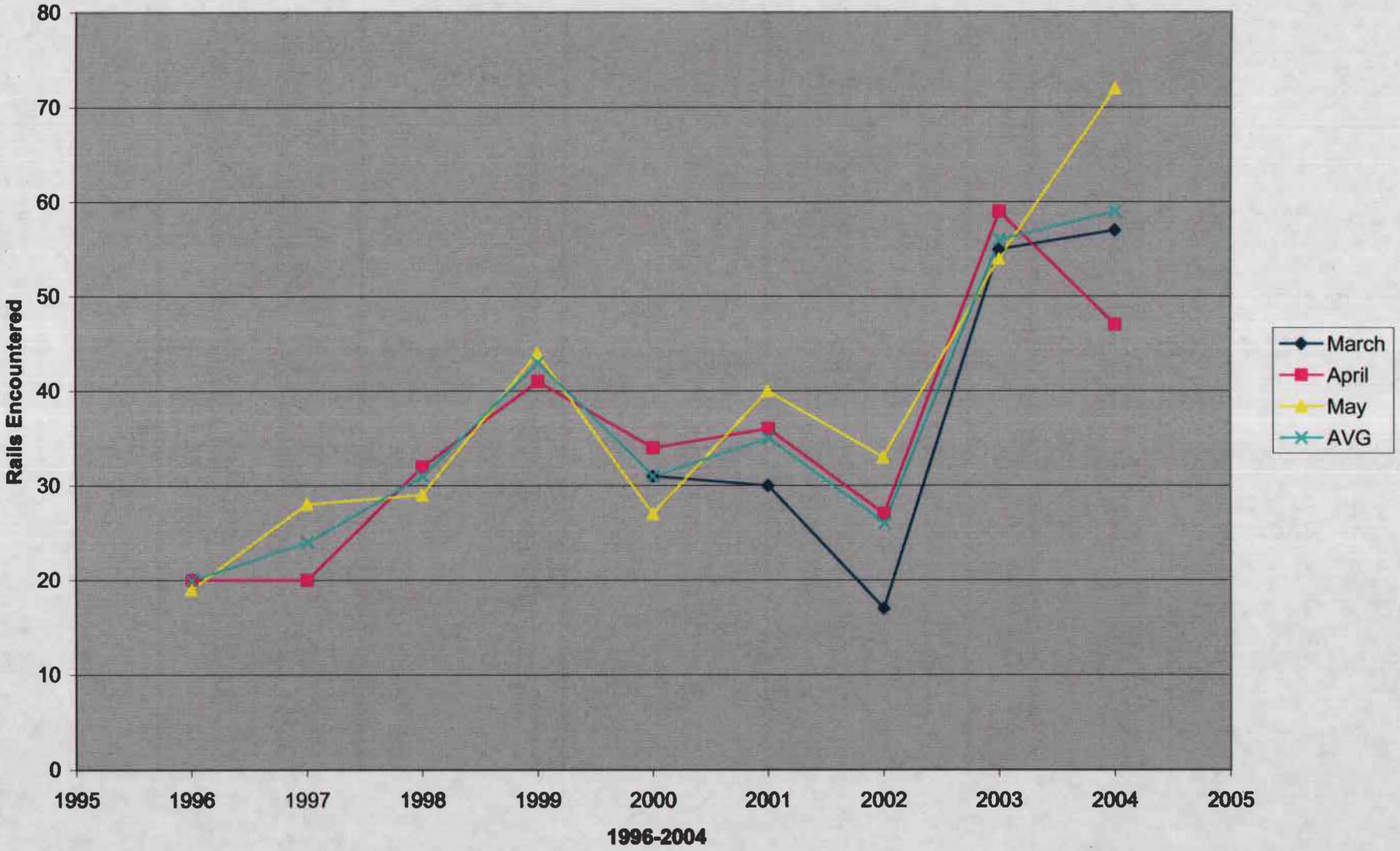

Yuma Clapper Rail Survey Sites
Topock Gorge
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
Arizona
California
Castle Rock Bay
Clear Bay
N
1 0 1 Kilometers
Map 4

Figure 3, Yuma Clapper Rail Encounters - Topock Gorge, 1996-2004



YUMA CLAPPER RAIL OFFICIAL SURVEY LOCATIONS

ANNUAL SURVEY REQUIRED

Topock Marsh	Fish and Wildlife Service (FWS)
Topock Gorge	Bureau of Reclamation (BOR)
Bill Williams Delta	FWS
Cibola NWR	FWS
Imperial Division	Bureau of Land Management (BLM)#
Imperial NWR	FWS
Mittry Lake/Teal Alley/YPG Slough	Arizona Game & Fish Department (AGFD)
Gila River (Buckeye-Arlington)	AGFD, FWS, Dick Todd
Other Internal Arizona Areas	AGFD, FWS
IWA: Wister Unit	California Department of Fish & Game (CDFG)
Sonny Bono-Salton Sea NWR	FWS
Barnacle Beach (Salton Sea)	FWS
Cienega de Santa Clara	University of Arizona, AGFD, FWS

SURVEY ON THREE YEAR ROTATION*

SURVEY IN 2000 and 2003

Mohave Division	BOR
Parker Division	CDFG, Colorado River Indian Tribes (CRIT)
Laguna Division	AGFD, BLM
Yuma Valley Drains	BOR

SURVEY IN 2001 and 2004

Lake Havasu	BLM
Palo Verde Division	CDFG
Yuma Division	AGFD
Lower Gila River/Quigley Pond	AGFD

SURVEY IN 2002

Parker Strip (CRIT)	CRIT
Cibola Division	CDFG, FWS
Limitrophe Division	AGFD

#BLM has requested assistance from other agencies to complete this location
*locations in this category can be surveyed more often if the responsible agency wishes

Attachment 1

Yuma Clapper Rail Survey Sites
Topock Gorge, Havasu National Wildlife Refuge
Global Positioning System (GPS) Coordinates

Datum NAD 27
UTM Zone 11

Site #	Easting	Northing	Site #	Easting	Northing
1	731,402	3,844,171	27	735,266	3,831,508
2	731,826	3,842,684	28	735,494	3,831,452
3	732,711	3,840,914	29	735,429	3,830,575
4	733,050	3,840,007	30	735,584	3,829,935
5	733,184	3,839,440	31	736,117	3,829,247
6	733,586	3,839,226	32	736,572	3,829,896
7	733,972	3,838,602	33	736,379	3,829,973
8	732,923	3,837,894	34	736,499	3,829,238
9	734,405	3,836,767	35	736,989	3,828,856
10	734,593	3,836,528	36	737,505	3,828,366
11	734,250	3,836,531	37	737,982	3,827,928
12	734,612	3,835,665	38	738,416	3,827,816
13	734,370	3,834,909	39	738,365	3,828,607
14	734,935	3,834,816	40	738,657	3,827,575
15	734,560	3,833,853	41	738,872	3,827,369
16	734,741	3,833,630	42	739,031	3,826,883
17	735,181	3,833,727	43	739,041	3,826,380
18	735,914	3,833,191	44	739,246	3,826,114
19	736,214	3,832,978	45	739,448	3,826,097
20	736,337	3,832,541	46	739,538	3,825,478
21	736,577	3,831,774	47	739,727	3,825,310
22	736,882	3,831,465	48	739,332	3,825,469
23	736,903	3,831,082	49	738,984	3,826,049
24	736,315	3,831,121	50	738,537	3,826,002
25	734,266	3,831,258	51	738,721	3,826,604
26	735,120	3,831,362	52	738,378	3,827,352

Figure 1, GPS Locations of Survey Sites

Figure 2. Yuma Clapper Rail Occurence
Topock Gorge HNWR
1996-2004

CLAPPER RAIL OCCURRENCE AT SURVEY SITES - TOPOCK GORGE -1996 TO 2004																										
SITE #	Apr-96	May-96	Apr-97	May-97	Apr-98	May-98	Apr-99	May-99	Mar-00	Apr-00	May-00	Mar-01	Apr-01	May-01	Mar-02	Apr-02	May-02	Mar-03	Apr-03	May-03	Mar-04	Apr-04	May-04	Total	Occurance	SITE #
1	0	0	0	0	0	0	1	2	0	0	0	2	1	2	0	0	0	1	0	2	0	0	1	12	8	1
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	2
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0	1	2	2	8	5	3
4	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	1	4
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
7	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	1	1	0	2	2	7
8	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	8
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	2	3	8	3	9
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	1	10
11	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	2	0	5	4	11
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	3	3	12
13	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	13
14	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	14
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	15
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	16
17	0	0	0	0	3	1	4	3	0	0	0	0	1	1	1	0	2	1	4	1	2	1	1	26	14	17
18	0	2	0	0	0	1	1	0	0	2	1	1	1	1	0	0	1	1	1	0	5		0	18	12	18
19	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	1	0	2	2	1	2	0	11	7	19
20	0	0	0	1	1	1	0	2	0	2	1	0	1	2	1	0	1	1	2	4	2	0	0	22	14	20
21	3	4	1	2	1	1	1	0	0	1	2	5	4	3	4	0	3	3	4	4	6	4	3	59	20	21
22	0	2	2	1	2	0	1	3	3	4	0	4	1	4	0	2	3	4	4	5	3	3	2	53	19	22
23	3	0	0	1	1	0	1	1	0	1	0	0	0	0	0	0	1	0	1	2	0	5	2	19	11	23
24	3	1	0	1	1	0	0	0	0	1	5	2	2	0	0	0	1	0	1	0	0	0	1	19	11	24
25	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	25
26	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	2	0	0	0	1	2	0	8	5	26
27	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0	3	2	27
28	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	2	2	0	0	1	7	5	28
29	0	0	0	1	0	0	3	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	1	8	5	29
30	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	3	3	30
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31
32	1	0	0	0	2	1	0	2	0	0	1	0	3	0	0	0		0	0	0	0	0	2	12	8	32
33	3	2	2	2	0	1	5	3	0	0	1	0	0	0	0	2	1	1	0	0	0	0	3	26	13	33
34	0	2	1	0	1	1	1	1	0	0	0	0	3	3	0	2	0	0	1	0	1	0	0	17	11	34
35	2	0	0	1	3	1	5	1	8	0	0	1	2	1	0	0	2	5	3	2	6	2	5	50	17	35
36	1	1	1	1	0	2	2	6	3	1	1	2	0	0	0	2	0	1	3	0	6	1	4	38	17	36
37	2	2	0	0	2	1	1	4	0	0	0	3	2	2	0	1	0	2	3	3	0	0	0	28	13	37
38	0	0	1	3	2	3	2	3	1	1	0	1	3	3	0	7	4	4	5	5	6	2	1	57	19	38
39	1	0	0	2	1	0	0	4	0	1	0	1	1	0	0	2	0	1	2	2	2	1	4	25	14	39
40	0	0	1	0	0	1	2	1	2	2	2	0	0	1	1	1	3	4	2	2	1	0	6	32	16	40
41	0	2	1	1	0	3	1	0	5	1	1	1	1	4	0	0	5	1	1	0	0	1	8	37	16	41
42	0	0	2	2	3	3	2	0	0	1	2	2	1	3	4	3		2	2	0	2	0	3	37	16	42
43	1	1	1	2	2	3	0	1	0	3		0	0	3	0	0	0	1	1	3	0	5	0	27	13	43
44	0	0	2	2	0	2	1	3	0	0	0	0	0	0	0	0	0	2	2	3	1	2	2	22	11	44
45	0	0		0	0	0	0	0	0	0	0	0	2	0	0	0	0	3	1	0	1	0	3	10	5	45
46	0	0	0	1	0	1	0	0		2	2	0	0	0	0	2	0	3	1	0		3	0	15	8	46
47		0	1	1	1	1	0	0	1	0	0	0	2	0	0	0	1	2	2	0	1	1	0	14	11	47
48		0	0	1	1	0	0	1	3	1	2	0	4	2	0	1	0	1	0	3	1	1	0	22	13	48
49		0	1	0	1	0	1	1	2	2	0	0	0	1	0	1	0	4	0	2	1	1	0	18	12	49
50			0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0		0	0	0	2	2	50
51			3	1	1	0	3	1	2	2	2	2	1	3	2	0	1	3	4	2	0	0	5	38	17	51
52				0	0	0	0	0	0	3	2	0	0	0	0	0	0	2	2	2	3	0	5	19	7	52
TOTAL	20	19	20	28	32	29	41	44	30	34	27	30	36	40	17	27	33	55	59	54	57	47	72	851	421	TOTAL
Avg/Yr		20		24		31		43			30			35			26			56			59			By Year

Note: Blank spaces indicate that site was not visited.

YUMA CLAPPER RAIL SURVEY
COVER SHEET
(January 2000)

Date:_____

Location Information:
Location Name_____Route_____

Map Name_____Township/Range/Section_____

Observer(s)_____

Weather:
Start %Cloud Cover_____Temp_____Wind Speed_____
End %Cloud Cover_____Temp_____Wind Speed_____

Data Summary:

1) Total individual rails seen or heard while surveying _____
2) Number of other rails seen or heard (incidentals) _____

Total rails per route or location equals #1+#2 _____
For rails/hours, each stop is 7 minutes

Observations:

Events during survey that may have affected results:

Other Observations/Comments

General Location_____ Date_____

Observor(s)_____

Survey Method_____ % Cloud Cover_____

Temperature Range_____ Wind Velocity at Start_____ Finish_____

Stop No.	Time	Total Birds Monitored	Sighted	Clatter	Kek	Kek-burr	Other	Habitat Type

Totals

Attachment 2

Yuma Clapper Rail Survey Data Sheet January 2000

Location_____ Route_____ Date_____

Weather start_____ end_____ Observer_____

Stop #	Time start	Time stop	Clatter call	Kek call	Other call	Was Rail seen?	Was Rail Heard?	Was Rail Paired?	Other Species?	Habitat Type Where Rail Was Detected?

Page total:

Total rails recorded on survey _____

Incidental observations of rails in survey area _____

Attachment 3, back page

YUMA CLAPPER RAIL SURVEY
OPTIONAL DATA SHEET
COVER SHEET
MARCH 2003

Date of survey:_____
Location
Name:_____ Route:_____
Map Name:_____ Township/Range/Section:_____
Observers:_____
Weather:
Start: % Cloud Cover:_____ Temp:_____ Wind Speed:_____ Precipitation:_____
End: % Cloud Cover:_____ Temp:_____ Wind Speed:_____ Precipitation:_____
Instructions:

- Use one line of data sheet for each individual bird detected at each survey point. Where more than one individual encountered, give each individual a number (YCRA 1, YCRA 2 etc.). If a pair is detected, each bird gets a separate line and number. The pair is identified in the "Comments" section.
- If bird is seen but not heard, indicate with an "s" in the data boxes. If seen and heard, indicate with "1s").
- Timed data boxes reflect silent and active call-broadcast periods divided into 8 one-minute intervals. If a bird is seen or heard during any part of each one-minute period, record it. For example, YCRA 1 may be heard during the initial passive minute, the 2nd calling minute, and the 4th calling minute. A notation should be made in each of the three relevant columns.
- In the "calls heard" column, note which types of calls were made by the individual bird during the 8-minute survey period. Please use the following for YCRA calls: kek (k); clatter (c); kekburr (kb); kekhurrah (kh), other (o)
- If other secretive marsh birds are heard during the survey, record them in the same way as the YCRA individuals. A list of species abbreviations and call types is given below:

  Least Bittern (LEBI: coo, kak, other)
  Virginia Rail (VIRA: grunt, ticket, kicker, other)
  Sora Rail (SORA: whinny, perweep, keep, other)
  Black Rail (BLRA: kickydoo, grr, churt, other)

Data summary:
Number YCRA recorded (seen or heard) during survey:_____
Number YCRA incidentally observed (seen or heard): _____

Comments/Events during survey that may have affected results:

Date: Location: Route Page:

*put an's' in appropriate column if bird was seen but not heard, '1s' if was seen and heard use one line for each individual (example, YCRA 1, YCRA 2, etc.). If a pair is detected, note which birds are paired in the comments.

Sta #	Time Start	Species of individual Detected	Responded During:								calls heard	repeat?	distance (estimate)	direction	Comments
			Pass 1 min	**YCRA 1st**	**YCRA 2nd**	Silent 1st	Silent 2nd	**YCRA 3rd**	**YCRA 4th**	Pass 1 min					

AR073872

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Record Id 7303
County Imperial
Year 2006
Spp YCR ⊕
Srv. Rpt. D.B. d.m. 1/19/06
GIS RN 6-18-13
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Fire effects on Yuma Clapper Rails and California Black Rails on the Lower Colorado River



Courtney J. Conway
Christopher P. Nadeau
Linden Piest

Wildlife Research Report Number 2006-07

* Additional info attached in back. CDs w/ coordinates in permit file

Fire effects on Yuma Clapper Rails and California Black Rails on the Lower Colorado River

Final Report
Joint Fire Science Program
Project ID Number: 03-3-2-07

Also submitted to

U.S. Bureau of Reclamation
Imperial National Wildlife Refuge
Havasu National Wildlife Refuge
Sonny Bono Salton Sea National Wildlife Refuge
U.S. Bureau of Land Management
Sonoran Joint Venture
Arizona Game and Fish Department

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31 December 2006

Suggested Citation: Conway, C. J., C. P. Nadeau, and L. Piest. 2006. Fire effects on Yuma Clapper Rails and California Black Rails on the Lower Colorado River. Arizona Cooperative Fish and Wildlife Research Unit, Wildlife Research Report Number 2006-07, Tucson, Arizona.

Executive Summary

The Yuma clapper rail (*Rallus longirostris yumanensis*) is a federally endangered species and 90% of the U.S. population exists in only 2 wetlands associated with the Lower Colorado River. The California black rail (*Laterallus jamaicensis coturniculus*) is another sensitive species of national management concern that occurs in this region. Historically, marsh habitats along the lower Colorado River were highly ephemeral with periodic flooding and natural fires which eliminated decadent stands of emergent vegetation. Years of flood control and fire suppression has resulted in substantial areas of decadent emergent marsh habitat. To ensure long-term persistence of the Yuma clapper rail and California black rail, we examined the effectiveness of prescribed fire as a possible management tool to restore habitat for these 2 species. Numbers of Yuma clapper rails and California black rails increased significantly following fire in burned sites compared to control sites. Increases were apparent in the first year following fire for clapper rails and in year 2 post-fire for black rails. As a result of the field protocols developed for this project, we initiated a national program for monitoring marsh birds and for evaluating the effects of management actions on marsh birds. The protocols developed by this project are being used by over 100 field offices representing 40 state and federal land management agencies. Products from this study are available on the project webpage: www.ag.arizona.edu/srnr/research/coop/azfwru/fire_effects_on_rails.

Introduction

The Yuma clapper rail (*Rallus longirostris yumanensis*) is a federally endangered species that occurs along the lower Colorado River, in the Imperial Valley of California, in the Colorado River Delta, and along the west coast of Mexico. Ninety percent of the U.S. population exists in only 2 wetlands (Conway et al. 1993) and much existing wetland habitat remains unoccupied. To ensure long-term persistence of U.S. populations, we need to have effective management and mitigation activities that improve habitat quality and benefit Yuma clapper rail populations. One possible management activity that has been proposed to benefit Yuma clapper rail populations is prescribed burning in areas with decadent emergent vegetation (Conway et al. 1993).

Historically, marsh habitats along the lower Colorado River were highly ephemeral with periodic flooding and natural fires eliminating decadent stands of emergent vegetation. These stochastic events resulted in areas of early successional emergent marsh habitat thought to be beneficial to rails (Conway 1990, Conway et al. 1993). Years of flood control and fire suppression has resulted in substantial areas of decadent emergent marsh habitat and very little early successional emergent marsh along the lower Colorado River. Prescribed fire may be the best technique for creating early-successional emergent marsh habitat required to enhance populations of Yuma clapper rails. Indeed, prescribed fire has been repeatedly suggested as a promising conservation measure for restoring Yuma clapper rail populations (Conway et al. 1993, Conway 1995, Eddleman and Conway 1998, Conway and Eddleman 2000), but has yet to be evaluated.

The California black rail (*Laterallus jamaicensis coturniculus*) is another sensitive species of national management concern that may simultaneously benefit from prescribed burning. California black rails are listed as state endangered in Arizona (Arizona Game and Fish

Department 1988), state threatened in California (California Department of Fish and Game 1989), and federally endangered in Mexico. Black Rails are also considered a species of national conservation concern in the U.S. (U.S. Fish and Wildlife Service 2002), are on the National Audubon Society's "*WatchList*", and were once a Category 1 "candidate" species for federal listing under the Endangered Species Act (U. S. Dept. of Interior 1989). The lower Colorado River is one of three areas remaining with a moderate breeding population of California black rails (Evens et al. 1991, Conway et al. 2001). Hence, active on-the-ground habitat restoration efforts to specifically benefit California black rails on the lower Colorado River should begin now in an effort to recover populations and prevent federal ESA listing.

The effects of fire on California black rails are not known, and opinions are equivocal. Repking (1975) suggested fire be investigated as a possible management tool for California black rails, but Todd (1980) cautioned that regrowth of common threesquare (*Schoenoplectus pungens*), a wetland plant commonly associated with black rails, may not occur fast enough and may be eliminated completely by fire. Areas with three-square bulrush may burn hotter and regrowth may occur at a slower pace compared to cattail in the wetter portions of a marsh (Todd 1980). This project will help determine whether or not fire is beneficial to California black rails.

We conducted pre- and post-burn surveys in both burned and control marshes to examine the effects of fire on the abundance of rails and the quality of rail habitat. This project addresses the goals of the Lower Colorado River Multi-species Conservation Plan (LCR MSCP). Both the Yuma clapper rail and California black rail are considered priority species of concern in the LCR MSCP and goals for both species include the enhancement of existing habitat, restoration of unsuitable habitat, and the establishment of additional breeding locations on the LCR.

Field Locations

Study Sites were located along the lower Colorado River in Arizona (Yuma County) and California (Imperial County), and south of the Salton Sea in the Imperial Valley of California (Imperial County). We worked closely with Imperial National Wildlife Refuge, Havasu National Wildlife Refuge, and Sony Bono Salton Sea National Wildlife Refuge to conduct burns and marsh bird surveys at each refuge. We also surveyed marshes on other state and federally owned lands. See Tables 1-2 for a summary of each study site.

Methods

We conducted call-broadcast surveys for both species of rails in 4 types of study sites: sites recently burned by wildfire (n=7), non-burned (control) sites near each wildfire (n=14), sites recently burned by prescribed fire (n=19), and non-burned (control) sites near each prescribed burn (n=24) (Tables 1-2). At each study site, we conducted at least 3 replicate surveys from March-July in years pre- and post-fire. Hence, we had both temporal (pre-burn vs. post-burn) and spatial (burned and unburned) controls built into the study design, providing a rigorous evaluation of the usefulness of fire for marsh management and restoration of Yuma clapper rails and California black rails.

We worked closely with Bureau of Land Management and U.S. Fish and Wildlife Service fire crews to have burns conducted for this study. We developed survey protocols based on our previous studies of marsh bird survey methods (Conway et al. 1993, Conway and Gibbs 2001,

Conway et al. 2001) and on recommendations from a recent wetland bird monitoring workshop at the USGS Patuxent Wildlife Research Center (Ribic et al.1999). Surveys were conducted during mornings between one half-hour before sunrise until 10:00 am and in the evenings between 5:00 pm until dusk (one half-hour after sunset). All surveys were conducted on days without rain and when wind speeds did not exceed 5 mph. Based on previous marsh bird survey work in the region, conditions during most (99%) mornings are favorable for surveys (i.e., without too much wind) whereas 42% of evenings are too windy for surveys. All surveyors attended 2 weeks of extensive field training, and each surveyor took a hearing test (audiogram) to check their ability to hear subtle bird vocalizations. We used repeated measures analysis of variance to examine whether fire increased abundance of rails.

Results

Numbers of Yuma clapper rails increased following fire and abundance was higher compared to control sites in the 2 years post-burn (Fig. 1). Numbers of California black rails increased following fire and abundance was higher compared to control sites in years 2 and 3 post-burn (Fig. 2). During the course of developing the field protocols for this project, we saw a need to make our field protocols available to land management agencies across the country. Hence, we developed a stand-alone set of field protocols for use by others so that data could be pooled across the country to examine the effects of fire (and other management actions) on secretive marsh birds. This subsequently led to the development a national program for monitoring marsh birds. The protocols developed by this project are being used by over 100 field offices representing 40 state and federal land management agencies. Several of these field offices are using our field protocols to examine fire effects. Products produced from this study are listed in Appendix 1 and 2, and many of these are available on the project's webpage (www.ag.arizona.edu/srnr/research/coop/azfwru/fire_effects_on_rails).

Acknowledgments

The project is funded by Joint Fire Science Program with additional funding provided by U.S. Bureau of Reclamation, Sonoran Joint Venture, Imperial National Wildlife Refuge, and USGS-USFWS Science Support Program. Imperial National Wildlife Refuge provided temporary field housing, field vehicles, and a boat for our field personnel; we thank Ken Edwards, Greg Birkenfeld, Jackie Ferrier, and Guy Wagner for their support and assistance. Sonny Bono-Salton Sea National Wildlife Refuge also provided temporary housing for the project; we thank Chris Schonomen for his support of the project. Havasu National Wildlife Refuge provided temporary field housing and use of a boat; we thank Greg Wolf, John Earle, Jack Allen, and Aimee Haskew for their support and assistance. Bureau of Reclamation, Boulder City provided a boat for our field surveys and we thank Greg Finnegan for assistance with the boat and trailer. BLM and USFWS fire crews planned and conducted prescribed fires. Carl Olsen from the University of Arizona Entomology Museum provided assistance and training in identification of invertebrates. Other personnel working on the project included Michael Vamstad, Amy Stabler, Heather Cara Stutzman, Sian Wallace, Paul Sweet, Augustus Keck, Nick Bartok, Roberta Montano, Nick Mannan, Erik Meyer, Meaghan Conway, Archer

Larned, and Jake Mohlman. We obtained USFWS permits to conduct call-broadcast surveys for Yuma Clapper Rails (permit # TE039466-0). We also obtained the necessary permits from the Institutional Animal Care and Use Committee at the University of Arizona.

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Table 1. Location of prescribed burns (and control areas) used as study sites for examining the effects of fire on marsh birds along the Lower Colorado River.

study site	State	County	UTM (NAD83)	date burned	size of burn (ha)	land ownership	paired control sites
N. Mittry Lake (pts 39-54)	AZ	Yuma	11 S 738750 3637905	21 Feb 2003	20	BLM & AGFD	South Dredge Ramp (pts 1-29)
Imperial NWR housing marsh (pts 1-7)	AZ	Yuma	11 S 734940 3654203	20 Feb 2003	4	USFWS	Painted Desert Trail (points1-6) Martinez Lake (points 1-29)[1]
Imperial NWR (field 11&10, pts 1-6)	AZ	Yuma	11 S 734552 3652472	20 Feb 2003	7	USFWS	Imperial NWR (field 16, pts 1-8)
Imperial NWR (field 12, pts 1-4)	AZ	Yuma	11 S 734262 3652341	7 Mar 2004	9	USFWS	Imperial NWR (field 21, pts 1-8)
Imperial NWR (field 13, pts 1-8)	AZ	Yuma	11 S 734530 3652026	27 Feb 2005	4	USFWS	Imperial NWR (field 17, pts 1-9)
Imperial NWR (field 14, pts 1-11)	AZ	Yuma	11 S 734664 3652025	28 Feb 2006	8	USFWS	Imperial NWR (field 28, pts 1-4)[2] Imperial NWR (field 10, pts 1-2)
Island Lake - INWR (pts 1-19)	AZ	La Paz	11 S 725741 3657740	4 Feb 2004	242	USFWS	Taylor Lake (pts 1-18) Clear Lake (pts 10-12)
Imperial Dam Rd Marsh B (pts 1-8)	CA	Imperial	11 S 734713 3638457	27 Feb 2005	2	USBR & BLM	Imperial Dam Rd Marsh A (pts 1-7)
Imperial Dam Rd Marsh C (pts 1-9)	CA	Imperial	11 S 734715 3638315	27 Feb 2005	4	USBR & BLM	Senator Wash shore (pts 30-37)
Willow Lake - Havasu NWR (pts B1-14)	AZ	Mohave	11 S 727778 3851716	9 Nov 2001	113	USFWS	Willow Lake (points C1-15)

Table 1. Continued.

Upper Goose Lake - Havasu NWR (pts B1-9)	AZ	Mohave	11 S 728125 3854403	22 Feb 2003	62	USFWS	Upper Goose Lake (pts C1-11)
No Name Lake - Havasu NWR (pts B1-19)	AZ	Mohave	11 S 725484 3851295	7 Feb 2004	46	USFWS	Beal Lake (pts C1-13)
Whiskey Slough - Havasu NWR (pts B1-6)	AZ	Mohave	11 S 727169 3854265	28 Feb 2006	37	USFWS	Whiskey Slough (pts C1-7)
Reidman 3 - SSNWR (pts 1-6)	CA	Imperial	11 S 620048 3660908	13 Feb 2002	8 (20)	USFWS	Reidman 4 (pts 1-3)
Hazard 6 - SSNWR (pts 1-8)	CA	Imperial	11 S 631343 3672562	Mar/Apr 2002	11	USFWS	Hazard 7 (pts 1-6)
B-1 pond (pts 1-11)	CA	Imperial	11 S 620551 3661218	2007	15	USFWS	A-1 pond (pts 1-9)
Hazard 10 - SSNWR (pts 1-6)	CA	Imperial	11 S 632263 3674070	30 Jan 2006	16	USFWS	Hazard 10A (pts 1-3)
Union Pond - SSNWR (pts 1-6)	CA	Imperial	11 S 628342 3671668	Jan/Feb 2001	4	USFWS	Headquarters B pond (pts 1-4)
Hazard 11 - SSNWR (pts 1-3)	CA	Imperial	11 S 632643 3674137	2007	4	USFWS	Bruchard Bay (pts 1-6)
South Teal Alley	AZ	Yuma	11 S 738951 3637440	25 Feb 2005		BLM & AGFD	North Teal Alley
Mittry Lake Islands	AZ	Yuma	11 S 738951 3637440	25 Feb 2005		BLM & AGFD	

[1]also control for Ferguson Lake
[2]Also burned on 28 Feb 2006

Table 2. Location of incidental fires (and control areas) used as additional study sites for examining the effects of fire on marsh birds along the Lower Colorado River.

study site	State	County	UTM (NAD83)	date burned	size of burn (ha)	land ownership	paired control sites
North Mittry Lake (pts 1-54)[1]	AZ	Yuma	11 S 738750 3637905	12 Mar 2003	~324	BLM & AGFD	Hidden Shores (pts 1-66) South of Dredge Ramp (pts 1-29)
South Mittry Lake (pts 1-14)	AZ	Yuma	11 S 739279 3636185	2 Apr 2002	26	BLM & AGFD	Arizona Channel (pts 31-49)
Mission Wash (pts 13-19)	CA	Imperial	11 S 730170 3635403	29 Mar 2001	38	Ft. Quechan Tribe	East Pond (pts 1-8)
Mission Wash (points 1-12)	CA	Imperial	11 S 729595 3635236	Jun 2001		Ft. Quechan Tribe	All-American/Senator's Wash (pts 1-14)
West Pond (pts 1-19)	CA	Imperial	11 S 736216 3640753	29 Jan 2002	10	USBR	West Pond (pts 26-46) Hidden Shores Marsh (pts 1-23)
Draper Lake (pt 1)	CA	Imperial	11 S 716027 3670669	8 Aug 2001	81	USFWS	Cibola1 (pts 1) Cibola2 (pts 1-2)
Ferguson Lake (YCR pts 1-15) (BLRA pts 1-32)	CA	Imperial	11 S 734499 3650658	29 Feb 2000	83	BLM & USFWS	**YCR controls:** Martinez Lake (pts 1-29) **BLRA controls:** Squaw Lake (pts 13-18) S. Squaw Lake (pts 1-5) Deer Island (pts 1-15) AZ Channel (pts 1-30)
Hidden Shores (pts 16-54)	AZ	Yuma	11 S 737319 3641843	27 Feb 2005	135		

[1]includes the smaller prescribed burn area at N. Mittry that was burned 21 Feb 2003.

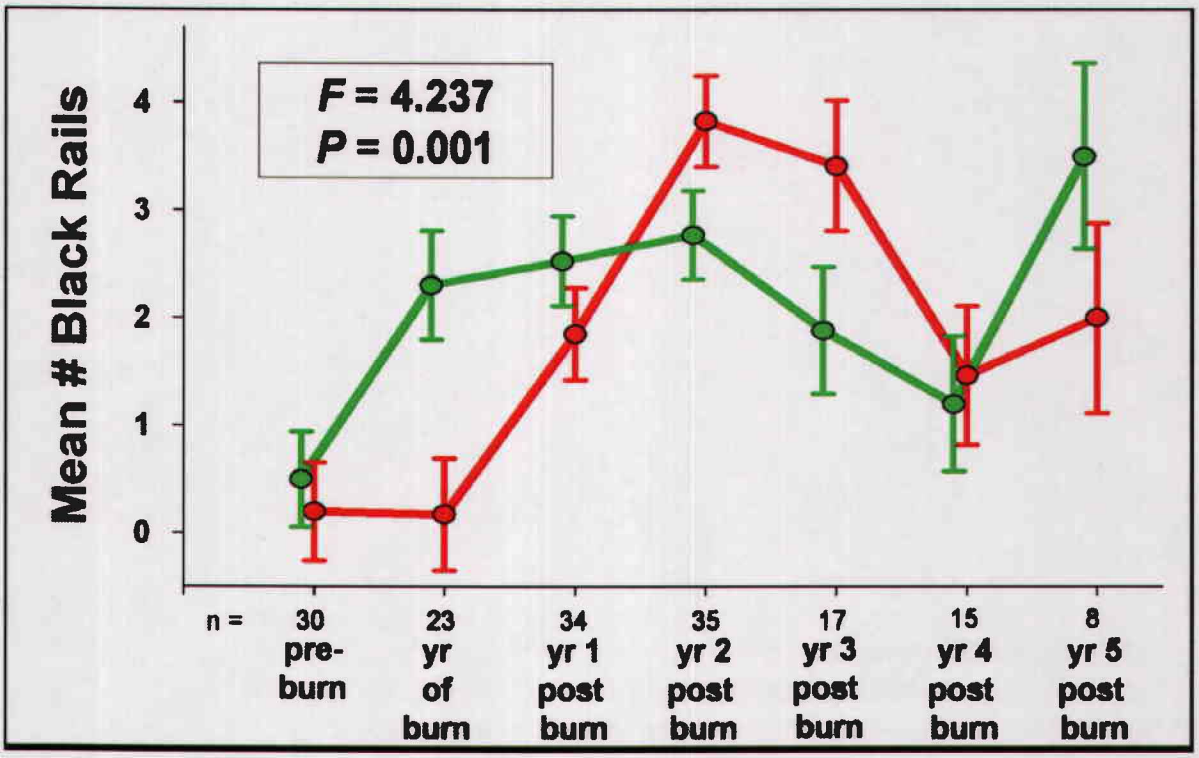


Figure 1. Numbers of Yuma clapper rails increased following fire and abundance was higher compared to control sites in the 2 years post-burn.

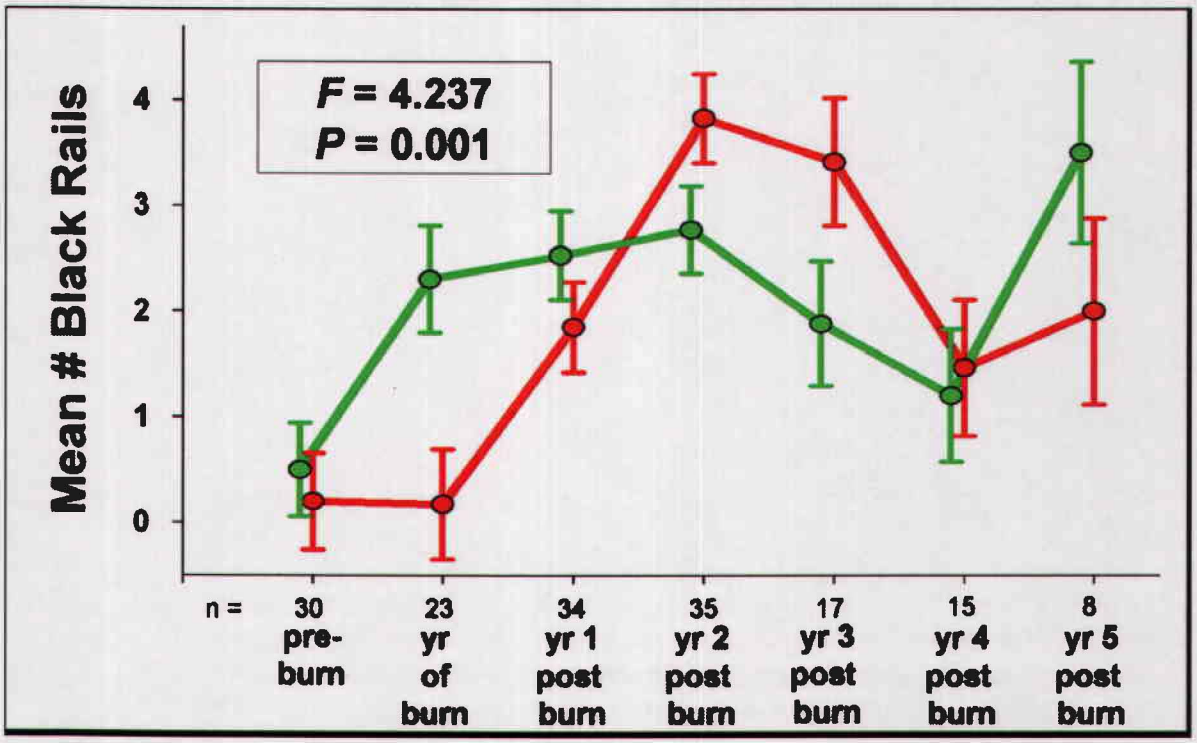


Figure 2. Numbers of California black rails increased following fire and abundance was higher compared to control sites in years 2 and 3 post-burn.

Appendix 1. Crosswalk between proposed and delivered FFS outreach activities

Proposed	Delivered	Status
Annual Progress Reports	2 annual reports ; see citations in Appendix 2	done
Final Technical Report	this document	done
Publications	13 publications; see list in Appendix 2	12 completed, 1 in prep.
Electronic Copies of Data	on file with USDI	done
Field Methods	explained in this document	done
Project Webpage	Research Project #12 under: http://www.ag.arizona.edu/srnr/research/coop/azfwru/cjc/	done
Website	http://ag.arizona.edu/srnr/research/coop/azfwru/NationalMarshBird/	done
Workshops	2 in **2004**, 1 in **2005**, 1 in **2006**	done
PowerPoint Presentation	Nadeau, C.P., and C.J. Conway. **2005**. Fire effects on Yuma clapper rails and California black rails along the lower Colorado River.	done
Conference Presentations	11 presentations; see list in Appendix 2	10 completed, 1 will be given on 8 February 2007
Annual Meetings	met annually with BLM and USFWS fire management personnel	done
Poster	Nadeau, C.P., and C.J. Conway. **2005**. Fire effects on Yuma clapper rails and California black rails along the lower Colorado River. JFSP Principal Investigator's Conference. San Diego, CA.	done

Appendix 2. Conference presentations and publications based on results from the JFSP project, Fire effects on Yuma Clapper Rails and California Black Rails on the Lower Colorado River.

Presentations:

Conway, C. J., C. P. Nadeau, and L. A. Piest. 2007. Effectiveness of prescribed fire as a management tool to improve habitat quality of endangered Yuma clapper rails and California black rails along the Lower Colorado River. Arizona-New Mexico Joint meeting of The Wildlife Society and American Fisheries Society. Albuquerque, NM 7 February 2007.

Conway, C. J., and M. Woodrey. 2006. Implementing standardized monitoring for secretive marsh birds on NOAAs Estuarine Research Reserves. 22nd Annual Conference of NOAA's National Estuarine Research Reserve Program. Cleveland, OH. 18 October 2006. INVITED.

Nadeau, C. P., C. J. Conway, L. Piest, O. Hinojosa-Huerta, and B. Burger. 2006. The effectiveness of multi-species versus single-species call-broadcast surveys for the federally endangered Yuma clapper rail. IV North American Ornithological Conference, Veracruz, Mexico, 6 October 2006.

Conway, C. J., and M. Woodrey. 2006. A continental program for estimating population trends of marsh birds and monitoring ecological integrity of marshlands in North America. NOAA and Environmental Protection Agency's National Estuary Program Monitoring & Indicators Summer Seminar Series. Washington, D.C. 17 August 2006.

Conway, C. J. 2006. Recommended continental survey protocols for conducting marsh bird surveys across North America. Marsh Bird Monitoring Technical Workshop, Patuxent National Wildlife Research Center, Laurel, MD. 7 March 2006.

Nadeau, C. P., and C. J. Conway. 2006. The North American Marsh Bird Monitoring Protocol: a summary of the protocol and its use on the lower Colorado River. Lower Colorado River MSCP Terrestrial Biology Conference, Laughlin, NV, 24 January 2006.

Nadeau, C. P., and C. J. Conway. 2005. Fire effects on Yuma clapper rails and California black rails along the lower Colorado River. Joint Fire Science Program Principal Investigator's Conference. San Diego, California, 1 November 2005.

Conway, C. J. 2005. A standardized North American marsh bird monitoring program. National Estuarine Research Reserve Research Coordinator Annual Meeting, Grand Bay, Mississippi, 17 February 2005. INVITED.

Conway, C. J. 2004. Using prescribed fire to recover the federally endangered Yuma Clapper Rail on the Lower Colorado River National Wildlife Refuges. U.S. Fish and Wildlife Service Region 2 Fire Management Conference. Tucson, AZ. 7 December 2004.

Conway, C. J. 2004. Evaluating the effects of fire on Yuma Clapper Rails and California Black Rails. 90-min presentation to management staff at Sonny Bono-Salton Sea National Wildlife Refuge. 19 April 2004. INVITED.

Peer-reviewed Publications:

Conway, C. J., C. P. Nadeau, and L. A. Piest. In prep. Effectiveness of prescribed fire as a management tool to improve habitat quality of endangered Yuma clapper rails and California black rails along the Lower Colorado River. *Conservation Biology*.

Conway, C. J., and C. Sulzman. Accepted pending revision. Habitat associations and population

trajectory of California Black Rails in the southwestern U.S. *Wetlands*.

Conway, C. J., and S. Droege. 2006. A unified strategy for monitoring changes in abundance of birds associated with North American tidal marshes. *Studies in Avian Biology* 32:382-397.

Conway, C. J., and J. P. Gibbs. 2005. Effectiveness of call-broadcast surveys for monitoring marsh birds. *Auk* 122:26-35.

Conway, C. J., and S.T.A. Timmermans. 2005. Progress toward developing field protocols for a North American marsh bird monitoring program. Pp. 997-1005 *in* C.J. Ralph and T.D. Rich, eds. Bird Conservation Implementation and Integration in the Americas: Proceedings of the Third International Partners in Flight Conference, Volume 2. U.S. Department of Agriculture General Technical Report PSW-GTR-191. Pacific Southwest Research Station, Forest Service, Albany, California.

Conway, C. J., C. Sulzman, and B. A. Raulston. 2004. Factors affecting detection probability of California Black Rails. *Journal of Wildlife Management* 68:360-370.

Technical Publications:

Conway, C. J., and C. P. Nadeau. 2006. Fire effects on Yuma Clapper Rails and California Black Rails on the Lower Colorado River. Arizona Cooperative Fish and Wildlife Research Unit, Wildlife Research Report Number 2006-07, Tucson, AZ. (this document).

Conway, C. J., and C. Nadeau. 2005. Development of a National Marsh Bird Monitoring Program, Progress Report, May 2005. USGS Arizona Cooperative Fish and Wildlife Research Unit Report, Tucson, AZ.

Conway, C. J. 2005. Standardized North American Marsh Bird Monitoring Protocols. Wildlife Research Report #2005-04, USGS Arizona Cooperative Fish and Wildlife Research Unit, Tucson, Arizona.

Conway, C. J., and C. Nadeau. 2005. Evaluating the usefulness of prescribed fire to restore habitat for the Yuma clapper rail and California black rail along the lower Colorado River. Pages 31-33 in D.D. Dolton, ed., Webless Migratory Game Bird Research Program, 2004 Annual Report. U.S. Fish and Wildlife Service, Denver, CO.

Conway, C. J., and C. Nadeau. 2005. Effects of fire on Yuma Clapper Rails and California Black Rails. 2004 Annual Report. Wildlife Research Report #2005-01, USGS Arizona Cooperative Fish and Wildlife Research Unit, Tucson, AZ.

Conway, C. J., and C. Nadeau. 2004. Development of a National Marsh Bird Monitoring Program, Progress Report, September 2004. USGS Arizona Cooperative Fish and Wildlife Research Unit Report, Tucson, AZ.

Conway, C. J. 2004. Effects of Fire on Yuma Clapper Rails and California Black Rails: 2003 Annual Report. Submitted to U.S. Bureau of Reclamation, Arizona Game and Fish Department, U.S. Fish and Wildlife Service, U.S. Bureau of Land Management, and the USDA-USDI Joint Fire Science Program. USGS Arizona Cooperative Fish and Wildlife Research Unit, Wildlife Research Report #01-04.



"Christopher P. Nadeau" <cnadeau@email.arizona.edu>
07/09/2007 02:07 PM

To Stacey_Love@fws.gov
cc cconway@ag.arizona.edu
bcc
Subject USFWS Permit Report

Stacey,

I summarized our data in a few different ways in hopes that it will give you what you need. Please let me know if you need further information. I also attached maps created from 1:24000 USGS Topos.

Chris

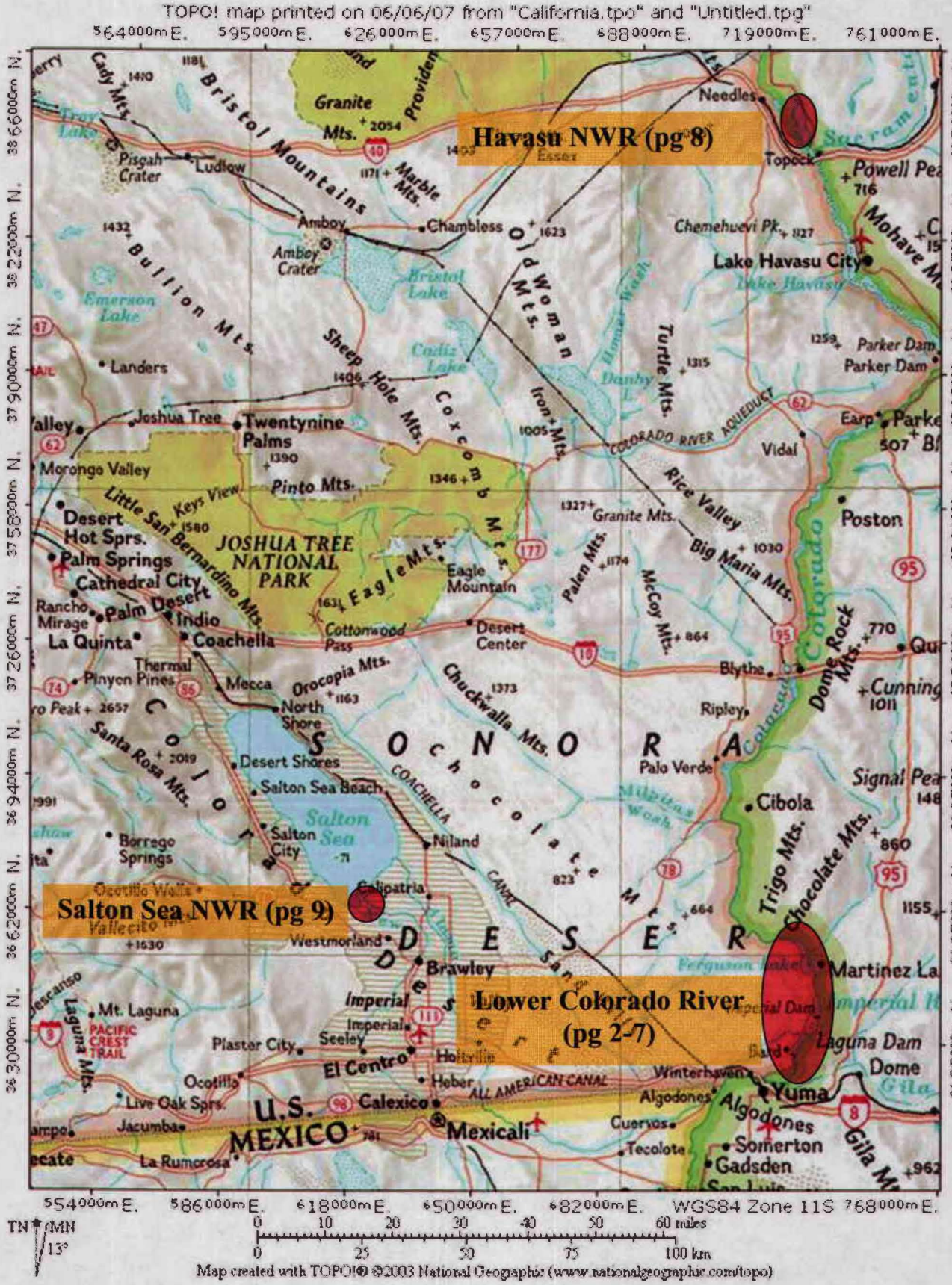
--

Christopher Nadeau
Wildlife Biologist
University of Arizona
104 Biological Sciences East
Tucson, Arizona 85721
ph:(520)626-8912

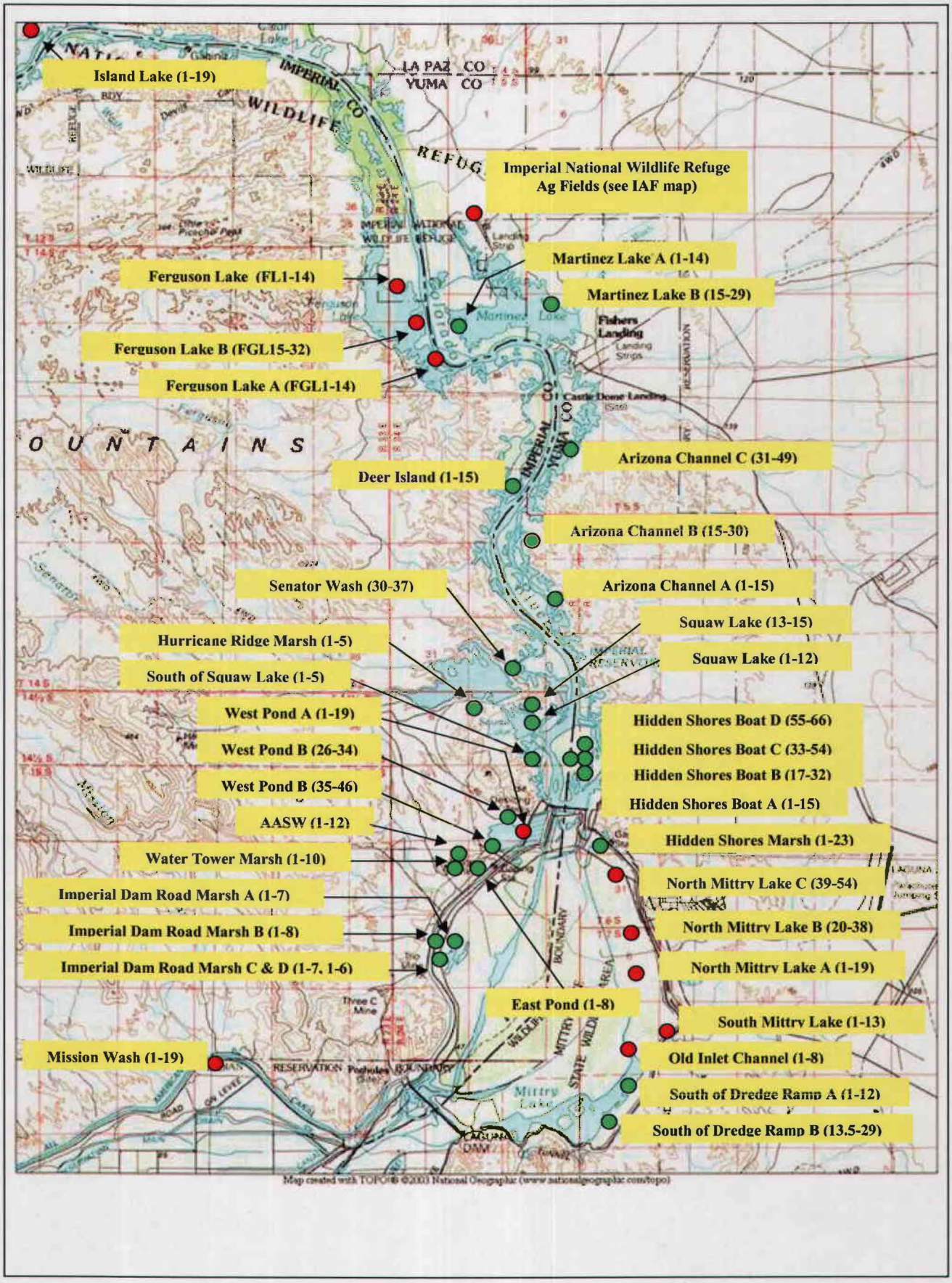

2004-2005CLRASummary.xls


AllSurveyLocations.doc

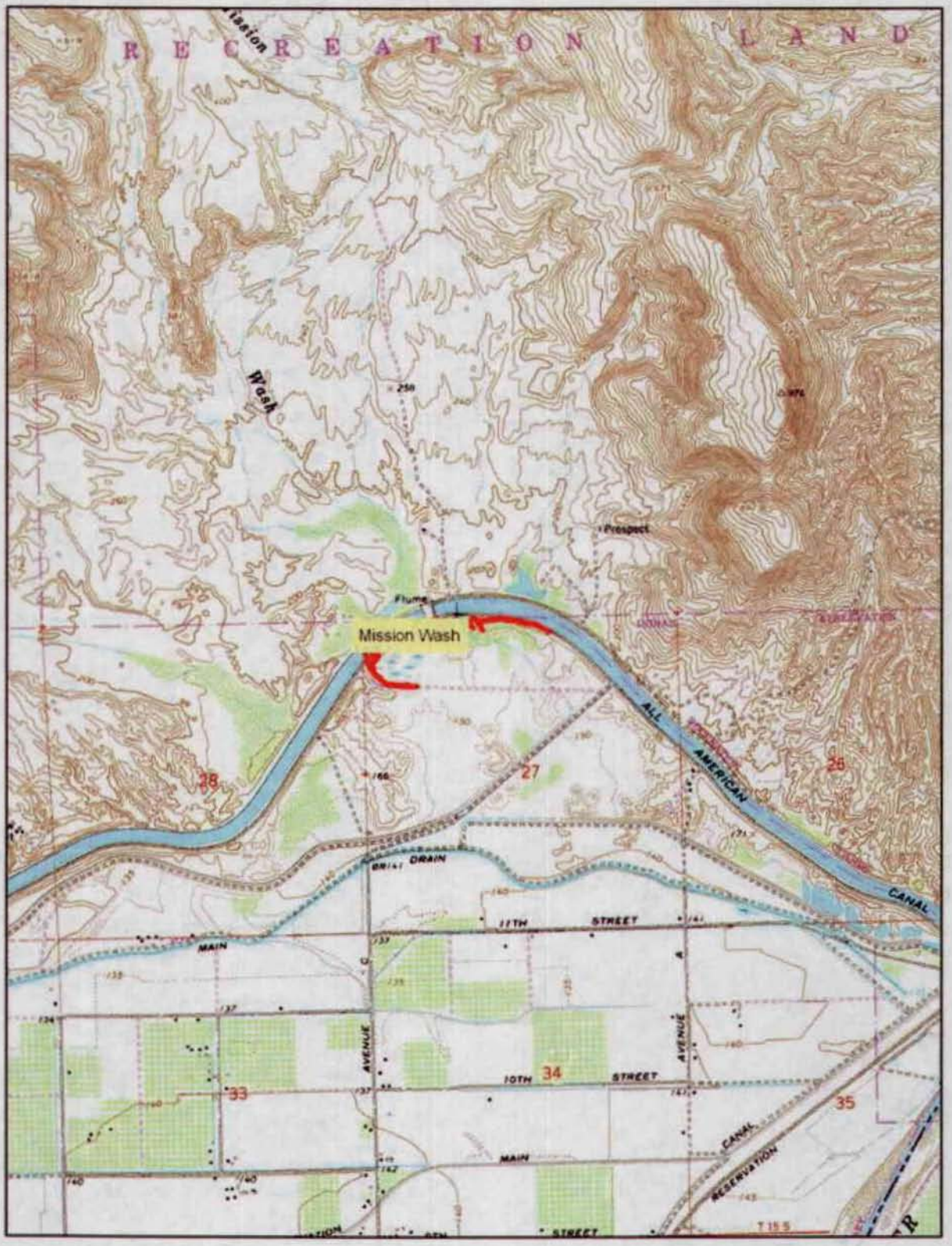
General Survey Location Map



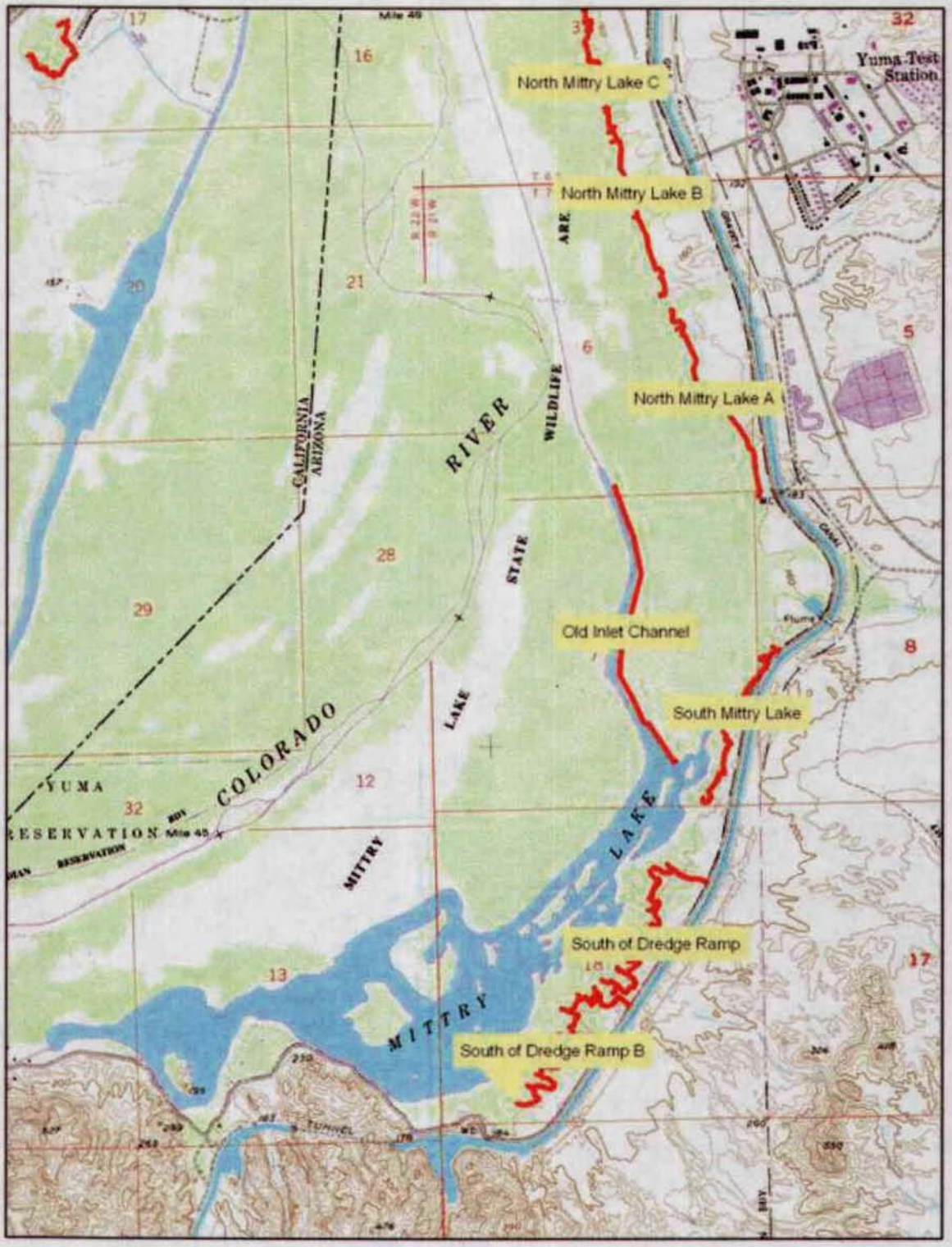
Lower Colorado River



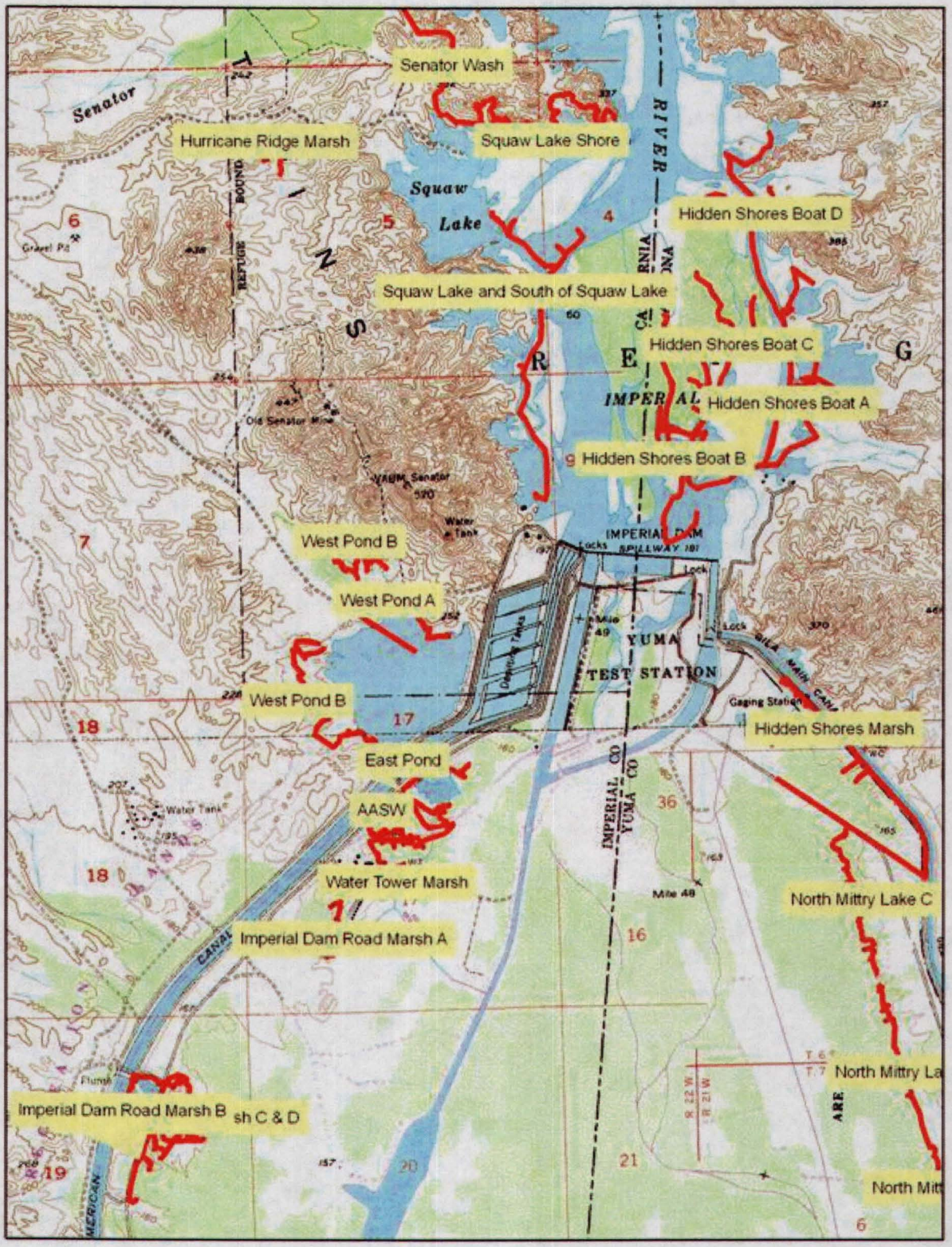
Lower Colorado River – Mission Wash



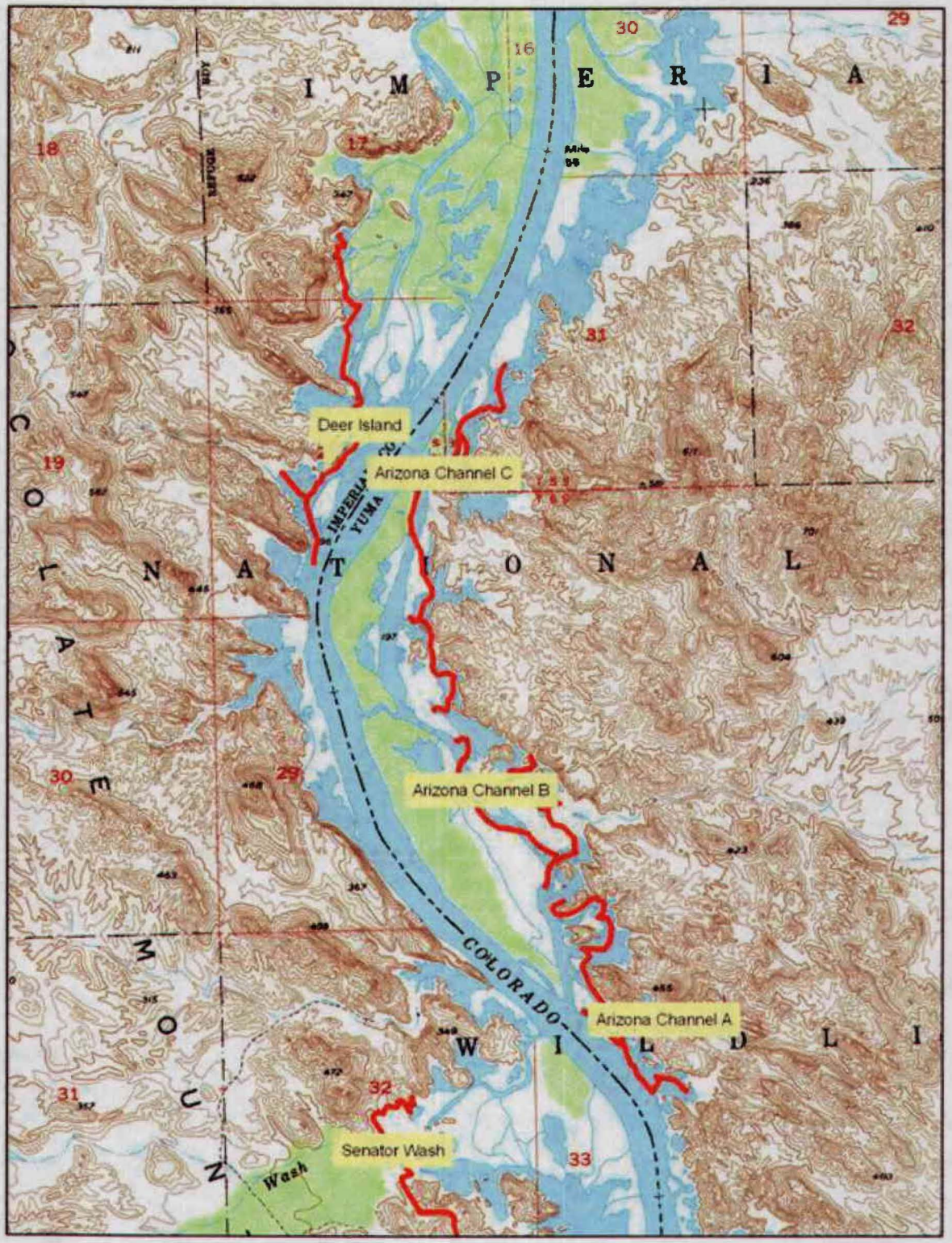
Lower Colorado River – North Mittry Lake



Lower Colorado River – Imperial Reservoir



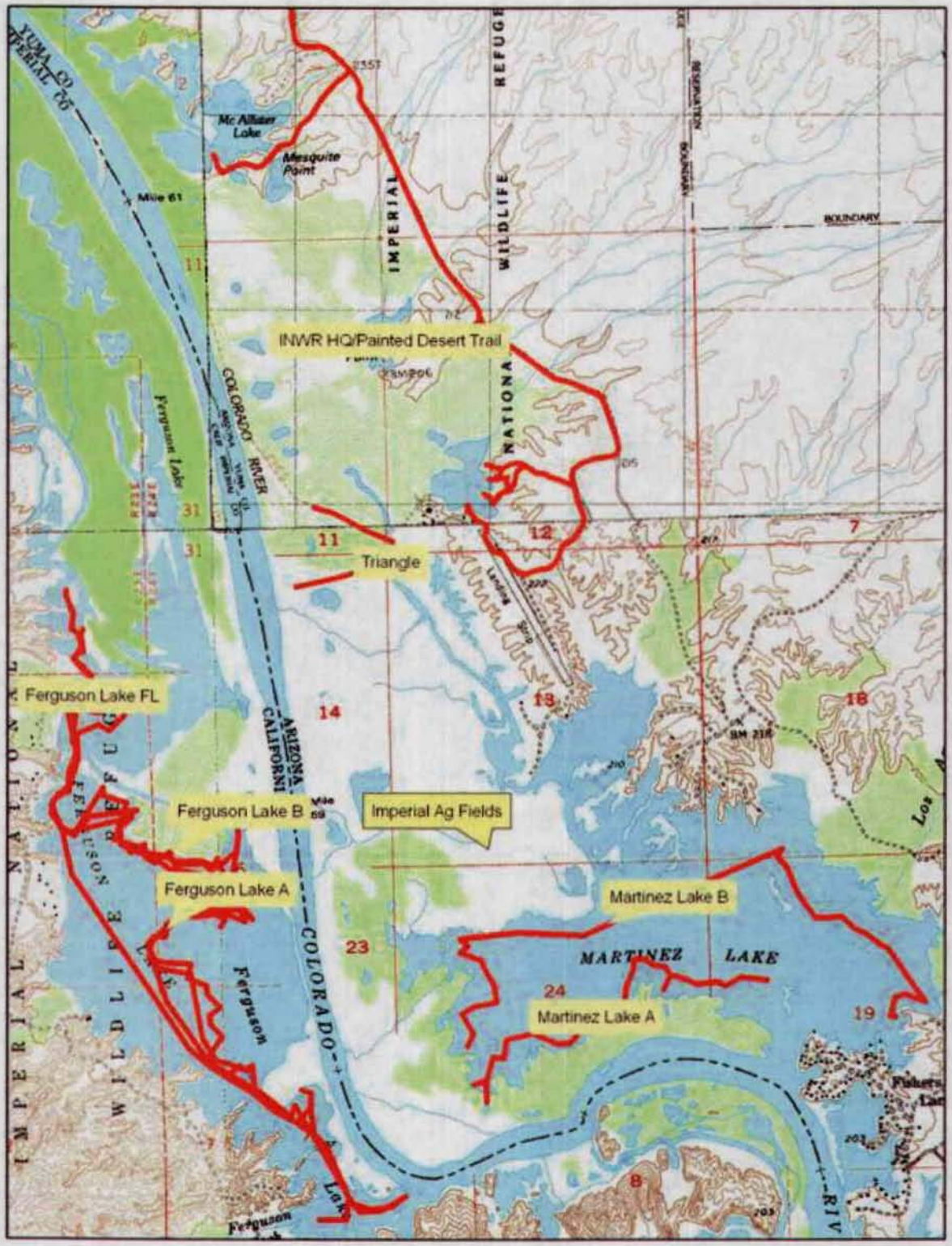
Lower Colorado River – Arizona Channel



Lower Colorado River – Island Lake



Lower Colorado River – Imperial National Wildlife Refuge





"Christopher P . Nadeau" <cnadeau @email.arizona.edu>
07/26/2007 12:04 PM

To Stacey_Love@fws.gov
cc
bcc
Subject Re: USFWS Permit Report

History: This message has been replied to.

Stacey,

This was a glaring error on my part. We have been going around on this for so long I got confused as to which report we were discussing. I forgot I had sent
you the most up to date report. The attached table should replace the one I sent yesterday. Hopefully this table makes more sense.

Again, I apologize for the confusion,
Chris

Quoting Stacey_Love@fws.gov:

> Chris,
>
> Thank you for the tables. However, I don't understand the
> "2006AndDataNotInReports" table. What data aren't in reports? Why aren't
> they in reports? Also, it is my understanding that the Power Plant and
> Fire Effects reports include 2006 work. Is that in the
> "2006AndDataNotInReports" table? If so, why isn't the 2006 work in the
> "EffectsOfFireReport" and the "PowerPlantReport" tables as requested?
> Please let me know as soon as you can.
>
> Thanks,
> Stacey
>
>
>
>
>
> "Christopher P. Nadeau" <cnadeau@email.arizona.edu>
> 07/25/2007 03:24 PM
>
> To Stacey_Love@fws.gov
> cc cconway@ag.arizona.edu
> Subject Re: USFWS Permit Report
>
>
>
>
>
>
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>
>
>
> Hi Stacey,
>

> A table summarizing our data (formatted to match your example) is attached.
>
> -Chris
>
>
> Quoting Stacey_Love@fws.gov:
>
>> Hi Chris,
>>
>> Well, I quickly made up a table--hopefully it makes sense. Please let me
>> know if it doesn't.
>>
>> Thanks,
>> Stacey
>>
>> (See attached file: TableExample.xls)
>>
>>
>>
>>
>> "Christopher P.
>> Nadeau"
>> <cnadeau@email.ar
> To
>> izona.edu> Stacey_Love@fws.gov
>>
> cc
>> 07/17/2007 03:14
>> PM
> Subject
>> Re: USFWS Permit Report
>>
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>>
>> Stacey,
>>
>>
>> I guess I'm still confused. What do you mean by "results"?
>>
>>
>> Can you please send me an example table showing the data you would like
> and
>> the format you would like the data in? That way I can try to reproduce
>> exactly what you want.
>>
>>
>> -Chris
>>
>>
>>
>> Quoting Stacey_Love@fws.gov:
>>
>>> Hello Chris,
>>>

>>> Thanks for the additional maps--they look good.
>>>
>>> I'm sorry if I wasn't clear with my request; the table doesn't quite
> have
>>> everything we're looking for. For each report (lower Colorado River and
>>> Geothermal power plant site), please send a separate table showing range
>> of
>>> dates at each site (sites within the study area, such as Rock Hill marsh
>>> and Deer Island) with personnel and with results. Also, please include
>> the
>>> information for 2006.
>>>
>>> Per our conversation, we will not make any changes to your list of
>>> authorized individuals on your permit at this time. As we discussed, all
>>> individuals conducting/assisting with your activities in CA must be on
>> your
>>> permit, unless they are authorized for those activities under their own
>>> permit. When you have a list of individuals compiled for next season,
>>> please contact Sandy Marquez (sandy_marquez@fws.gov) to make a request
> to
>>> change the List of Authorized Individuals. For each individual, please
>>> specify whether they are independent or supervised. For each independent
>>> individual, please include a summary of each individuals' experience
> with
>>> YCR (including approximate hours of direct observation) and two
>> references
>>> and/or letters of recommendation. For each supervised individual, please
>>> send a current resume. Also, please allow us ample time to review your
>>> request before the season starts. If that's difficult, please be in
>>> communication with Sandy so we can work with you to get it done.
>>>
>>> Please let me know if you have any questions.
>>>
>>> Thanks,
>>> Stacey
>>>
>>> Stacey Love
>>> U.S. Fish and Wildlife Service
>>> Carlsbad Fish and Wildlife Office
>>> 6010 Hidden Valley Road
>>> Carlsbad, CA 92011
>>> (760) 431-9440 x263
>>> stacey_love@fws.gov
>>>
>>>
>>>
>>> "Christopher P.
>>> Nadeau"
>>> <cnadeau@email.ar To
>>> izona.edu> Stacey_Love@fws.gov
>>> cc
>>> 07/09/2007 02:07 cconway@ag.arizona.edu
>>> PM Subject
>>> USFWS Permit Report
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>>> I summarized our data in a few different ways in hopes that it will give
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>>> what you need. Please let me know if you need further information. I
> also
>>> attached maps created from 1:24000 USGS Topos.
>>>
>>> Chris
>>>
>>> --
>>>
>>> Christopher Nadeau
>>> Wildlife Biologist
>>> University of Arizona
>>> 104 Biological Sciences East
>>> Tucson, Arizona 85721
>>> ph:(520)626-8912
>>> [attachment "2004-2005CLRASummary.xls" deleted by Stacey
>>> Love/CFWO/R1/FWS/DOI] [attachment "AllSurveyLocations.doc" deleted by
>>> Stacey Love/CFWO/R1/FWS/DOI]
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>> Christopher Nadeau
>> Wildlife Biologist
>> University of Arizona
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> ph:(520)626-8912
>
> [attachment "2004-2006SurveySummary(observersAndRangeOfDates).xls" deleted
> by Stacey Love/CFWO/R1/FWS/DOI]

--

Christopher Nadeau
Wildlife Biologist
University of Arizona
104 Biological Sciences East
Tucson, Arizona 85721
ph:(520)626-8912

FireSurveys

Site	Year	First Date Surveyed	Last Date Surveyed	Observers	Average # of Birds Detected Per Survey		Total # of Birds Detected Per Survey (repeat detections included)	
					BLRA	CLRA	BLRA	CLRA
a-1 pond	2004	13-Apr-04	12-May-04	Chris Nadeau, Erik Meyer, Nick Bartok, Roberta Montano	0.0	20.0	0.0	180.0
a-1 pond	2005	12-Apr-05	20-May-05	Chris Nadeau, Crissa Cooey, Nick Bartok	0.0	25.2	0.0	126.0
a-1 pond	2006	12-Apr-06	12-May-06	Archer Larned, Chris Nadeau, Jake Molhmann, Nick Bartok	0.0	32.4	0.0	162.0
aasw	2004	13-Mar-04	02-Jun-04	Erik Meyer, Mike Vamstad, Nick Bartok	1.8	3.0	9.0	6.0
aasw	2005	25-Mar-05	16-Jun-05	Crissa Cooey, Nick Mannan	2.0	2.0	8.0	4.0
aasw	2006	03-Apr-06	16-Jun-06	Archer Larned, Chris Nadeau, Jake Molhmann, Meaghan Conway, Nick Bartok	3.4	1.0	17.0	1.0
adobe lake	2006	18-May-06	18-May-06	Nick Bartok	2.0	11.0	2.0	11.0
arizona channel a	2004	15-Mar-04	03-Jun-04	Chris Nadeau, Courtney Conway, Nick Bartok	5.4	3.0	27.0	18.0
arizona channel a	2005	26-Mar-05	19-Jun-05	Amy Schwarzer, Chris Nadeau, Nick Bartok, Nick Mannan	5.2	4.5	26.0	9.0
arizona channel a	2006	06-Apr-06	27-Jun-06	Archer Larned, Chris Nadeau, Meaghan Conway, Nick Bartok	10.6	3.8	53.0	15.0
arizona channel b	2004	15-Mar-04	03-Jun-04	Chris Nadeau, Mike Vamstad, Nick Bartok, Roberta Montano	5.0	2.2	30.0	11.0
arizona channel b	2005	26-Mar-05	27-Jun-05	Chris Nadeau, Crissa Cooey, Nick Bartok, Nick Mannan	5.2	3.4	26.0	17.0
arizona channel b	2006	07-Apr-06	02-Jul-06	Jake Molhmann, Nick Bartok	9.2	3.3	46.0	10.0
arizona channel c	2004	28-Mar-04	17-Jun-04	Chris Nadeau, Erik Meyer, Nick Bartok, Roberta Montano	1.5	1.5	9.0	3.0
arizona channel c	2005	31-Mar-05	10-Jul-05	Amy Schwarzer, Chris Nadeau, Nick Bartok	2.3	2.0	9.0	6.0
arizona channel c	2006	10-Apr-06	04-Jul-06	Chris Nadeau, Meaghan Conway, Nick Bartok	2.5	2.0	10.0	2.0
b-1 pond	2004	13-Apr-04	13-May-04	Chris Nadeau, Erik Meyer, Nick Bartok, Roberta Montano	0.0	20.6	0.0	144.0
b-1 pond	2005	12-Apr-05	18-May-05	Amy Schwarzer, Crissa Cooey, Nick Bartok	1.0	18.8	1.0	94.0
b-1 pond	2006	12-Apr-06	15-May-06	Chris Nadeau, Jake Molhmann, Nick Bartok	0.0	24.6	0.0	123.0
beal lake	2004	02-Apr-04	15-Jun-04	Chris Nadeau, Erik Meyer, Mike Vamstad, Nick Bartok	0.0	8.0	0.0	56.0
beal lake	2005	05-Apr-05	22-Jun-05	Amy Schwarzer, Chris Nadeau, Crissa Cooey, Nick Mannan	2.0	8.0	2.0	48.0
beal lake	2006	04-Apr-06	20-Jun-06	Archer Larned, Chris Nadeau, Jake Molhmann	0.0	1.0	0.0	1.0
bruchard bay	2004	15-Apr-04	13-May-04	Erik Meyer, Mike Vamstad, Nick Bartok	0.0	7.7	0.0	46.0
bruchard bay	2005	13-Apr-05	15-May-05	Amy Schwarzer, Chris Nadeau, Nick Bartok	2.3	3.4	9.0	17.0
bruchard bay	2006	14-Apr-06	11-May-06	Jake Molhmann, Meaghan Conway, Nick Bartok	0.0	7.8	0.0	39.0
deer island	2004	16-Mar-04	04-Jun-04	Chris Nadeau, Erik Meyer, Mike Vamstad, Nick Bartok, Roberta Montano	3.0	1.0	9.0	1.0
deer island	2005	27-Mar-05	27-Jun-05	Amy Schwarzer, Nick Bartok, Nick Mannan	8.6	1.3	43.0	4.0
deer island	2006	25-Apr-06	07-Jul-06	Archer Larned, Chris Nadeau, Meaghan Conway, Nick Bartok	3.8	3.3	19.0	10.0
east pond	2004	14-Mar-04	02-Jun-04	Chris Nadeau, Roberta Montano	1.0	2.3	2.0	9.0
east pond	2005	26-Mar-05	16-Jun-05	Amy Schwarzer, Crissa Cooey, Nick Mannan	0.0	2.0	0.0	2.0
east pond	2006	03-Apr-06	20-Jun-06	Archer Larned, Jake Molhmann, Meaghan Conway, Nick Bartok	2.3	0.0	7.0	0.0
ferguson lake a	2004	18-Mar-04	05-Jun-04	Erik Meyer, Nick Bartok, Roberta Montano	4.0	2.0	4.0	2.0
ferguson lake a	2005	25-Mar-05	20-Jun-05	Amy Schwarzer, Chris Nadeau, Crissa Cooey, Nick Bartok, Nick Mannan	2.5	2.0	5.0	8.0
ferguson lake a	2006	15-Mar-06	07-Jul-06	Archer Larned, Chris Nadeau, Jake Molhmann, Meaghan Conway, Nick Bartok	5.0	2.5	35.0	10.0
ferguson lake b	2004	16-Mar-04	04-Jun-04	Chris Nadeau, Erik Meyer, Nick Bartok, Roberta Montano	1.3	2.5	4.0	5.0
ferguson lake b	2005	27-Mar-05	23-Jun-05	Crissa Cooey, Nick Bartok, Nick Mannan	2.4	3.0	12.0	3.0
ferguson lake b	2006	04-Apr-06	27-Jun-06	Chris Nadeau, Jake Molhmann, Meaghan Conway, Nick Bartok	2.0	1.8	12.0	7.0
ferguson lake fl	2004	19-Mar-04	04-Jun-04	Chris Nadeau, Erik Meyer, Nick Bartok, Roberta Montano	1.7	3.2	5.0	16.0
ferguson lake fl	2005	27-Mar-05	19-Jun-05	Chris Nadeau, Crissa Cooey, Nick Bartok, Nick Mannan	3.2	2.8	19.0	25.0
ferguson lake fl	2006	13-Mar-06	23-Jun-06	Archer Larned, Chris Nadeau, Courtney Conway, Jake Molhmann, Meaghan Conway, Nick Bartok	2.7	3.0	19.0	15.0
hazard 10	2004	13-Apr-04	12-May-04	Erik Meyer, Mike Vamstad, Roberta Montano	0.0	2.0	0.0	12.0
hazard 10	2005	12-Apr-05	14-May-05	Amy Schwarzer, Chris Nadeau, Nick Bartok	0.0	2.8	0.0	11.0
hazard 10	2006	13-Apr-06	11-May-06	Archer Larned, Chris Nadeau, Jake Molhmann, Nick Bartok	0.0	2.8	0.0	11.0
hazard 10a	2004	13-Apr-04	12-May-04	Erik Meyer, Mike Vamstad, Roberta Montano	0.0	7.6	0.0	53.0
hazard 10a	2005	12-Apr-05	14-May-05	Amy Schwarzer, Chris Nadeau, Nick Bartok	0.0	4.8	0.0	29.0
hazard 10a	2006	13-Apr-06	11-May-06	Archer Larned, Chris Nadeau, Jake Molhmann, Nick Bartok	0.0	3.0	0.0	12.0
hazard 11	2004	13-Apr-04	12-May-04	Erik Meyer, Mike Vamstad, Roberta Montano	0.0	6.6	0.0	46.0
hazard 11	2005	12-Apr-05	14-May-05	Amy Schwarzer, Chris Nadeau, Crissa Cooey, Nick Bartok	0.0	7.2	0.0	43.0

FireSurveys

Site	Year	First Date Surveyed	Last Date Surveyed	Observers	Average # of Birds Detected Per Survey		Total # of Birds Detected Per Survey (repeat detections included)	
					BLRA	CLRA	BLRA	CLRA
hazard 11	2006	13-Apr-06	11-May-06	Archer Larned, Chris Nadeau, Jake Molhmann, Nick Bartok	0.0	4.2	0.0	21.0
hazard 6	2004	13-Apr-04	14-May-04	Erik Meyer, Mike Vamstad, Roberta Montano	0.0	12.8	0.0	128.0
hazard 6	2005	12-Apr-05	13-May-05	Amy Schwarzer, Chris Nadeau, Crissa Cooey	0.0	11.5	0.0	115.0
hazard 6	2006	11-Apr-06	14-May-06	Archer Larned, Chris Nadeau, Jake Molhmann, Meaghan Conway	0.0	7.3	0.0	44.0
hazard 7	2004	13-Apr-04	14-May-04	Erik Meyer, Mike Vamstad, Roberta Montano	0.0	5.1	0.0	56.0
hazard 7	2005	12-Apr-05	13-May-05	Amy Schwarzer, Chris Nadeau, Crissa Cooey	0.0	9.7	0.0	97.0
hazard 7	2006	11-Apr-06	14-May-06	Archer Larned, Chris Nadeau, Jake Molhmann, Meaghan Conway	0.0	8.7	0.0	61.0
headquarters marsh	2004	13-Apr-04	14-May-04	Erik Meyer, Mike Vamstad, Nick Bartok, Roberta Montano	0.0	3.8	0.0	38.0
headquarters marsh	2005	12-Apr-05	19-May-05	Amy Schwarzer, Chris Nadeau, Crissa Cooey, Nick Bartok	0.0	5.0	0.0	50.0
headquarters marsh	2006	11-Apr-06	12-May-06	Chris Nadeau, Jake Molhmann, Meaghan Conway, Nick Bartok	0.0	2.2	0.0	13.0
hidden shores boat a	2004	17-Mar-04	10-Jun-04	Chris Nadeau, Erik Meyer, Nick Bartok	5.6	6.6	28.0	33.0
hidden shores boat a	2005	28-Mar-05	29-Jun-05	Amy Schwarzer, Nick Bartok, Nick Mannan	9.2	3.8	46.0	19.0
hidden shores boat a	2006	13-Mar-06	26-Jun-06	Archer Larned, Chris Nadeau, Jake Molhmann, Meaghan Conway, Nick Bartok	5.4	6.9	38.0	48.0
hidden shores boat b	2004	18-Mar-04	11-Jun-04	Chris Nadeau, Erik Meyer, Nick Bartok	3.8	9.0	15.0	54.0
hidden shores boat b	2005	28-Mar-05	29-Jun-05	Amy Schwarzer, Chris Nadeau, Nick Bartok, Nick Mannan	4.5	7.8	18.0	39.0
hidden shores boat b	2006	14-Apr-06	02-Jul-06	Archer Larned, Meaghan Conway, Nick Bartok	2.6	11.3	13.0	68.0
hidden shores boat c	2004	28-Mar-04	13-Jun-04	Erik Meyer, Mike Vamstad, Nick Bartok, Roberta Montano	2.7	6.5	16.0	39.0
hidden shores boat c	2005	07-Apr-05	01-Jul-05	Amy Schwarzer, Chris Nadeau, Nick Bartok, Nick Mannan	7.0	9.4	35.0	47.0
hidden shores boat c	2006	19-Mar-06	04-Jul-06	Archer Larned, Chris Nadeau, Jake Molhmann, Meaghan Conway, Nick Bartok	6.5	13.5	39.0	81.0
hidden shores boat d	2004	19-Mar-04	06-Jun-04	Chris Nadeau, Erik Meyer, Roberta Montano	11.2	7.0	67.0	35.0
hidden shores boat d	2005	04-Apr-05	28-Jun-05	Amy Schwarzer, Chris Nadeau, Nick Bartok	17.0	5.7	85.0	17.0
hidden shores boat d	2006	11-Apr-06	03-Jul-06	Archer Larned, Chris Nadeau, Meaghan Conway, Nick Bartok	14.0	9.3	70.0	28.0
hidden shores marsh	2004	10-Mar-04	02-Jun-04	Chris Nadeau, Roberta Montano	5.8	8.0	29.0	56.0
hidden shores marsh	2005	25-Mar-05	19-Jun-05	Amy Schwarzer, Crissa Cooey, Nick Bartok	2.8	10.2	14.0	51.0
hidden shores marsh	2006	16-Mar-06	19-Jun-06	Archer Larned, Chris Nadeau, Courtney Conway, Jake Molhmann, Meaghan Conway, Nick Bartok	6.9	19.1	62.0	153.0
hurricane ridge marsh	2004	20-Mar-04	08-Jun-04	Chris Nadeau, Erik Meyer, Nick Bartok, Roberta Montano	1.5	1.5	3.0	3.0
hurricane ridge marsh	2005	27-Mar-05	19-Jun-05	Crissa Cooey	1.0	0.0	2.0	0.0
hurricane ridge marsh	2006	15-Mar-06	26-Jun-06	Archer Larned, Chris Nadeau, Jake Molhmann, Meaghan Conway, Nick Bartok	2.0	1.0	8.0	1.0
iaf jackie's clra	2004	16-Apr-04	16-Jun-04	Chris Nadeau, Nick Bartok, Roberta Montano	2.0	5.4	8.0	38.0
iaf jackie's clra	2005	31-Mar-05	07-Jul-05	Amy Schwarzer, Chris Nadeau, Crissa Cooey	4.4	6.6	22.0	73.0
iaf jackie's clra	2006	12-Mar-06	12-Mar-06	Archer Larned, Chris Nadeau, Jake Molhmann, Meaghan Conway, Nick Bartok	37.0	11.0	37.0	11.0
imperial dam road marsh a	2004	19-Mar-04	21-Jun-04	Chris Nadeau, Erik Meyer, Mike Vamstad, Nick Bartok, Roberta Montano	1.3	1.0	8.0	2.0
imperial dam road marsh a	2005	29-Mar-05	09-Jul-05	Amy Schwarzer, Chris Nadeau, Crissa Cooey, Nick Bartok, Nick Mannan	1.3	0.0	8.0	0.0
imperial dam road marsh a	2006	10-Apr-06	27-Jun-06	Archer Larned, Jake Molhmann, Meaghan Conway, Nick Bartok	1.8	1.0	11.0	1.0
imperial dam road marsh b	2004	19-Mar-04	21-Jun-04	Chris Nadeau, Erik Meyer, Nick Bartok, Roberta Montano	1.0	4.0	1.0	36.0
imperial dam road marsh b	2005	29-Mar-05	09-Jul-05	Amy Schwarzer, Chris Nadeau, Crissa Cooey, Nick Bartok, Nick Mannan	1.5	3.0	3.0	27.0
imperial dam road marsh b	2006	10-Apr-06	27-Jun-06	Archer Larned, Jake Molhmann, Meaghan Conway, Nick Bartok	1.0	3.2	2.0	16.0
imperial dam road marsh c	2004	23-Mar-04	21-Jun-04	Chris Nadeau, Erik Meyer, Nick Bartok	0.0	3.8	0.0	42.0
imperial dam road marsh c	2005	29-Mar-05	06-Jul-05	Amy Schwarzer, Chris Nadeau, Crissa Cooey, Nick Bartok, Nick Mannan	1.0	3.7	1.0	33.0
imperial dam road marsh c	2006	10-Apr-06	05-Jul-06	Archer Larned, Chris Nadeau, Jake Molhmann, Meaghan Conway, Nick Bartok	0.0	3.7	0.0	22.0
imperial dam road marsh d	2004	23-Mar-04	21-Jun-04	Chris Nadeau, Erik Meyer, Nick Bartok	1.0	2.7	2.0	30.0
imperial dam road marsh d	2005	29-Mar-05	06-Jul-05	Amy Schwarzer, Chris Nadeau, Crissa Cooey, Nick Bartok, Nick Mannan	2.0	3.4	10.0	24.0
imperial dam road marsh d	2006	10-Apr-06	05-Jul-06	Archer Larned, Chris Nadeau, Jake Molhmann, Meaghan Conway, Nick Bartok	0.0	1.5	0.0	3.0
inwr ag field 10-27	2004	27-Mar-04	25-Jun-04	Erik Meyer, Nick Bartok, Roberta Montano	1.0	3.3	1.0	10.0
inwr ag field 10-27	2005	30-Mar-05	28-Jun-05	Amy Schwarzer, Chris Nadeau, Nick Mannan	3.0	0.0	3.0	0.0
inwr ag field 10-27	2006	11-Apr-06	28-Jun-06	Archer Larned, Chris Nadeau, Jake Molhmann, Meaghan Conway	1.0	3.0	1.0	12.0
inwr ag field 11	2004	27-Mar-04	23-Jun-04	Chris Nadeau, Erik Meyer, Roberta Montano	1.0	10.0	1.0	20.0
inwr ag field 11	2005	30-Mar-05	13-Jul-05	Amy Schwarzer, Chris Nadeau, Crissa Cooey, Nick Bartok, Nick Mannan	0.0	4.0	0.0	12.0

FireSurveys

Site	Year	First Date Surveyed	Last Date Surveyed	Observers	Average # of Birds Detected Per Survey		Total # of Birds Detected Per Survey (repeat detections included)	
					BLRA	CLRA	BLRA	CLRA
inwr ag field 11	2006	29-Mar-06	23-Jun-06	Archer Larned, Chris Nadeau, Jake Molhmann, Meaghan Conway, Nick Bartok	2.5	5.9	5.0	41.0
inwr ag field 12	2004	25-Mar-04	11-Jun-04	Chris Nadeau, Mike Vamstad, Nick Bartok, Roberta Montano	0.0	2.0	0.0	6.0
inwr ag field 12	2005	02-Apr-05	08-Jul-05	Amy Schwarzer, Chris Nadeau, Crissa Cooey	0.0	3.0	0.0	3.0
inwr ag field 12	2006	19-Mar-06	28-Jun-06	Archer Larned, Chris Nadeau, Courtney Conway, Jake Molhmann, Meaghan Conway, Nick Bartok	1.0	2.8	1.0	17.0
inwr ag field 13	2004	29-Mar-04	24-Jun-04	Erik Meyer, Nick Bartok, Roberta Montano	1.0	1.8	1.0	9.0
inwr ag field 13	2005	03-Apr-05	15-Jul-05	Amy Schwarzer, Crissa Cooey, Nick Mannan	1.0	3.4	1.0	17.0
inwr ag field 13	2006	06-Mar-06	29-Jun-06	Archer Larned, Chris Nadeau, Jake Molhmann, Meaghan Conway, Nick Bartok	8.7	5.9	26.0	41.0
inwr ag field 14	2004	27-Mar-04	25-Jun-04	Erik Meyer, Nick Bartok, Roberta Montano	1.0	6.8	2.0	41.0
inwr ag field 14	2005	30-Mar-05	28-Jun-05	Amy Schwarzer, Chris Nadeau, Nick Mannan	2.0	4.0	6.0	20.0
inwr ag field 14	2006	06-Mar-06	28-Jun-06	Archer Larned, Chris Nadeau, Jake Molhmann, Meaghan Conway, Nick Bartok	1.0	7.6	2.0	38.0
inwr ag field 16	2004	27-Mar-04	23-Jun-04	Chris Nadeau, Erik Meyer, Roberta Montano	2.8	2.0	11.0	4.0
inwr ag field 16	2005	30-Mar-05	13-Jul-05	Amy Schwarzer, Chris Nadeau, Crissa Cooey, Nick Bartok, Nick Mannan	3.4	1.0	17.0	1.0
inwr ag field 16	2006	29-Mar-06	23-Jun-06	Archer Larned, Chris Nadeau, Jake Molhmann, Meaghan Conway, Nick Bartok	4.6	2.0	23.0	6.0
inwr ag field 17	2004	29-Mar-04	24-Jun-04	Erik Meyer, Nick Bartok, Roberta Montano	2.5	2.3	5.0	7.0
inwr ag field 17	2005	03-Apr-05	15-Jul-05	Amy Schwarzer, Crissa Cooey, Nick Mannan	2.3	1.0	9.0	1.0
inwr ag field 17	2006	12-Apr-06	29-Jun-06	Archer Larned, Jake Molhmann, Nick Bartok	3.4	1.0	17.0	2.0
inwr ag field 21	2004	25-Mar-04	11-Jun-04	Chris Nadeau, Mike Vamstad, Nick Bartok	1.3	3.3	5.0	13.0
inwr ag field 21	2005	02-Apr-05	08-Jul-05	Amy Schwarzer, Chris Nadeau, Crissa Cooey	2.2	2.0	11.0	4.0
inwr ag field 21	2006	07-Apr-06	28-Jun-06	Archer Larned, Chris Nadeau, Jake Molhmann, Nick Bartok	4.2	5.0	21.0	20.0
inwr ag field 28	2004	25-Mar-04	25-Jun-04	Erik Meyer, Nick Bartok, Roberta Montano	0.0	2.0	0.0	2.0
inwr ag field 28	2005	30-Mar-05	28-Jun-05	Amy Schwarzer, Chris Nadeau, Nick Mannan	0.0	0.0	0.0	0.0
inwr ag field 28	2006	30-May-06	16-Jun-06	Archer Larned, Chris Nadeau	0.0	0.0	0.0	0.0
inwr hq bunkhouse	2004	24-Mar-04	25-Jun-04	Chris Nadeau, Erik Meyer, Nick Bartok, Roberta Montano	0.0	0.0	0.0	0.0
inwr hq bunkhouse	2005	02-Apr-05	11-Jul-05	Amy Schwarzer, Chris Nadeau, Crissa Cooey, Nick Mannan	0.0	0.0	0.0	0.0
inwr hq bunkhouse	2006	29-Mar-06	21-Jun-06	Archer Larned, Meaghan Conway, Nick Bartok	0.0	0.0	0.0	0.0
island lake	2004	14-Apr-04	24-Jul-04	Chris Nadeau, Nick Bartok, Roberta Montano	0.0	1.3	0.0	4.0
island lake	2005	27-Jun-05	15-Jul-05	Chris Nadeau	1.0	0.0	1.0	0.0
island lake	2006	05-Jul-06	13-Jul-06	Chris Nadeau, Nick Bartok	0.0	0.0	0.0	0.0
martinez lake a	2004	13-Mar-04	03-Jun-04	Chris Nadeau, Erik Meyer, Mike Vamstad, Nick Bartok, Roberta Montano	1.0	1.2	3.0	6.0
martinez lake a	2005	25-Mar-05	18-Jun-05	Amy Schwarzer, Chris Nadeau, Nick Bartok, Nick Mannan	1.5	1.9	3.0	15.0
martinez lake a	2006	27-Mar-06	20-Jun-06	Archer Larned, Jake Molhmann, Meaghan Conway, Nick Bartok	2.3	3.6	7.0	18.0
martinez lake b	2004	13-Mar-04	05-Jun-04	Chris Nadeau, Erik Meyer, Nick Bartok, Roberta Montano	1.7	2.7	5.0	16.0
martinez lake b	2005	25-Mar-05	20-Jun-05	Amy Schwarzer, Nick Bartok, Nick Mannan	1.0	3.8	3.0	34.0
martinez lake b	2006	20-Mar-06	22-Jun-06	Archer Larned, Chris Nadeau, Courtney Conway, Jake Molhmann, Meaghan Conway, Nick Bartok	1.3	4.3	4.0	30.0
mission wash a	2004	14-Mar-04	03-Jun-04	Chris Nadeau, Erik Meyer, Mike Vamstad, Nick Bartok, Roberta Montano	10.6	2.0	53.0	4.0
mission wash a	2005	26-Mar-05	17-Jun-05	Crissa Cooey, Nick Mannan	4.0	1.5	20.0	3.0
mission wash a	2006	17-Mar-06	19-Jun-06	Archer Larned, Chris Nadeau, Jake Molhmann, Meaghan Conway, Nick Bartok	0.0	0.0	0.0	0.0
mission wash b	2004	14-Mar-04	03-Jun-04	Chris Nadeau, Erik Meyer, Mike Vamstad, Nick Bartok, Roberta Montano	2.0	0.0	2.0	0.0
mission wash b	2005	26-Mar-05	17-Jun-05	Crissa Cooey, Nick Mannan	3.4	2.0	17.0	2.0
mission wash b	2006	06-Apr-06	19-Jun-06	Jake Molhmann, Meaghan Conway, Nick Bartok	0.0	0.0	0.0	0.0
no name lake	2004	02-Apr-04	15-Jun-04	Chris Nadeau, Erik Meyer, Roberta Montano	0.0	5.0	0.0	30.0
no name lake	2005	05-Apr-05	22-Jun-05	Amy Schwarzer, Chris Nadeau, Crissa Cooey	0.0	6.5	0.0	39.0
no name lake	2006	04-Apr-06	20-Jun-06	Meaghan Conway, Nick Bartok	0.0	6.7	0.0	20.0
north mittry lake a	2004	22-Mar-04	10-Jun-04	Chris Nadeau, Nick Bartok, Roberta Montano	3.0	5.8	21.0	35.0
north mittry lake a	2005	29-Mar-05	29-Jun-05	Amy Schwarzer, Crissa Cooey, Nick Mannan	13.6	8.4	68.0	42.0
north mittry lake a	2006	20-Mar-06	26-Jun-06	Archer Larned, Chris Nadeau, Courtney Conway, Jake Molhmann, Meaghan Conway, Nick Bartok	4.4	7.1	31.0	50.0
north mittry lake b	2004	21-Mar-04	08-Jun-04	Chris Nadeau, Erik Meyer, Mike Vamstad, Nick Bartok, Roberta Montano	4.6	11.4	23.0	57.0
north mittry lake b	2005	28-Mar-05	28-Jun-05	Amy Schwarzer, Crissa Cooey, Nick Mannan	7.2	8.0	36.0	40.0

FireSurveys

Site	Year	First Date Surveyed	Last Date Surveyed	Observers	Average # of Birds Detected Per Survey		Total # of Birds Detected Per Survey (repeat detections included)	
					BLRA	CLRA	BLRA	CLRA
north mittry lake b	2006	06-Mar-06	28-Jun-06	Archer Larned, Jake Molhmann, Meaghan Conway, Nick Bartok	3.1	4.4	22.0	31.0
north mittry lake c	2004	21-Mar-04	06-Jun-04	Chris Nadeau, Nick Bartok, Roberta Montano	6.4	12.2	45.0	73.0
north mittry lake c	2005	27-Mar-05	28-Jun-05	Amy Schwarzer, Chris Nadeau, Crissa Cooey	5.2	7.8	26.0	39.0
north mittry lake c	2006	07-Mar-06	23-Jun-06	Archer Larned, Chris Nadeau, Jake Molhmann, Meaghan Conway, Nick Bartok	5.6	8.0	45.0	64.0
old inlet channel	2004	09-May-04	06-Jul-04	Chris Nadeau, Erik Meyer, Nick Bartok, Roberta Montano	1.0	9.0	1.0	27.0
old inlet channel	2005	13-Jun-05	27-Jun-05	Chris Nadeau	2.0	4.5	2.0	9.0
old inlet channel	2006	11-May-06	26-May-06	Chris Nadeau	0.0	5.0	0.0	10.0
painted desert trail	2004	24-Mar-04	25-Jun-04	Chris Nadeau, Erik Meyer, Nick Bartok, Roberta Montano	0.0	2.0	0.0	4.0
painted desert trail	2005	02-Apr-05	11-Jul-05	Amy Schwarzer, Chris Nadeau, Crissa Cooey, Nick Mannan	0.0	1.0	0.0	1.0
painted desert trail	2006	29-Mar-06	21-Jun-06	Archer Larned, Meaghan Conway, Nick Bartok	1.0	2.0	1.0	2.0
reidman 3	2004	13-Apr-04	14-May-04	Chris Nadeau, Erik Meyer, Roberta Montano	0.0	15.6	0.0	187.0
reidman 3	2005	12-Apr-05	13-May-05	Amy Schwarzer, Chris Nadeau, Crissa Cooey, Nick Bartok	0.0	15.3	0.0	153.0
reidman 3	2006	12-Apr-06	11-May-06	Archer Larned, Chris Nadeau, Jake Molhmann, Nick Bartok	0.0	22.6	0.0	113.0
reidman 4	2004	13-Apr-04	14-May-04	Chris Nadeau, Erik Meyer, Roberta Montano	0.0	16.7	0.0	167.0
reidman 4	2005	12-Apr-05	13-May-05	Amy Schwarzer, Chris Nadeau, Crissa Cooey, Nick Bartok	0.0	22.3	0.0	223.0
reidman 4	2006	12-Apr-06	11-May-06	Archer Larned, Chris Nadeau, Jake Molhmann, Nick Bartok	0.0	14.4	0.0	72.0
senator wash	2004	20-Mar-04	08-Jun-04	Chris Nadeau, Erik Meyer, Mike Vamstad, Nick Bartok, Roberta Montano	3.7	3.7	33.0	22.0
senator wash	2005	27-Mar-05	19-Jun-05	Crissa Cooey	4.6	2.6	23.0	13.0
senator wash	2006	15-Mar-06	26-Jun-06	Archer Larned, Chris Nadeau, Jake Molhmann, Meaghan Conway, Nick Bartok	1.7	1.3	10.0	5.0
south mittry lake	2004	23-Mar-04	23-Jun-04	Chris Nadeau, Erik Meyer, Mike Vamstad, Nick Bartok, Roberta Montano	4.6	9.8	73.0	128.0
south mittry lake	2005	29-Mar-05	01-Jul-05	Amy Schwarzer, Crissa Cooey, Nick Mannan	8.2	8.4	82.0	84.0
south mittry lake	2006	07-Mar-06	28-Jun-06	Archer Larned, Chris Nadeau, Jake Molhmann, Meaghan Conway, Nick Bartok	6.4	6.3	51.0	57.0
south of dredge ramp a	2004	22-Mar-04	16-Jun-04	Chris Nadeau, Erik Meyer, Nick Bartok, Roberta Montano	4.3	2.5	65.0	32.0
south of dredge ramp a	2005	30-Mar-05	28-Jun-05	Amy Schwarzer, Chris Nadeau, Crissa Cooey, Nick Mannan	6.0	1.6	54.0	8.0
south of dredge ramp a	2006	09-Mar-06	24-Jun-06	Archer Larned, Chris Nadeau, Jake Molhmann, Meaghan Conway	1.8	2.0	7.0	4.0
south of dredge ramp b	2004	22-Mar-04	17-Jun-04	Chris Nadeau, Erik Meyer, Mike Vamstad, Nick Bartok, Roberta Montano	2.1	2.0	25.0	10.0
south of dredge ramp b	2005	29-Mar-05	09-Jul-05	Chris Nadeau, Crissa Cooey, Nick Bartok, Nick Mannan	6.1	2.0	55.0	10.0
south of dredge ramp b	2006	09-Mar-06	24-Jun-06	Archer Larned, Jake Molhmann, Meaghan Conway, Nick Bartok	5.0	1.0	30.0	3.0
squaw lake and south of squaw lake	2004	18-Mar-04	05-Jun-04	Chris Nadeau, Erik Meyer, Nick Bartok	5.0	7.2	35.0	36.0
squaw lake and south of squaw lake	2005	29-Mar-05	28-Jun-05	Chris Nadeau, Nick Bartok, Nick Mannan	4.0	3.0	32.0	18.0
squaw lake and south of squaw lake	2006	26-Apr-06	06-Jul-06	Archer Larned, Chris Nadeau, Jake Molhmann, Meaghan Conway	5.4	3.5	27.0	14.0
squaw lake shore	2004	20-Mar-04	08-Jun-04	Chris Nadeau, Erik Meyer, Mike Vamstad, Nick Bartok, Roberta Montano	6.3	4.0	88.0	56.0
squaw lake shore	2005	27-Mar-05	28-Jun-05	Chris Nadeau, Crissa Cooey, Nick Mannan	4.6	4.0	46.0	36.0
squaw lake shore	2006	04-Apr-06	21-Jun-06	Archer Larned, Jake Molhmann, Meaghan Conway, Nick Bartok	10.2	5.3	51.0	16.0
triangle	2004	12-Jun-04	24-Jun-04	Chris Nadeau, Nick Bartok, Roberta Montano	0.0	6.0	0.0	6.0
triangle	2005	03-Apr-05	08-Jun-05	Amy Schwarzer, Crissa Cooey, Nick Mannan	1.3	3.0	4.0	12.0
triangle	2006	12-Apr-06	23-Jun-06	Archer Larned, Chris Nadeau, Nick Bartok	2.0	1.5	6.0	3.0
union pond	2004	13-Apr-04	14-May-04	Erik Meyer, Mike Vamstad, Nick Bartok, Roberta Montano	0.0	9.5	0.0	105.0
union pond	2005	12-Apr-05	19-May-05	Amy Schwarzer, Chris Nadeau, Crissa Cooey, Nick Bartok	0.0	9.4	0.0	94.0
union pond	2006	11-Apr-06	13-May-06	Chris Nadeau, Jake Molhmann, Meaghan Conway, Nick Bartok	0.0	20.0	0.0	160.0
upper goose lake burn	2004	31-Mar-04	15-Jun-04	Chris Nadeau, Erik Meyer, Mike Vamstad, Nick Bartok	0.0	1.8	0.0	11.0
upper goose lake burn	2005	06-Apr-05	23-Jun-05	Chris Nadeau, Nick Mannan	0.0	3.3	0.0	23.0
upper goose lake burn	2006	07-Apr-06	21-Jun-06	Archer Larned, Chris Nadeau, Jake Molhmann, Nick Bartok	0.0	6.0	0.0	18.0
upper goose lake control	2004	02-Apr-04	16-Jun-04	Chris Nadeau, Erik Meyer, Roberta Montano	0.0	2.0	0.0	8.0
upper goose lake control	2005	08-Apr-05	22-Jun-05	Amy Schwarzer, Chris Nadeau, Nick Bartok, Nick Mannan	0.0	4.2	0.0	21.0
upper goose lake control	2006	05-Apr-06	20-Jun-06	Chris Nadeau, Jake Molhmann, Meaghan Conway, Nick Bartok	0.0	2.3	0.0	9.0
water tower marsh	2004	14-Mar-04	02-Jun-04	Chris Nadeau, Roberta Montano	1.8	0.0	7.0	0.0
water tower marsh	2005	26-Mar-05	16-Jun-05	Amy Schwarzer, Crissa Cooey, Nick Mannan	1.3	1.0	5.0	1.0

FireSurveys

Site	Year	First Date Surveyed	Last Date Surveyed	Observers	Average # of Birds Detected Per Survey		Total # of Birds Detected Per Survey (repeat detections included)	
					BLRA	CLRA	BLRA	CLRA
water tower marsh	2006	03-Apr-06	20-Jun-06	Archer Larned, Jake Molhmann, Meaghan Conway, Nick Bartok	3.6	0.0	18.0	0.0
west pond a	2004	09-Mar-04	01-Jun-04	Chris Nadeau, Mike Vamstad, Roberta Montano	5.1	2.0	36.0	2.0
west pond a	2005	25-Mar-05	15-Jun-05	Amy Schwarzer, Chris Nadeau, Crissa Cooey, Nick Mannan	6.8	2.8	34.0	11.0
west pond a	2006	28-Mar-06	15-Jun-06	Archer Larned, Jake Molhmann, Meaghan Conway, Nick Bartok	7.4	4.0	37.0	20.0
west pond b	2004	12-Mar-04	01-Jun-04	Chris Nadeau, Courtney Conway, Erik Meyer, Nick Bartok	3.9	2.8	27.0	11.0
west pond b	2005	04-Mar-05	16-Jun-05	Amy Schwarzer, Chris Nadeau, Crissa Cooey, Nick Bartok, Nick Mannan	8.9	2.0	71.0	6.0
west pond b	2006	28-Mar-06	16-Jun-06	Archer Larned, Meaghan Conway, Nick Bartok	9.0	4.0	45.0	20.0
whiskey slough burn	2004	31-Mar-04	15-Jun-04	Chris Nadeau, Erik Meyer, Roberta Montano	0.0	0.0	0.0	0.0
whiskey slough burn	2005	06-Apr-05	26-Jun-05	Amy Schwarzer, Chris Nadeau, Crissa Cooey, Nick Bartok	0.0	1.3	0.0	5.0
whiskey slough burn	2006	06-Apr-06	21-Jun-06	Archer Larned, Chris Nadeau, Jake Molhmann, Meaghan Conway, Nick Bartok	0.0	0.0	0.0	0.0
whiskey slough control	2004	31-Mar-04	15-Jun-04	Chris Nadeau, Erik Meyer, Roberta Montano	0.0	1.0	0.0	2.0
whiskey slough control	2005	06-Apr-05	25-Jun-05	Amy Schwarzer, Crissa Cooey, Nick Bartok	0.0	1.5	0.0	6.0
whiskey slough control	2006	06-Apr-06	21-Jun-06	Archer Larned, Chris Nadeau, Jake Molhmann, Meaghan Conway, Nick Bartok	0.0	1.5	0.0	3.0
willow lake burn	2004	02-Apr-04	15-Jun-04	Chris Nadeau, Erik Meyer, Nick Bartok	0.0	2.5	0.0	10.0
willow lake burn	2005	06-Apr-05	24-Jun-05	Chris Nadeau, Nick Bartok, Nick Mannan	0.0	3.0	0.0	15.0
willow lake burn	2006	07-Apr-06	22-Jun-06	Archer Larned, Meaghan Conway, Nick Bartok	0.0	1.3	0.0	4.0
willow lake control	2004	31-Mar-04	16-Jun-04	Chris Nadeau, Erik Meyer, Nick Bartok, Roberta Montano	0.0	1.1	0.0	8.0
willow lake control	2005	06-Apr-05	25-Jun-05	Amy Schwarzer, Chris Nadeau, Nick Mannan	0.0	3.0	0.0	9.0
willow lake control	2006	05-Apr-06	23-Jun-06	Archer Larned, Chris Nadeau, Jake Molhmann, Meaghan Conway, Nick Bartok	0.0	1.7	0.0	5.0

Record Id 8941
County Imperial
Year 2006
Spp YCR(+) CBR(-)
Srv. Rpt.
D.B. DL 10/3/07
GIS 6/26/08
L+R
File

DOS PALMAS CORE MARSH SURVEYS FOR YUMA CLAPPER RAIL AND CALIFORNIA BLACK RAIL

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USDI Bureau of Land Management

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DOS PALMAS CORE MARSH SURVEYS FOR YUMA CLAPPER RAIL AND CALIFORNIA BLACK RAIL

1.0 INTRODUCTION

AMEC Earth and Environmental, Inc. (AMEC) ornithologists conducted surveys for Yuma Clapper Rail (*Rallus longirostris yumanensis*) and California Black Rail (*Laterallus jamaicensis coturniculus*) in the 105 acre Dos Palmas Core Marsh in the spring of 2006. The Core Marsh is part of the Bureau of Land Management's (BLM's) Dos Palmas Area of Critical Environmental Concern (ACEC), and is mostly owned by the Center for Natural Lands Management (CNLM) (see Appendix I, Map 1).

The purpose of these surveys was to establish replicable survey stations and collect baseline data regarding the current status of each species in the Core Marsh, and to provide information regarding habitat quantity, suitability, and use by the two rail species. The results of these surveys will be used as the baseline for monitoring change over time and will provide information for adaptive management strategies for the aquatic habitats in the Core Marsh. Marsh birds may be "indicator" species for assessing wetland ecosystem quality and restoration efforts.

A goal of the surveys was to compare hydrological and vegetative characteristics of the Dos Palmas Core Marsh with the habitat parameters described in the ornithological literature (for each species), but the information gathered in the aural-based surveys did not allow for a precise characterization of the habitat parameters at rail locations (see **Results**, below).

1.1 Background

1.1.1 Yuma Clapper Rail

The Yuma Clapper Rail (*Rallus longirostris yumanensis*) is one of up to 21 subspecies of the widespread Clapper Rail (*Rallus longirostris*). The Yuma Clapper Rail is found in a "variety of marshy situations, from pure cattails and rushes to (marginally) stands of cane and flooded salt cedar" (Garrett and Dunn 1981). In the Imperial Valley and Salton Sea area the Yuma Clapper Rail is most common in freshwater marshes near the sea, but occurs locally "some distance from the sea at Dos Palmas Spring" (Garrett and Dunn 1981).

The Yuma Clapper Rail is a federally-listed Endangered species, and a California-listed Threatened species. Populations of Yuma Clapper Rails have undergone decline in the United States due to the limited distribution, and destruction and degradation of freshwater marsh habitat.

The Yuma Clapper Rail is a slender, tawny-breasted bird with grayish edges on brown centered back feathers, olive wing coverts, vertical white bars on the flanks, a white stripe over the eye, and a partially orange bill.

1.1.2 California Black Rail

The California Black Rail (*Laterallus jamaicensis coturniculus*) the smallest rail in North America, is a California-listed Threatened species, and, like the Yuma Clapper Rail, is found in marsh habitats and has been impacted by the loss and degradation of these habitats. Bulrush (*Scirpus* sp.) marshes seem to be favored in the Imperial Dam area (Garrett and Dunn 1981). The population of Black Rails in the Colorado River Valley between Needles, California and Yuma, Arizona was estimated to be 75-100 individuals in 1991 (Evens *et al.* 1991).

The California Black Rail is a rare to uncommon bird in the Salton Sea area, with most detections occurring in spring and summer, and its status considered "irregular and unpredictable" (Garrett and Dunn 1981). The uncertain status of the species makes it difficult to determine population dynamics, but there is evidence that canal lining projects have decreased habitat for the California Black Rail east of the Salton Sea (Evens et al. 1991).

The California Black Rail is blackish above with white speckling, has a chestnut nape, grayish-black underparts, narrow white barring on the flanks, and a short black bill.

2.0 SURVEY METHODOLOGY

AMEC ornithologists John F. Green and Chet McGaugh made survey visits on four dates in the spring of 2006 (see Table 1).

Table 1

Date	Route	Stations	Time	Surveyors
April 6	North	1-6	0639-0922	Green/McGaugh
April 19	East	7-15	0654-0950	Green/McGaugh
May 11	West	16-22	0624-0907	Green/McGaugh
June 13	East	7-15	2030-2230	Green/McGaugh

McGaugh is permitted to take (harass by survey) Yuma Clapper Rails under Federal Fish and Wildlife Permit TE836517-5.

Yuma Clapper Rail and California Black Rail are included in the Memorandum of Understanding by and between AMEC Earth and Environmental, Inc. and California Department of Fish and Game (expiration date February 28, 2007).

Stations were established based on accessibility, position relative to marsh habitat and position relative to other stations. Table 1 shows which stations were on each route (North, East, or West). The routes consisted of the stations surveyed on a particular day. Map 2 (Appendix I) shows the location of each of the stations. Each station was photographed and flagged, and a GPS waypoint was marked. Table 2 (see **Results**, below) shows the coordinates of each station and the rail detections at each. Appendix V contains the photographic exhibits.

Table 2

Station	Yuma Clapper Rail(s) detected?	California Black Rail(s) detected?	Coordinates: Decimal Degrees; Datum: NAD27 CONUS	
			Latitude	Longitude
1	No	No	33.50216	-115.82731
2	No	No	33.50104	-115.82811
3	No	No	33.50158	-115.82653
4	No	No	33.49960	-115.82487
5	No	No	33.49958	-115.82282
6	Yes, 6 April	No	33.49958	-115.82125
7	Yes, 19 April	No	33.49995	-115.81848
8	Yes, 19 April	No	33.49907	-115.81778
9	No	No	33.49761	-115.81722
10	Yes, 19 April	No	33.49639	-115.81869
11	Yes, 13 June	No	33.49495	-115.81881
12	No	No	33.49377	-115.81981
13	Yes, 19 April	No	33.49201	-115.82063
14	No	No	33.49048	-115.82114
15	No	No	33.48913	-115.82129
16	No	No	33.49985	-115.82662
17	Yes, 11 May	No	33.49855	-115.82574
18	No	No	33.49738	-115.82467
19	Yes, 11 May	No	33.49589	-115.82440
20	No	No	33.49455	-115.82337
21	No	No	33.49299	-115.82235
22	No	No	33.49696	-115.82328

As Map 2 (Appendix I) indicates, the survey stations were almost completely on the perimeter of the marsh. It was decided that establishing points in the interior of the marsh would be very difficult, budget-consuming, hard to replicate, and potentially harmful to birds and their nests. Station 22, though clearly not deep into the Core Marsh, took 43 minutes to reach after completing the survey at station 21. A route through the center of the Core Marsh may be desirable for future surveys, but considerable work, done prior to the survey/nesting season, will be necessary to establish interior marsh stations.

The "Yuma Clapper Rail Survey Protocol" (U.S. Fish and Wildlife Service 2000) establishes requirements for official surveys for the Yuma Clapper Rail. The protocol requires two surveys at each location to be conducted between March 15 and May 15, with at least one week between surveys. Surveys are to be conducted between 30 minutes before sunrise until 3.5 hours after sunrise. Survey points should be 150-200 meters apart, depending on local conditions. Surveys should not be conducted if winds exceed 10 miles per hour.

AMEC's Yuma Clapper Rail surveys for the most part followed the protocol, but each station was only surveyed once. Whereas multiple surveys would likely have provided more information on the status of Yuma Clapper Rails in the Core Marsh, the three days necessary to survey the marsh one time, the difficulty in accessing survey stations, and the "first time through" results

(multiple Yuma Clapper Rails) accomplished as much as we could really expect this season, considering time and budget. A second survey would have likely provided new detections at some different stations, and perhaps no detections at previously "occupied" stations, and a not much clearer picture of the species status in the marsh.

The official Yuma Clapper Rail survey cassette tape was played at each station, with broadcast duration and sequence of listening periods as described in the protocol: two minutes broadcast, two minutes listen, two minutes broadcast, one minute listen, for a total survey time of seven minutes, not including a one minute period of listening prior to the first tape broadcast.

Recorded Black Rail vocalizations were played following each of the Yuma Clapper Rail survey periods. The same broadcast and listening period sequence and duration was used. Only Black Rail vocalizations were played during the 13 June nocturnal survey, but a Yuma Clapper Rail responded at Station 11.

Stations 1-6 and 16-22 were surveyed one time for California Black Rails; Stations 7-15 were surveyed twice for California Black Rails, once in the morning and once in the evening. Stations 7-15 were the stations determined to be most safely accessed in the dark.

Equipment used included a cassette tape player, an iPod with external speaker, official Yuma Clapper Rail survey cassette tape, several digital Black Rail vocalization recordings, binoculars, two Global Positioning System (GPS) units, a digital SLR camera, and maps.

3.0 RESULTS

Yuma Clapper Rails were detected (heard) at 8 of the 22 stations (Table 2). No Yuma Clapper Rails were seen. (See Appendix II, "Yuma Clapper Rail Survey Cover Sheets" and Appendix III, "Yuma Clapper Rail Survey Data Sheets"). At station 6 and station 7 two Yuma Clapper Rails were heard; at all other stations (stations 8, 10, 11, 13, 17, and 19) only single birds were heard. Both "clatter" calls and "kek" calls were heard.

While it was hoped that vegetative and hydrological characteristics of the Yuma Clapper Rail locations in the Core Marsh could be examined and compared with the habitat parameters described in the ornithological literature, the aural detection of rails did not allow for the collection of data on habitat use, vegetation, or hydrological conditions. Most of the Yuma Clapper Rails heard were 50m+ distance from the station, and the dense, tall vegetation made assessment of the vegetative characteristics of the location the rail was calling from impossible. No Yuma Clapper Rails were seen during the surveys, and only once were the ornithologists close enough to a calling bird that the habitat being used could be determined (station 8).

It was noted that the hydrology of the marsh, as determined by the fluctuations of surface water and mud at stations that were revisited on the evening of 13 June, doesn't necessarily correspond with rain or the lack thereof.

California Black Rails were not detected. However, AMEC ornithologists do not believe that the survey level of effort was adequate to establish that the species was absent from the Dos Palmas Core Marsh in 2006. Gibbs and Melvin (1993) posit that three surveys are needed to confirm

seasonal presence/absence of marsh birds in a wetland with 90% certainty. For California Black Rails, these replicate surveys are best done during three 10 day survey windows separated by 20 days to accommodate seasonal and locational variability. In the Lower Colorado River region, survey periods of 21-30 March, 21-30 April, and 21-30 May are suggested (Conway *et al.* 2002).

Of possible relevance to the non-detection of California Black Rails in the Core Marsh is the fact that none were detected in other parts of the Dos Palmas ACEC in 2006, including an area where one was detected on 7 April 2005 by AMEC ornithologist John Green, but could not be re-found on 20 April 2005. Much of what is known about the status and distribution of this species (resident? summer visitor? migrant? less common in winter? declining?) is likely an "artifact of detectability" (Patten *et al.* 2003).

Other wetland bird species detected during the surveys include Virginia Rail, Sora, and Least Bittern. A complete list of bird species detected at Dos Palmas during the course of AMEC's rail surveys is included as Appendix IV.

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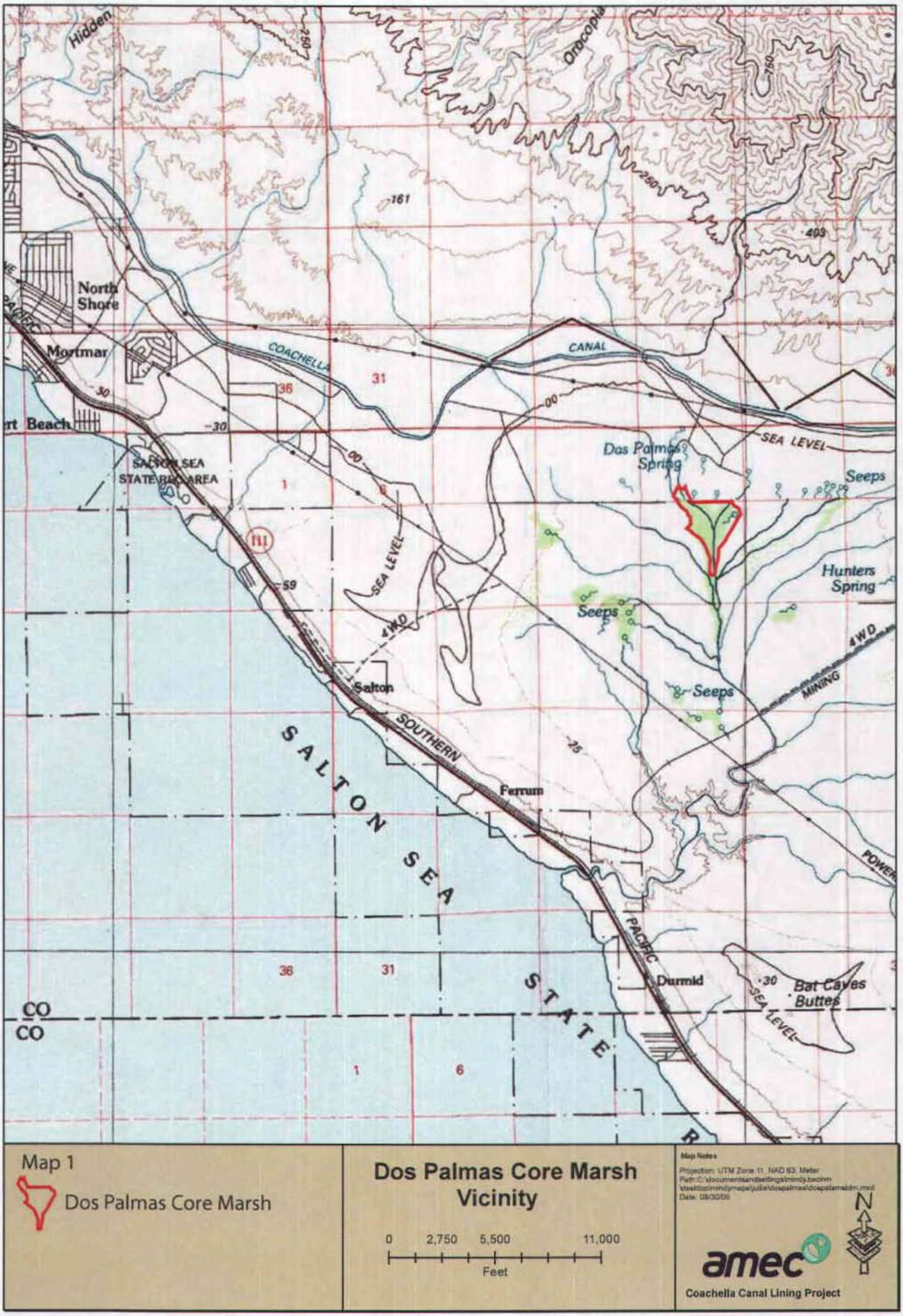
Appendix I
Maps


Hidden
Orocopia
North Shore
Mortmar
COACHELLA CANAL
Beach
SALTON SEA STATE REC AREA
Das Palmas Spring
SEA LEVEL
Seeps
Hunters Spring
4WD
MINING
Salton
SOUTHERN PACIFIC
Ferrum
SALTON SEA STATE R
Durmid
Bat Caves Buttes
POWER
CO
CO
Map 1
Dos Palmas Core Marsh
Dos Palmas Core Marsh Vicinity
0 2,750 5,500 11,000
Feet
Map Notes
Projection: UTM Zone 11, NAD 83, Meter
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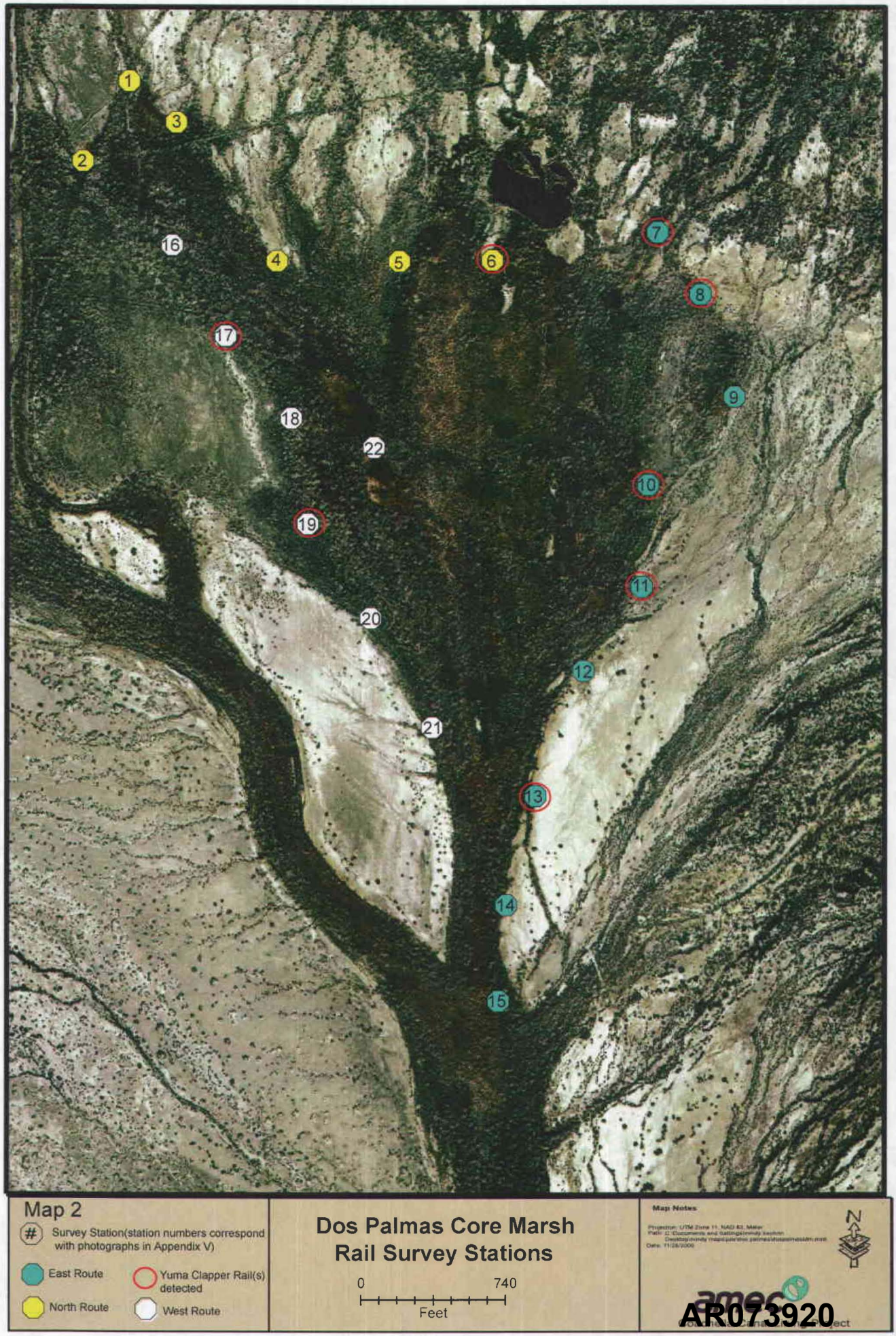
Coachella Canal Lining Project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21
22
Map 2
Survey Station(station numbers correspond with photographs in Appendix V)
East Route
Yuma Clapper Rail(s) detected
North Route
West Route
Dos Palmas Core Marsh
Rail Survey Stations
0
740
Feet
Map Notes
N
amec

AR073920

Appendix II
Yuma Clapper Rail Survey Cover Sheets

YUMA CLAPPER RAIL SURVEY
COVER SHEET
(JANUARY 2000)

Date: APRIL 6, 2006

Location Information:
Location Name TOS PALMAS CORE MARSH Route NORTH, STATIONS 1-6

Map Name CROCODILE CANYON, DURMID Township/Range/Section T8S, R11E, S3, 10

Observer(s) CHET MCCAUGH, JOHN GREEN

Weather:
Start %Cloud Cover 0 Temp 45°F Wind Speed 0
End % Cloud Cover 0 Temp 62°F Wind Speed 0-2

Data Summary:

1) Total individual rails seen or heard while surveying 2
2) Number of other rails seen or heard (incidentals) 5

Total rails per route or location equals #1+#2 7
For rails/hour, each stop is 7 minutes

Observations:

Events during survey that may have affected results:

Other Observations/Comments:

YUMA CLAPPER RAIL SURVEY
COVER SHEET
(JANUARY 2000)

Date: APRIL 19, 2006

Location Information:
Location Name DOS PALMAS COVE MARSH Route EAST, STATIONS 7-15

Map Name OROYOPIA CANYON, DUBOIS Township/Range/Section T8S, R11E, S3,10

Observer(s) CHET MCGAUGH, JOHN GREEN

Weather:
Start %Cloud Cover 0 Temp 62°F Wind Speed 0
End % Cloud Cover 40 Temp 80°F Wind Speed 0

Data Summary:

1) Total individual rails seen or heard while surveying 2
2) Number of other rails seen or heard (incidentals) 10

Total rails per route or location equals #1+#2 12
For rails/hour, each stop is 7 minutes

Observations:

Events during survey that may have affected results:

Other Observations/Comments:

YUMA CLAPPER RAIL SURVEY
COVER SHEET
(JANUARY 2000)

Date: MAY 11, 2006

Location Information:
Location Name DOS PALMAS CORE MARSH Route WEST, STATIONS 16-22

Map Name CROCCPIA CANYON, DURMID Township/Range/Section T8S, R11E, S3,10

Observer(s) CHET MCGAUGH, JOHN GREEN

Weather:
Start %Cloud Cover 10 Temp 70° F Wind Speed 0
End % Cloud Cover 10 Temp _____ Wind Speed 0

Data Summary:

1) Total individual rails seen or heard while surveying 2
2) Number of other rails seen or heard (incidentals) 2

Total rails per route or location equals #1+#2 4
For rails/hour, each stop is 7 minutes

Observations:

Events during survey that may have affected results:

Other Observations/Comments:

Appendix III
Yuma Clapper Rail Survey Data Sheets

Yuma Clapper Rail Survey Data Sheet — January 2000

Location DOS PALMAS Route NORTH Date APRIL 6, 2006

Weather-start 45°F, Ø WIND, Ø MOON, Ø CLOUDS end 62°F, 0-2 WIND, Ø CLOUDS, Ø MOON Observer C. McGAUGH, J. GREEN

Stop #	Time Start	Time Stop	Clatter Call	Kek Call	Other Call	Was Rail Seen?	Was Rail Heard?	Was Rail Paired?	Other Species?	Habitat Type Where Rail Was Detected
1	0639	0646								
2	0703	0710							SORA	
3	0748	0755								
4	0814	0821							VIRA SORA LEBI	
5	0840	0847							SORA	
6	0915	0922	✓	✓		NO	YES-2		VIRA 2	

Page total:

Total rails recorded on survey _____

Incidental observations of rails in survey area _____

Yuma Clapper Rail Survey Data Sheet January 2000

Location DOS PALMAS Route EAST Date APRIL 19, 2006

Weather-start 62-80°F, 0 WIND end 0-40% COVER Observer C McGAUGH, J. GREEN

Stop #	Time Start	Time Stop	Clatter Call	Kek Call	Other Call	Was Rail Seen?	Was Rail Heard?	Was Rail Paired?	Other Species?	Habitat Type Where Rail Was Detected
8	0654	0701	✓	✓		NO	YES		VIRA	
7	0714	0721	✓	✓		NO	YES(2?)	?		
9	0747	0754								
10	0806	0813	✓			NO	YES		VIRA	
11	0830	0837							VIRA 2-3	
12	0848	0855								
13	0905	0912		✓		NO	YES		VIRA 2	SORA 2
14	0923	0930							SORA	
15	0943	0950							VIRA	

Page total:

Total rails recorded on survey _____

Incidental observations of rails in survey area _____

Yuma Clapper Rail Survey Data Sheet — January 2000

Location DOS PALMAS Route WEST Date MAY 11, 2006

Weather-start 70°F, 10% THIN CLOUDS, & MOON & WIND end Observer C MCGAUGH, S. GREEN

Stop #	Time Start	Time Stop	Clatter Call	Kek Call	Other Call	Was Rail Seen?	Was Rail Heard?	Was Rail Paired?	Other Species?	Habitat Type Where Rail Was Detected
16	0624	0631							LEBI	
17	0644	0651	✓			NO	yes		LEBI	
18	0704	0711								
19	0724	0731	✓			NO	yes			
20	0743	0750								
21	0810	0817							VIRA	
22	0900	0907							VIRA	

Page total:

Total rails recorded on survey _____

Incidental observations of rails in survey area _____

Appendix IV
Dos Palmas Core Marsh Rail Surveys: Bird Species List

DOS PALMAS CORE MARSH RAIL SURVEYS: BIRD SPECIES LIST

This list reports only birds observed in the Dos Palmas area during the rail surveys, travel (by foot) to rail survey stations, and related activities.

Nomenclature and taxonomy generally follows the American Ornithologists' Union Checklist and its supplements.

SYMBOLS AND ABBREVIATIONS:

* Non-native species

** Sensitive species (State or Federally Listed as Threatened or Endangered, or a CDFG Species of Special Concern, or a USFWS Bird of Conservation Concern)

BIRDS	CLASS AVES
Ducks, Geese, and Swans	**Family Anatidae**
American Wigeon	*Anas americana*
Mallard	*Anas platyrhynchos*
Cinnamon Teal	*Anas cyanoptera*
Ring-necked Duck	*Aythya collaris*
Ruddy Duck	*Oxyura jamaicensis*
New World Quail	**Family Odontophoridae**
Gambel's Quail	*Callipepla gambelii*
Grebes	**Family Podicipedidae**
Pied-billed Grebe	*Podilymbus podiceps*
Herons, Bitterns, and Allies	**Family Ardeidae**
**Least Bittern	*Ixobrychus exilis*
Great Blue Heron	*Ardea herodias*
Green Heron	*Butorides virescens*
Black-crowned Night-Heron	*Nycticorax nycticorax*
New World Vultures	**Family Cathartidae**
Turkey Vulture	*Cathartes aura*
Hawks, Kites, Eagles, and Allies	**Family Accipitridae**
**Northern Harrier	*Circus cyaneus*
**Cooper's Hawk	*Accipiter cooperii*
**Swainson's Hawk	*Buteo swainsoni*
Red-tailed Hawk	*Buteo jamaicensis*
Caracaras and Falcons	**Family Falconidae**
American Kestrel	*Falco sparverius*

Rails, Gallinules, and Coots	**Family Rallidae**
**Yuma Clapper Rail	*Rallus longirostris yumanensis*
Virginia Rail	*Rallus limicola*
Sora	*Porzana carolina*
Common Moorhen	*Gallinula chloropus*
American Coot	*Fulica americana*
Lapwings and Plovers	**Family Charadriidae**
Killdeer	*Charadrius vociferus*
Sandpipers, Phalaropes, and Allies	**Family Scolopacidae**
Greater Yellowlegs	*Tringa melanoleuca*
**Long-billed Curlew	*Numenius americanus*
Least Sandpiper	*Calidris minutilla*
Wilson's Snipe	*Gallinago delicata*
Pigeons and Doves	**Family Columbidae**
*Eurasian Collared-Dove	*Streptopelia decaocto*
White-winged Dove	*Zenaida asiatica*
Mourning Dove	*Zenaida macroura*
Common Ground-Dove	*Columbina passerina*
Cuckoos, Roadrunners, and Anis	**Family Cuculidae**
Greater Roadrunner	*Geococcyx californianus*
Typical Owls	**Family Strigidae**
Great Horned Owl	*Bubo virginianus*
Goatsuckers	**Family Caprimulgidae**
Lesser Nighthawk	*Chordeiles acutipennis*
Common Poorwill	*Phalaenoptilus nuttallii*
Swifts	**Family Apodidae**
**Vaux's Swift	*Chaetura vauxi*
White-throated Swift	*Aeronautes saxatalis*
Woodpeckers and Allies	**Family Picidae**
Ladder-backed Woodpecker	*Picoides scalaris*
Northern Flicker	*Colaptes auratus*
Tyrant Flycatchers	**Family Tyrannidae**
**Olive-sided Flycatcher	*Contopus cooperi*
**Willow Flycatcher	*Empidonax traillii*
Hammond's Flycatcher	*Empidonax hammondii*
Gray Flycatcher	*Empidonax wrightii*
Black Phoebe	*Sayornis nigricans*
Say's Phoebe	*Sayornis saya*
Ash-throated Flycatcher	*Myiarchus cinerascens*
Western Kingbird	*Tyrannus verticalis*
Shrikes	**Family Laniidae**
**Loggerhead Shrike	*Lanius ludovicianus*

Vireos	**Family Vireonidae**
Plumbeous Vireo	*Vireo plumbeus*
Warbling Vireo	*Vireo gilvus*
Crows and Jays	**Family Corvidae**
Common Raven	*Corvus corax*
Swallows	**Family Hirundinidae**
Tree Swallow	*Tachycineta bicolor*
Violet-green Swallow	*Tachycineta thalassina*
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*
Cliff Swallow	*Petrochelidon pyrrhonota*
Barn Swallow	*Hirundo rustica*
Penduline Tits and Verdins	**Family Remizidae**
Verdin	*Auriparus flaviceps*
Wrens	**Family Troglodytidae**
Cactus Wren	*Campylorhynchus brunneicapillus*
Marsh Wren	*Cistothorus palustris*
Kinglets	**Family Regulidae**
Ruby-crowned Kinglet	*Regulus calendula*
Old World Warblers and Gnatcatchers	**Family Sylviidae**
Blue-gray Gnatcatcher	*Polioptila caerulea*
Black-tailed Gnatcatcher	*Polioptila melanura*
Thrushes	**Family Turdidae**
Swainson's Thrush	*Catharus ustulatus*
Mockingbirds and Thrashers	**Family Mimidae**
Northern Mockingbird	*Mimus polyglottos*
Starlings	**Family Sturnidae**
*European Starling	*Sturnus vulgaris*
Silky-flycatchers	**Family Ptilogonatidae**
Phainopepla	*Phainopepla nitens*
Wood-Warblers	**Family Parulidae**
Orange-crowned Warbler	*Vermivora celata*
Nashville Warbler	*Vermivora ruficapilla*
Yellow-rumped Warbler	*Dendroica coronata*
Black-throated Gray Warbler	*Dendroica nigrescens*
MacGillivray's Warbler	*Oporornis tolmiei*
Common Yellowthroat	*Geothlypis trichas*
Wilson's Warbler	*Wilsonia pusilla*
**Yellow-breasted Chat	*Icteria virens*

Emberizids	**Family Emberizidae**
Abert's Towhee	*Pipilo aberti*
Chipping Sparrow	*Spizella passerina*
Black-throated Sparrow	*Amphispiza bilineata*
Song Sparrow	*Melospiza melodia*
Lincoln's Sparrow	*Melospiza lincolnii*
White-crowned Sparrow	*Zonotrichia leucophrys*
Cardinals, Saltators, and Allies	**Family Cardinalidae**
Black-headed Grosbeak	*Pheucticus melanocephalus*
Blackbirds	**Family Icteridae**
Western Meadowlark	*Sturnella neglecta*
Great-tailed Grackle	*Quiscalus mexicanus*
Brown-headed Cowbird	*Molothrus ater*
Bullock's Oriole	*Icterus bullockii*
Fringilline & Cardueline Finches & Allies	**Family Fringillidae**
House Finch	*Carpodacus mexicanus*

Appendix V
Photographic Exhibits: Rail Survey Stations

APPENDIX V. PHOTOGRAPHIC EXHIBITS: RAIL SURVEY STATIONS



Photo 1. Rail Survey Station #1.

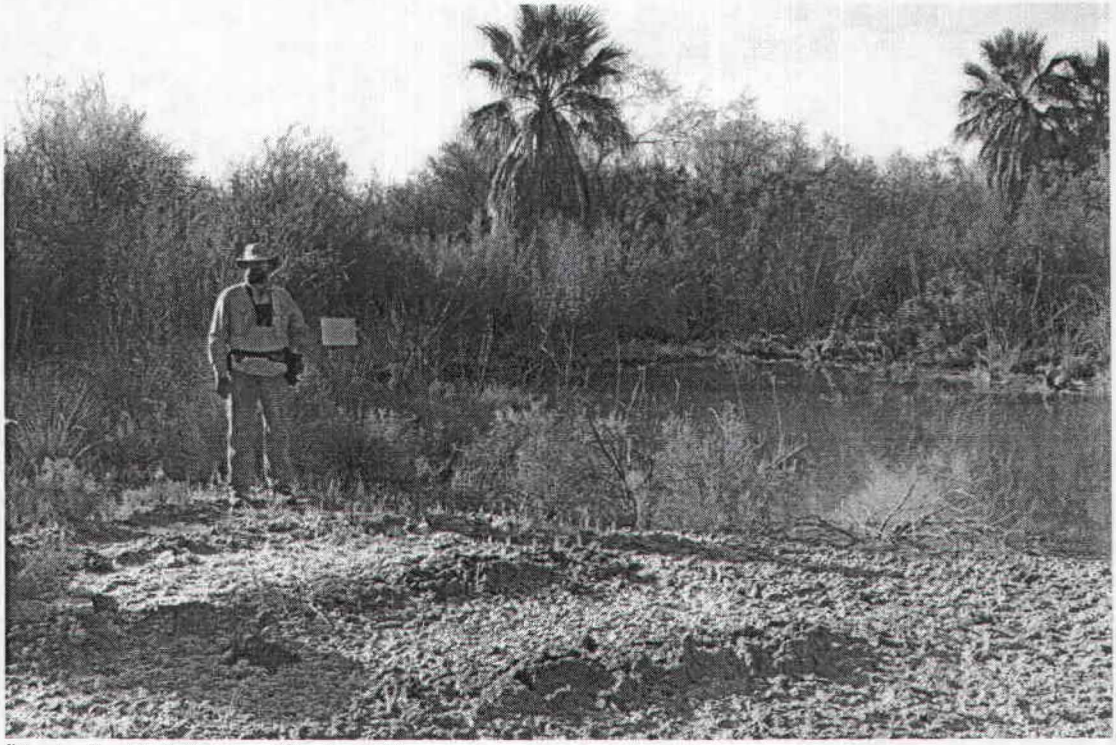

Photo 2. Rail Survey Station #2.



Photo 3. Rail Survey Station #3.

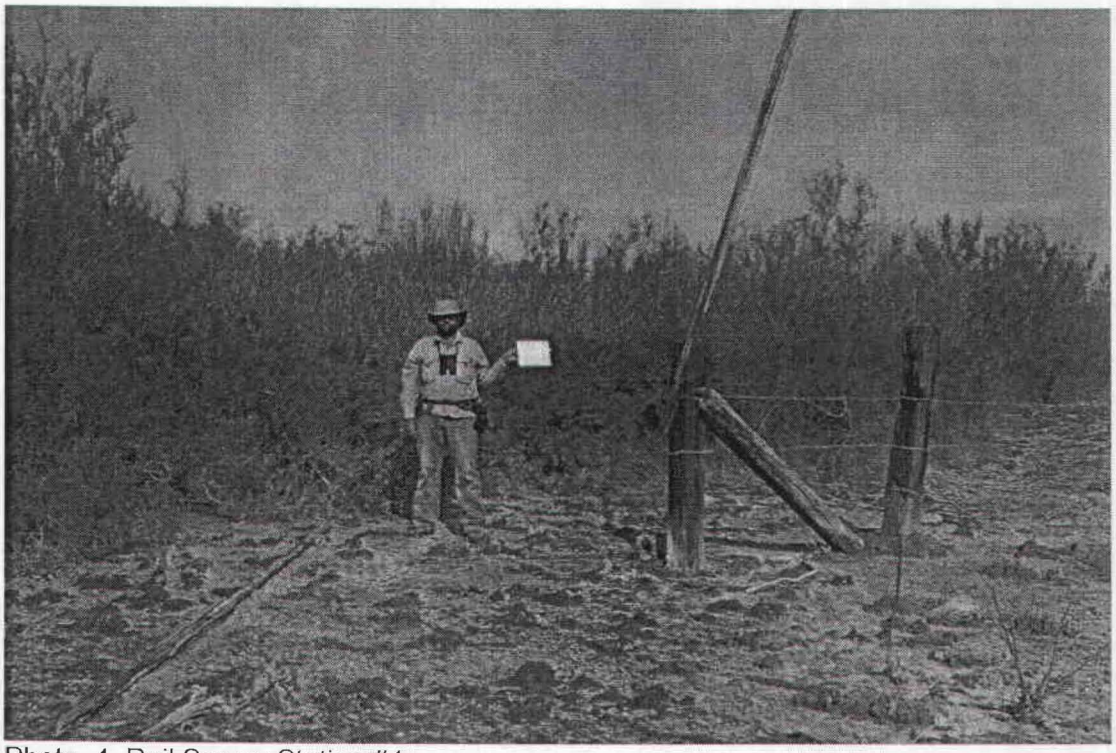

Photo 4. Rail Survey Station #4.



Photo 5. Rail Survey Station #5.

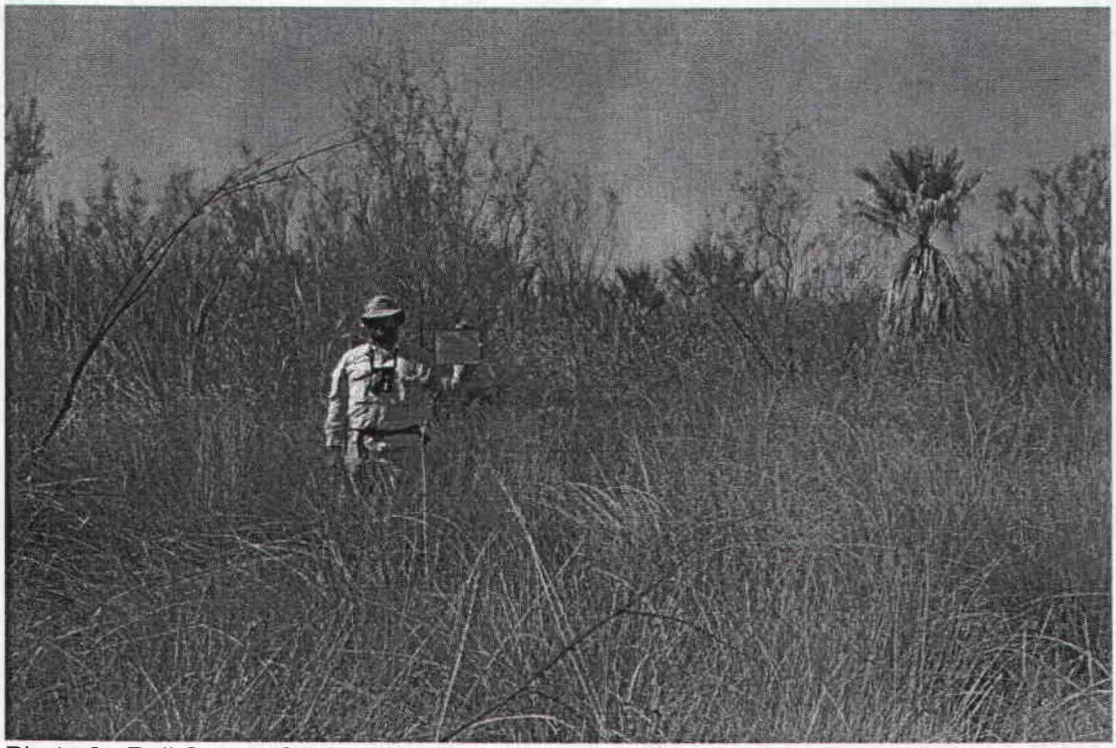

Photo 6. Rail Survey Station #6. Yuma Clapper Rail detected from this point, 6 April.



Photo 7. Rail Survey Station #7. Yuma Clapper Rail detected from this point, 19 April.

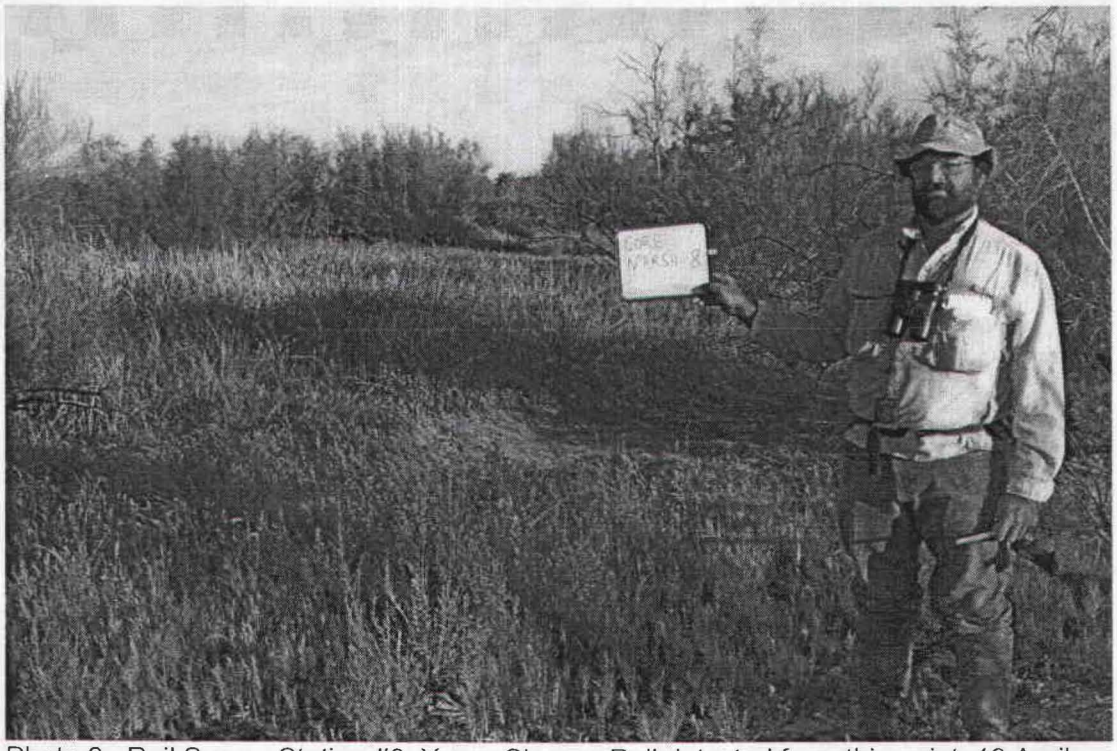

Photo 8. Rail Survey Station #8. Yuma Clapper Rail detected from this point, 19 April.

Konecny Biological Services
Biological Consulting, Research, Conservation

July 8, 2007
07-01-A

RECEIVED
OCT 10 2007
US FWS
CARLSBAD FIELD OFFICE, CA

EcoSystems Restoration Associates
8954 Rio San Diego Drive, Suite 610
San Diego, CA 92108

Attn: Mr. Tito Marchant

Re: Results of a Focused Survey for the Yuma Clapper Rail, California Black Rail, and Gila Woodpecker; and a Habitat Assessment for the Western Yellow-billed Cuckoo at the Imperial Irrigation District's All American Canal Lining Project Between Pilot Knob and Power Drop Three, Imperial County, California, 2007.

Dear Mr. Marchant:

This letter report presents the results of focused surveys for the Yuma clapper rail (*Rallus longirostris yumanensis*), California black rail (*Laterallus jamaicensis coturniculus*), and the Gila woodpecker (*Melanerpes uropygialis*); and a habitat assessment for the western yellow-billed cuckoo (*Coccyzus americanus occidentalis*) (cuckoo) for the Imperial Irrigation District's All American Canal Lining Project (AACLP) between Pilot Knob and Power Drop Three, in Imperial County, California. The Yuma clapper rail is listed as an endangered species by the United States Fish and Wildlife Service (USFWS), and as a threatened species by the California Department of Fish and Game (CDFG). The California black rail is listed as a threatened species by CDFG. The woodpecker and the cuckoo are listed as endangered species by CDFG. The cuckoo is considered a Candidate for listing by the USFWS.

Surveys for the Yuma clapper rail and California black rail were conducted following protocol established by Conway (2005), and guidance received from the USFWS Carlsbad Field Office (Carol Roberts pers.comm.). The Gila woodpecker survey was conducted following guidance received from CDFG (John Gustafson pers. comm). The surveys were conducted by wildlife biologist John Konecny, and assisted by EcoSystems Restoration Associates (ERA) biologists Doug Willick and Patrick Del Pizzo. This activity is authorized by USFWS section 10(a) permit number TE837308-4, and CDFG Memorandum of Understanding.

INTRODUCTION

The Yuma clapper rail is a slender, tawny-breasted bird with grayish edges on brown centered back feathers, olive wing coverts, vertical white bars on the flanks, a white stripe over the eye, and a partially orange bill. The Yuma clapper rail occurs along the lower Colorado River in freshwater marsh dominated by cattails (*Typha* sp.), bulrush (*Scirpus* sp.), and common reed (*Phragmites australis*), from Needles, California, south to the Colorado River delta (Tomlinson and Todd 1973). Additional populations occur at the south end of the Salton Sea, and the Salt and Gila Rivers (Eddleman 1989). Yuma clapper rails forage primarily on crustaceans and minnows during the breeding season, and rely more on a diet of seeds and vegetation in the winter. Recent claims of migratory movement along the lower Colorado River could not be confirmed by radiotelemetry studies (Eddleman 1989, Conway 1990). Populations of Yuma clapper rails have undergone decline in the United States due to their limited distribution, and destruction and degradation of freshwater marsh habitat.

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The California black rail is a small, sparrow-sized secretive rail, blackish above with white speckling, has a chestnut nape, grayish-black underparts, narrow white barring on the flanks, and a short black bill. The California black rail occurs in the lower Colorado River area from the Imperial Dam, south to the Mexican border, with smaller, isolated populations scattered from Marin and San Luis Obispo Counties in coastal California, southward to San Diego County, northwestern Baja California, and the lower Imperial Valley (Eddleman *et al* 1994, Small 1994). California black rails tend to favor mixed pickleweed (*Salicornia* sp.), cordgrass (*Spartina foliosa*), and bulrush marshes in coastal habitats; and bulrush and cattail freshwater marshes in inland areas (Small 1994). Black rails typically forage on aquatic and terrestrial invertebrates and seeds. Like the Yuma clapper rail, the California black rail has undergone decline due to habitat degradation and destruction. The population of California black rails along the Colorado River from Needles, California, to Yuma, Arizona, probably numbers between 75-100 individuals (Evens et al. 1991).

The Gila woodpecker is a medium sized picid with a black and white barred back and rump. Both sexes have a grayish-tan head and under parts. The male is larger than the female and has a red patch on the crown. The Gila woodpecker is a common inhabitant of saguaro cactus (*Carnegiea gigantean*) in the Sonoran desert. Along the lower Colorado River, it is found in old growth riparian cottonwood (*Populus freemontii*) and willow (*Salix* sp.), and also desert washes where palo verde (*Cercidium floridum*), mesquite (*Prosopis glandulosa* and *P. pubescens*), and ironwood (*Olneya tesota*) reach large size (Grinnell and Miller 1944, Kaufman 1996). It can also be found in date palm (*Phoenix dactilifera*) groves, Mexican fan palms, utility poles, and shade trees in residential areas (Patten *et al* 2003, Small 1994).

The nest site is a cavity excavated in cactus and trees, usually eight to 30 feet (13 meters) above the ground. Availability of diggable tree-trunks for nesting seems to be a primary factor for presence (Grinnell and Miller 1944). Other species, such as owls, kestrels, starlings, and flycatchers use old Gila woodpecker nest holes. The Gila woodpecker's decline has been attributed to the loss of riparian woodland and desert washes for agriculture and urbanization. In California, the Gila woodpecker is a rare to uncommon resident (Kaufman 1996, Small 1994).

The cuckoo is a member of the roadrunner family (Family Cuculidae) and is a medium sized bird, with grayish-brown upperparts, a white underbelly, bright brown wings, a down curved yellow lower mandible, and a bold black and white pattern on the underside of the tail. The cuckoo is a rare and very local summer breeding resident, arriving in the area in late May and early June, and departing in early September for its wintering ground in South America. The cuckoo has never been detected historically along the New River (Patten 2003) and there are only six summer records in the Salton Sink. The cuckoo was considered uncommon in the Colorado River Valley (Garrett and Dunn 1981). However, during the last several decades this species has declined significantly in this area (Rosenberg *et.al.* 1991), as a result of habitat alterations discussed below.

The cuckoo's preferred nesting habitat is mature willow (*Salix* sp.), mesquite, and cottonwood riparian forests, with a dense understory of willow, blackberry (*Rubus* sp.), wild grape (*Vitis* sp.), and nettle (*Urtica* sp.). The cuckoo requires an average of 17 hectares (43 acres) per pair for foraging and nesting (Wiggens 2005). Foraging is done predominantly in the cottonwood overstory, and nesting is done almost exclusively in willow understory.

The cuckoo was once common in riparian habitat throughout the western United States, but in the past 70 years has undergone a severe decline. It has been extirpated from Idaho, Nevada and

Utah, and although still breeding in southern and central California, Arizona and New Mexico, its range has been greatly reduced. It is estimated that 50-75 pairs of breeding cuckoos occur annually in California. The largest breeding populations occur along the upper Sacramento River in the Sacramento Valley, and the South Fork Kern River in Kern County (Wiggens 2005).

Loss and degradation of breeding habitat has been the greatest contributor to the decline of the cuckoo in California and other western states. Habitat conversion for agricultural purposes has removed much of the original riparian woodland, and flood control measures and channelization have further depleted the riparian habitats used by the cuckoo as well as other riparian birds. The significant reduction in the population size and range of the cuckoo resulted in it being listed by CDFG as a state threatened species in 1971, and then relisted as an endangered species in 1988. In 2001, the USFWS was petitioned to list the cuckoo under the federal Endangered Species Act of 1973. The 12 month finding of the USFWS was that federal listing was warranted, but precluded by higher listing actions. The USFWS now considers the cuckoo a Candidate for federal listing.

PROJECT LOCATION

The AACLP is located in the southeastern portion of Imperial County. The eastern terminus is located at Sidewinder Road, and project continues westward 21 miles (34 kilometers) to the western terminus at Power Drop Three (Figure 1).

Specifically, the survey area is located in Township 17 South, Range 19 East, Sections 3, 4, and 5, and Range 18 East, Sections 1, 2, 3, and 4 of the Midway Well NW 7.5 minute quadrangle; and Township 16 South and Range 21 East, Sections 33, 32, and 31, Township 17 South and Range 20 East, Sections 6, 36, 32, and 31, and Township 17 South and Range 19 East, Sections 1 and 2 of the Grays Well NE 7.5 minute quadrangle.

PROJECT SITE DESCRIPTION

The All American Canal is a man-made tributary running from the Colorado River westward through the City of Calexico to Pullman Road just north of the United States/Mexico border. At this point, the All American Canal turns north and becomes the Westside Main Canal. Imperial Irrigation District access roads parallel most of the All American Canal on both the north and south sides. Most of the area between Pilot Knob and Power Drop Three is creosote bush scrub, characterized by creosote bush (*Larrea tridentate*), quailbush (*Atriplex lentiformis*), with an occasional honey or screwbean mesquite; and an eight mile (13 kilometer) reach of open, shifting sand in the Imperial Sand Dunes Recreation Area.

Emergent common reed is present in a narrow band along both banks of most of the All American Canal. Small, isolated, and dried seep patches of cattail and bulrush freshwater marsh are present along a five mile (eight kilometer) reach, mostly on the south side of the All American Canal between Power Drops One and Three. The topography of the entire area is relatively flat, and the elevation of the survey area ranges from approximately 120-166 feet (36-72 meters) above Mean Sea Level.

METHODS

Five focused survey events for the Yuma clapper rail and California black rail were conducted at least one week apart following the protocol developed by Conway (2005) and guidance provided by the USFWS Carlsbad Field Office (Carol Roberts pers. com.). A habitat assessment was

conducted during the first survey on April 2nd, 2007, and nine areas of wetland habitat were identified as potential Yuma clapper rail or California black rail habitat between Power Drop One and Three. One of these areas was located on the north side of the All American Canal, the other eight were located on the south side. Surveys for the two species were conducted concurrently on the mornings of April 2nd, April 16th, April 30, May 7th, and May 14th. Surveys were initiated approximately 30 minutes prior to sunrise, approximately 0600, and continued until no later then 1000. The surveys were conducted by stopping at each of the nine wetland areas and passively listening for Yuma clapper rails and black rail vocalization for five minutes. If rails were not detected passively, digital vocalization of alternating Yuma clapper rail "*clatter*" and black rail "*growl*" and "*kee-kee-doo*" calls were played for an additional four minute period, alternating between one minute of silence and one minute of vocalizations, before proceeding to the next station. A summary of environmental conditions present for the five surveys is presented in Table 1 below. Rail data sheets are included as Attachment 1.

Table 1. Summary of Environmental Conditions Present for Five Yuma Clapper Rail and California Black Rail Surveys; and Three Gila Woodpecker Surveys of the Imperial Irrigation District's AACLP Between Pilot Knob and Power Drop Three, Imperial County, California, 2007.

Survey #	Date	Surveyor (Species) *	Time	Weather Conditions (OC = overcast)
1	04/02/07	JK, PD (YCR, CBR)	0615-1020	59-76F, wind 1-6 mph, 10% OC
2	04/16/07	JK, DW (YCR, CBR)	0612-0930	52-64F, wind 1-9 mph, 50-100% OC
3	04/30/07	JK (YCR, CBR, GW)	0605-1240	63-85F, wind 1-3 mph, 0% OC
4	05/07/07	JK (YCR, CBR, GW)	0555-1215	62-94F, wind 1-5 mph, 0% OC
5	05/14/07	JK (YCR, CBR, GW)	0600-1210	64-94, wind 1-5 mph, 0-5% OC

* JK-John Konecny; DW-Doug Willick; PD-Patrick Del Pizzo
YCR-Yuma clapper rail; CBR-California black rail; GW-Gila woodpecker

A Gila woodpecker and yellow-billed cuckoo habitat assessment was conducted throughout the 21 mile reach after the second rail survey on April 16th, 2007, with ERA biologist Doug Willick. Potential woodpecker habitat was identified in four areas; one large patch of tamarisk south of Power Drop Three; a large patch of mesquite/palo verde scrub west of Sidewinder Road; and two small patches of mesquite in between. No potential cuckoo habitat was detected within the 21 mile reach.

Three focused Gila woodpecker surveys were conducted at least one week apart beginning on April 30th, 2007. The surveys were initiated after the rail surveys were completed, beginning at approximately 0930 and continuing until no later then 1240. The surveys were conducted by stopping at each of the four potential areas and passively listening and visually looking for woodpeckers for five minutes. All trees large enough for nest cavities were examined visually. Utility poles were also inspected for nest cavities. If Gila woodpeckers were not identified visually by this passive method, a digital recording of the Gila woodpecker's "*churr*" was played with a MP3 player. A response was listened for for an additional five minutes before proceeding to the next station.

A protocol survey for rail was not conducted for the reach of All American Canal between Sidewinder Road and Power Drop One. Only a narrow band of emergent common reed is present within this area of the Canal and it is not know to support Yuma clapper rails or California black rails. Spot surveys utilizing digital vocalizations of the two species were conducted in this reach

in the pre-dusk hours of April 30th, May7th, and May 14th. A spot survey was conducted every two miles on each of the three evenings, incrementally increasing the starting point by one half mile each night. By using this method, one spot survey was conducted every half mile of the 21 mile reach over three weeks. Call prompt methodology described for rails above was used during the spot surveys.

RESULTS

No Yuma clapper rails or California black rails were detected in the five focused surveys between Power Drops One and Three. No Gila woodpeckers were detected during the three surveys between Pilot Knob and Power Drop Three. No Yuma clapper rails or California black rails were detected during the spot surveys between Sidewinder Road and Power Drop One.

DISCUSSION

Freshwater marsh habitat present between Power Drops One and Three of the All American Canal appears to be in a very dried out condition, as well as being very small and isolated, so the absence of rails is not unexpected. In its current condition, these patches represent only very minimal Yuma clapper rail and California black rail habitat. There appears to be adequate hydrological conditions immediately east of Power Drop Three, but the marsh habitat appears to have been mowed or cleared in the recent past. This area most resembles habitat between Power Drops Three and Four where California black rails and Yuma clapper rails have been detected (Evens *et al* 1991, Konecny 2006) and may revert to potential habitat, given the opportunity to mature.

Yuma clapper rails have been detected in common reed marshes in the lower Colorado River Valley in past studies (Anderson and Ohmart 1985). Since a thin band of common reed is present within the All American Canal for much of its length, it was decided to conduct spot checks for rails in the reach between Sidewinder Road and Power Drop One. No Yuma clapper rails or California black rails were detected in this area in 2007. It may be that the vegetation present is not of sufficient area to support these species, or prey items are not present because of the rapidly moving water. Zembal (pers, comm.) observed sporadic individual Yuma clapper rails in these common reed bands inside the All American Canal between Power Drops Three and Four during his surveys of the area in 1980. These observations were always in areas where seep marshes were established on both sides of the Canal, and he concluded that the individual rails were likely moving between foraging/nesting habitat on either side of the Canal.

Gila woodpeckers are an uncommon and local breeding resident in the southern Salton Sink (Patten *et al* 2003), increasing in abundance closer to the Colorado River Valley (Garrett and Dunn 1981). It is considered locally common in the El Centro and Mexicali Valley areas (Patten *et al* 2003). The Gila woodpecker requires a tree with at least a three inch (seven centimeter) diameter for its nest cavity, so resident opportunities are very few within the survey area.

Based on the habitat requirements of the cuckoo, no potential cuckoo habitat exists anywhere in the 21 mile reach between Sidewinder Road and Power Drop Three. Only four patches of tamarisk/palo verde/mesquite habitat exist throughout the reach, and the patches are not even close to the prerequisite 40 contiguous acres, and do not consist of old growth structure. Consequently, cuckoos are not expected to occur in this reach of the AACLP.

The results of focused surveys for listed species are typically considered valid for one year by the USFWS and CDFG. Therefore, if any potential habitat for the two rail species, or Gila

woodpecker, remains in the project area by spring 2008, it is recommended that these surveys be repeated. If you have any questions or require additional information, please call me at (760) 489-5276.

Sincerely,

John K. Konecny
Wildlife Biologist
TE837308-4

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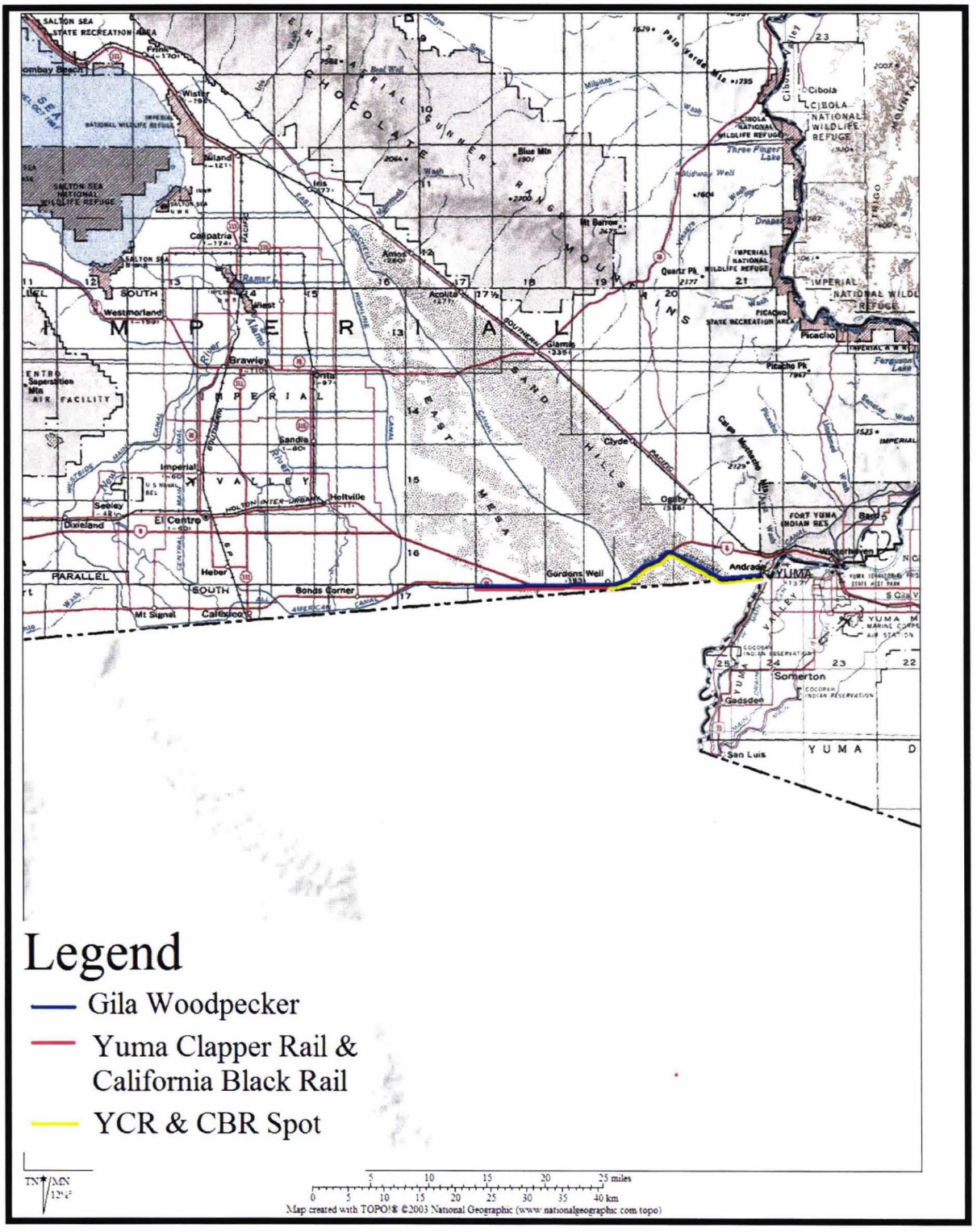

Figure 1. Location of Imperial Irrigation District's All American Canal Lining Project, Imperial County, California, 2007; and Survey Areas for the Focused Yuma Clapper Rail (YCR) and California Black Rail (CBR) Survey, Gila Woodpecker Survey, and YCR and CBR Spot Checks.

Attachment 1. Rail Data Sheets

National Marsh Bird Monitoring Program Survey Data Sheet

Pg 1 of 1

Date 2 April 2007

Name of marsh or route : AAC Impact Area

Observer(s) *(list all)**: JK, PD

Survey replicate # : 1

	Before	After
Temperature *(°F)* :	59	76
Wind speed *(mph)* :	1-3	4-6
Cloud cover *(%)* :	5	5
Precipitation *(see below)* :	Ø	Ø

No Yuma clapper rail or California black rail detected

**list all observers in order of their contribution to the data collected*

put an "S" in the appropriate column if the bird was seen, a "1" if the bird was heard, and "1S" if both heard and seen

Station#	Start Time (military)	Background noise	Species	Responded During: Before	Pass 0-1	Pass 1-2	Pass 2-3	Pass 3-4	Pass 4-5	BLRA 5-6	LEBI 6-7	VIRA 7-8	CLRA 8-9	After	Call Type(s)	Direction	Distance (meters)	Detected at a Previous Point	Comments
N-1	0625	2	Ø													○			
E-1	0719	1	Ø													○			
E-2	0720	1	Ø													○			
E-3	0745	1	Ø													○			Sora
E-4	0820	1	Ø													○			
W-1	0852	1	Ø													○			
W-2	0925	Ø	Ø													○			
W-3	0953	Ø	Ø													○			
W-4	1020	Ø	Ø													○			
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Call Types: BLRA: *kicky-doo, grr, churt* CLRA: cltr, kburr, kek, khurrah LEBI: *coo, kak, ert* VIRA: *grunt, ticket, kicker*

If the call type is not one of the above listed types, describe the call in the comments column

Precipitation: light rain, rain, heavy rain, light snow, snow, heavy snow, fog, none

Background noise: 0 *no noise* 1 *faint noise* 2 *moderate noise (probably can't hear some birds beyond 100m)*

3 *loud noise (probably can't hear some birds beyond 50m)* 4 *intense noise (probably can't hear some birds beyond 25m)*

National Marsh Bird Monitoring Program Survey Data Sheet

Pg 1 of 1

Date 16 April 2007

Name of marsh or route : AAC Impact Area

Observer(s) *(list all)**: JK, DW

Survey replicate # : 2

	Before	After
Temperature *(°F)* :	52	66
Wind speed *(mph)* :	1-3	4-9
Cloud cover *(%)* :	5	100
Precipitation *(see below)* :	ø	ø

No Yuma clapper rail or California black rail detected

**list all observers in order of their contribution to the data collected*

put an "S" in the appropriate column if the bird was seen, a "1" if the bird was heard, and "1S" if both heard and seen

Station#	Start Time (military)	Background noise	Species	Responded During: Before	Pass 0-1	Pass 1-2	Pass 2-3	Pass 3-4	Pass 4-5	BLRA 5-6	LEBI 6-7	VIRA 7-8	CLRA 8-9	After	Call Type(s)	Direction	Distance (meters)	Detected at a Previous Point	Comments
N-1	0612	1	ø													○			
E-1	0629	1	ø													○			
E-2	0714	1	ø													○			
E-3	0754	1	ø													○			
E-4	0808	1	ø													○			
W-1	0833	1	ø													○			
W-2	0845	ø	ø													○			
W-3	0900	ø	ø													○			
W-4	0920	ø	ø													○			
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Call Types: BLRA: *kicky-doo, grr, churt* CLRA: cltr, kburr, kek, khurrah LEBI: *coo, kak, ert* VIRA: *grunt, ticket, kicker*

If the call type is not one of the above listed types, describe the call in the comments column

Precipitation: light rain, rain, heavy rain, light snow, snow, heavy snow, fog, none

Background noise: 0 *no noise* 1 *faint noise* 2 *moderate noise (probably can't hear some birds beyond 100m)*

3 *loud noise (probably can't hear some birds beyond 50m)* 4 *intense noise (probably can't hear some birds beyond 25m)*

National Marsh Bird Monitoring Program Survey Data Sheet

Date 30 April 2007

Name of marsh or route : AAC Impact Area

Observer(s) *(list all)**: JK

Survey replicate # : 3

	Before	After
Temperature *(°F)* :	63	85
Wind speed *(mph)* :	1-3	1-3
Cloud cover *(%)* :	Ø	Ø
Precipitation *(see below)* :	Ø	Ø

No Yuma clapper rail or California black rail detected

**list all observers in order of their contribution to the data collected*

put an "S" in the appropriate column if the bird was seen, a "1" if the bird was heard, and "1S" if both heard and seen

Station#	Start Time (military)	Background noise	Species	Responded During: Before	Pass 0-1	Pass 1-2	Pass 2-3	Pass 3-4	Pass 4-5	BLRA 5-6	LEBI 6-7	VIRA 7-8	CLRA 8-9	After	Call Type(s)	Direction	Distance (meters)	Detected at a Previous Point	Comments
N-1	0605	2	Ø													○			
E-1	0623	1	Ø													○			
E-2	0705	1	Ø													○			
E-3	0745	1	Ø													○			
E-4	0800	1	Ø													○			
W-1	0825	1	Ø													○			
W-2	0837	Ø	Ø													○			
W-3	0854	Ø	Ø													○			
W-4	0918	Ø	Ø													○			
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National Marsh Bird Monitoring Program Survey Data Sheet

Date 7 May 2007

Name of marsh or route : AAC Impact Area

Observer(s) *(list all)**: JK

Survey replicate # : 4

	Before	After
Temperature *(°F)* :	62	94
Wind speed *(mph)* :	1-3	3-5
Cloud cover *(%)* :	Ø	Ø
Precipitation *(see below)* :	Ø	Ø

No Yuma clapper rail or California black rail detected

**list all observers in order of their contribution to the data collected*

put an "S" in the appropriate column if the bird was seen, a "1" if the bird was heard, and "1S" if both heard and seen

Station#	Start Time (military)	Background noise	Species	Responded During: Before	Pass 0-1	Pass 1-2	Pass 2-3	Pass 3-4	Pass 4-5	BLRA 5-6	LEBI 6-7	VIRA 7-8	CLRA 8-9	After	Call Type(s)	Direction	Distance (meters)	Detected at a Previous Point	Comments
N-1	0555	2	Ø													◯			
E-1	0612	1	Ø													◯			
E-2	0658	1	Ø													◯			
E-3	0740	1	Ø													◯			Sosg
E-4	0756	1	Ø													◯			
W-1	0820	1	Ø													◯			
W-2	0835	Ø	Ø													◯			
W-3	0852	Ø	Ø													◯			
W-4	0915	Ø	Ø													◯			
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Call Types: BLRA: *kicky-doo, grr, churt* CLRA: cltr, kburr, kek, khurrah LEBI: *coo, kak, ert* VIRA: *grunt, ticket, kicker*

If the call type is not one of the above listed types, describe the call in the comments column

Precipitation: light rain, rain, heavy rain, light snow, snow, heavy snow, fog, none

Background noise: 0 *no noise* 1 *faint noise* 2 *moderate noise (probably can't hear some birds beyond 100m)*

3 *loud noise (probably can't hear some birds beyond 50m)* 4 *intense noise (probably can't hear some birds beyond 25m)*

National Marsh Bird Monitoring Program Survey Data Sheet

Date 14 May 2007

Name of marsh or route : AAC Impact Area

Observer(s) *(list all)**: JK

Survey replicate # : 5

	Before	After
Temperature *(°F)* :	64	94
Wind speed *(mph)* :	1-3	3-5
Cloud cover *(%)* :	Ø	5
Precipitation *(see below)* :	Ø	Ø

No Yuma clapper rail or California black rail detected

**list all observers in order of their contribution to the data collected*

put an "S" in the appropriate column if the bird was seen, a "1" if the bird was heard, and "1S" if both heard and seen

Station#	Start Time (military)	Background noise	Species	Responded During: Before	Pass 0-1	Pass 1-2	Pass 2-3	Pass 3-4	Pass 4-5	BLRA 5-6	LEBI 6-7	VIRA 7-8	CLRA 8-9	After	Call Type(s)	Direction	Distance (meters)	Detected at a Previous Point	Comments
N-1	0600	2	Ø													◯			
E-1	0618	1	Ø													◯			
E-2	0703	1	Ø													◯			
E-3	0743	1	Ø													◯			
E-4	0759	1	Ø													◯			
W-1	0824	1	Ø													◯			
W-2	0838	Ø	Ø													◯			
W-3	0857	Ø	Ø													◯			
W-4	0918	Ø	Ø													◯			
																◯			
																◯			
																◯			
																◯			
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																◯			
																◯			

Call Types: BLRA: *kicky-doo, grr, churt* CLRA: cltr, kburr, kek, khurrah LEBI: *coo, kak, ert* VIRA: *grunt, ticket, kicker*

If the call type is not one of the above listed types, describe the call in the comments column

Precipitation: light rain, rain, heavy rain, light snow, snow, heavy snow, fog, none

Background noise: 0 *no noise* 1 *faint noise* 2 *moderate noise (probably can't hear some birds beyond 100m)*

3 *loud noise (probably can't hear some birds beyond 50m)* 4 *intense noise (probably can't hear some birds beyond 25m)*

8887
Imperial
2007
YCR (-)
RECEIVED
OCT 10 2007
US FWS
CARLSBAD FIELD OFFICE, CA

Konecny Biological Services
Biological Consulting, Research, Conservation

July 17, 2007
06-03-A

EcoSystems Restoration Associates
8954 Rio San Diego Drive, Suite 610
San Diego, CA 92108

Attn: Mr. Tito Marchant

Re: Results of a Focused Survey for the Yuma Clapper Rail and California Black Rail at the Imperial Irrigation District's All American Canal Lining Project Wetland Enhancement Site, Imperial County, California, 2007.

Dear Mr. Marchant:

This letter report presents the results of focused surveys for the Yuma clapper rail (*Rallus longirostris yumanensis*), and California black rail (*Laterallus jamaicensis coturniculus*), at the Imperial Irrigation District's All American Canal Lining Project wetland enhancement site in Imperial County, California. The Yuma clapper rail is listed as an endangered species by the United States Fish and Wildlife Service (USFWS), and as a threatened species by the California Department of Fish and Game (CDFG). The California black rail is listed as a threatened species by CDFG.

Surveys for the Yuma clapper rail and California black rail were conducted following protocol established by Conway (2005), and guidance received from the USFWS Carlsbad Field Office (Carol Roberts pers.comm.). The surveys were conducted by wildlife biologist John Konecny, and assisted by EcoSystems Restoration Associates (ERA) biologists Doug Willick and Patrick Del Pizzo. This activity is authorized by USFWS section 10(a) permit number TE837308-4, and CDFG Memorandum of Understanding.

INTRODUCTION

The Yuma clapper rail is a slender, tawny-breasted bird with grayish edges on brown centered back feathers, olive wing coverts, vertical white bars on the flanks, a white stripe over the eye, and a partially orange bill. The Yuma clapper rail occurs along the lower Colorado River in freshwater marsh dominated by cattails (*Typha* sp.), bulrush (*Scirpus* sp.), and common reed (*Phragmites australis*), from Needles, California, south to the Colorado River delta (Tomlinson and Todd 1973). Additional populations occur at the south end of the Salton Sea, and the Salt and Gila Rivers (Eddleman 1989). Yuma clapper rails forage primarily on crustaceans and minnows during the breeding season, and rely more on a diet of seeds and vegetation in the winter. Recent claims of migratory movement along the lower Colorado River could not be confirmed by radiotelemetry studies (Eddleman 1989, Conway 1990). Populations of Yuma clapper rails have undergone decline in the United States due to their limited distribution, and destruction and degradation of freshwater marsh habitat.

The California black rail is a small, sparrow-sized secretive rail, blackish above with white speckling, has a chestnut nape, grayish-black underparts, narrow white barring on the flanks, and a short black bill. The California black rail occurs in the lower Colorado River area from the Imperial Dam, south to the Mexican border, with smaller, isolated populations scattered from

1501 east Grand Avenue, # 2403, Escondido, California, 92027
Tel: (760) 489-5276 E-mail: jkonecny@cox.net

Marin and San Luis Obispo Counties in coastal California, southward to San Diego County, northwestern Baja California, and the lower Imperial Valley (Eddleman *et al* 1994, Small 1994). California black rails tend to favor mixed pickleweed (*Salicornia* sp.), cordgrass (*Spartina foliosa*), and bulrush marshes in coastal habitats; and bulrush and cattail freshwater marshes in inland areas (Small 1994). Black rails typically forage on aquatic and terrestrial invertebrates and seeds. Like the Yuma clapper rail, the California black rail has undergone decline due to habitat degradation and destruction. The population of California black rails along the Colorado River from Needles, California, to Yuma, Arizona, probably numbers between 75-100 individuals (Evens et al. 1991).

PROJECT LOCATION

The All American Canal Lining Project enhancement area is located south of State Route 98, approximately 15 miles (25 kilometers) east of the City of Calexio, between Power Drops Three and Four on the north side of the All American Canal (Figure 1). Potential Yuma clapper rail and California black rail habitat exists in pockets on both the north and south sides throughout the area as the result of seepage from the earthen lined canal sides. Specifically, the survey area is located in Township 17 South, Range 17 East, Section 1; and Range 18 East, Section 6 of the Midway Well 7.5-minute quadrangle.

PROJECT SITE DESCRIPTION

The All American Canal is a man-made tributary of the Colorado River, and runs in an east-west direction just north of the United States/Mexico border. Access roads parallel the All American Canal on both the north and south sides. Emergent bulrush, cattails, and common reed (*Phragmites australis*) are present in varying densities along its length. In the Canal's reach between Power Drop Three and Four, seep wetlands characterized by cattails, bulrush, common reed, and scattered willow (*Salix* sp.) form extensive wetland areas. Recovery canals parallel the All American Canal on both sides in this reach, and ponded water is collected between the levee roads and the recovery canals. Upland vegetation throughout the reach is characterized by tamarisk (*Tamarix* sp.), arrowweed (*Pluchea sericea*), and quailbush (*Atriplex lentiformis*), with an occasional honey mesquite (*Prosopis glandulosa*), and creosote bush (*Larrea tridentate*). A dirt utility power line road parallels the recovery canal in this area on the north side, and bisects the 43 acre (17 hectare) enhancement area. Agricultural fields are present to the north of State Route 95, approximately four miles (6.5 km) west of the enhancement area. The topography of the entire area is relatively flat, and the elevation of the survey area ranges from approximately 105 feet (32 meters) to 95 feet (29 meters) above Mean Sea Level.

METHODS

Five focused survey events for the Yuma clapper rail and California black rail were conducted at least one week apart following the protocol developed by Conway (2005) and guidance provided by the USFWS Carlsbad Field Office (Carol Roberts pers. com.). Surveys for the two species were conducted concurrently on the mornings of April 3rd, April 17th, May 1st, May 8th, and May 15th. Surveys were initiated approximately 30 minutes prior to sunrise, approximately 0600, and continued until no later then 1000.

The surveys were conducted by stopping at fifteen points that are at approximately 270 foot (120 meters) intervals along the recovery canal road and in a circle around the 43 acre enhancement site (Figure 2) and listening for Yuma clapper rails and black rails for five minutes. If rails were not detected passively, digital vocalization of alternating Yuma clapper rail "*clatter*" and black

rail "*growl*" and "*kee-kee-doo*" calls were played for an additional four minute period, alternating between one minute of silence and one minute of vocalizations, before proceeding to the next station. A summary of environmental conditions present for the five surveys is presented in Table 1 below. Rail data sheets are included as Attachment 1.

Table 1. Environmental Conditions During Five Yuma Clapper Rail and California Black Rail Surveys of the Imperial Irrigation District's All-American Canal Lining Project Wetland Enhancement Site, Imperial County, California, 2007.

Survey #	Date	Surveyor (Species) *	Time	Weather Conditions (OC = overcast)
1	04/03/07	JK, PD (YCR, CBR)	0618-0945	57-74F, wind 1-5 mph, 10% OC
2	04/17/07	JK, DW (YCR, CBR)	0635-1015	52-68F, wind 1-7 mph, 0% OC
3	05/01/07	JK (YCR, CBR)	0610-0935	63-85F, wind 1-3 mph, 0% OC
4	05/08/07	JK (YCR, CBR)	0600-0945	62-83F, wind 1-5 mph, 0% OC
5	05/15/07	JK (YCR, CBR)	0610-1000	64-86, wind 1-5 mph, 0-5% OC

* JK-John Konecny; DW-Doug Willick; PD-Patrick Del Pizzo
YCR-Yuma clapper rail; CBR-California black rail

RESULTS

One California black rail territory (Figure 3) was detected in the marsh area between the main canal and recovery canal, on the eastern side of the enhancement site. This California black rail was detected on four of the five surveys. California black rails were heard vocalizing from the south side of the canal, outside of the enhancement area on four of the five surveys. No Yuma clapper rails were detected in the enhancement area; however one Yuma clapper rail was heard "kekking" from the south side of the canal on April 3rd and 17th, 2007. Virginia rails (*Rallus limicola*) and soras (*Porzana carolina*) were also detected in the survey area.

DISCUSSION

California black rails have been detected in the area by several previous investigators and the trend has shown a decline in the numbers of this species in this reach. Eighty individuals were recorded by McCaskie in 1980, 30 to 50 individuals in 1984 by Kasprzyk (both in Evens *et al* 1991), and 18 individuals by Evens (1991). These surveys were conducted in March and April of their respective years. Yuma clapper rails have also been documented as occurring in the general area, with five to six individuals present in 1980 (Zembal, pers.com.). Konecny (2006A) detected six California black rails and one Yuma clapper rail during the fall of 2005. In these studies, the majority of California black rails and all of the Yuma clapper rails have been detected on the south side of the All American Canal. The decline in rail numbers is likely attributed to the reduction of wetland habitat in the area, due to the installation of pumps that pump seep water from the recovery canals back into the main canal.

Only one California black rail territory was detected in the enhancement area in 2007. This represents a decrease from four territories in the same area in 2006 (Konecny 2006B). Additionally, no rail territories were found north of the power line road where all four had been detected in 2006. The periphery of the marsh has been manipulated in the enhancement process and it is possible there was too much disturbance of the area for black rails to remain. It may also be that there were subtle changes in the depth or chemistry of the water in the marsh, affecting the black rails and their food supply.

It is encouraging that one California black rail was detected in the marsh area between the main All American Canal and the recovery canal. With the continuing growth of the marsh from the enhancement process, the population of California black rails will hopefully increase as well, as long as the marsh maintains the habitat parameters described by Eddleman (1994), i.e. dominance of cattails and bulrush, stable water level with moist soil and water not exceeding one inch (3 centimeters), and maintenance of at least 4.5 acres (1.8 hectare) of preferred habitat per pair.

At the same time, it is discouraging not to find Yuma clapper rails in this area. It is not known why this absence occurs. It may well be a prey related variable, or the water level may be too variable or deep.

The results of focused surveys for listed species are typically considered valid for one year by the USFWS and CDFG. If you have any questions or require additional information, please call me at (760) 489-5276.

Sincerely,

John K. Konecny
Wildlife Biologist
TE837308-4

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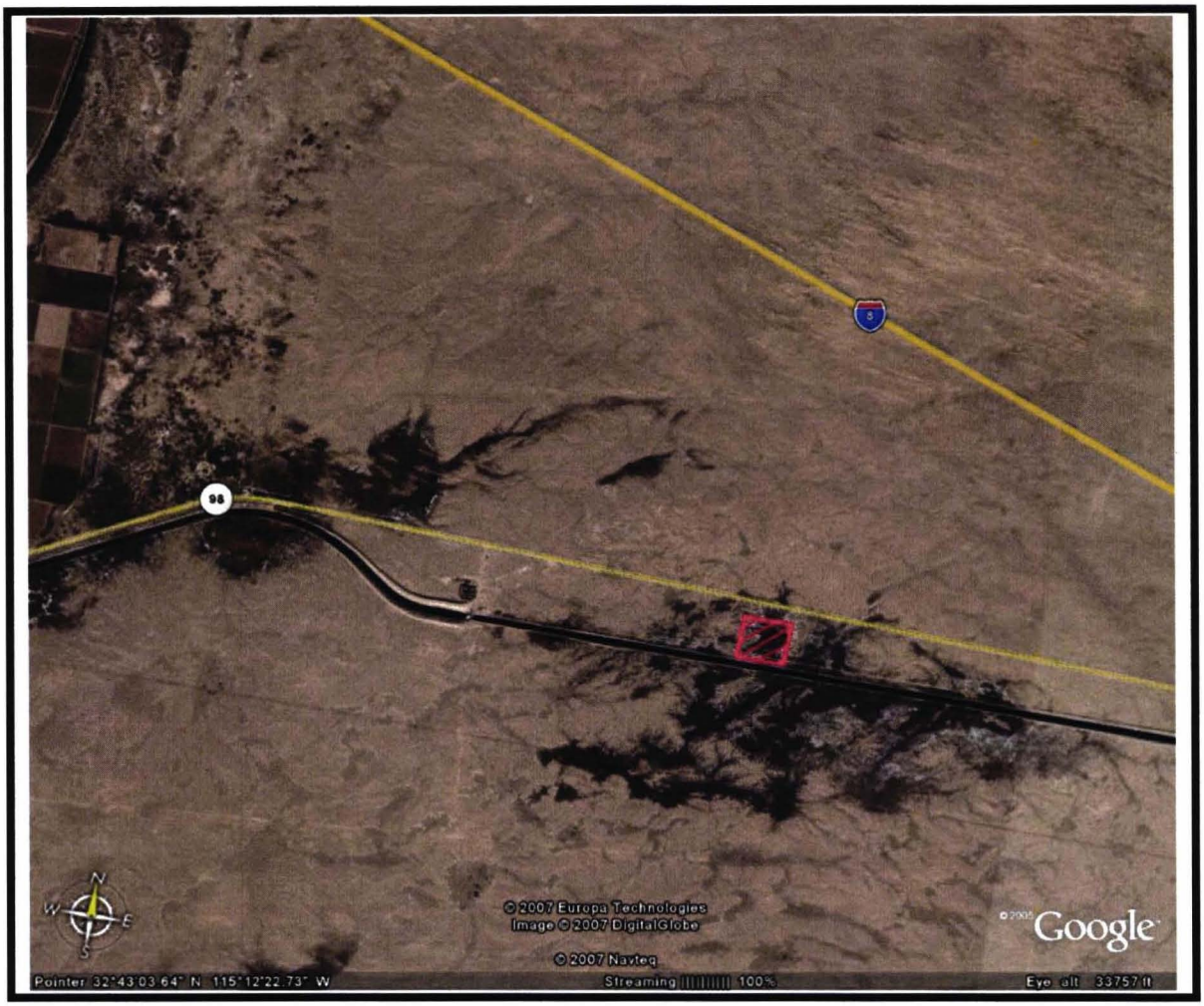

Figure 1. Location of Yuma Clapper Rail and California Black Rail Survey Area (red cross hatched area) for the Imperial Irrigation District's All American Canal Lining Project Wetland Enhancement Site, Imperial County, California, 2007.



Figure 2. Location of the Fifteen Survey Point Locations at the Yuma Clapper Rail and California Black Rail Survey Area for the Imperial Irrigation District's All American Canal Lining Project Wetland Enhancement Site, Imperial County, California, 2007.



Figure 3. Location of the California Black Rail (yellow asterisk) Detected during the Imperial Irrigation District's All American Canal Lining Project Wetland Enhancement Site Yuma Clapper Rail and California Black Rail Survey, Imperial County, California, 2007.

Attachment 1. Yuma Clapper Rail Data Sheets

National Marsh Bird Monitoring Program Survey Data Sheet

Date 3 April 2007

Name of marsh or route : AAC Enlargement Area

Observer(s) *(list all)**: JK, PD

Survey replicate # : 1

	Before	After
Temperature *(°F)* :	57	74
Wind speed *(mph)* :	1-3	3-5
Cloud cover *(%)* :	10	10
Precipitation *(see below)* :	ø	ø

**list all observers in order of their contribution to the data collected*

put an "S" in the appropriate column if the bird was seen, a "1" if the bird was heard, and "1S" if both heard and seen

Station#	Start Time (military)	Background noise	Species	Responded During: Before	Pass 0-1	Pass 1-2	Pass 2-3	Pass 3-4	Pass 4-5	BLRA 5-6	LEBI 6-7	VIRA 7-8	CLRA 8-9	After	Call Type(s)	Direction	Distance (meters)	Detected at a Previous Point	Comments
1	0618	1	ø													◯			
2	0629	1	BLRA	1	1	1	1	1	1	1				1	K-D	(S)	30		
3	0642	1	BLRA	1	1	1	1	1		1					K-D	(S)	>100M	yes	YCR on other side
4	0653	1	BLRA	1	1	1	1			1				1	K-D	(S)	>100M	yes	VIRA
5	0710	1	BLRA												K-D	(S)	>100M	yes	
6	0721	1	ø													◯			
7	0733	1	ø													◯			
8	0747	1	ø													◯			
9	0801	1	ø													◯			
10	0818	1	ø													◯			
11	0832	1	ø													◯			
12	0853	1	ø													◯			
13	0910	1	ø													◯			
14	0924	1	ø													◯			
15	0936	1	ø													◯			
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Call Types: BLRA: *kicky-doo, grr, churt* CLRA: cltr, kburr, kek, khurrah LEBI: *coo, kak, ert* VIRA: *grunt, ticket, kicker*

If the call type is not one of the above listed types, describe the call in the comments column

Precipitation: light rain, rain, heavy rain, light snow, snow, heavy snow, fog, none

Background noise: 0 *no noise* 1 *faint noise* 2 *moderate noise (probably can't hear some birds beyond 100m)*

3 *loud noise (probably can't hear some birds beyond 50m)* 4 *intense noise (probably can't hear some birds beyond 25m)*

National Marsh Bird Monitoring Program Survey Data Sheet

Date 17 April 2007

Name of marsh or route : AAC Enhancement Area

Observer(s) *(list all)**: JK, DW

Survey replicate # : 2

	Before	After
Temperature *(°F)* :	50	68
Wind speed *(mph)* :	1-3	3-7
Cloud cover *(%)* :	ø	ø
Precipitation *(see below)* :	ø	ø

YCR & CBR detected on the south side of canal, but not at point on north side

**list all observers in order of their contribution to the data collected*

put an "S" in the appropriate column if the bird was seen, a "1" if the bird was heard, and "1S" if both heard and seen

Station#	Start Time (military)	Background noise	Species	Responded During: Before	Pass 0-1	Pass 1-2	Pass 2-3	Pass 3-4	Pass 4-5	BLRA 5-6	LEBI 6-7	VIRA 7-8	CLRA 8-9	After	Call Type(s)	Direction	Distance (meters)	Detected at a Previous Point	Comments
E1	0640	1	ø													◯			YCR & CBR detected
E2	0651	1	ø													◯			across(s) of the
E3	0702	1	ø													◯			canal, but
E4	0714	1	ø													◯			not at point
W5	0738	1	ø													◯			
W6	0749	1	ø													◯			Sora
W7	0801	1	ø													◯			
N8	0820	1	ø													◯			
N9	0831	1	ø													◯			
N10	0845	1	ø													◯			
N11	0858	1	ø													◯			
N12	0914	1	ø													◯			
N13	0928	1	ø													◯			
N14	0940	1	ø													◯			
N15	0952	1	ø													◯			
																◯			
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Call Types: BLRA: *kicky-doo, grr, churt* CLRA: cltr, kburr, kek, khurrah LEBI: *coo, kak, ert* VIRA: *grunt, ticket, kicker*

If the call type is not one of the above listed types, describe the call in the comments column

Precipitation: light rain, rain, heavy rain, light snow, snow, heavy snow, fog, none

Background noise: 0 *no noise* 1 *faint noise* 2 *moderate noise (probably can't hear some birds beyond 100m)*

3 *loud noise (probably can't hear some birds beyond 50m)* 4 *intense noise (probably can't hear some birds beyond 25m)*

National Marsh Bird Monitoring Program Survey Data Sheet

Pg 1 of 1

Date 1 May 2007

Name of marsh or route : AAC Enhancement Area

Observer(s) *(list all)**: JK

Survey replicate # : 3

	Before	After
Temperature *(°F)* :	63	85
Wind speed *(mph)* :	1-3	1-3
Cloud cover *(%)* :	Ø	Ø
Precipitation *(see below)* :	Ø	Ø

One CBR detected on north side, east side of enhancement area

**list all observers in order of their contribution to the data collected*

put an "S" in the appropriate column if the bird was seen, a "1" if the bird was heard, and "1S" if both heard and seen

Station#	Start Time (military)	Background noise	Species	Responded During: Before	Pass 0-1	Pass 1-2	Pass 2-3	Pass 3-4	Pass 4-5	BLRA 5-6	LEBI 6-7	VIRA 7-8	CLRA 8-9	After	Call Type(s)	Direction	Distance (meters)	Detected at a Previous Point	Comments
1	0610	1	Ø													◯			
2	0621	1	BLRA	1	1	1	1	1	1	1	1	1	1	1	K-D	(S)	50M	no	
3	0633	1	Ø													◯			
4	0644	1	Ø													◯			
5	0702	1	Ø													◯			
6	0713	1	Ø													◯			
7	0725	1	Ø													◯			
8	0739	1	Ø													◯			
9	0753	1	Ø													◯			
10	0810	1	Ø													◯			
11	0825	1	Ø													◯			
12	0849	1	Ø													◯			
13	0907	1	Ø													◯			
14	0918	1	Ø													◯			
15	0928	1	Ø													◯			
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Call Types: BLRA: *kicky-doo, grr, churt* CLRA: cltr, kburr, kek, khurrah LEBI: *coo, kak, ert* VIRA: *grunt, ticket, kicker*

If the call type is not one of the above listed types, describe the call in the comments column

Precipitation: light rain, rain, heavy rain, light snow, snow, heavy snow, fog, none

Background noise: 0 *no noise* 1 *faint noise* 2 *moderate noise (probably can't hear some birds beyond 100m)*

3 *loud noise (probably can't hear some birds beyond 50m)* 4 *intense noise (probably can't hear some birds beyond 25m)*

National Marsh Bird Monitoring Program Survey Data Sheet

Pg 1 of 1

Date 8 May 2007

Name of marsh or route : AAC Enhancement Area

Observer(s) *(list all)**: JY

Survey replicate # : 4

	Before	After
Temperature *(°F)* :	62	83
Wind speed *(mph)* :	1-3	3-5
Cloud cover *(%)* :	Ø	Ø
Precipitation *(see below)* :	Ø	Ø

**list all observers in order of their contribution to the data collected*

put an "S" in the appropriate column if the bird was seen, a "1" if the bird was heard, and "1S" if both heard and seen

Station#	Start Time (military)	Background noise	Species	Responded During: Before	Pass 0-1	Pass 1-2	Pass 2-3	Pass 3-4	Pass 4-5	BLRA 5-6	LEBI 6-7	VIRA 7-8	CLRA 8-9	After	Call Type(s)	Direction	Distance (meters)	Detected at a Previous Point	Comments
1	0600	1	Ø													◯			
2	0612	1	BLRA	1	1	1	1	1	1	1	1	1	1	1	K-D	(S)	50m	no	
3	0624	1	Ø													◯			
4	0636	1	Ø													◯			
5	0655	1	Ø													◯			
6	0707	1	Ø													◯			
7	0719	1	Ø													◯			
8	0733	1	Ø													◯			
9	0749	1	Ø													◯			
10	0809	1	Ø													◯			
11	0829	1	Ø													◯			
12	0849	1	Ø													◯			
13	0903	1	Ø													◯			
14	0917	1	Ø													◯			
15	0935	1	Ø													◯			
																◯			
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Call Types: BLRA: *kicky-doo, grr, churt* CLRA: cltr, kburr, kek, khurrah LEBI: *coo, kak, ert* VIRA: *grunt, ticket, kicker*

If the call type is not one of the above listed types, describe the call in the comments column

Precipitation: light rain, rain, heavy rain, light snow, snow, heavy snow, fog, none

Background noise: 0 *no noise* 1 *faint noise* 2 *moderate noise (probably can't hear some birds beyond 100m)*

3 *loud noise (probably can't hear some birds beyond 50m)* 4 *intense noise (probably can't hear some birds beyond 25m)*

National Marsh Bird Monitoring Program Survey Data Sheet

Pg 1 of 1

Date

Name of marsh or route : AAC Enhancement Area

Observer(s) *(list all)**: JK

Survey replicate # : 5

	Before	After
Temperature *(°F)* :	64	86
Wind speed *(mph)* :	1-3	3-5
Cloud cover *(%)* :	Ø	Ø
Precipitation *(see below)* :	Ø	Ø

**list all observers in order of their contribution to the data collected*

put an "S" in the appropriate column if the bird was seen, a "1" if the bird was heard, and "1S" if both heard and seen

Station#	Start Time (military)	Background noise	Species	Responded During: Before	Pass 0-1	Pass 1-2	Pass 2-3	Pass 3-4	Pass 4-5	BLRA 5-6	LEBI 6-7	VIRA 7-8	CLRA 8-9	After	Call Type(s)	Direction	Distance (meters)	Detected at a Previous Point	Comments
1	0610	1	Ø													◯			
2	0623	1	BLRA	1	1	1	1	1	1	1	1	1	1	1	K-D	(S)	50m	no	
3	0635	1	Ø													◯			
4	0648	1	Ø													◯			
5	0705	1	Ø													◯			
6	0718	1	Ø													◯			
7	0730	1	Ø													◯			
8	0745	1	Ø													◯			
9	0800	1	Ø													◯			
10	0816	1	Ø													◯			
11	0835	1	Ø													◯			
12	0900	1	Ø													◯			
13	0920	1	Ø													◯			
14	0935	1	Ø													◯			
15	0950	1	Ø													◯			
																◯			
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																◯			

Call Types: BLRA: *kicky-doo, grr, churt* CLRA: cltr, kburr, kek, khurrah LEBI: *coo, kak, ert* VIRA: *grunt, ticket, kicker*

If the call type is not one of the above listed types, describe the call in the comments column

Precipitation: light rain, rain, heavy rain, light snow, snow, heavy snow, fog, none

Background noise: 0 *no noise* 1 *faint noise* 2 *moderate noise (probably can't hear some birds beyond 100m)*

3 *loud noise (probably can't hear some birds beyond 50m)* 4 *intense noise (probably can't hear some birds beyond 25m)*

DEC 04 2007

DRAFT
YUMA CLAPPER RAIL, CALIFORNIA BLACK RAIL
and
DESERT PUPFISH SURVEYS
Union Pacific Railroad Project
Riverside and Imperial Counties, CA

9129
Riverside
Imperial
2007
YCR (+)
DEPU (+)
DK 1/30/07
RN 12-4-08

Prepared for:

Chambers Group, Inc.
Corporate Headquarters
17671 Cowan Ave., Suite 100
Irvine, CA 92614

By

Arthur Davenport
Davenport Biological Services
P.O. Box 1692
Barstow, California 92312
619-729-4242

September 8, 2007

Introduction

Davenport Biological Services was hired by Chambers Group, Inc., to complete surveys for three sensitive species along Union Pacific Railroad's rail line between Mecca and Niland, California (Figure 1). Within this area, focused surveys were completed for the Yuma clapper rail (*Rallus longirostris yumanensis*), California black rail (*Laterallus jamaicensis coturniculus*), and desert pupfish (*Cyprinodon macualrius*) at wetlands that intersected and/or crossed under the rail line. Surveys were completed at 27 sites for the Yuma clapper rail and black rail. Surveys were completed at 27 sites for the desert pupfish. Other species observed during this study are listed in Appendix 1.

The survey was completed under Federal Recovery Permit # TE802450-5

Species Information

Yuma Clapper Rail
The Yuma clapper rail was listed as an endangered species under the Endangered Species Act of 1973, as amended (ESA), on 11 March 1967 (FR 32:4001). The Yuma clapper rail is also listed as threatened under California's Endangered Species Act (CESA).

The Yuma clapper rail occupies marsh habitats including canals and drains where cover and food is available. Vegetative cover often consists of cattail (*Typha latifolia*) and bulrush (*Scirpus californicus*). Yuma clapper rails have also been observed in wetlands where there is a canopy of tamarisk (*Tamarix ramosissima*), and an under-story of cattails or other wetland plants (e.g., bullrush). The food of the clapper rail includes a variety of animals, including fish, crayfish, and insects.

Information regarding the migration patterns of Yuma clapper rails is contradictory. There is some indirect evidence that they move post breeding. However, other studies did not detect migration (Eddleman 1989). Yuma clapper rails begin pair formation in mid February. First nests of Yuma clapper rail have been documented in mid March. Peak nest initiation is in mid May (Eddleman 1989).

California Black Rail
The California black rail is not listed as an endangered or threatened species under the ESA. The California black rail is listed as a threatened species under CESA.

The California black rail occupies wet meadow and marsh habitats. Black rails seem to prefer marsh vegetation that is relatively short (less than about 1 meter tall). Along the coast, most records of black rail are from *Salicornia* dominated marshes (Garrett and Dunn 1981). Based on habitat use along the lower Colorado River, black rail seem to prefer bulrush-dominated marshes (Garrett and Dunn 1981). Based on a personal observation along the Virgin River (northern extent of their range), black rail also occur in short, *Typha* dominated freshwater marsh. The food of the black rail is varied and includes insects and plant material.

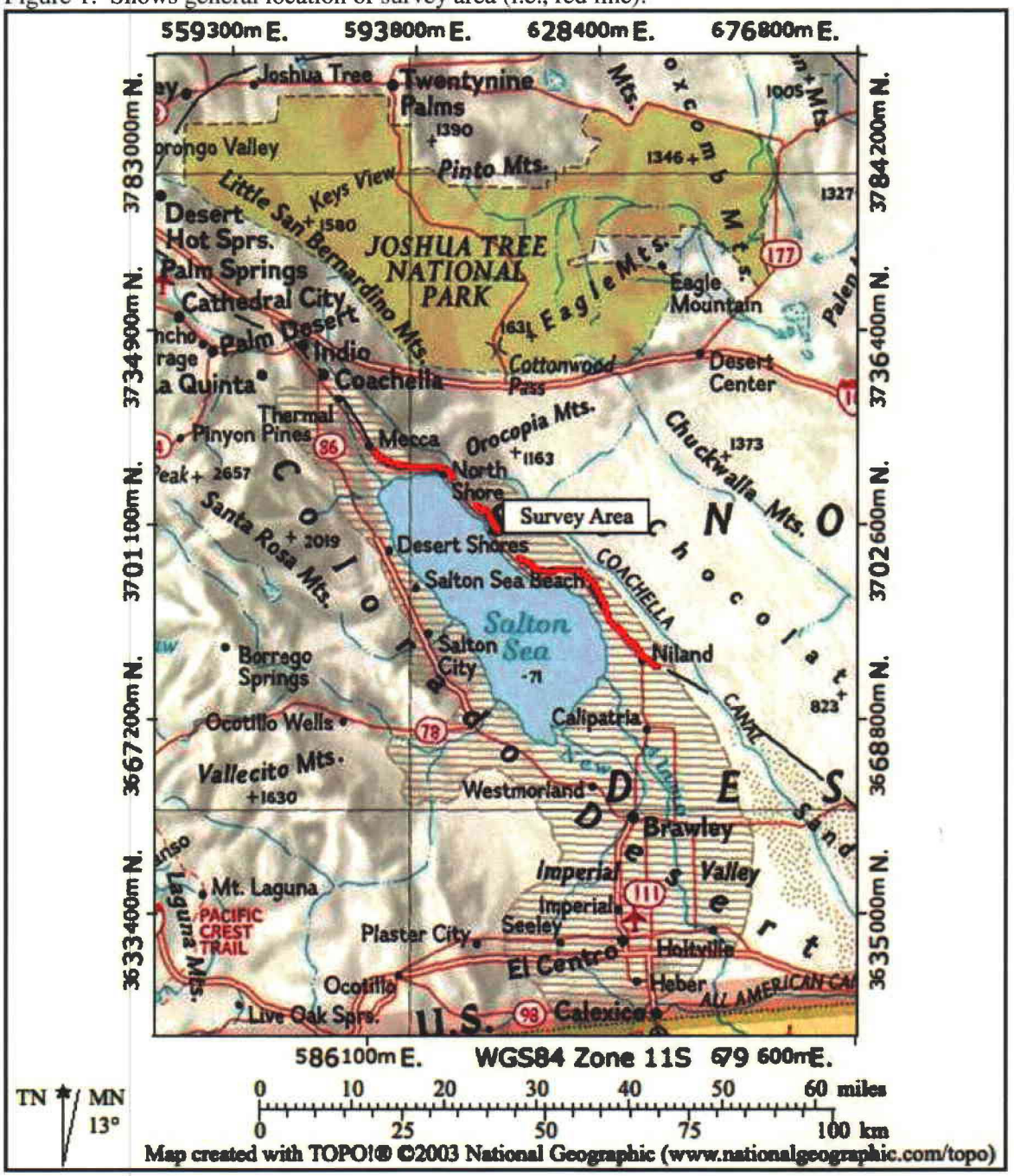
The spring migration of black rails extends from mid March to early May. Fall migration extends from early September to early November. Black rails may initiate pair formation between late February and July, however information is lacking regarding this topic. Peak nest initiation ranges between 10 March and 6 July (Eddleman et al., 1994). The black rail is common along the Colorado River from April to the end of August (Garrett and Dunn, 1981).

Desert Pupfish

The desert pupfish was listed as an endangered species under the ESA, on 31 March 1986 (FR 51:10850). The desert pupfish is also listed as endangered under CESA.

The desert pupfish occupies aquatic habitats including canals and drains where cover and food is available. Additionally, desert pupfish have been documented in shoreline pools and where drains and washes empty into the Salton Sea (California Department of Fish and Game, unpub. data., 2007). Based on this data, the presence and numbers of desert pupfish is highly variable between years. For example, during 1997 and 1998 surveys of upper Salt Creek, 102 and 0 desert pupfish were documented, respectively.

Figure 1. Shows general location of survey area (i.e., red line).



Methods

Initially, along the project alignment, between mile marker 618 and 675.94, 269 bridges and/or culverts were checked for potential Yuma clapper rail, California black rail, and desert pupfish habitat. Following the initial habitat survey, repeat surveys for the rails and pupfish were completed at 31 and 27 sites, respectively.

Yuma Clapper Rail
The survey was repeated three times, and the surveys were completed at least one week apart. A survey of the entire site was repeated two times per survey event. Thus, a total of six survey passes were completed. The initial survey pass of each survey employed passive listening. Tape playback of Yuma clapper rail calls was only used where rails were not heard. Per the general survey protocol for Yuma clapper rails, the first two surveys were completed between 15 March and 15 May 2007. The survey for Yuma clapper rails was initiated on 20 March 2007, and was completed on 22 May 2007. Surveys were initiated around 0300 and completed by 1100 hours.

Surveys were conducted by walking along the edges of the drains and other water bodies. The first survey pass was passive, and no tape play back of calls was used. During the second survey pass of each survey, tape play back of calls was used at 20meter intervals. Once a Yuma clapper rail was detected, no tape playback was used in its immediate vicinity (i.e., within 50 meters).

California Black Rail
The survey was completed three times. The survey for California black rail was initiated on 20 March 2007, and was completed on 22 May 2007. A survey of the entire site was repeated two times per survey event. Thus, a total of six survey passes were completed. The initial survey pass of each survey employed passive listening. Tape playback of rail calls was only used where California black rails were not heard. Surveys were completed several weeks apart. Surveys were initiated around 0300 and completed by 0600 hours.

Surveys were conducted by walking along the edges of the drains and other water bodies. The first survey pass was passive, and no tape play back of calls was used. During the second and third survey pass, tape play back of calls was used at 20meter intervals. Once a rail was detected, no tape playback was used in its vicinity (i.e., within 50 meters).

Desert Pupfish
The survey was completed three times. The survey for desert pupfish was initiated on 23 May 2007, and was completed on September 7, 2007. The surveys of all drains and canals included passive observation. That is, all water bodies within the project area were visually scanned for desert pupfish. Where no pupfish were observed, unknown species were captured using a dip-net and identified. In addition, where water was clouded, and observation of fish impaired, minnow traps were incorporated into the survey. Where minnow traps were used, the traps were left for no more than two hours between checks. All traps were baited with a small container of soft cat food (.e., perforated film canister or small sealed plastic bag). While checking traps, captured fish were observed without complete removal of the trap from the water.

Results

Suitable habitat for the Yuma clapper rail and California black rail, of differing quality, was found within 31 drains and other waterways that crossed the rail line. Concerning the California black rail, most of the habitat appeared to be of marginal quality for this species. Regarding the Desert pupfish, 27 drains and/or other waterways were found to have suitable habitat for this

species. However, all lateral canals were found to have drop structures that present a significant barrier to the upstream movement of this species.

Yuma Clapper Rail
Seven pairs of Yuma clapper rails were detected during this survey. In addition, one single Yuma clapper rail was also detected (Table 1; Figures 2 and 3).

Black Rail
One pair of California black rails was detected during this survey (Table 1; Figure 3).

Desert Pupfish
Desert pupfish were detected at two sites during this survey (Table 2; Figure 4a & 4b).

Table 1. Summarized results of Yuma clapper rail and California black rail surveys (GPS; NAD 83).

Bridge Mile Marker	Location	Name	Habitat	Rail Species	Pair Status	GPS Location (NAD 83)		Comments
	--					Easting	Northing	
	--	Air Port Blvd. Bridge	Yes	AMCO	2 Pairs			
618.50	--	HWY 111 Bridge	Yes	SORA	1 Single			
	--	66th Street	Yes	CMHE				
630.88	--		Yes	--				
635.475	--		Yes	--				
640.87	--	Salt Creek	Yes	--				
651.99	--		Yes	VIRA	1 Single			5mWTracks
652.49	--		Yes	--				
652.99	--		Yes	--				
653.56	1		Yes	YCRA VIRA SORA	1 Pair 1 Pair 1 Single	622452	3693500	Tamarisk Dominated
653.96	--		Yes	--				
656.58	--		Yes	--				
	2	Fly Wash	Yes	YCRA	1 Pair	629531	3687724	100mW111
659.55	3	Butler Wash	Yes	YCRA SORA VIRA	1 Pair 1 Single 1 Pair; 1 Sing.	629671	3687723	100mETracks 11mW111
659.69	4	Level Wash	Yes	YCRA	1 Pair; 1 Single	629715	3687531	15mW111
	5	Wister Wash	Yes	YCRA	1 Pair	629929	3687221	20mW111 Last Survey HabDryUnder Tracks
	6	ND5 Lateral	Yes	YCRA	1 Pair	630050	3687015	HabMowed 2ndSurv
660.45	--	Sand Wash	Yes	--				
	--	ND4 Lateral	Yes	--				
	--	ND3 Lateral	Yes	--				Hab. Removed
	--	ND2 Lateral	Yes	--				
661.17	7	Polo Wash	Yes	CBRA; YCRA	1 Pair 1 Pair	631106 631080	3685536 3685550	40mW111
661.95	--	ND2 Lateral	Yes	--				
662.43	--	Niland Creek	Yes	--				Poor Quality/Drying Out
663.11	--	Z Drain	Yes	--				
	--	Y Lateral	Yes	--				
664.00	--		Yes	--				
664.09	--		Yes	--				
	--	W Lateral	Yes	--				
668.71	--		Yes	--				Canal Deeply Incised
671.90	--		Yes	--				

AMCO: American Coot; CMHE: Common Moorhen; VIRA: Virginia Rail; SORA: Sora; YCRA: Yuma Clapper Rail

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Figure 2. Location of Yuma clapper rail pair (location No. 1).

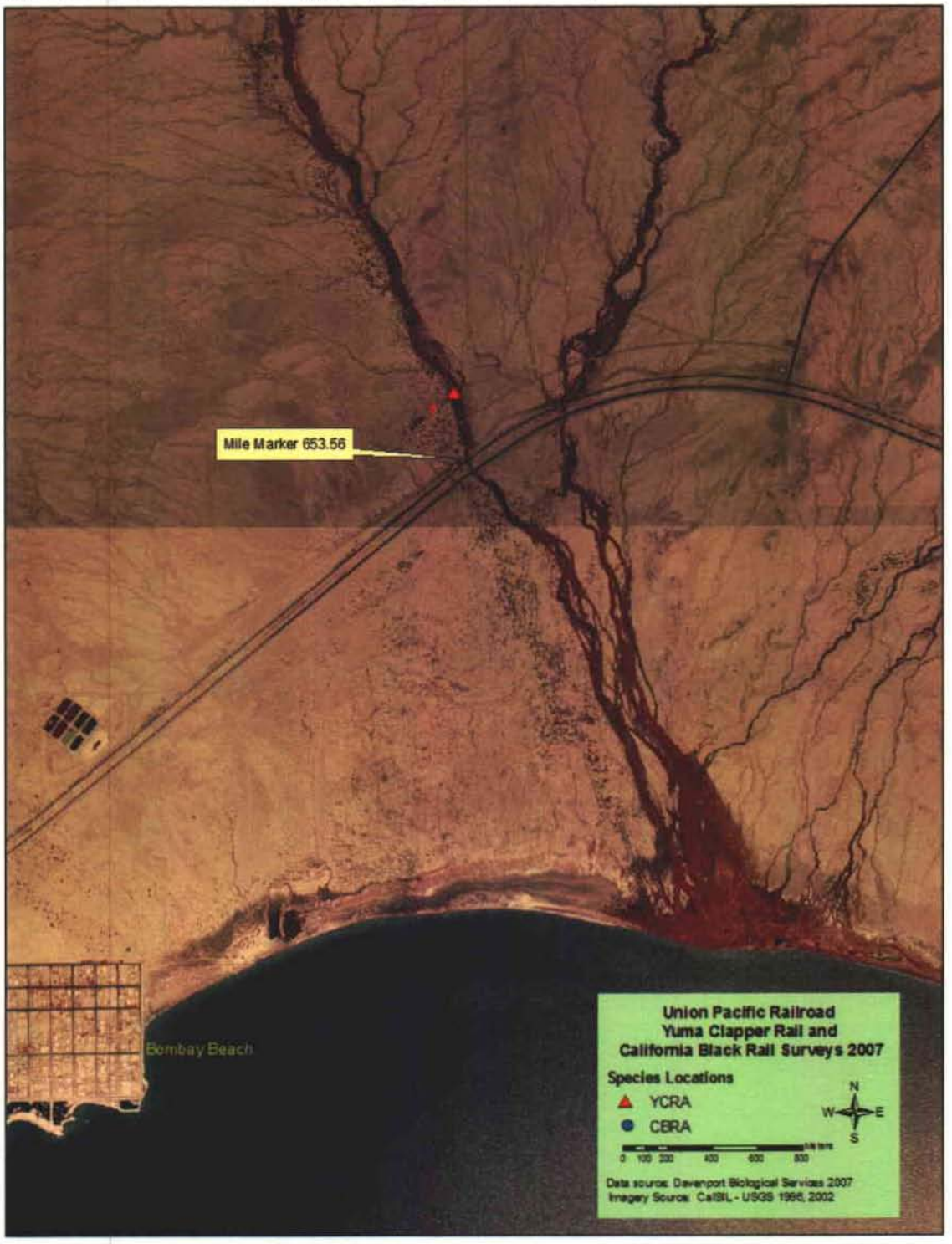

Figure 3. Locations of Yuma clapper rails pairs (locations No. 2 through 7), and California black rail (i.e., location No. 8).



Table 2. Summarized results of desert pupfish survey (24 & 25 Apr, 23 & 24 May, & 7 Sep, 2007)(GPS; NAD 83).

Bridge Mile Marker	Name	Habitat Present	Species Observed	Max. Numb. Obser.	GPS Location (NAD 83)		Comments
					Easting	Northing	
	Air Port Blvd. Bridge	Yes	*Gambusia affinis*	10			
618.50	HWY 111 Bridge	Yes	*Gambusia affinis*	5			
623.95	66th Street	Yes	*Gambusia affinis*	20			
630.88	Cleveland St.	Yes	***Cyprinodon macularius*** *Gambusia affinis* *Poecliopsis gracilis* *Unk. cichlid*	**15** 20 100 300	595257	3711040	Leopard frogs also present
635.40		Yes	*Gambusia affinis*	3			
635.475		Yes	--				
640.87	Salt Creek	Yes	*Gambusia affinis*				Dry during September Survey
651.99		Yes	*Gambusia affinis* *Poecilia latipinna*	20 5			Dry during September Survey
652.30		Yes	*Gambusia affinis* *Poecilia latipinna* *Oreochromis mossambicus* *Oreochromis aureus*	20 10 10 2			
653.56		Yes	***Cyprinodon macularius*** *Gambusia affinis* *Poecilia mexicana*	20 100 30	622411	3693508	Desert pupfish and mollys caught during September Survey
653.96		Yes	--				
656.58		Yes	--				
	Fly Wash	Yes	*Gambusia affinis*	20			Dry as of 24May07
659.55	Butler Wash	Yes	*Gambusia affinis*	20			
659.69	Level Wash	Yes	*Gambusia affinis*	20			
	Wister Wash	Yes	--				Dry as of 24May07
	ND5 Lateral	Yes	*Gambusia affinis*	20			Barrier; Drop Structure
	ND4 Lateral	Yes	*Gambusia affinis*	5			Barrier; Drop Structure
661.28	ND3 Lateral	Yes	*Gambusia affinis*	5			Barrier; Drop Structure
	ND2 Lateral	Yes	--				Barrier; Drop Structure
661.17	Polo Wash	Yes	--				
661.95	ND2 Lateral	Yes	*Gambusia affinis* *Oreochromis mossambicus*	40 1			Barrier; Drop Structure
662.43	Niland Creek	Yes	*Gambusia affinis*	4			
662.49	I Lateral	Yes	*Gambusia affinis*	40			Barrier; Drop Structure
663.11	Z Drain	Yes	*Gambusia affinis*	5			
	Y Lateral	Yes	*Gambusia affinis* *Cyprinus carpio*	20 1			Barrier; Drop Structure
	W Lateral	Yes	*Gambusia affinis*	20			Barrier; Drop Structure

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Figure 4a. Location of habitat occupied by desert pupfish during this survey (Location No. 1; 2007).

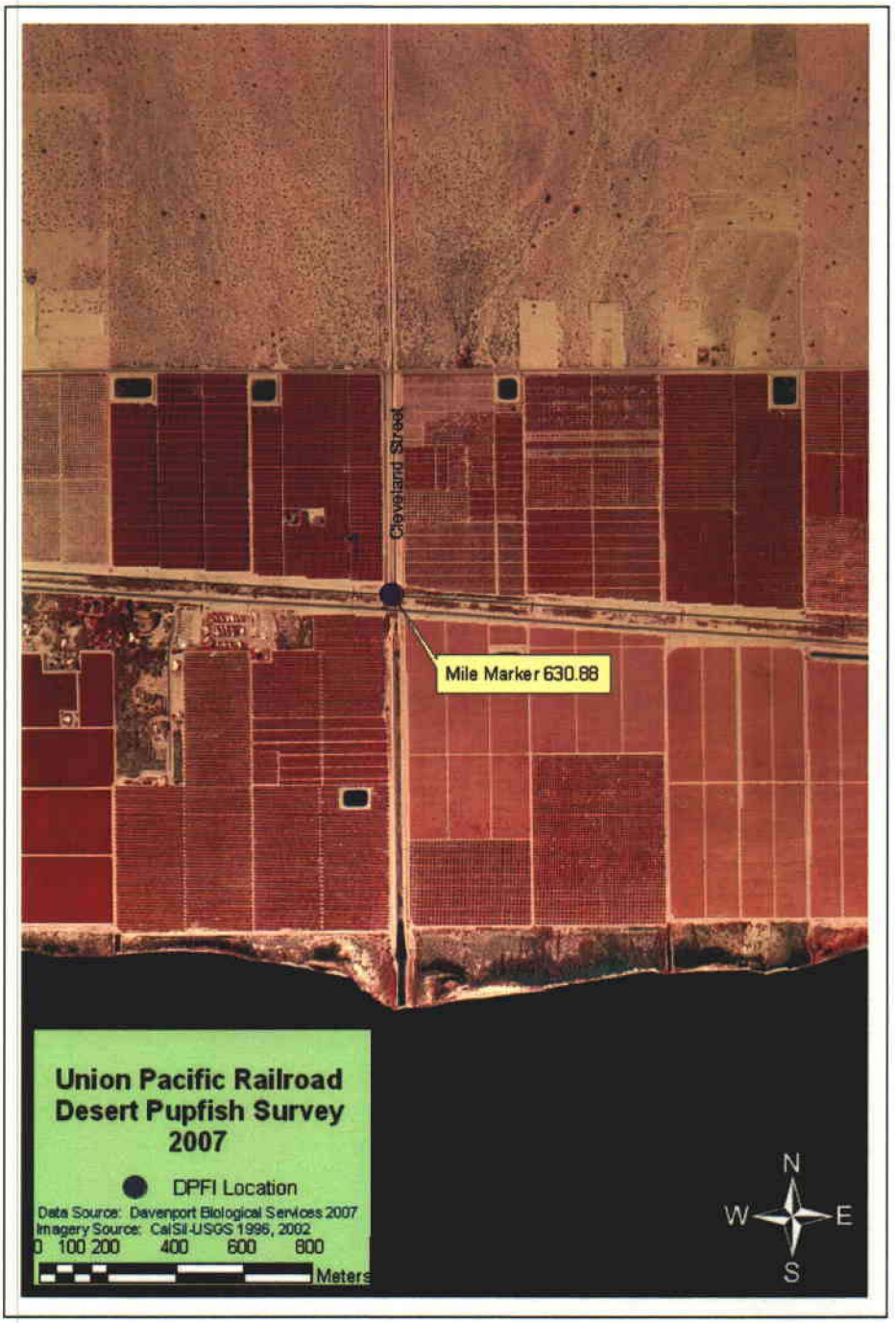
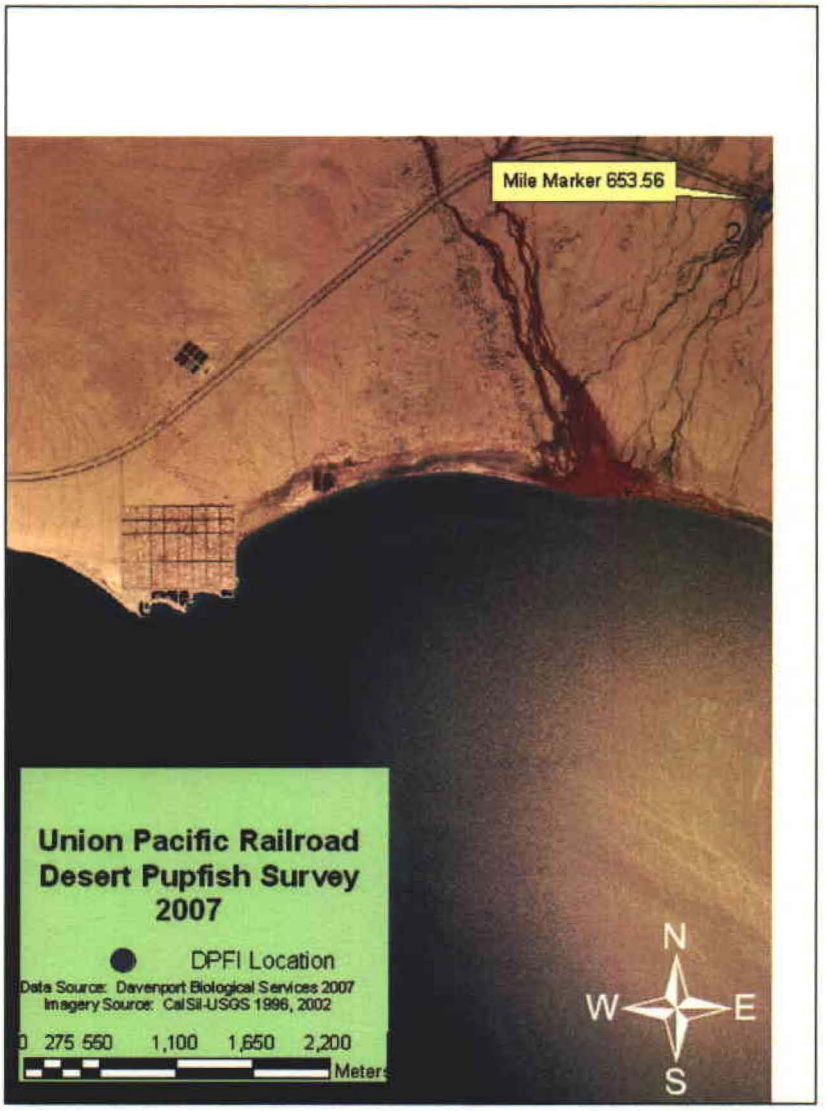


Figure 4b. Location of habitat occupied by desert pupfish during this survey (Location No. 2; 2007).



Discussion

Yuma Clapper Rail
Six pairs of Yuma clapper rails were documented during this survey. The general use areas of the pairs appeared to be consistent between survey passes. Due to the heavy cover of cattail within the drains, and the secretive nature of this species, radio telemetry would be needed to fully assess the territory size and its use by these birds. However, given the presence of suitable foraging and/or nesting habitat at or immediately adjacent to the rail line, and the proximity of the detected Yuma clapper rails, all suitable habitat within 200 meters of Yuma clapper rail locations should be considered occupied.

Black Rail
Two California black rails were found at one location. The two appear to represent a pair. The habitat, which was located on the outer southeast edge of a shallow reservoir, was somewhat degraded due to the loss of water. The vegetation was short (i.e., less than a 0.5 meter in height), which is typical of their habitat.

Desert Pupfish
Of the 27 potential locations, Desert pupfish were found at two sites during this survey. The reason for their apparent absence from several of the canals is likely due to the presence of a variety of fish barriers. For example, the presence of drop structures between the rail line and occupied habitat of the Salton Sea presents a substantial barrier to movement of desert pupfish to the project area (Figure 5). Additionally, the presence of water within the drains appears to be highly variable. Regarding this, while some aquatic habitat diminished over the course o f this survey (e.g., Fly Wash), other previously dry streams/drains became inundated (e.g., Bug Wash). Thus, the variability in the presence of suitable habitat likely affects the temporal presence of desert pupfish. Other factors that may affect the presence of desert pupfish include the presence of exotic fish (Black 1980). However, exotic fish occurred at both locations where desert pupfish were found during this survey. Thus, the mere presence of exotic fish should not be used as a basis for determining the potential presence desert pupfish. The variability in occupation of suitable habitat is highlighted by the presence of desert pupfish in upper Salt Creek in 1996 and 1997, and their apparent absence in 1998. In addition, desert pupfish were found during the September portion of this survey, where they were not detected during the two earlier surveys. The lack of detection during the earlier surveys is unknown. The species may have been present and missed. Or, the species may have shifted its location within the drainage between the survey events.

Regarding Salt Creek, the presence of desert pupfish within the project area should be assumed. The reason for this is the presence of desert pupfish both up and downstream of the project site and the lack of barriers to fish movement. The absence of water within the project area during the September survey underscores the ecological variability of this species' habitat.

Due to their proximity to the Salton Sea, and the lack of fish barriers, all washes and drains that empty into the Salton Sea may harbor desert pupfish during a wet cycle. The potential for the future presence of desert pupfish seems most likely between mile marker 618 and 666.96. That is, if water is present within any of these, the potential for the presence of desert pupfish remains.

Figure 5. Shows drop structure on S Lateral.



Conclusion

Yuma Clapper Rail

Habitat conditions, of varying quality, were found to be suitable for Yuma clapper rails at 27 locations (i.e., bride/culvert crossing); Yuma clapper rails were found to occupy seven of these locations. Of these, six locations were confirmed to have a pair of Yuma clapper rails (e.g., based on two clapper rails calling at same time from same location).

California Black Rail

Habitat conditions within the project area for California black rail appear poor. However, despite the poor conditions, one pair of California black rail was found immediately adjacent to the project area.

Desert Pupfish

Desert pupfish were detected at two sites during this survey. Despite their apparent absence where Salt Creek crosses the project area, desert pupfish should be assumed to be present at this location.

References

Black, G. F. 1980. The status of the desert pupfish Cyprinodon macularius (Baird and Girard) in California. Inland Fisheries Endangered Species Program – Special Publication 80-1.

California Department of Fish and Game. 2006. California Natural Diversity Data Base, Rare Find.

Eddleman, W. R. 1989. Biology of the Yuma Clapper Rail in Southwestern U.S. and Northwestern Mexico. Final Report. U. S. Bureau of Reclamation, Yuma Projects Office and U. S. Fish and Wildlife Service, Region 2.

Eddleman, W. R., R. E. Flores, and M. L. Legare. 1994. Black Rail (*Laterallus jamaicensis*). In the Birds of North America, No. 123 (A. Poole and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington, D.C.: The American Ornithologists' Union.

Eddleman, W. R., and C. J. Conway. 1998. Clapper Rail (*Rallus longirostris*). In The Birds of North America, No. 340 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Garrett, K. & J. Dunn. 1981. *Birds of Southern California*. The Artesian Press, Los Angeles California. Published by the Los Angeles Audobon Society.

Appendix 1. Animals observed within the survey area (based on direct observation and/or sign).

ANIMALS

INVERTEBRATES

Lepidoptera

Cabbage White	*Pieris rapae*
West Coast Lady	*Vanessa annabella*

VETEBRATES

Reptiles

Western Whiptail Lizard	*Cnemidophorus tigris*
Desert Spiney Lizard	*Sceloporus magister*
Western diamondback rattlesnake	*Crotalus atrox*

Birds

Ring-necked Pheasant	*Phasianus colchicus*
Gambel's Quail	*Callipepla gambelii*
Green Heron	*Butorides virescens*
Turkey Vulture	*Cathartes aura*
Northern Harrier	*Circus cyanus*
Red Tailed Hawk	*Buteo jamaicensis*
American Kestrel	*Falco sparverious*
Yuma Clapper Rail	*Rallus longirostris yumanensis*
Virginia Rail	*Rallus limicola*
Sora	*Porzana carolina*
Common Moorhen	*Gallinula chloropus*
Mourning Dove	*Zenaida macroura*
White-winged Dove	*Zenaida asiatica*
Ruddy Ground Dove	*Columbina talpacoti*
Inca Dove	*Columbina inca*
Eurasian Collared-Dove	*Streptopelia decaocto*
Greater Roadrunner	*Geococcyx californianus*
Lesser Nighthawk	*Chordeiles acutipennis*
White-throated Swift	*Aeronautes saxatalis*
Anna's Hummingbird	*Calypte anna*
Black-chinned Hummingbird	*Archilochus alexandri*
Rufous Hummingbird	*Selasphorus rufus*
Allen's Hummingbird	*Selasphorus sasin*
Western Wood-Pewee	*Contopus sordidulus*
Willow Flycatcher	*Empidonax traillii*
Black Phoebe	*Sayornis nigricans*
Say's Phoebe	*Sayornis saya*
Ash-throated Flycatcher	*Myiarchus cinerascens*
Western Kingbird	*Tyrannus verticalis*
Common Raven	*Corvus corax*
Northern Rough-wing Swallow	*Stelgidopteryx serripennis*
Barn Swallow	*Hirundo rustica*
Tree Swallow	*Tachycineta bicolor*

AR073984

Birds (Cont.)	
Black-tailed Gnatcatcher	*Polioptila melanura*
Orange-Crowned Warbler	*Vermivora celata*
Yellow Warbler	*Dendroica petechia*
Wilson's Warbler	*Wilsonia pusilla*
Yellow-Rumped Warbler	*Dendroica coronata*
Common Yellowthroat	*Geothlypis trichas*
Abert's Towhee	*Pipilo aberti*
Savannah Sparrow	*Passerculus sandwichensis*
Song Sparrow	*Melospiza melodia*
White-crowned Sparrow	*Zonotrichia albicollis*
Blue Grosbeak	*Passerina caerulea*
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*
Red-winged Blackbird	*Agelaius phoeniceus*
Great-tailed Grackle	Quiscalus mexicanus
Brown-headed Cowbird	*Molothrus ater*
Lesser Goldfinch	*Carduelis psaltria*
House Finch	*Carpodacus mexicanus*
House Sparrow	*Passer domesticus*
European Starling	*Sturnus vulgaris*

Mammals	
Coyote	*Canis latrans*
Valley Pocket Gopher	*Thomomys bottae*
Desert Cottontail	*Sylvilagus audoboni*

AR073985



artdavenpo@aol.com
01/24/2008 06:33 PM

To Stacey_Love@fws.gov
cc
bcc
Subject Re: PDFs and request for more information

History: This message has been replied to.

Stacey,

The attached file contains a signed and dated general certification statement for all of my reports; please feel free to attach a copy of it to all of my reports. As indicated in the cert, I collected the data. The dates of the surveys should be in the reports. I will have to get back to you regarding the other information (e.g., temp data and such). Requirements of No. 17 represent a complex mix of items needed for various species. That is, not all items were meant to apply to all species. However, I will try and put something together that is useful. Between the the various, differing, requirements of CDFG offices and the Fish and Wildlife Service, reporting has become a very time consuming event; it takes days to compile this stuff. It would be nice if the information requested by all was the same.

Art!

-----Original Message-----
From: Stacey_Love@fws.gov
To: artdavenpo@aol.com
Cc: Sandy_Marquez@fws.gov
Sent: Wed, 23 Jan 2008 2:49 pm
Subject: PDFs and request for more information

Hi Art,

Here are the PDFs you requested. Enjoy!

As I mentioned on the phone, we received several reports without a surveyor certification statement. They're also missing some methodology information such as names of personnel (even if it was just you, it should state that), dates of surveys, temperature and weather conditions at the beginning and end of each survey (please see number 17 of the terms and conditions of your permit). Many permittees put that information in a table, if that's helpful to you. Please send me the surveyor certification statements and additional methodology information (as best you can), and continue to send that information in the future. You don't need to resend the entire reports, just the additional information and I'll attach them to each report. We really appreciate all your efforts to send in the reports; we just need to tie up a few loose ends.

Here's the names of the reports:



artdavenpo@aol.com
01/25/2008 05:54 PM

To Stacey_Love@fws.gov
cc
bcc
Subject Date, temp, and Weather Data

History: This message has been replied to.

Stacey,

The attached file contains the project related survey date, temp, and weather data as requested (it took about four hours to compile it). I am really sorry I snapped at you today, I am really frustrated with permit related issues (mainly with the State) and its bleeding over into areas it shouldn't. I rarely get that snappy so you can imagine how irritated I've become with the State. Again, please accept my apologies.

Sincerely,

Art

More new features than ever. Check out the new AOL Mail! [attachment "PrmtTable.doc" deleted by Stacey Love/CFWO/R1/FWS/DOI]

Table 1. Date, Temp, and Weather Data Per Project.

Project	Dates	Biologist	Temp Start/Stop (Fahrenheit)	Wind Start/Stop	Cloud Cover Start/Stop
Chiu Parcel-SBKR	10Sep07	A. Davenport	89/77	0/0	0/0
Chiu	11Sep07	A. Davenport	60/60; 62/62	0/0;0/0	0/0;0/0
Chiu	12Sep07	A. Davenport	69/69; 63/73	0/0;0/0	0/0;0/0
Chiu	13Sep07	A. Davenport	68/64; 64/64	0/0;0/0	0/0;0/0
Chiu	14Sep07	A. Davenport	65/65; 62/70	0/0;0/0	0/0;0/0
Chiu	15Sep07	A. Davenport	64/64; 59/72	0/0;0/0	0/0;0/0
Chiu	16Oct07	A. Davenport	55/60	2/1	100% ML/100% ML
Chiu	17Oct07	A. Davenport	54/59	0/0	100% ML/100% ML
Chiu	18Oct07	A. Davenport	49/64	0/0	5%/5%
Chiu	19Oct07	A. Davenport	58/70	0/1	5%/0
Chiu	20Oct07	A. Davenport	57/68	0/0	0/0
Mentone Pipeline-SBKR	21Aug07	A. Davenport	73/72; 66/76	0/0;0/0	0/0;0/0
Mentone Pipeline	22Aug07	A. Davenport	70/70; 66/76	1/1;0/0	0/0;0/0
Mentone Pipeline	23Aug07	A. Davenport	70/67; 62/62	0/0;0/0	0/0; 100% ML/100% ML
Mentone Pipeline	24Aug07	A. Davenport	66/66; 60/61	0/0;0/0	0/0;0/0
Mentone Pipeline	28Aug07	A. Davenport	73/71; 69/68	0/0;1/1	0/0;0/0
Mentone Pipeline	29Aug07	A. Davenport	75/73; 73/74	0/0;0/0	0/0;0/0
Mentone Pipeline	30Aug07	A. Davenport	88/88; 83/84	0/1;0/0	80%/80%; 80%/50%
Mentone Pipeline	31Aug07	A. Davenport	81/81; 80/80	0/0;0/0	30%/30%; 30%/30%
UPRR-YCRA & DPFI	19Mar07	A. Davenport	70/70	2/2	20%/20%
UPRR	20Mar07	A. Davenport	58/66	0/1	20%/40%
UPRR	21Mar07	A. Davenport	60/61	0/0	80%/80%
UPRR	24Apr07	A. Davenport	59/82	0/0	0/0
UPRR	25Apr07	A. Davenport	58/72	0/0	0/0
UPRR	26Apr07	A. Davenport	64/64	0/0	0/0
UPRR	22May07	A. Davenport	68/80	2/1	0/0
UPRR	23May07	A. Davenport	71/85	1/1	0/0
UPRR	24May07	A. Davenport	66/91	0/0	10%/5%
UPRR	7Sep07	A. Davenport	84/102	0/0	0/0
Redlands-SBKR	18Jul07	A. Davenport	65/65; 61/68	0/0; 0/0	0/0; 0/0
Redlands	19Jul07	A. Davenport	76/76; 60/65	0/0; 0/0	0/0; 0/0
Redlands	20Jul07	A. Davenport	72/72; 69/74	0/0; 0/0	0/0; 0/0
Redlands	21Jul07	A. Davenport	70/70; 61/68	0/0; 0/0	0/0; 0/0
Redlands	22Jul07	A. Davenport	68/68; 64/68	0/0; 0/0	0/0; 5%/10%
Redlands	23Jul07	A. Davenport	73/73; 70/75	0/0; 0/0	70%/70%; 100%/100%
Redlands	24Jul07	A. Davenport	75/75; 67/75	0/0; 1/1	50%/50%; 10%/10%
Redlands	25Jul07	A. Davenport	77/77; 67/74	0/0; 0/0	0/0; 0/0
Redlands	26Jul07	A. Davenport	75/75; 66/76	0/0; 0/0	5%/5%; 5%/1%
Redlands	27Jul07	A. Davenport	75/75; 66/74	1/1; 0/1	10%/10%; 5%/10%
Redlands	3Aug07	A. Davenport	75/75;72/75	0/0; 0/0	50%/50%; 0/5%
Redlands	4Aug07	A. Davenport	70/70;65/72	0/0; 0/0	0/0; 5%/20%
Redlands	5Aug07	A. Davenport	70/70; 65/72	0/0; 0/0	100%ML/50%ML
Redlands	6Aug07	A. Davenport	75/75; 63/72	0/0; 0/0	0/0; 100%ML/50%ML
Redlands	7Aug07	A. Davenport	75373; 58/64	0/0; 0/1	0/20%ML; 100%ML/100%ML
NCTD Trestles-ARTO	30Apr07	A. Davenport	65/65; 61/61	0/0; 0/0	0/0; 0/0
NCTD Trestles	31Apr07	A. Davenport	62/82; 60/60	0/0; 0/0	0/0; 0/0
NCTD Trestles	1May07	A. Davenport	62/60	0/0	100%ML/100%ML
NCTD Trestles	2May07	A. Davenport	61/60	1/3	60%ML/60%ML
Lib. Enrgy-YCRA	21May07	A. Davenport	71/79	0/3	0/0
Lib. Enrgy	24May07	A. Davenport	66/64	0/0	10%/5%
Lib. Enrgy	2Jun07	A. Davenport	77/81	0/1	20%/80%

AR073988

Lib. Enrgy	17Jun07	A. Davenport	68/90	1/1	0/0
Lib. Enrgy	24Jun07	A. Davenport	72/87	0/0	10%/10%
Lib. Enrgy	1July07	A. Davenport	72/87	0/0	5%/5%
Lib. Enrgy	7July07	A. Davenport	82/91	0/0	0/0
GlenHelenPrkwy-CAGN	21Dec06	A. Davenport	45/53	0/1	0/0
GlenHelenPrkwy	30Dec06	A. Davenport	53/69	0/1	0/0
GlenHelenPrkwy	6Jan07	A. Davenport	44/55	0/10	0/0
GlenHelenPrkwy	21Jan07	A. Davenport	50/60	0/5	0/0
GlenHelenPrkwy	27Jan07	A. Davenport	48/56	0/2	20%/30%
GlenHelenPrkwy	4Feb07	A. Davenport	67/70	5/10	0/0
GlenHelenPrkwy	9Feb07	A. Davenport	55/65	0/0	50%/50%
GlenHelenPrkwy	17Feb07	A. Davenport	65/70	2/6	0/0
GlenHelenPrkwy	18Feb07	A. Davenport	63/78	1/2	20%/50%
GlenHelenPrkwy	24Feb07	A. Davenport	50/65	2/2	0/0
La Tuna Cyn-CAGN	24Mar07	A. Davenport	54/66	0/0	100%ML/50%ML
La Tuna Cyn	31Mar07	A. Davenport	50/63	1/0	0/0
La Tuna Cyn	7Apr07	A. Davenport	54/64	0/0	100%ML/100%ML
La Tuna Cyn	21Apr07	A. Davenport	53/60	1/1	0/20%ML
La Tuna Cyn	28Apr07	A. Davenport	66/72	1/1	0/0
La Tuna Cyn	110May07	A. Davenport	68/74	1/1	0/0

DEC 0 7 2007

YUMA CLAPPER RAIL, BLACK RAIL, AND SOUTHWESTERN WILLOW FLYCATCHER SURVEYS

Liberty Energy Project

(Section 17 & 18; T10S, R14E; Wister 7.5' USGS Quadrangle)

Imperial County, CA

9/30
Imperial
2007
YCR (+)
SWWF (+)
DK 1/30/08
GIS RN 12-5-08

Prepared For:

UltraSystems Environmental
100 Pacifica, Suite 250
Irvine, CA 92619

By:

Arthur Davenport
Davenport Biological Services
P.O. Box 1692
Barstow, California 92312
619-729-4242

August 11, 2007

INTRODUCTION

Davenport Biological Services (DBS) was hired by Ultra Systems to complete presence/absence surveys for several threatened or endangered species near Niland, California (Figure 1). The surveys were completed within the project area of the Liberty Energy Site Plan (Figure 2). Within this area, focused surveys were completed for the Yuma clapper rail (*Rallus longirostris yumanensis*), black rail (*Laterallus jamaicensis*), and southwestern willow flycatcher (*Empidonax traillii extimus*).

The Yuma clapper rail was listed as an endangered species under the Endangered Species Act of 1973, as amended (ESA), on 11 March 1967 (FR 32:4001). The Yuma clapper rail is also listed as threatened under California's Endangered Species Act (CESA). The Yuma clapper rail occupies marsh habitats including canals and drains where cover and food is available. Vegetative cover often consists of cattail (*Typha latifolia*) and bulrush (*Scirpus acutus*). This species has also been observed in wetlands where there is a canopy of tamarisk (*Tamarix ramosissima*), and an understory of cattails or other wetland plants (e.g., bullrush). The food of the clapper rail includes a variety of invertebrate species, including crayfish and insects.

Information regarding the migration patterns of Yuma clapper rails is contradictory. There is some indirect evidence that they move post breeding. However, other studies did not detect migration (Eddleman 1989). Yuma clapper rails begin pair formation in mid February. First nests of Yuma clapper rail have been documented in mid March. Peak nest initiation is in mid May (Eddleman 1989).

The California black rail is not listed as an endangered or threatened species under the ESA. The California black rail is listed as a threatened species under California's Endangered Species Act.

The California black rail occupies wet meadow and marsh habitats. Black rails seem to prefer marsh vegetation that is relatively short (less than about 1 meter tall). Along the coast, most records of black rail are from *Salicornia* dominated marshes (Garrett and Dunn 1981). Based on habitat use along the lower Colorado River, black rail seem to prefer bulrush-dominated marshes (Garrett and Dunn 1981). Based on a personal observation along the Virgin River (northern extent of their range), black rail also occur in short, *Typha* dominated freshwater marsh. The food of the black rail is varied and includes insects and plant material.

The spring migration of black rails extends from mid March to early May. Fall migration extends from early September to early November (Eddleman et al., 1994). Black rails may initiate pair formation between late February and July (Eddleman et al., 1994), however information is lacking regarding this topic. Peak nest initiation ranges between 10 March and 6 July (Flores and Eddleman 1993). The black rail is common along the Colorado River from April to the end of August (Garrett and Dunn, 1981).

The southwestern willow flycatcher was listed as an endangered species under the ESA, on 27 February 1995 (FR 60:10715). The willow flycatcher (*Empidonax traillii*) is listed as endangered under CESA. The flycatcher nests in riparian vegetation and generally arrives in southern California in mid May, departing for South America in September or October. Food of the willow flycatcher includes a wide variety of insects. It is important to note that suitable habitat for this species includes riparian vegetation dominated by tamarisk.

The survey was completed under Federal Recovery Permit # TE802450-5

Figure 1. General location of the project site.

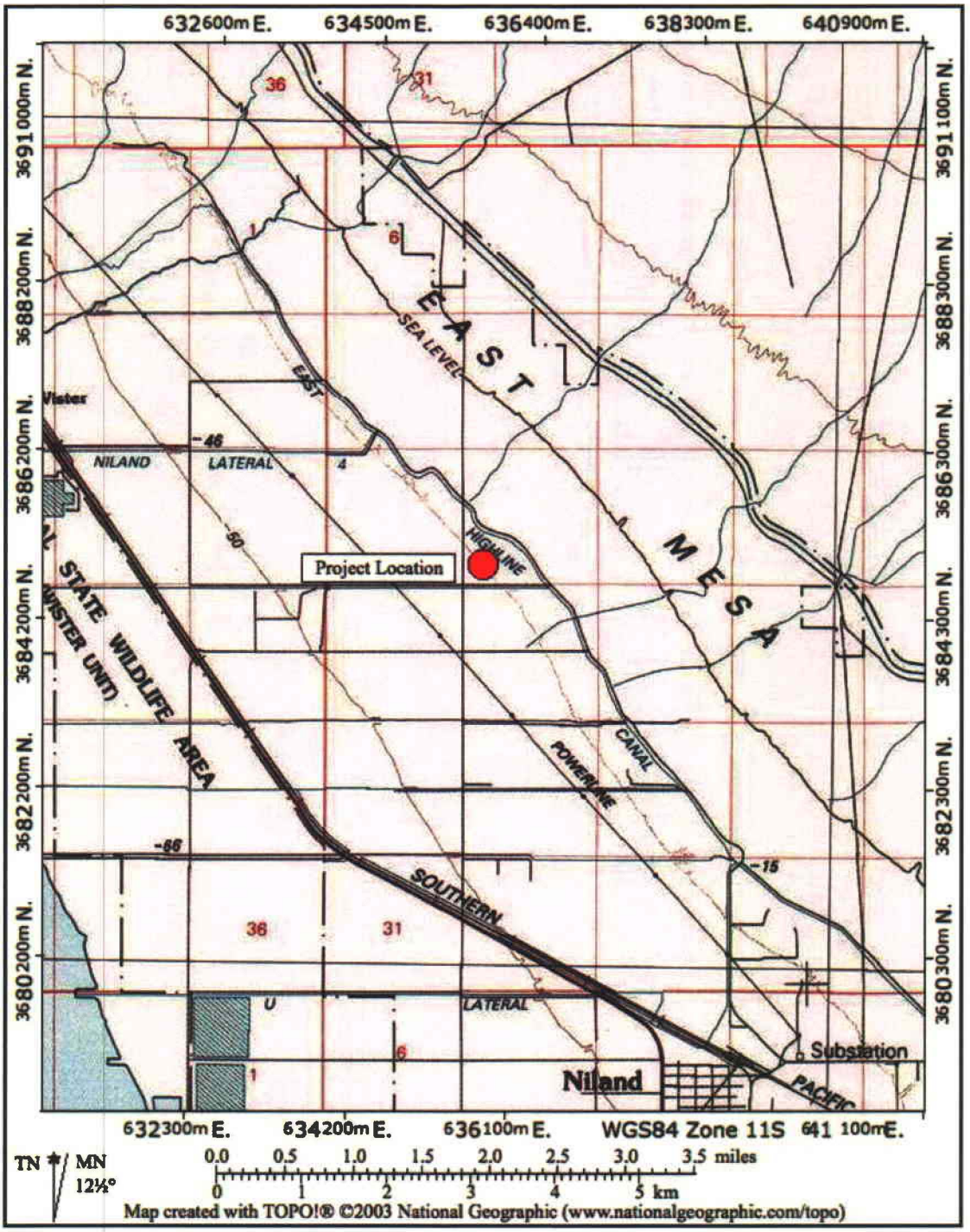
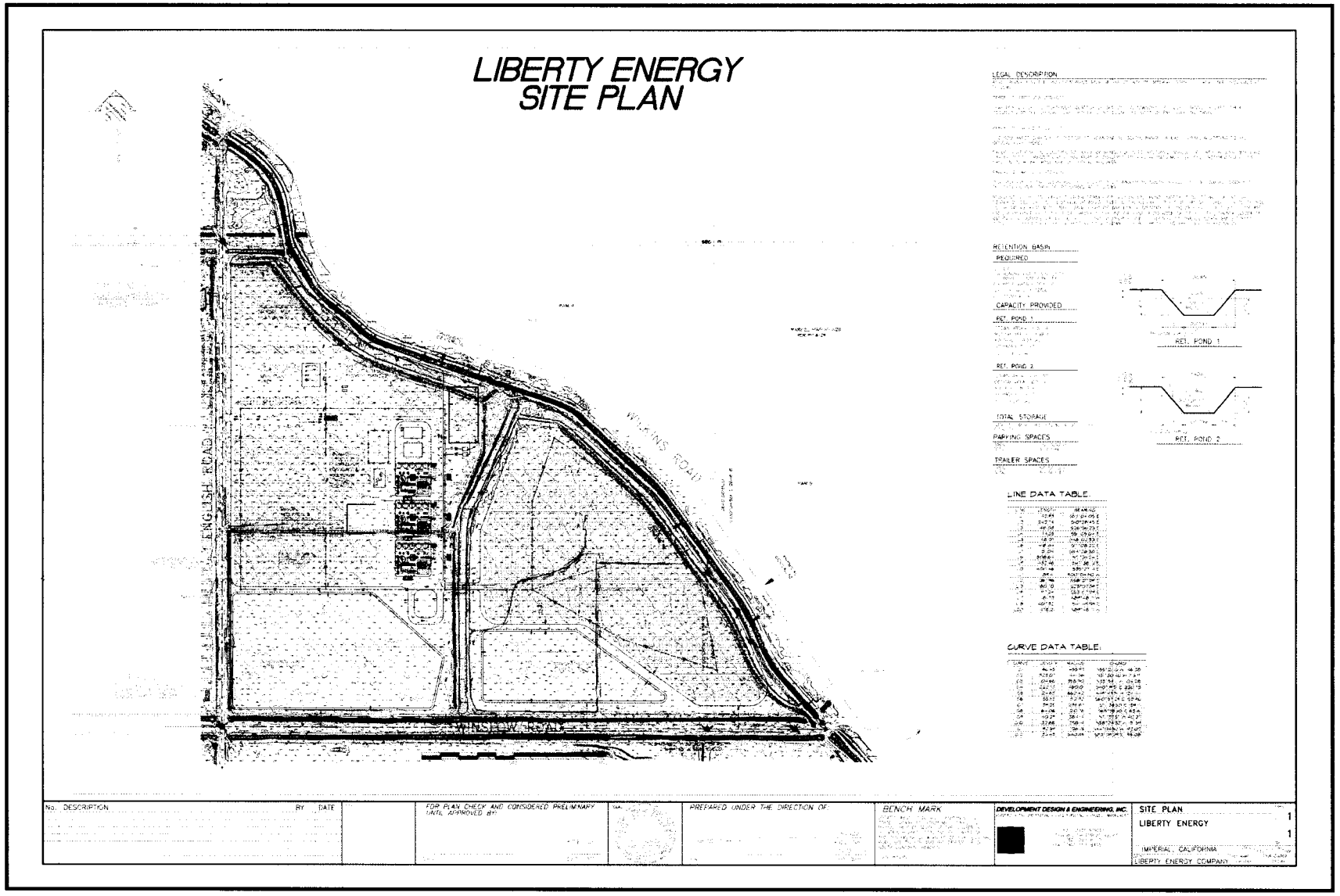


Figure 2. Liberty Energy Site Plan



AR073993

METHODS

Background Search

Information regarding the historic distribution of YCRA, BLRA, and SWFL in the vicinity of the proposed project was also reviewed. In this regard, information from the Museum of Vertebrate Zoology, Berkley, and California Natural Diversity Data Base was reviewed.

Field Survey

Initial surveys for rails were strictly passive. Surveys were completed during prime calling periods of both rail species. The use of tape play back of calls was only used after a location was thought to be unoccupied. Under no circumstances were rails pursued (i.e., chased, followed, trailed, tracked, shadowed, etc.).

A list of all birds observed during the field surveys was recorded and is included as Appendix 1.

Yuma Clapper Rail

The survey was repeated six times, and the surveys were completed at least one week apart. During each of the six survey events, three survey passes were completed of all potentially suitable habitat. Thus, a total of 18 survey passes were completed during the course of this survey. The first survey pass of each survey employed passive listening. Tape playback of Yuma clapper rail calls was only used where rails were not heard. Per the general survey protocol for Yuma clapper rails, the first two surveys were completed between March 15 and May 15, 2007. The survey for YCRA was initiated on 21 May 2007, and was completed on 7 July 2007. Surveys were initiated around 0430 and completed by 1100 hours.

Surveys were conducted by walking along the edge of the drains. The first survey pass was passive, and no tape play back of calls was used. During the second and third survey pass, tape play back of calls was used at 20meter intervals. Once a YCRA was detected, no tape playback was used in its vicinity.

Black Rail

The survey was completed six times. The survey for BLRA was initiated on 21 May 2007, and was completed on 7 July 2007. A survey of the entire site was repeated two times per survey event. Thus, a total of 12 survey passes were completed during this survey. Survey events were conducted at approximately weekly intervals. Surveys were initiated around 0400 and completed by 0600 hours.

Surveys were conducted by walking along the edge of the drains. The first survey pass of each survey was passive, and no tape play back of calls was used. During the second survey pass, tape play back of calls was used at 20meter intervals.

Southwestern Willow Flycatcher

All riparian habitat located within the project area was surveyed a total of seven times between 21 May 2007 and 7 July 2007. Two survey passes were completed per survey event. Thus, a total of

14 survey passes were completed during this survey. Survey events were conducted at approximately one week intervals. All surveys were initiated by 6:00 AM.

The surveys consisted of slowly moving along the riparian vegetation scanning for willow flycatchers and listening for their diagnostic song and/or call. The first survey pass was passive. During the second survey pass, a tape of the song of the willow flycatcher was played at approximately 20meter intervals along the entire stretch of the survey route. When played, only two to three songs were broadcast and then a couple minutes would pass waiting for a response. Following the first play and wait interval, the tape was played again and again several minutes would pass waiting for a response before moving further down the riparian strip. In addition to the use of song and just prior to moving on to the next stopping point, pishing was also used in an attempt to elicit a response. Once a willow flycatcher was observed, no tape playback or pishing was used in its vicinity.

RESULTS

Background Search

No YCRA, BLRA, or SWFL are previously known from the site. The closest location of YCRA occurs at the Wister Waterfowl Management Area, located approximately two miles west of the project site.

Field Survey

Yuma Clapper Rail

Three pairs of YCRA were detected during this survey. The locations of YCRA observations are depicted in Figure 3. Two of the pairs were located on the project site (Pair #1 and #3). The third pair (Pair #2) was located immediately adjacent to the project site. One of the pairs of YCRA (Pair #1) was detected with chicks. The nesting success of the other two pairs is unknown.

Black Rail

No BLRA were observed or otherwise detected during this survey.

Southwestern Willow Flycatcher

Willow flycatchers were observed at five locations within the project site (Figure 3). Although the location of willow flycatcher groups was consistent between survey events, nesting was not confirmed for all of the locations.

Figure 3. Locations of YCRA and SWFL detected at the project site (2007).

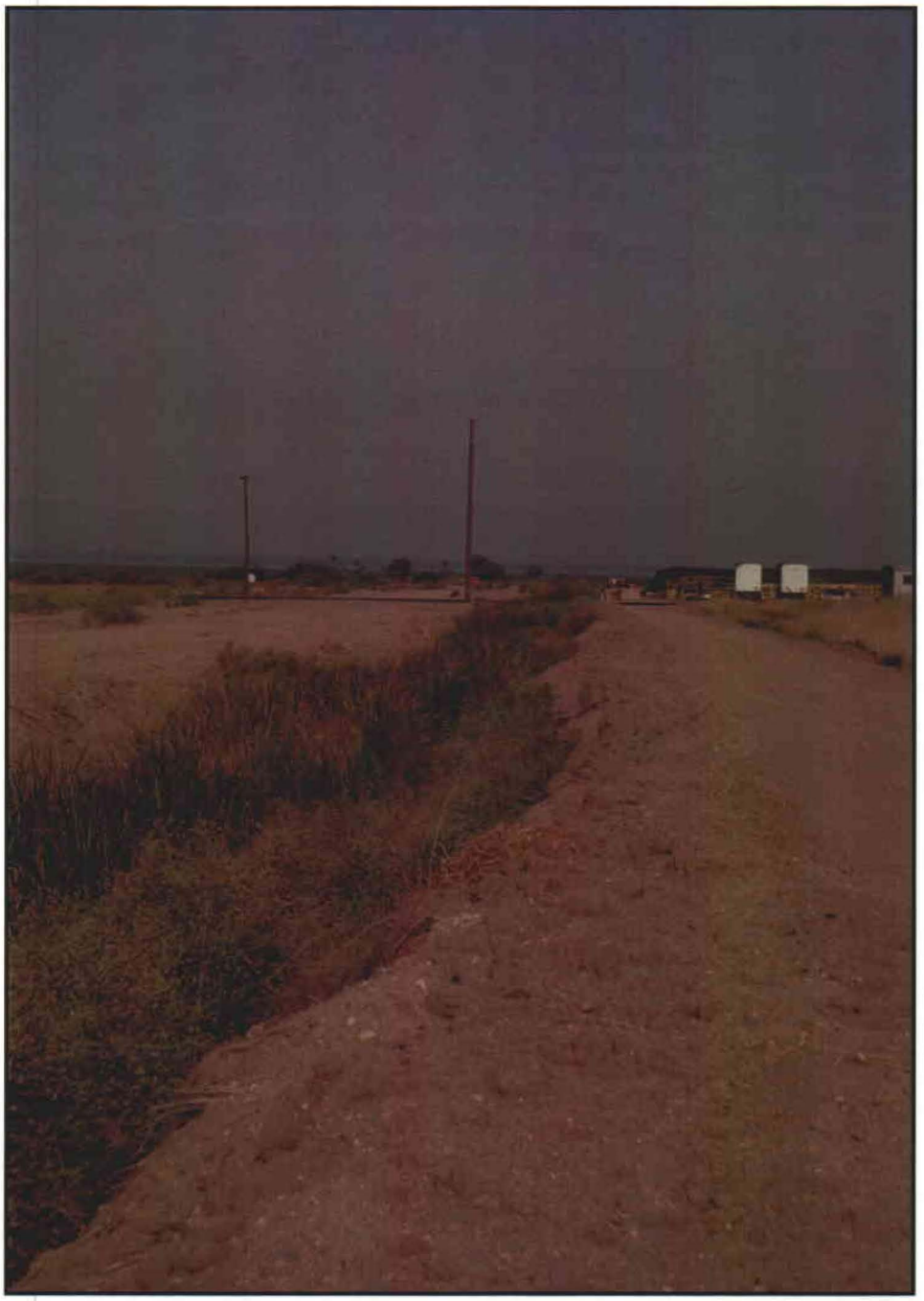


DISCUSSION

Yuma Clapper Rail

Three pairs of YCRA were documented occupying the site during this survey. The use areas of the pairs appeared to be consistent between survey passes. In addition, habitat use was found to extend beyond the drains. On two occasions, rails were observed outside the cover of the drains. On one occasion, a rail was observed moving between parallel drains (Pair #2). On another occasion, one of the rails from Pair #3 was observed returning from a dry, weedy, agricultural field. Due to the heavy cover of cattail within the drains, and the secretive nature of this species, radio telemetry would be needed to fully assess the territory size and use by these birds. The nesting success of all three pairs remains unknown. However, one of the pairs (Pair #1) is known

Figure 4. View of habitat occupied by YCRAPair #1.



to have been successful in hatching a brood of chicks. The habitat occupied by YCRA on this site is narrow (Figure 4).

Black Rail

No black rails were documented during this survey. Due to height of the cattail, the habitat within the project site appears to be of marginal quality for black rail.

Figure 5. Shows portion of area occupied by two willow flycatchers (Location #5).



Southwestern Willow Flycatcher

The habitat on and immediately adjacent to the site was composed of tamarisk, honey mesquite (*Prosopis glandulosa*), iron wood (*Olnea tesota*), athel (*Tamarix aphylla*), and common reed (*Phragmites australis*). Although there was a large canal running between the stands of trees, the soil was dry beneath the trees, at four of the flycatcher locations. At the site of flycatcher location #5, tamarisk was growing within and along the edge of a wet drain filled with cattails (Figure 5). Five groups of willow flycatchers (WIFL) were observed on site during this survey. The groups were found to be occupying the same locations between survey events. All five of the use areas are known to have been occupied by WIFL from 21 May 2007 to 17 June 2007. One willow WIFL was observed on 24 June 2007. The individual observed on 24 June, appears to have been a juvenile (e.g., had buffy wing bars). No willow flycatchers were observed on either 1 July 2007 or 7 July 2007.

Although specific arrival and nesting data regarding SWFL is lacking for the Niland area, some data is available for the Colorado River. Based on information provided by the San Diego Natural History Museum (1995), the arrival date for male SWFL along the Colorado River is 28 April. Female SWFL appear to arrive about one week later (around 5 May). In general, initiation of territorial defense appears to occur immediately after their arrival. Nest initiation appears to occur within 10 to 14 days after spring arrival. The earliest clutch initiation date is 24 May. The interval between laying of eggs in a clutch is usually 1 day. The average clutch size is 3 eggs; it takes approximately 3 days for a clutch to be complete. Incubation takes 12 to 13 days. Fledging takes 12 to 15 days. Dispersal from natal territories occurs 14 to 15 days after fledging (San Diego Natural History Museum 1995). Based on information from the Museum of Vertebrate

Zoology, Berkley, an egg set was collected in Los Angeles, on 20 May (MVZ Egg 2205). Thus, based on this information, fledglings could have dispersed from their natal territories by 1 July.

Due to the lack of nest confirmation, determination of the subspecies of all willow flycatchers observed on site is complicated. Based on arrival, nesting, fledging, and dispersal data, the SWFL could have been on site during the 1 July and 7 July surveys. However, earlier nest initiation, by a week, could account for the apparent absence of birds during the last two surveys. The presence of a juvenile WIFL (at Location #4) supports the conclusion that at least one of the groups observed on site were SWFL.

CONCLUSION

During the 2007 nesting season, the site was occupied by two pairs of YCRA. A third pair of YCRA (i.e., Pair #2) was located immediately adjacent to the site. No BLRA were detected. The habitat on site appears to be of marginal quality for BLRA. Based on the dates of observation, and the number of flycatchers observed, the site had five distinct locations occupied by willow flycatchers. In addition, based on the dates of observation, and the presence of a juvenile, at least one territorial pair of SWFL was present on site.

RECOMMENDATIONS

In order to reduce potential impacts to YRCA and SWFL as a result of project activities, the following steps are recommended for implementation into project plans:

- Maintain, at a minimum, a 30-meter buffer between project buildings, use areas, and roads and YCRA and SWFL habitat.
- Due to the use by the YCRA of adjacent upland habitat, maintain a buffer of undeveloped habitat adjacent to the rails habitat. Limit the spatial area of grading and other habitat disturbing activities to the smallest area practicable.
- For unavoidable loss of habitat, provide and maintain replacement habitat adjacent to habitat occupied by YCRA and SWFL, as appropriate.
- Mark the limits of grading/vehicle activity with a highly visible temporary barrier (e.g., orange plastic construction fencing).
- Monitor construction to ensure that construction activities remain within the limits of grading.
- Prevent artificial illumination of YCRA and SWFL habitat.
- Prevent runoff from the project (during construction and operation of the project) from entering habitat of the YCRA and SWFL.

REFERENCES

American Ornithologists' Union. 1957. Checklist of North American Birds. 5th ed. American Ornithologists' Union, Washington, DC.

California Department of Fish and Game. 2006. California Natural Diversity Data Base, Rare Find.

Garrett, K. & J. Dunn. 1981. *Birds of Southern California.* The Artesian Press, Los Angeles California. Published by the Los Angeles Audobon Society.

San Diego Natural History Museum. 1995. *Empidonax traillii extimus* in California. The Willow Flycatcher Workshop.

Appendix 1. Animals observed within the survey area (based on direct observation and/or sign).

ANIMALS

INVERTEBRATES

Lepidoptera

Cabbage White	*Pieris rapae*
West Coast Lady	*Vanessa annabella*

VERTEBRATES

Reptiles

Western Whiptail Lizard	*Cnemidophorus tigris*
Desert Spiny lizard	*Sceloporus magister*
Western diamondback rattlesnake	*Crotalus atrox*

Birds

Ring-necked Pheasant	*Phasianus colchicus*
Gambel's Quail	*Callipepla gambelii*
Green Heron	*Butorides virescens*
Turkey Vulture	*Cathartes aura*
Northern Harrier	*Circus cyanus*
Red Tailed Hawk	*Buteo jamaicensis*
American Kestrel	*Falco sparverious*
Yuma Clapper Rail	*Rallus longirostris yumanensis*
Common Moorhen	*Gallinula chloropus*
Mourning Dove	*Zenaida macroura*
White-winged Dove	*Zenaida asiatica*
Ruddy Ground Dove	*Columbina talpacoti*
Inca Dove	*Columbina inca*
Eurasian Collared-Dove	*Streptopelia decaocto*
Greater Roadrunner	*Geococcyx californianus*
Lesser Nighthawk	*Chordeiles acutipennis*
White-throated Swift	*Aeronautes saxatalis*
Anna's Hummingbird	*Calypte anna*
Black-chinned Hummingbird	*Archilochus alexandri*
Rufous Hummingbird	*Selasphorus rufus*
Allen's Hummingbird	*Selasphorus sasin*
Western Wood-Pewee	*Contopus sordidulus*
Willow Flycatcher	*Empidonax traillii*
Black Phoebe	*Sayornis nigricans*
Say's Phoebe	*Sayornis saya*
Ash-throated Flycatcher	*Myiarchus cinerascens*
Western Kingbird	*Tyrannus verticalis*
Common Raven	*Corvus corax*
Northern Rough-wing Swallow	*Stelgidopteryx serripennis*
Barn Swallow	*Hirundo rustica*
Tree Swallow	*Tachycineta bicolor*
Black-tailed Gnatcatcher	*Polioptila melanura*
Orange-Crowned Warbler	*Vermivora celata*

Birds (Cont.)	
Yellow Warbler	*Dendroica petechia*
Wilson's Warbler	*Wilsonia pusilla*
Yellow-Rumped Warbler	*Dendroica coronata*
Common Yellowthroat	*Geothlypis trichas*
Abert's Towhee	*Pipilo aberti*
Savannah Sparrow	*Passerculus sandwichensis*
Song Sparrow	*Melospiza melodia*
White-crowned Sparrow	*Zonotrichia albicollis*
Blue Grosbeak	*Passerina caerulea*
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*
Red-winged Blackbird	*Agelaius phoeniceus*
Great-tailed Grackle	Quiscalus mexicanus
Brown-headed Cowbird	*Molothrus ater*
Lesser Goldfinch	*Carduelis psaltria*
House Finch	*Carpodacus mexicanus*
House Sparrow	*Passer domesticus*
European Starling	*Sturnus vulgaris*
Mammals	
Coyote	*Canis latrans*
Valley Pocket Gopher	*Thomomys bottae*
Desert Cottontail	*Sylvilagus audoboni*



artdavenpo@aol.com
01/24/2008 06:33 PM

To Stacey_Love@fws.gov
cc
bcc
Subject Re: PDFs and request for more information

History: This message has been replied to.

Stacey,

The attached file contains a signed and dated general certification statement for all of my reports; please feel free to attach a copy of it to all of my reports. As indicated in the cert, I collected the data. The dates of the surveys should be in the reports. I will have to get back to you regarding the other information (e.g., temp data and such). Requirements of No. 17 represent a complex mix of items needed for various species. That is, not all items were meant to apply to all species. However, I will try and put something together that is useful. Between the the various, differing, requirements of CDFG offices and the Fish and Wildlife Service, reporting has become a very time consuming event; it takes days to compile this stuff. It would be nice if the information requested by all was the same.

Art!

-----Original Message-----
From: Stacey_Love@fws.gov
To: artdavenpo@aol.com
Cc: Sandy_Marquez@fws.gov
Sent: Wed, 23 Jan 2008 2:49 pm
Subject: PDFs and request for more information

Hi Art,

Here are the PDFs you requested. Enjoy!

As I mentioned on the phone, we received several reports without a surveyor certification statement. They're also missing some methodology information such as names of personnel (even if it was just you, it should state that), dates of surveys, temperature and weather conditions at the beginning and end of each survey (please see number 17 of the terms and conditions of your permit). Many permittees put that information in a table, if that's helpful to you. Please send me the surveyor certification statements and additional methodology information (as best you can), and continue to send that information in the future. You don't need to resend the entire reports, just the additional information and I'll attach them to each report. We really appreciate all your efforts to send in the reports; we just need to tie up a few loose ends.

Here's the names of the reports:

CERTIFICATION

I hereby certify that the statements furnished above present the data and information required for this biological evaluation, and that the facts, statements, and information presented are true and correct to the best of my knowledge. Fieldwork conducted for this assessment was performed by me or under my supervision.

Date: Dec 31, 2007 Signed: Arthur E. Davenport



artdavenpo@aol.com
01/25/2008 05:54 PM

To Stacey_Love@fws.gov
cc
bcc
Subject Date, temp, and Weather Data

History: This message has been replied to.

Stacey,

The attached file contains the project related survey date, temp, and weather data as requested (it took about four hours to compile it). I am really sorry I snapped at you today, I am really frustrated with permit related issues (mainly with the State) and its bleeding over into areas it shouldn't. I rarely get that snappy so you can imagine how irritated I've become with the State. Again, please accept my apologies.

Sincerely,

Art

More new features than ever. Check out the new AOL Mail! [attachment "PrmtTable.doc" deleted by Stacey Love/CFWO/R1/FWS/DOI]

Table 1. Date, Temp, and Weather Data Per Project.

Project	Dates	Biologist	Temp Start/Stop (Fahrenheit)	Wind Start/Stop	Cloud Cover Start/Stop
Chiu Parcel-SBKR	10Sep07	A. Davenport	89/77	0/0	0/0
Chiu	11Sep07	A. Davenport	60/60; 62/62	0/0;0/0	0/0;0/0
Chiu	12Sep07	A. Davenport	69/69; 63/73	0/0;0/0	0/0;0/0
Chiu	13Sep07	A. Davenport	68/64; 64/64	0/0;0/0	0/0;0/0
Chiu	14Sep07	A. Davenport	65/65; 62/70	0/0;0/0	0/0;0/0
Chiu	15Sep07	A. Davenport	64/64; 59/72	0/0;0/0	0/0;0/0
Chiu	16Oct07	A. Davenport	55/60	2/1	100% ML/100% ML
Chiu	17Oct07	A. Davenport	54/59	0/0	100% ML/100% ML
Chiu	18Oct07	A. Davenport	49/64	0/0	5%/5%
Chiu	19Oct07	A. Davenport	58/70	0/1	5%/0
Chiu	20Oct07	A. Davenport	57/68	0/0	0/0
Mentone Pipeline-SBKR	21Aug07	A. Davenport	73/72; 66/76	0/0;0/0	0/0;0/0
Mentone Pipeline	22Aug07	A. Davenport	70/70; 66/76	1/1;0/0	0/0;0/0
Mentone Pipeline	23Aug07	A. Davenport	70/67; 62/62	0/0;0/0	0/0; 100% ML/100% ML
Mentone Pipeline	24Aug07	A. Davenport	66/66; 60/61	0/0;0/0	0/0;0/0
Mentone Pipeline	28Aug07	A. Davenport	73/71; 69/68	0/0;1/1	0/0;0/0
Mentone Pipeline	29Aug07	A. Davenport	75/73; 73/74	0/0;0/0	0/0;0/0
Mentone Pipeline	30Aug07	A. Davenport	88/88; 83/84	0/1;0/0	80%/80%; 80%/50%
Mentone Pipeline	31Aug07	A. Davenport	81/81; 80/80	0/0;0/0	30%/30%; 30%/30%
UPRR-YCRA & DPFI	19Mar07	A. Davenport	70/70	2/2	20%/20%
UPRR	20Mar07	A. Davenport	58/66	0/1	20%/40%
UPRR	21Mar07	A. Davenport	60/61	0/0	80%/80%
UPRR	24Apr07	A. Davenport	59/82	0/0	0/0
UPRR	25Apr07	A. Davenport	58/72	0/0	0/0
UPRR	26Apr07	A. Davenport	64/64	0/0	0/0
UPRR	22May07	A. Davenport	68/80	2/1	0/0
UPRR	23May07	A. Davenport	71/85	1/1	0/0
UPRR	24May07	A. Davenport	66/91	0/0	10%/5%
UPRR	7Sep07	A. Davenport	84/102	0/0	0/0
Redlands-SBKR	18Jul07	A. Davenport	65/65; 61/68	0/0; 0/0	0/0; 0/0
Redlands	19Jul07	A. Davenport	76/76; 60/65	0/0; 0/0	0/0; 0/0
Redlands	20Jul07	A. Davenport	72/72; 69/74	0/0; 0/0	0/0; 0/0
Redlands	21Jul07	A. Davenport	70/70; 61/68	0/0; 0/0	0/0; 0/0
Redlands	22Jul07	A. Davenport	68/68; 64/68	0/0; 0/0	0/0; 5%/10%
Redlands	23Jul07	A. Davenport	73/73; 70/75	0/0; 0/0	70%/70%; 100%/100%
Redlands	24Jul07	A. Davenport	75/75; 67/75	0/0; 1/1	50%/50%; 10%/10%
Redlands	25Jul07	A. Davenport	77/77; 67/74	0/0; 0/0	0/0; 0/0
Redlands	26Jul07	A. Davenport	75/75; 66/76	0/0; 0/0	5%/5%; 5%/1%
Redlands	27Jul07	A. Davenport	75/75; 66/74	1/1; 0/1	10%/10%; 5%/10%
Redlands	3Aug07	A. Davenport	75/75;72/75	0/0; 0/0	50%/50%; 0/5%
Redlands	4Aug07	A. Davenport	70/70;65/72	0/0; 0/0	0/0; 5%/20%
Redlands	5Aug07	A. Davenport	70/70; 65/72	0/0; 0/0	100%ML/50%ML
Redlands	6Aug07	A. Davenport	75/75; 63/72	0/0; 0/0	0/0; 100%ML/50%ML
Redlands	7Aug07	A. Davenport	75373; 58/64	0/0; 0/1	0/20%ML; 100%ML/100%ML
NCTD Trestles-ARTO	30Apr07	A. Davenport	65/65; 61/61	0/0; 0/0	0/0; 0/0
NCTD Trestles	31Apr07	A. Davenport	62/82; 60/60	0/0; 0/0	0/0; 0/0
NCTD Trestles	1May07	A. Davenport	62/60	0/0	100%ML/100%ML
NCTD Trestles	2May07	A. Davenport	61/60	1/3	60%ML/60%ML
Lib. Enrgy-YCRA	21May07	A. Davenport	71/79	0/3	0/0
Lib. Enrgy	24May07	A. Davenport	66/64	0/0	10%/5%
Lib. Enrgy	2Jun07	A. Davenport	77/81	0/1	20%/80%

AR074006

Lib. Enrgy	17Jun07	A. Davenport	68/90	1/1	0/0
Lib. Enrgy	24Jun07	A. Davenport	72/87	0/0	10%/10%
Lib. Enrgy	1July07	A. Davenport	72/87	0/0	5%/5%
Lib. Enrgy	7July07	A. Davenport	82/91	0/0	0/0
GlenHelenPrkwy-CAGN	21Dec06	A. Davenport	45/53	0/1	0/0
GlenHelenPrkwy	30Dec06	A. Davenport	53/69	0/1	0/0
GlenHelenPrkwy	6Jan07	A. Davenport	44/55	0/10	0/0
GlenHelenPrkwy	21Jan07	A. Davenport	50/60	0/5	0/0
GlenHelenPrkwy	27Jan07	A. Davenport	48/56	0/2	20%/30%
GlenHelenPrkwy	4Feb07	A. Davenport	67/70	5/10	0/0
GlenHelenPrkwy	9Feb07	A. Davenport	55/65	0/0	50%/50%
GlenHelenPrkwy	17Feb07	A. Davenport	65/70	2/6	0/0
GlenHelenPrkwy	18Feb07	A. Davenport	63/78	1/2	20%/50%
GlenHelenPrkwy	24Feb07	A. Davenport	50/65	2/2	0/0
La Tuna Cyn-CAGN	24Mar07	A. Davenport	54/66	0/0	100%ML/50%ML
La Tuna Cyn	31Mar07	A. Davenport	50/63	1/0	0/0
La Tuna Cyn	7Apr07	A. Davenport	54/64	0/0	100%ML/100%ML
La Tuna Cyn	21Apr07	A. Davenport	53/60	1/1	0/20%ML
La Tuna Cyn	28Apr07	A. Davenport	66/72	1/1	0/0
La Tuna Cyn	110May07	A. Davenport	68/74	1/1	0/0

Rec 9342
County Riverside
Year 2007
Spp YCR (—)
Sec. P. D.B. DK 5/16/08
GIS
DFG

GRIFFITH WILDLIFE BIOLOGY

John T. Griffith
22670 Hwy M-203
PO Box 47
Calumet, MI 49913

FILE COPY

14 June 2007

Jill Himes
Himes Consulting LLC
3272 West Venice Way
Chandler, AZ 85226

RE: 2007 Yuma clapper rail and black rail protocol survey at Mayflower Park

Ms. Himes:

I have completed protocol surveys for the Yuma clapper rail (2-3 surveys at least 7 days apart between 15 March and 31 May) and black rail (3 surveys, once each in the last 10 days of March, April, and May) at Mayflower Park (along the Colorado River upstream of Blythe) in Riverside County, California.

The surveys were performed on 28 March, 25 April, and 30 May 2007. No Yuma clapper rail or black rail were detected.

A map showing the project location, an aerial photograph showing the survey area, photographs of the survey area, and Yuma clapper rail protocol survey forms are attached.

Potential habitat (emergent vegetation such as cattails and rushes) for the rails exists in the area to be dredged, but most of the lagoon has filled in and supports, as does the surrounding upland, arrow weed, mesquite, and willow habitat more suitable for Arizona Bell's vireo and southwestern willow flycatcher (neither of which species were detected during the rail surveys and likely would have been if present).

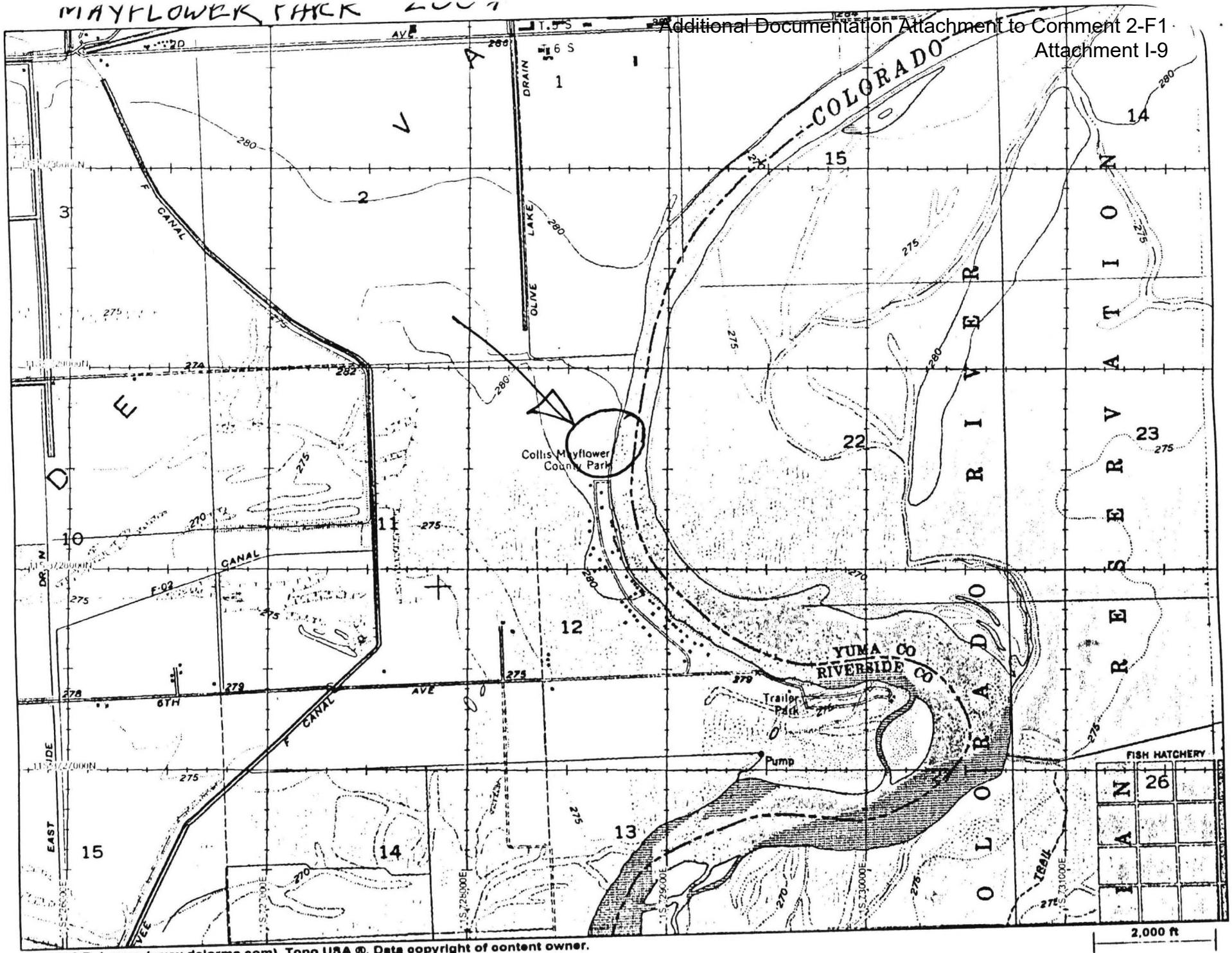
There is tamarisk growing in the study area. The dredging operation may offer an opportunity to remove all of this invasive, non-native species.

Thank you for the opportunity to perform these protocol surveys. Please let me know if you need any additional information.

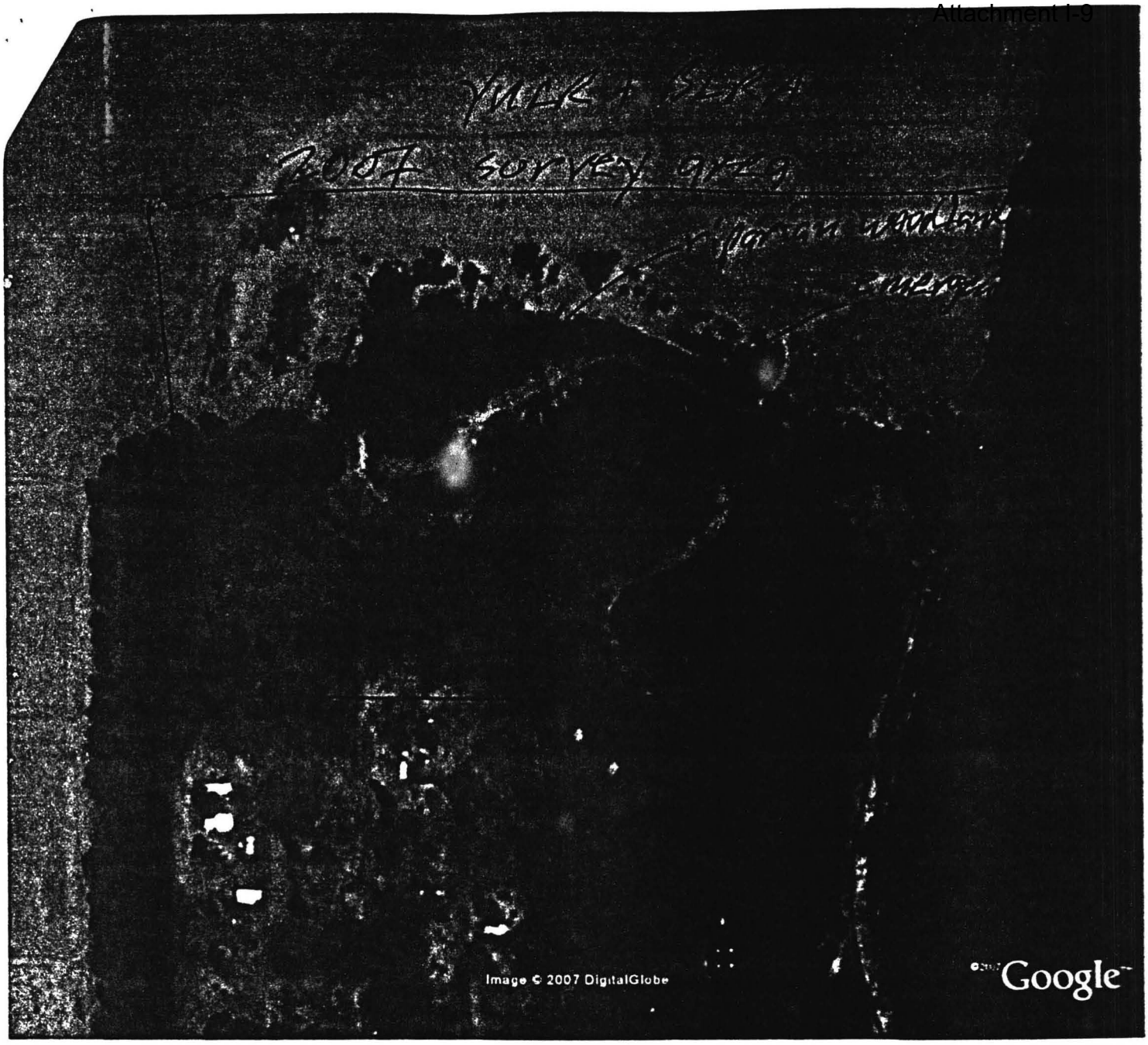
John T. Griffith

RECEIVED
MAY 14 2008
U.S.F.W.S.
CARLSBAD FIELD OFFICE, NM

MAYFLOWER PARK 2004

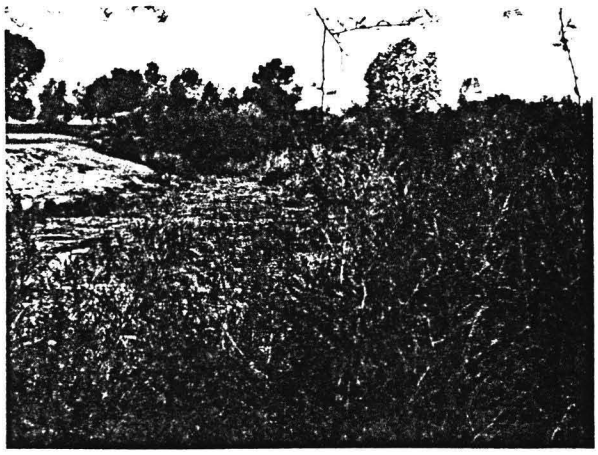


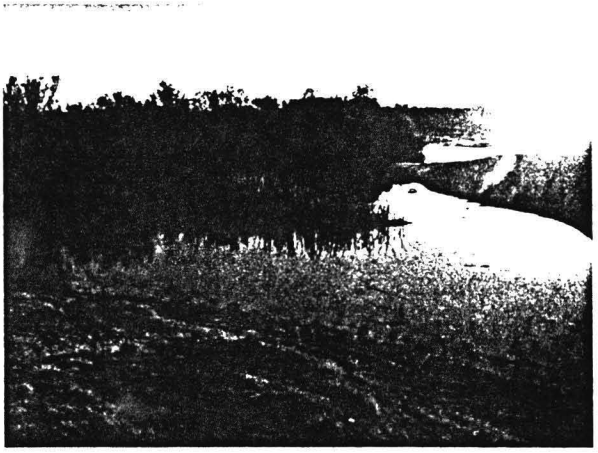
© 2002 DeLorme (www.delorme.com). Topo USA ®. Data copyright of content owner.
Scale: 1 : 26,000 Map Rotation: 0° Magnetic Declination: 0.0°E



MAYFLOWER PARK 2007

Mayflower Park 2007 Yuma clapper rail and black rail survey area.








YUMA CLAPPER RAIL SURVEY
COVER SHEET
(JANUARY 2000)

RPT Date: 6/12/2007

Location Information:
Location Name MAYFLOWER PARK Route NA / RIV. CO. PARK
Map Name BLYTHE NE Township/Range/Section T6S R23E S12
Observer(s) JOHN T. GRIFFITH

Weather:
1) 0545 Start %Cloud Cover 0 Temp 43 Wind Speed 0
0845 End % Cloud Cover 0 Temp 59 Wind Speed 0
28 MAR 07

Data Summary:

1) Total individual rails seen or heard while surveying Ø
2) Number of other rails seen or heard (incidentals) Ø

Total rails per route or location equals #1+#2 Ø
For rails/hour, each stop is 7 minutes

Observations:

Events during survey that may have affected results: Ø
3 protocol surveys; Ø RAILS

Other Observations/Comments: see attached

2) 0545 / 80% / 60 / 0
0845 / 100% / 74 / 2.2
25 AP 07

3) 0500 / 0% / 68 / 2.3
0830 / 0% / 84 / 6.4
30 MY 07

AR074013



"Jane/John Griffith"
<griffithwildlifebiology@hughes.net>
05/02/2008 07:00 AM

To <Stacey_Love@fws.gov>
cc
bcc
Subject Re: packages from GWB

Dear Stacey,

The 2007 work at Lacda that needed a permit was performed by John Griffith (swfl surveys with tape and some incidental nest monitoring) and Art Davenport (late season swfl surveys with tape). Art has his own permit.

Dan Medic performed vireo surveys without a tape, so he did not need a permit.

The other 2007 work was performed by John. 758175

We'll make sure to be specific with permit numbers in the 2008 reports (so far John is performing all the surveys and monitoring).

Best,

Jane

Jane Griffith
John Griffith
906 337-0782
www.griffithwildlife.com

----- Original Message -----
From: Stacey_Love@fws.gov
To: Jane/John Griffith
Sent: Thursday, May 01, 2008 4:52 PM
Subject: Re: packages from GWB

Hi Jane,

I'll ask Sandy about the 2007 reports.

Yes, the Needles reports should go to Ventura.

Thanks for the clarification on the Camp Pendleton report. Please make sure this information (all individuals permitted to independently conduct activities and all permit numbers) is in future reports. I may need to contact you again with this same question for the 2007 reports.

Thanks again,
Stacey

Record Id 9381
County Imperial
Year 2008
Spp YCR (—)
Srv. Rpt.
D.B. DC 6/18/08
GIS
L+R

FOCUSED SURVEY
YUMA CLAPPER RAIL
Hudson Ranch Geothermal I Plant Project
(Section 24; T11S, R13E; Niland 7.5 " USGS Quadrangle)
Imperial County, CA

Prepared for:

Environmental Management Associates, Inc.
588 Explorer Street
Brea, CA 92821

By

Arthur Davenport
Davenport Biological Services
P.O. Box 1692
Barstow, California 92312
619-729-4242

June 10, 2008

RECEIVED
JUN 17 2008
US FWS
CARLSBAD FIELD OFFICE CA

Introduction

Davenport Biological Services (DBS) was hired by Environmental Management Associates, Inc. to complete presence/absence surveys for endangered species near Niland, California (Figure 1). The surveys were completed within the project area of the Hudson Ranch Geothermal I Power Plant project site. Within this area, and a 200 meter buffer, a focused survey was completed for the Yuma clapper rail (*Rallus longirostris yumanensis*).

Yuma Clapper Rail
The Yuma clapper rail was listed as an endangered species under the Endangered Species Act of 1973, as amended, on 11 March 1967 (FR 32:4001). The Yuma clapper rail is also listed as threatened under California's Endangered Species Act.

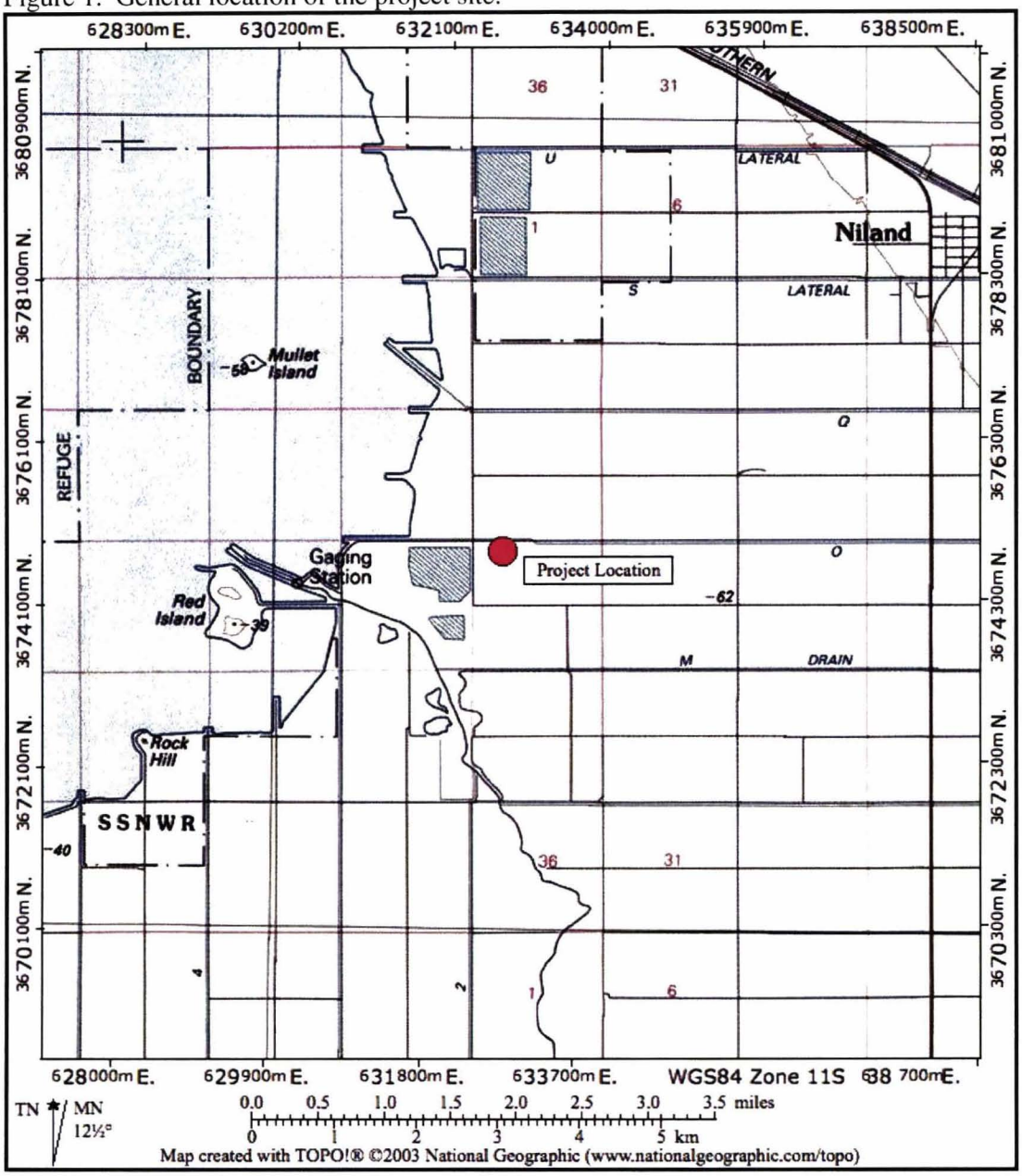
The Yuma clapper rail is common in Imperial County with local populations occurring at the Sony Bono National Wildlife Refuge, Imperial Wildlife Area, as well as within other patches of suitable marsh habitat throughout the valley. In 2007, 102 rails were detected at the Sony Bono National Wildlife Refuge and 398 detected within the Imperial Wildlife Area (USFWS unpub. data, 2008). Three pairs of Yuma clapper rails were detected in drains located approximately two miles east of the Imperial Wildlife Area (Davenport 2007). The habitat within the drains was narrow and dominated by cattail (*Typha latifolia*). The Yuma clapper rail occurs along the Colorado River and occurs as far north as Littlefield, Arizona (Gerald Braden, San Bernardino County Museum, pers. comm., 2008). It is important to note that on pair of Yuma clapper rails was detected at Walt's Place in 1992 (William Radke, USFWS, pers. comm., 2008). Walt's Place coincides with the project location.

Information regarding the migration patterns of Yuma clapper rails is contradictory. There is some indirect evidence that they move post breeding. However, other studies did not detect migration (Eddleman 1989). Yuma clapper rails begin pair formation in mid February. First nests of Yuma clapper rail have been documented in mid March. Peak nest initiation is in mid May (Eddleman 1989).

The Yuma clapper rail occupies marsh habitats including canals and drains where cover and food is available. Vegetative cover often consists of cattail (*Typha latifolia*) and bulrush (*Scirpus acutus*). This species has also been observed in wetlands where there is a canopy of tamarisk (*Tamarix ramosissima*), and an understory of cattails or other wetland plants (e.g., bullrush). The food of the clapper rail includes a variety of invertebrate species, including crayfish and insects.

The survey was completed under Federal Recovery Permit # TE802450-5

Figure 1. General location of the project site.



Methods

Field Survey

The focused survey was repeated five times, and the surveys were completed at least one week apart. During each of the five survey events, two survey passes were completed of all potentially suitable habitat on, and within, 200 meters of the project site. Thus, a total of 10 focused survey passes were completed during the course of this study. The two survey passes were spaced a minimum of 0.5 hours apart. During each survey pass, rails were listened for at sites spaced approximately 25 meters apart along the edge of the habitat. At each of these sites, a passive attempt to detect rails by their naturally occurring calls was completed for approximately 3 minutes. Following the listening for naturally occurring calls, two series of "kek" calls of the clapper rail were broadcast using an amplifier speaker (Mini Amplifier Speaker, RadioShack,

Cat. NO. 277-1008C). Following the broadcast of calls, responding rails were listened for during a two to three minute period of time prior to moving on to the next listening location. This method was repeated throughout the survey area.

Per the general annual census survey protocol for Yuma clapper rails, the first two surveys were completed between March 15 and May 15, 2008. The focused survey for Yuma clapper rails was initiated on 15 March 2008, and was completed on 17 April 2008. Morning surveys were initiated around 0700 and completed by 1000 hours and evening surveys were completed within two hours of sunset (Table 1). A sixth survey was also completed on 15 May 2008. This survey was completed in conjunction with a survey for the southwestern willow flycatchers (*Empidonax traillii extimus*) and consisted of only one survey pass.

Table 1. Shows date, survey time, and weather conditions during each survey pass.

Survey Date	Time	Temperature (F°)	Wind Speed (mph)	Cloud Cover (%)
	Start/Stop	Start/Stop	Start/Stop	
15 March 2008	0730/0930	55/60	5-10/5-10	0/0
24 March 2008	0700/0930	47/53	0/0	0/0
31 March 2008	0700/0930	51/58	0/0-1	0/0
6 April 2008	1800/2000	80/75	0-1/0-1	0/0
17 April 2008	0730/0930	66/68	0-1/1-5	0/0
15 May 2008	0730/0930	71/83	0-1/0-1	5/5

The species of all birds observed was recorded (Appendix 1).

Background Search
Information regarding the historic distribution of Yuma clapper rails in the vicinity of the proposed project was also reviewed. In this regard, information from the Sonny Bono National Refuge, Museum of Vertebrate Zoology, Berkley, and California Natural Diversity Data Base was reviewed.

Results

Background Search
The Yuma clapper rail was documented at the project site in 1992 (William Radke, US Fish and Wildlife Service, pers. comm., 2008). Other than this previous sighting, no other documentation of Yuma clapper rail for the site was found. However, Yuma clapper rails are known to currently exist within the Hazard Unit of the Sonny Bono National Wildlife Refuge. The Hazard Unit is located approximately 0.5 miles to the west of the project area. Additionally, additional Yuma clapper rails are known to exist within the Imperial Wildlife Area, which is located approximately two miles north of the project site.

Field Survey
Approximately 8.6 acres of suitable habitat was found to exist on site (Figures 2, 3, and 4). No Yuma clapper rails were observed or otherwise detected during this survey.

Figure 2. Shows border of project and location and amount of Yuma clapper rail habitat within project area.

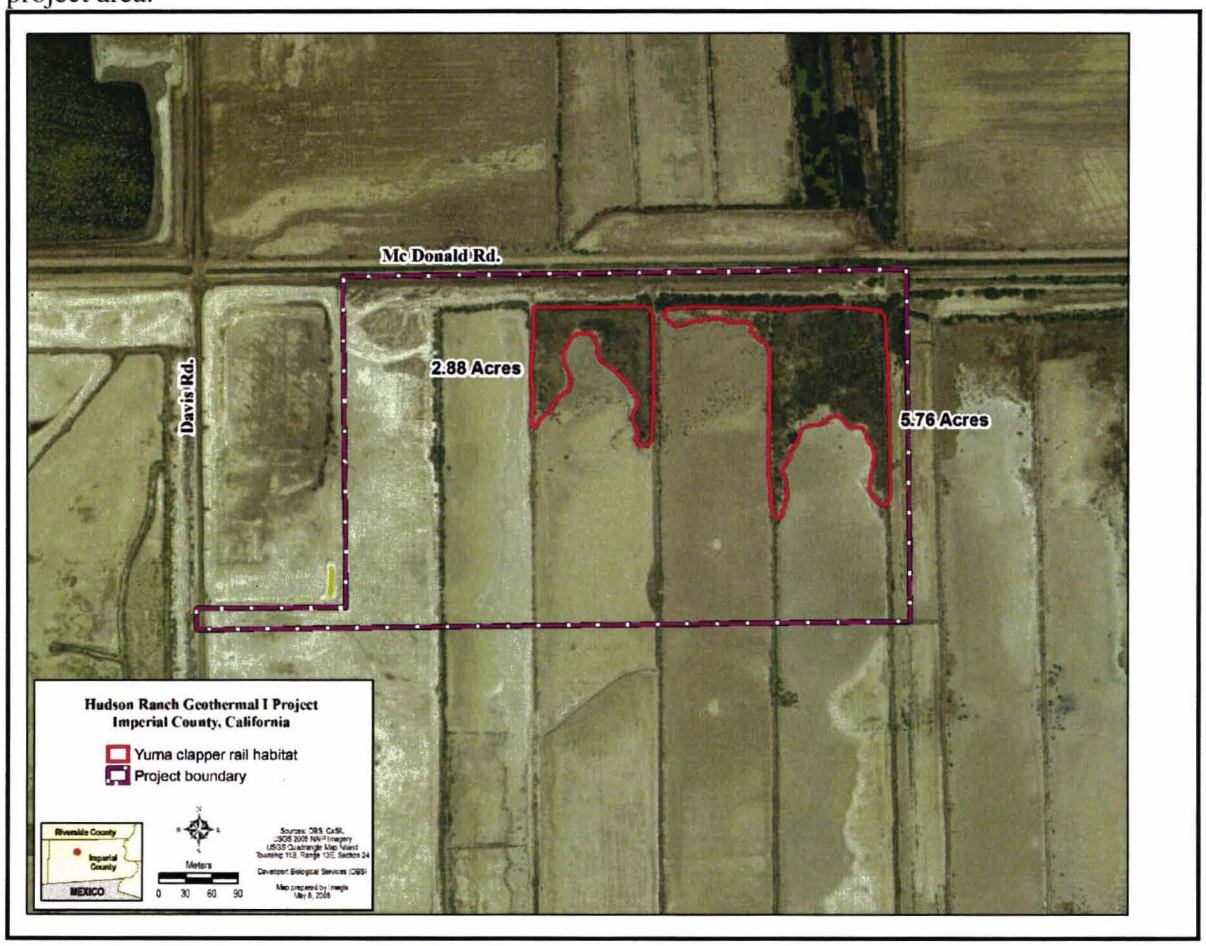


Figure 3. Shows border of project and location and amount of Yuma clapper rail habitat within project area.

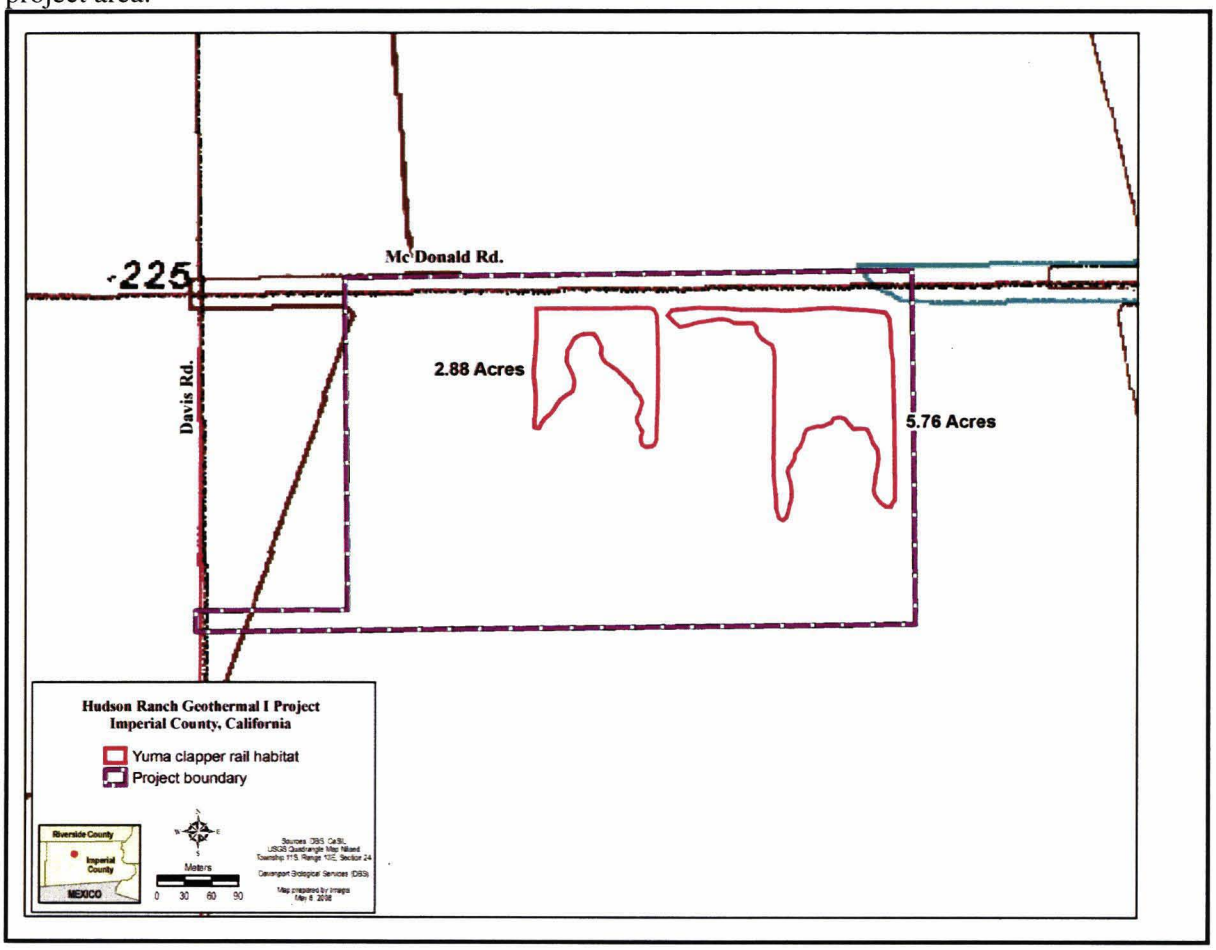
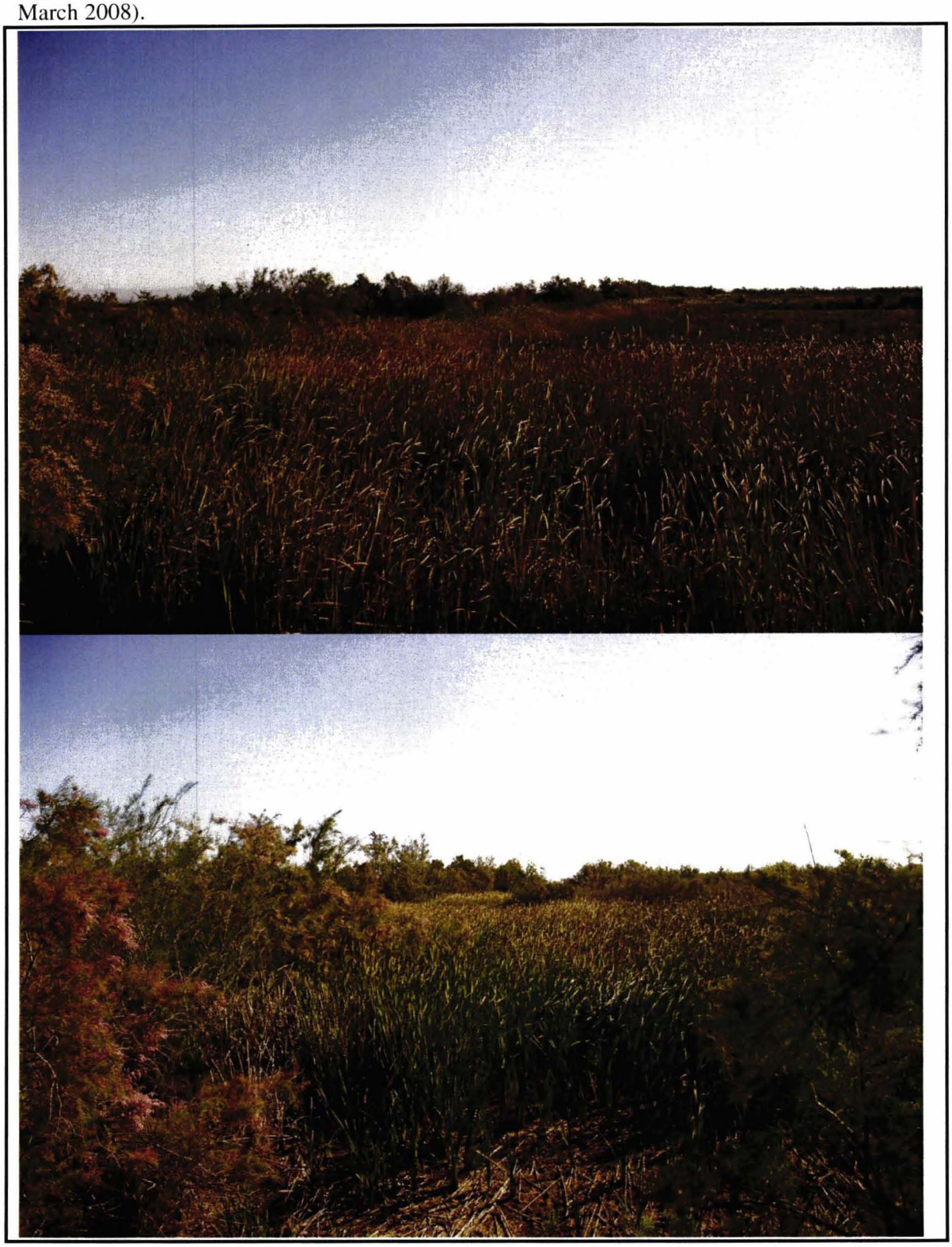


Figure 4. Shows condition of habitat found within project area during March (Photos take 15 March 2008).



Discussion

The absence of Yuma clapper rails is likely due to the changes in water availability that occurs at this site. Water is added to the ponds in the fall in anticipation of the waterfowl-hunting season. The ponds are then emptied or otherwise allowed to dry in the spring. Thus, nesting conditions for Yuma clapper rail declines rapidly due to the diminishing availability of water and food. These declining conditions likely discourage nesting attempts by the rails in this area.

Conclusion

During the 2008 nesting season, no Yuma clapper rails were detected on or within 200 meters of the project site. Thus, the site was determined to be unoccupied by Yuma clapper rails during the nesting season of 2008.

References

American Ornithologists' Union. 1957. Checklist of North American Birds. 5th ed. American Ornithologists' Union, Washington, DC.

California Department of Fish and Game. 2006. California Natural Diversity Data Base, Rare Find.

Eddleman, W. R. 1989. Biology of the Yuma Clapper Rail in Southwestern U.S. and Northwestern Mexico. Final Report. U. S. Bureau of Reclamation, Yuma Projects Office and U. S. Fish and Wildlife Service, Region 2.

Eddleman, W. R., and C. J. Conway. 1998. Clapper Rail (*Rallus longirostris*). In The Birds of North America, No. 340 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Garrett, K. & J. Dunn. 1981. *Birds of Southern California*. The Artesian Press, Los Angeles California. Published by the Los Angeles Audobon Society.

Rosenberg, K.V., R.D. Ohmart, W.C. Hunter, and B.W. Summer. 1991. Birds of the Lower Colorado River Valley. University of Arizona Press.

U.S. Fish and Wildlife Service. 1995. Endangered and threatened wildlife and plants; determination of endangered status for the southwestern willow flycatcher. Federal Register 60: 10715.

Appendix 1. Animals observed within the survey area (based on direct observation and/or sign).

ANIMALS

INVERTEBRATES
Lepidoptera

Cabbage White	*Pieris rapae*
West Coast Lady	*Vanessa annabella*

VETEBRATES
Reptiles

Desert Spiney lizard	*Sceloporus magister*

Birds

Green Heron	*Butorides virescens*
Killdeer	*Charadrius vociferus*
Gull-billed Tern	*Gelochelidon nilotica*
Turkey Vulture	*Cathartes aura*
Northern Harrier	*Circus cyanus*
American Kestrel	*Falco sparverious*
Mourning Dove	*Zenaida macroura*
Anna's Hummingbird	*Calypte anna*
Western Wood-Pewee	*Contopus sordidulus*
Pacific-slope Flycatcher	*Empidonax difficillis*
Black Phoebe	*Sayornis nigricans*
Say's Phoebe	*Sayornis saya*
Western Kingbird	*Tyrannus verticalis*
Common Raven	*Corvus corax*
Northern Rough-wing Swallow	*Stelgidopteryx serripennis*
Barn Swallow	*Hirundo rustica*
Black-tailed Gnatcatcher	*Polioptila melanura*
Wilson's Warbler	*Wilsonia pusilla*
Yellow-Rumped Warbler	*Dendroica coronata*
Common Yellowthroat	*Geothlypis trichas*
Warbling Vireo	*Vireo gilvus*
Marsh Wren	*Cistothorus palustris*
Song Sparrow	*Melospiza melodia*
White-crowned Sparrow	*Zonotrichia albicollis*
Red-winged Blackbird	*Agelaius phoeniceus*
Brown-headed Cowbird	*Molothrus ater*
Lesser Goldfinch	*Carduelis psaltria*
House Finch	*Carpodacus mexicanus*
European Starling	*Sturnus vulgaris*

Mammals

Coyote	*Canis latrans*
Raccoon	*Procyon lotor*
Desert Cottontail	*Sylvilagus audoboni*

CERTIFICATION

I hereby certify that the statements furnished above present the data and information required for this biological evaluation, and that the facts, statements, and information presented are true and correct to the best of my knowledge. Fieldwork conducted for this assessment was performed by me. I certify that I have not signed a nondisclosure or consultant confidentiality agreement with the project applicant or applicant's representative and that I have no financial interest in the project.

Date: June 10, 2008 Signed: Ruth E. Davenport

Record Id 95 33
County Imperial
Year 2007
Spp YCR (+)
Srv. Rpt.
D.B. Dic 8/4/08
GIS
L+R
File

Konecny Biological Services

Biological Consulting, Research, Conservation

June 26, 2008

Fish and Wildlife Service
6010 Hidden Valley Road
Carlsbad, CA 92009

Attn: Ms. Stacey Love

Re: Requested Reports

Dear Ms. Love:

This letter summarizes the results of a Yuma clapper rail survey I conducted for EcoSystems Restoration Associates (ERA), a San Diego based consulting firm, in 2007. Thirty-eight plots were surveyed in the Imperial Valley and Yuma area (see Year I Rail Survey Locations, Imperial Valley Area and AAC – Yuma area, attached) as baseline data for the Imperial Irrigation District (IID). ERA is preparing a Habitat Conservation Plan for IID.

Of the thirty-eight plots, Yuma clapper rails were detected in four; PS-33; PS-25; PS-9; and PR1-37. Imagery of the rail locations in these five plots is attached. Two pairs of Yuma clapper rails were detected in PS-33, east of Fig Lagoon. One pair and one advertising male Yuma clapper rail were detected in PS-25, in the Wister Unit of the California Department of Fish and Game. One pair of Yuma clapper rails and a California black rail were detected in PS-9 on the south side of the All American Canal. One pair of Yuma clapper rails was detected in PR1-37, by the Imperial Dam. A California black rail was detected in PS-3, south of the Imperial Dam. No other Yuma clapper rails were detected in the other thirty-four plots.

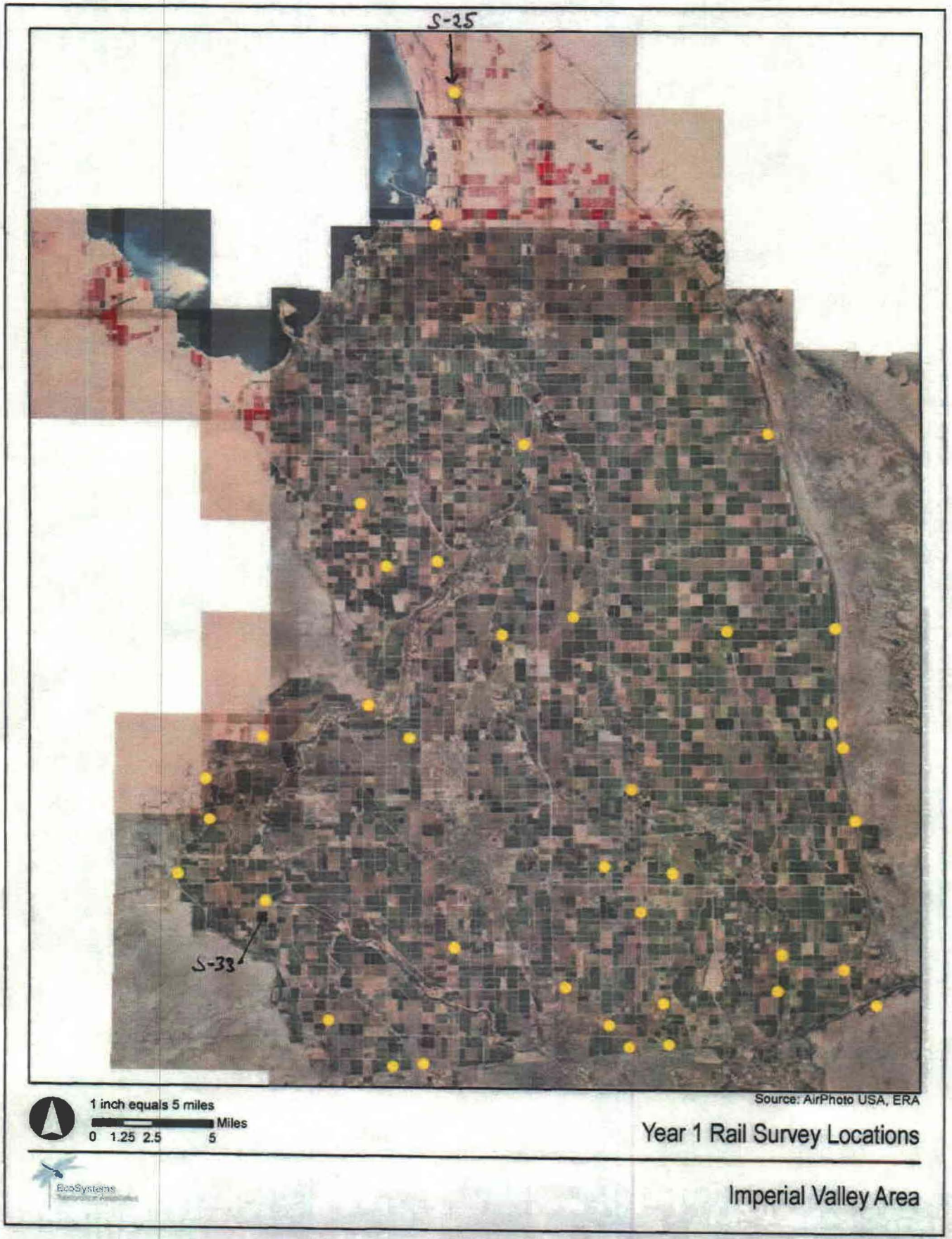
A report describing the complete faunal survey results in these thirty-eight plots will be provided by ERA. I certify that the information in this letter report and attached exhibits fully and accurately represent my work. If you have any questions or require additional information, please contact me at (760) 489-5276, the letterhead address, or jkonecny@cox.net.

Sincerely,

John K. Konecny

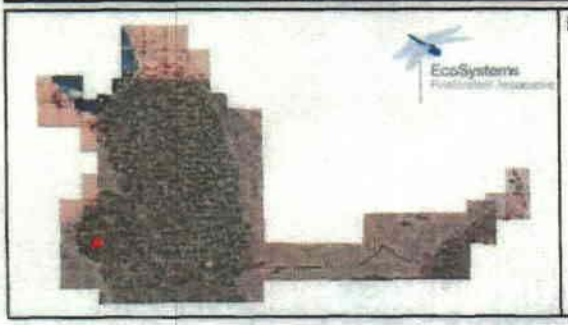
John K. Konecny
TE837308-4

1501 East Grand Avenue, # 2403, Escondido, California, 92027
Tel (760) 489-5276 E-mail jkonecny@nethere.com


S-25
S-33
1 inch equals 5 miles
Miles
0 1.25 2.5 5
Source: AirPhoto USA, ERA
Year 1 Rail Survey Locations
Imperial Valley Area

S-3
R1-4
S-9
Source: Airphoto USA
Year 1 Rail Survey Locat
AAC - Yuma 2
1 inch equals 5 miles
Miles
0 1.25 2.5 5
EcoSystems


PS-33
600 ft
Edge-to-Edge
150 ft
YCR
YCR
PS-33-PC1
Year 1 Point Count Locations
Rail
Year 1 Point Count 50m Buffers
Sentinel Plots
Year 1 Rotating Plots
0 100 200 400
Feet


EcoSystems

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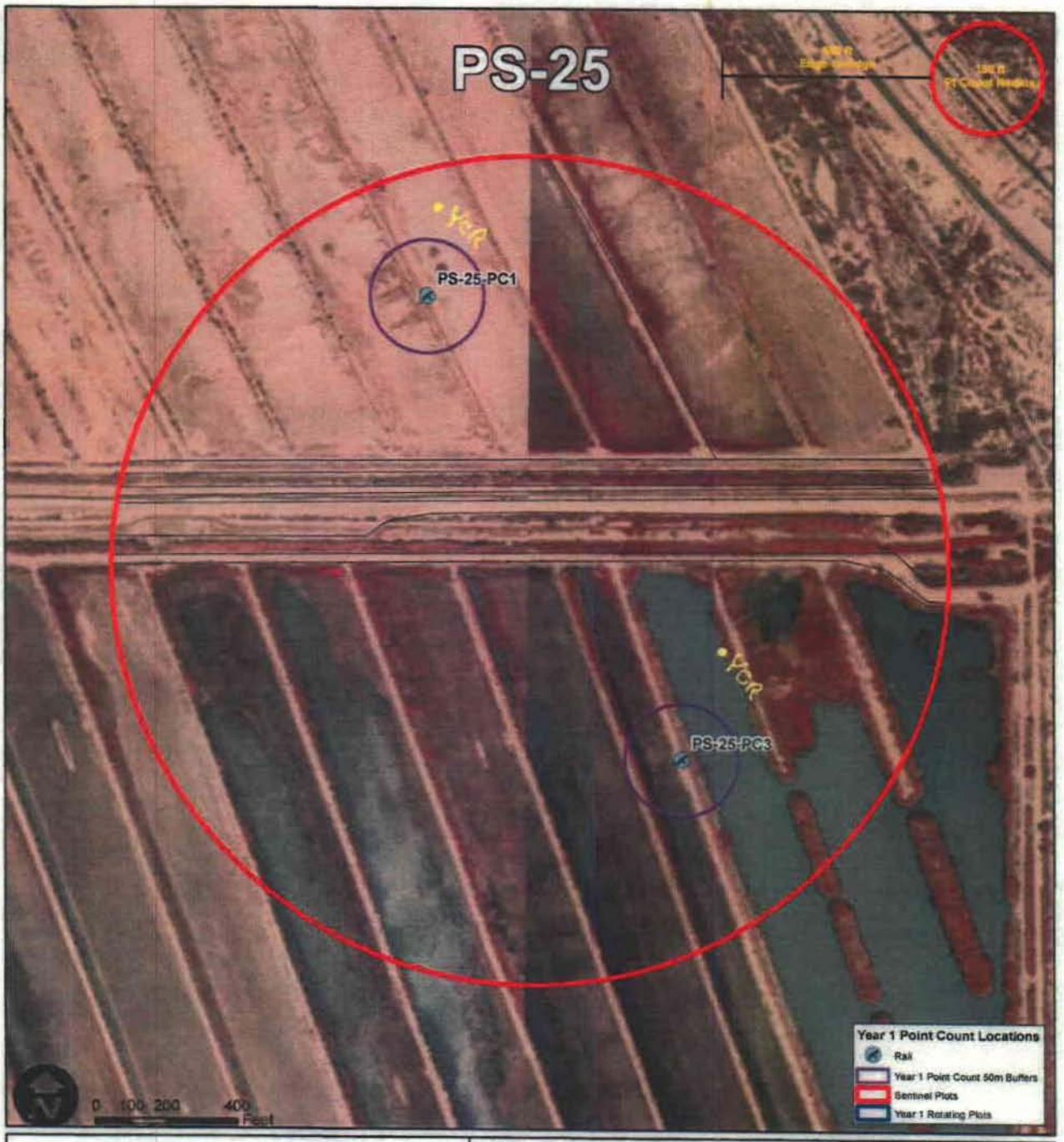
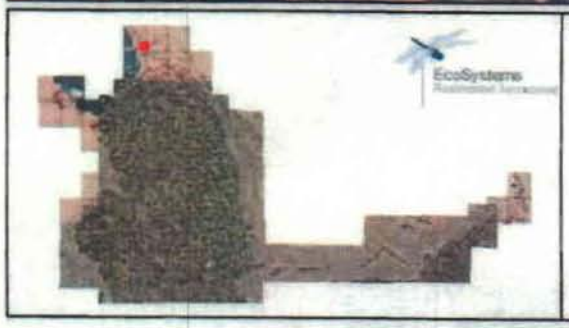

PS-25
PS-25-PC1
PS-25-PC3
Year 1 Point Count Locations
Rail
Year 1 Point Count 50m Buffers
Sentinel Plots
Year 1 Rotating Plots
0 100 200 400
Feet



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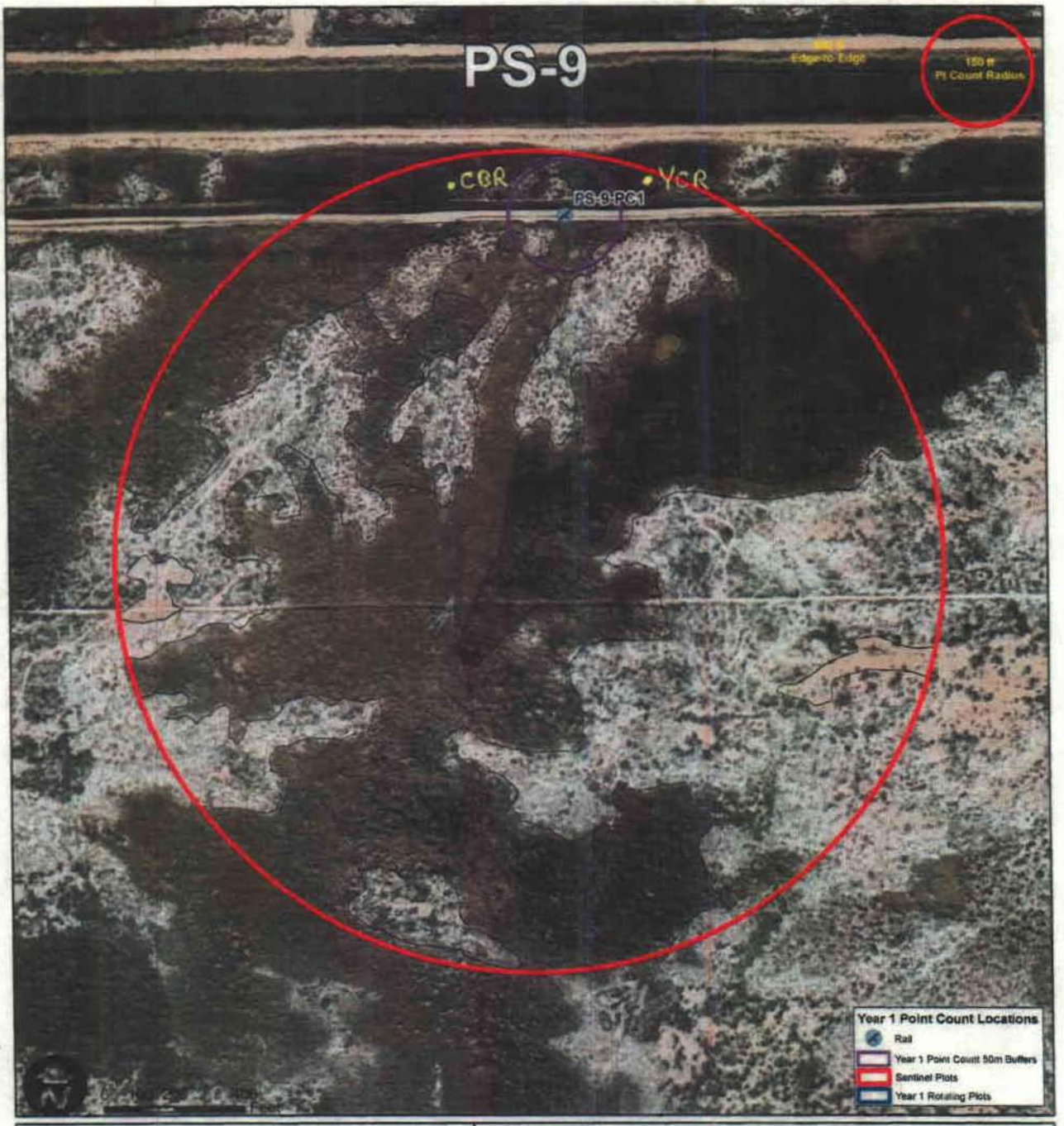
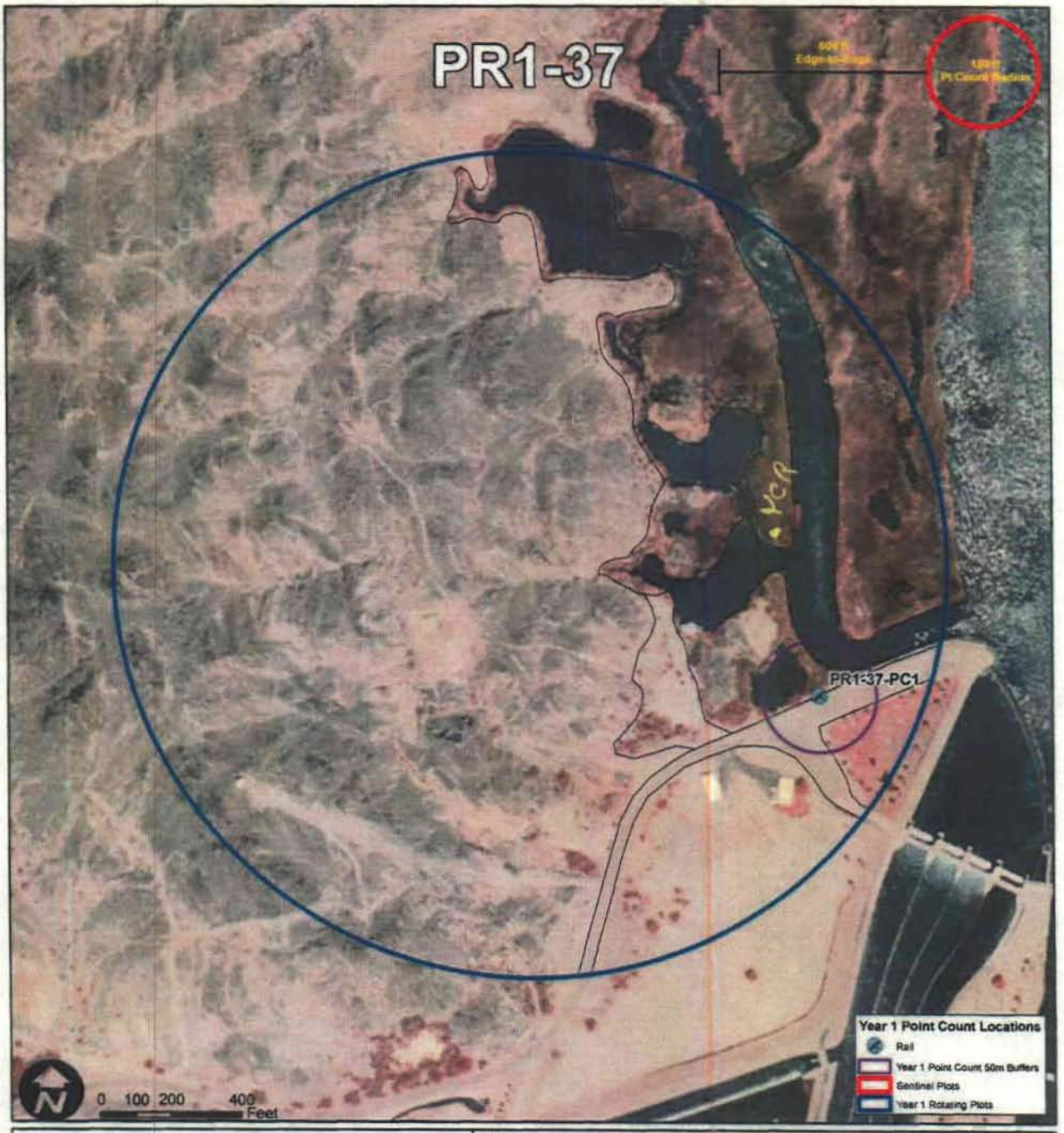
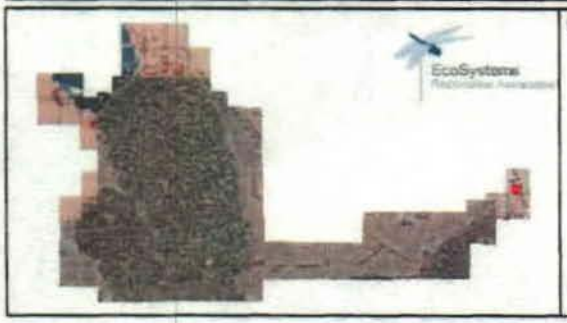

PS-9
Edge-to-Edge
150 m
Pt Count Radius
CBR
YCR
PS-9-PC1
Year 1 Point Count Locations
Rail
Year 1 Point Count 50m Buffers
Sentinel Plots
Year 1 Rotating Plots


EcoSystems

Notes:


PR1-37
PR1-37-PC1
Year 1 Point Count Locations
Rail
Year 1 Point Count 50m Buffers
Sentinel Plots
Year 1 Rotating Plots
N
0 100 200 400
Feet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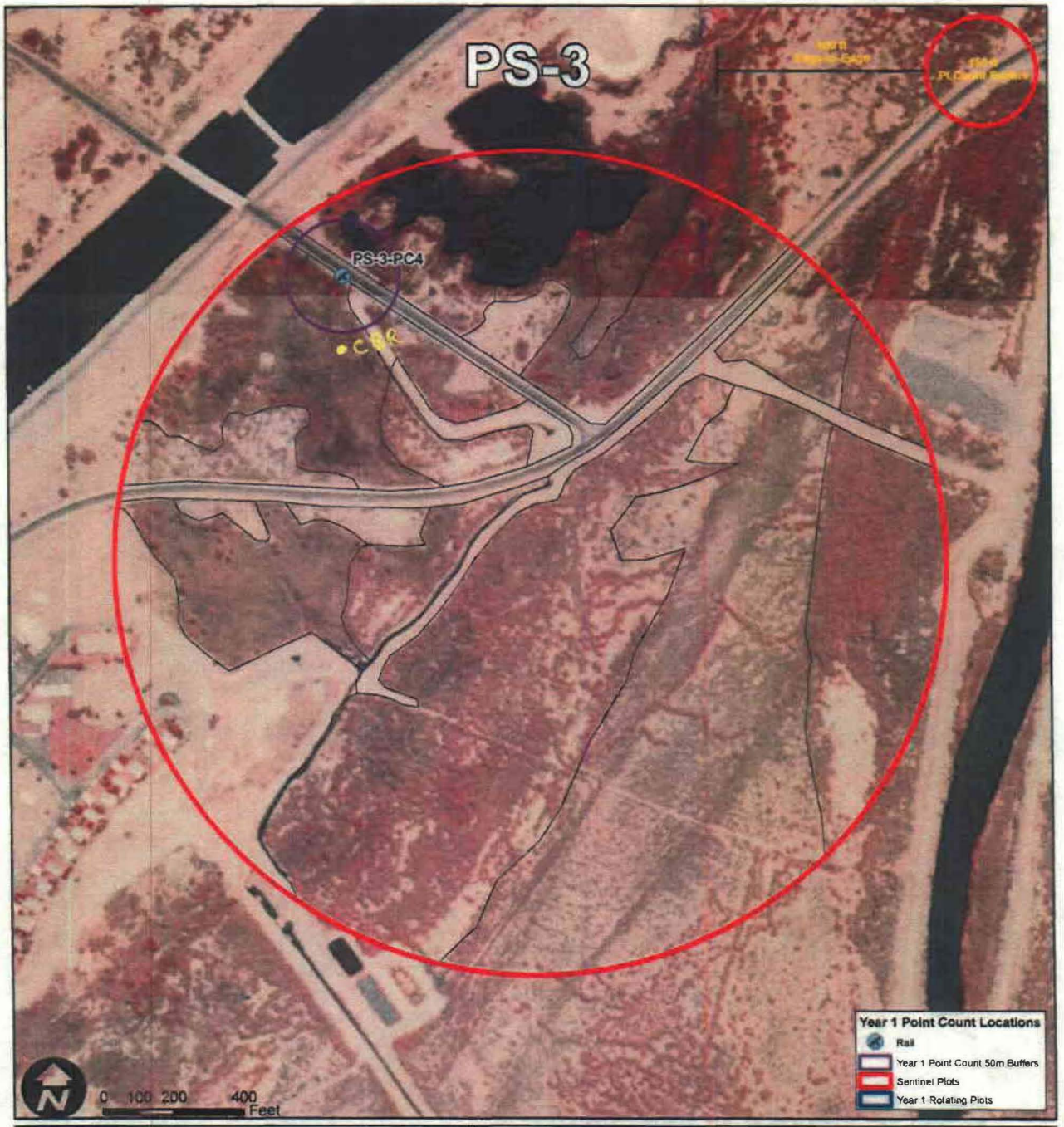
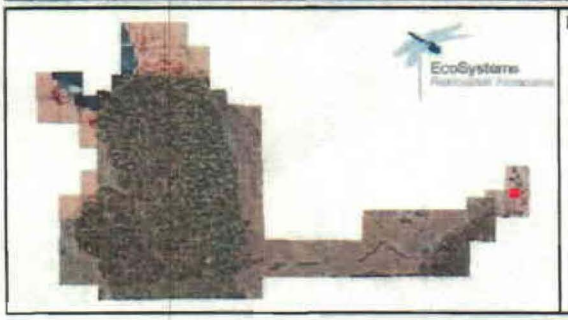

PS-3
PS-3-PC4
Year 1 Point Count Locations
Rail
Year 1 Point Count 50m Buffers
Sentinel Plots
Year 1 Rotating Plots
0 100 200 400
Feet


EcoSystems

Notes:



"John Konecny"
<jkonecny@cox.net>
07/17/2008 01:37 PM

To <Stacey_Love@fws.gov>
cc
bcc
Subject RE: IID report

Stacey,
The attached has the additional information you need. If you need something else, please call me

JK

From: Stacey_Love@fws.gov [mailto:Stacey_Love@fws.gov]
Sent: Monday, June 30, 2008 11:43 AM
To: jkonecny@cox.net
Subject: IID report

John,

I received your report--thank you. I'm sorry that I didn't understand that you were only sending me the results of the survey. I need the information specified under the 45-day report section of the Terms and Conditions of your permit (please see number 13) before considering your reporting complete. Specifically, please provide the methodology information described under 13.c. I'll paste it in here for your reference: "a complete description of survey methods including the names of personnel, the number of acres surveyed per biologist per survey-day, the number and dates of surveys, survey routes, the temperature and weather conditions at the beginning and end of each survey, and how frequently taped vocalizations were used, if at all".

If you would like to send this information via email, I can attach it to the report. Please let me know if you have any questions.

Thanks,
Stacey

"John Konecny" <jkonecny@cox.net>

05/26/2008 12:14 PM

To <Stacey_Love@fws.gov>
cc
SubjectRE: touching base

Hi Stacey,
ERA has apparently not provided any kind of report yet. I'll let them deal with their own reporting from now on. I' ll write you a sort letter summarizing the results for the IID survey and sign it. Can you send me the IID maps back (or a copy of what I sent you)?

JK

From: Stacey_Love@fws.gov [mailto:Stacey_Love@fws.gov]
Sent: Tuesday, May 20, 2008 11:08 AM
To: jkonecny@cox.net
Subject: touching base

Hi John,

I received the report you sent from Sweetwater Authority about three weeks ago. Thank you. Can ERA update me on the status of the IID report?

Thanks,
Stacey

Stacey Love
U.S. Fish and Wildlife Service
Carlsbad Fish and Wildlife Office
6010 Hidden Valley Road
Carlsbad, CA 92011
(760) 431-9440 x263



stacey_love@fws.gov IID Clapper Rail Baseline 2007 Conditions.doc

Konecny Biological Services
Biological Consulting, Research, Conservation

METHODS

Thirty-eight plots of 100 randomly selected plots in the Imperial Valley and Colorado River area were identified as having potential wetland habitat (Year I Rail Survey Locations, Imperial Valley Area and AAC – Yuma area, attached) for the Imperial Irrigation District (IID) baseline data collection phase by EcoSystems Restoration Associates (ERA). ERA is preparing a Habitat Conservation Plan for IID. The 2007 surveys were the first of three year series of baseline surveys. Each plot had at least one point where a focused rail survey was conducted as well as general avian point count. During the first survey event, the wetland habitat was ground truthed for suitable habitat for Yuma clapper rail and California black rail. Thirteen of the plots were omitted after the first round of surveys, leaving 25 plots to be surveyed during the last two survey events.

Three focused survey events for the Yuma clapper rail and California black rail were conducted at least one week apart between April 4th and May 18th, 2007, following the survey protocol approved by the USFWS (Conway 2006, Conway 2005) and guidance provided by the USFWS Carlsbad Field Office (Carol Roberts pers. com.). All surveys were conducted at dawn and were initiated approximately 30 minutes prior to sunrise, approximately 0600, and continued until no later than 1000.

The survey began by passively listening for Yuma clapper rails and black rails for five minutes. If rails were not detected, a digital vocalization, consisting of 30 seconds of California black rail followed by 30 seconds of silence, 30 seconds of least bittern (*Ixobrychus exillis*) followed by 30 seconds of silence, 30 seconds of Virginia rail (*Rallus limicola*) followed by 30 seconds of silence, and 30 seconds of Yuma clapper rail followed by 30 seconds of silence was played with an iPod and amplified speakers. A response was listened for during a one minute period following the recorded vocalizations before proceeding to the point station. Weather conditions during the three surveys are summarized in Table 1.

Table 1. Environmental Conditions During Three Focused Yuma Clapper Rail and California Black Rail Surveys for the Imperial Irrigation District's Habitat Conservation Plan Baseline Data Collection Project, Imperial County, California, 2007.

Survey #	Date	Surveyor (Species) *	Time	Weather Conditions (OC = overcast)
1A	04/04/07	JK, PD, (YCR, CBR)	0626-0951	55-83F, wind 1-5 mph, 30% OC
1B	04/05/07	JK, TC (YCR, CBR)	0618-0948	65-82F, wind 1-3 mph, 100% OC
1C	04/06/07	JK, TC (YCR, CBR)	0620-0918	59-75F, wind 1-5 mph, 30% OC
1D	04/18/07	JK, DW (YCR, CBR)	0632-0948	62-76F, wind 1-3 mph, 0% OC
1E	04/19/07	JK, AW (YCR, CBR)	0606-0950	60-75F, wind 3-7 mph, 0% OC
1F	04/20/07	JK, AW (YCR, CBR)	0558-0748	60-73F, wind 1-15 mph,10 0% OC
2A	05/02/07	JK, DW (YCR, CBR)	0545-0852	64-72F, wind 1-3 mph, 0% OC
2B	05/09/07	JK, DW (YCR, CBR)	0545-0949	61-88 F, wind 1-5 mph, 0% OC
2C	05/10/07	JK, DW (YCR, CBR)	0538-0943	64-95 F, wind 1-5 mph, 0% OC
2D	05/11/07	JK, DW (YCR, CBR)	0526-0752	65-85 F, wind 1-3 mph, 0% OC
3A	05/16/07	JK, AW (YCR,CBR)	0549-1000	66-82 F, wind 1-5 mph, 5% OC
3B	05/17/07	JK, AW (YCR, CBR)	0539-1002	65-94 F, wind 1-5 mph, 0% OC
3C	05/18/07	JK, AW (YCR, CBR)	0537-0922	64-89 F, wind 1-3 mph, 0% OC

1501 east Grand Avenue, # 2403, Escondido, California, 92027
Tel: (760) 489-5276 E-mail: jkonecny@cox.net

* JK-John Konecny; PD-Patrick Del Pizzo; TC-Travis Cooper; DW-Doug Willick, AW-Amanda Winchell; YCR-Yuma clapper rail; CBR-California black rail

RESULTS

Of the thirty-eight plots originally looked at, Yuma clapper rails were detected in four; PS-33; PS-25; PS-9; and PR1-37. Imagery of the rail locations in these five plots is attached. Two pairs of Yuma clapper rails were detected in PS-33, east of Fig Lagoon. One pair and one advertising male Yuma clapper rail were detected in PS-25, in the Wister Unit of the California Department of Fish and Game. One pair of Yuma clapper rails and a California black rail were detected in PS-9 on the south side of the All American Canal. One pair of Yuma clapper rails was detected in PR1-37, by the Imperial Dam. A California black rail was detected in PS-3, south of the Imperial Dam. No other Yuma clapper rails were detected in the other thirty-four plots.

CERTIFICATION

I certify that the information in this survey report and attached exhibits fully and accurately represent my work. If you have any questions or require additional information, please contact me at (760) 489-5276, the letterhead address, or jkonecny@cox.net.

Sincerely,

John K. Konecny
Wildlife Biologist
TE837308-4

Record ID 9538
County Imperial
Year 2008
Spp YCR (-)
Srv. Date
D.S. DIC 8/4/08
GIS
LAB

Konecny Biological Services

Biological Consulting, Research, Conservation

May 11, 2008
08-10-A

California Department of Transportation
District 11
4050 Taylor Street, MS 242
San Diego, CA 92101

Attn: Ms. Susan Scatolini

Re: Results of a Focused Survey for the Yuma Clapper Rail at the Proposed Caltrans Brawley Bypass Site Near the City of Brawley, Imperial County, California, 2008.

Dear Ms. Scatolini:

This letter report presents the results of focused surveys for the Yuma clapper rail (*Rallus longirostris yumanensis*) at the proposed Caltrans Brawley Bypass site near the City of Brawley, Imperial County, California. The Yuma clapper rail is listed as an endangered species by the United States Fish and Wildlife Service (USFWS), and as a threatened species by the California Department of Fish and Game (CDFG).

Surveys for the Yuma clapper rail were conducted following protocol approved by the USFWS (Conway 2006). The surveys were conducted by wildlife biologist John Konecny. This activity is authorized by USFWS section 10(a) permit number TE837308-4, and CDFG Memorandum of Understanding.

INTRODUCTION

The Yuma clapper rail is a slender, tawny-breasted bird with grayish edges on brown centered back feathers, olive wing coverts, vertical white bars on the flanks, a white stripe over the eye, and a partially orange bill. The Yuma clapper rail occurs along the lower Colorado River in freshwater marsh dominated by cattails (*Typha* sp.), bulrush (*Scirpus* sp.), and common reed (*Phragmites australis*), from Needles, California, south to the Colorado River delta (Tomlinson and Todd 1973). Additional populations occur at the south end of the Salton Sea, and the Salt and Gila Rivers (Eddleman 1989). Yuma clapper rails forage primarily on crustaceans and minnows during the breeding season, and rely more on a diet of seeds and vegetation in the winter. Recent claims of migratory movement along the lower Colorado River could not be confirmed by radiotelemetry studies (Eddleman 1989, Conway 1990). Populations of Yuma clapper rails have undergone decline in the United States due to their limited distribution, and destruction and degradation of freshwater marsh habitat.

PROJECT LOCATION

The proposed Caltrans Brawley Bypass is located north of the City of Brawley, California, and immediately west of State Route 111 (Figure 1). The Brawley Bypass crosses the New River west of the existing State Route 111 Bridge. It then continues westward along the existing Frederick's Road right-of-way, west of Western Avenue to its hookup with State Route 78/86. The survey area extends from just east of State Route 111, downstream approximately 3,200 feet

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(960 meters) (Figure 2). Specifically, the Brawley Bypass is located in Township 8 South, Range 21 East, and Section 29 of the Brawley 7.5-minute quadrangle.

PROJECT SITE DESCRIPTION

This project area is composed of mixed tamarisk scrub habitat characterized by honey mesquite (*Prosopis glandulosa*), screwbean mesquite (*P. pubescens*), tamarisk (*Tamarix* sp.), arrowweed (*Pluchea sericea*), and quail saltbush (*Atriplex lentiformis*).

Small patches of common reed (*Phragmites australis*) are present along this reach of the New River, along with overhanging branches of mesquite and tamarisk. The area north of the New River is disturbed, and characterized by tamarisk, saltbush, iodine bush (*Allenrolfea occidentalis*), and scattered mesquite. The Imperial County landfill is present along the downstream area on the south side of the New River, and there is an old abandoned cattle/sheep operation just upstream of the landfill, west of State Route 111. The topography of the entire area is relatively flat, and the elevation of the bridge site is approximately 230 feet (70 meters) above Mean Sea Level.

METHODS

Three focused survey events for the Yuma clapper rail were conducted at least one week apart following survey protocol approved by the USFWS (Conway 2006, Conway 2005). The three surveys were conducted on April 3rd, April 20th, and May 7th, 2008. The surveys were initiated approximately two hours before sunset and lasted until dark. All habitat downstream (west) of the State Route 111 Bridge was surveyed for a distance of 3,200 feet, as well as a small segment just east of the Bridge. The surveys were conducted by stopping at approximate 240 foot (80 meter) intervals along the New River and listening for clapper rails and other marsh birds for five-minutes. If rails were not detected, a digital vocalization, consisting of 30 seconds of California black rail (*Laterallus jamaicensis californicus*) followed by 30 seconds of silence, 30 seconds of least bittern (*Ixobrychus exillis*) followed by 30 seconds of silence, 30 seconds of Virginia rail (*Rallus limicola*) followed by 30 seconds of silence, and 30 seconds of Yuma clapper rail followed by 30 seconds of silence was played with an iPod and amplified speakers. A response was listened for during a one minute period following the recorded vocalizations before proceeding to the next station. Weather conditions during the three surveys are summarized below.

Table 1. Summary of Weather Conditions During Three Yuma Clapper Rail Surveys at the Proposed Caltrans Brawley Bypass Site, Imperial County, California, 2008.

Survey #	Date	Surveyor (Species) *	Time	Weather Conditions
1	04/03/08	JK (YCR)	1725-1900	0% overcast, 70-74F, wind 7-10 mph
2	04/20/08	JK (YCR)	1730-1910	0% overcast, 72-75F, wind 3-5 mph
3	05/07/08	JK (YCR)	1740-1945	0% overcast, 73-75F, wind 5-7 mph

* JK - John Konecny; LFCR - Yuma Clapper Rail

RESULTS

No Yuma clapper rails were detected during the three focused surveys of the Caltrans Brawley Bypass site in 2008. No federal or state listed endangered or threatened species were detected. A total of 33 species of birds were detected while conducting the surveys (Table 1). No other sensitive species were detected on the site.

DISCUSSION

Focused surveys for the Yuma clapper rail did not detect the species at the Brawley Bypass site in 2008. While small pockets of potential Yuma clapper rail habitat do occur in the reach of the New River in the vicinity of the project site, very little freshwater marsh is present in the survey area, and what is present could best be described as minimal. Yuma clapper rails were not detected in the area during a similar survey in 2006 and 2002 (Konecny 2006, Konecny 2002). Single individual Yuma clapper rails have been detected approximately 1,200 feet (360 meters) upstream of the State Route 111 bridge on June 4, 1997, and approximately 3,000 feet (900 meters) upstream of the bridge on August 28, 1998 by Caltrans biologists (D. McCaller per. com.).

The immediate area upstream of the bridge has a high degree of disturbance from previous agricultural use and operation of the landfill, and breeding habitat for the Yuma clapper rail does not exist. More extensive freshwater marsh is present upstream, west of Western Avenue. Nevertheless, in the vicinity of the Frederick's Road alternative, the New River may function as a dispersal and movement corridor for the Yuma clapper rail and other waterbirds.

The project should avoid construction during the Yuma clapper rail nesting season, described as March 1 through late August by Baicich (1997). Project mitigation for wetland impacts should be directed at maximizing freshwater marsh restoration in the general area.

CERTIFICATION

I certify that the information in this survey report and attached exhibits fully and accurately represent my work. The results of focused surveys for listed species are typically considered valid for one year by the USFWS and CDFG. If you have any questions or require additional information, please contact me at (760) 489-5276, the letterhead address, or jkonecny@cox.net.

Sincerely,

John K. Konecny
Wildlife Biologist
TE837308-4

REFERENCES CITED

Baicich P. J. and C. J. O. Harrison. 1997. A Guide to the Nest, Eggs, and Nestling of North American Birds. Academic Press. San Diego, California. 347pp.

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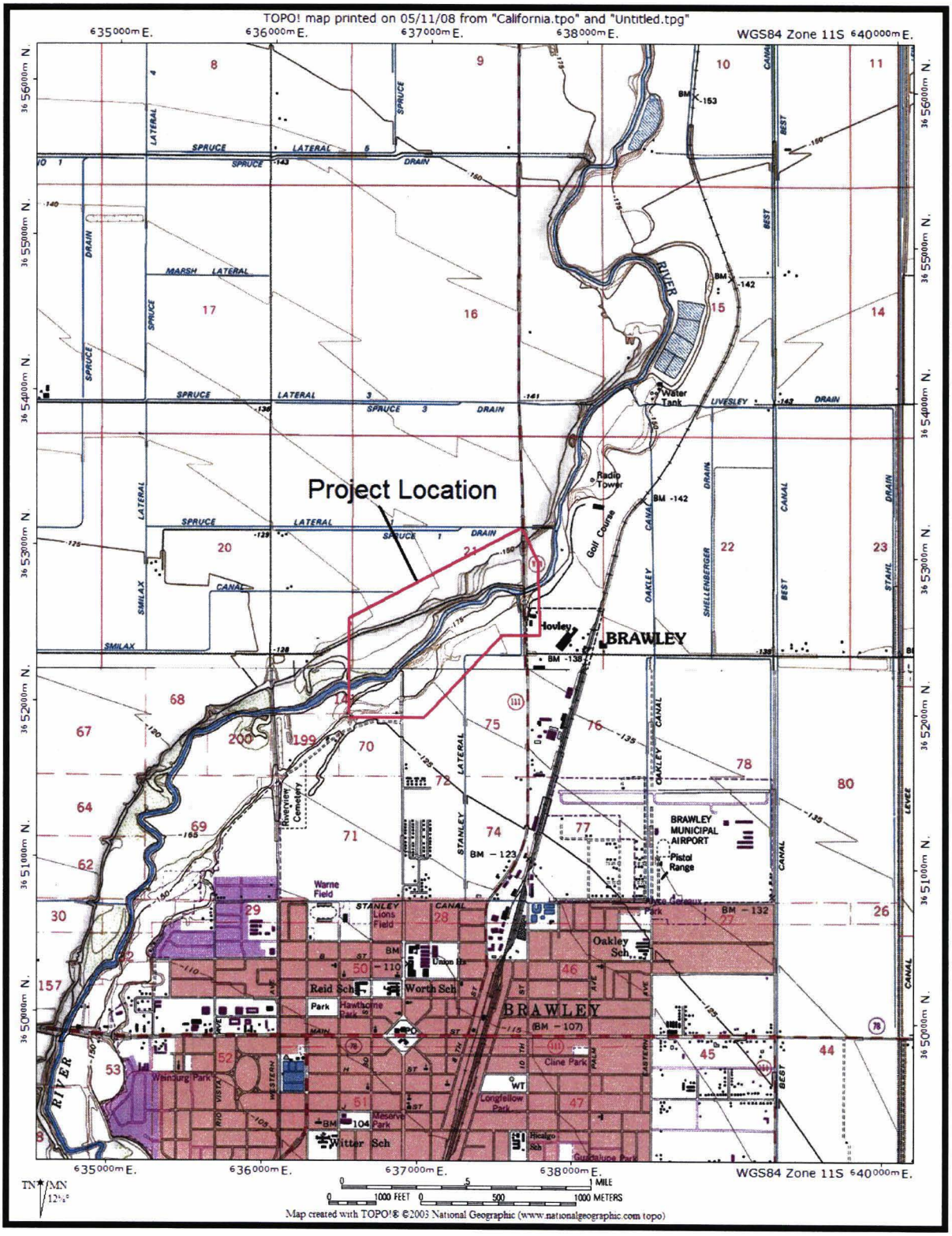

Figure 1. **Location of the General Vicinity Area for the Proposed Caltrans Brawley Bypass, Riverside County, California, 2008.**



Figure 1. **Location of the Yuma Clapper Rail Survey Area (in red) for the Proposed Caltrans Brawley Bypass, Riverside County, California, 2008.**

Table 1. Bird Species Detected During Three Focused Yuma Clapper Rail Surveys at the Caltrans Brawley Bypass Site, Riverside County, California, 2008.

Class Aves	
Family Ardeidae	
Great Blue Heron	*Ardea herodias*
Green Heron	*Butorides virescens*
Black-crowned Night Heron	*Nyticorax nycticorax*
Great Egret	*Ardea alba*
Snowy Egret	*Egretta thula*
Family Charadriidae	
Killdeer	*Charadrius vociferus*
Family Recurvirostridae	
Black-necked Stilt	*Himantopus mexicanus*
FamilyAccipitridae	
Red-tailed Hawk	*Buteo jamaicensis*
Family Falconidae	
American Kestrel	*Falco sparverius*
Family Rallidae	
American Coot	*Fulica americana*
Sora	*Porzaana carolina*
Family Columbidae	
Common Ground Dove	*Columbina passerina*
Mourning Dove	*Zenaida macroura*
Family Caprimulgidae	
Lesser Nighthawk	*Chordeiles acutipennis*
Family Trochilidae	
Costa's Hummingbird	*Calypte costae*
Family Tyrannidae	
Western Kingbird	*Tyrannus verticalis*
Black Phoebe	*Sayornis nigricans*
Family Hirundinidae	
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*
Cliff Swallow	*Petrochelidon pyrrhonota*
Family Remizidae	
Verdin	*Auriparus flaviceps*
Family Muscicapidae	
Black-tailed Gnatcatcher	*Polioptila melanura*

Family Mimidae	
Northern Mockingbird	*Mimus polyglottus*
Family Parulidae	
Wilson's Warbler	*Wilsonia pusilla*
MacGillivray's Warbler	*Oporornis tolmiel*
Family Emberizidae	
Abert's Towhee	*Pipilo aberti*
Song Sparrow	*Melospiza melodia*
Family Icteridae	
Common Yellowthroat	*Geothlypis trichas*
Red-winged Blackbird	*Agelaius phoeniceus*
Great-tailed Grackle	*Quiscalus mexicanus*
Brewer's Blackbird	*Euphagus cyanocephalus*
Brown-headed Cowbird	*Molothrus ater*
Family Fringillidae	
Lesser Goldfinch	*Carduelis psaltria*
House Finch	*Carpodacus mexicanus*

Record Id 9539
County Imperial
Year 2008
YCR (−)
Spp May 29, 2008
08-5-A
Srv. Rpt. D.B. Dw 8/4/08
GIS
L+R

Konecny Biological Services

Biological Consulting, Research, Conservation

Opus Environmental
540 Bryant Street, Ste. 200
Palo Alto, CA 94301

Attn: Mr. Larry Butcher

Re: Results of a Focused Survey for the Yuma Clapper Rail and California Black Rail at the Proposed Sempra Energy Line 6914 Loop, Imperial County, California, 2008.

Dear Mr. Larry Butcher:

This letter report presents the results of focused surveys for the Yuma clapper rail (*Rallus longirostris yumanensis*) and California black rail (*Laterallus jamaicensis coturniculus*) at the proposed Sempra Energy Line 6914 Loop site near the City of Brawley, Imperial County, California. The Yuma clapper rail is listed as an endangered species by the United States Fish and Wildlife Service (USFWS), and as a threatened species by the California Department of Fish and Game (CDFG). The California black rail is listed as a threatened species by the CDFG.

Surveys for the Yuma clapper rail and California black rail were conducted following protocol approved by the USFWS (Conway 2006, Conway 2005). The surveys were conducted by wildlife biologist John Konecny. This activity is authorized by USFWS section 10(a) permit number TE837308-4, and CDFG Memorandum of Understanding.

INTRODUCTION

The Yuma clapper rail is a slender, tawny-breasted bird with grayish edges on brown centered back feathers, olive wing coverts, vertical white bars on the flanks, a white stripe over the eye, and a partially orange bill. The Yuma clapper rail occurs along the lower Colorado River in freshwater marsh dominated by cattails (*Typha* sp.), bulrush (*Scirpus* sp.), and common reed (*Phragmites australis*), from Needles, California, south to the Colorado River delta (Tomlinson and Todd 1973). Additional populations occur at the south end of the Salton Sea, and the Salt and Gila Rivers (Eddleman 1989). Yuma clapper rails forage primarily on crustaceans and minnows during the breeding season, and rely more on a diet of seeds and vegetation in the winter. Recent claims of migratory movement along the lower Colorado River could not be confirmed by radiotelemetry studies (Eddleman 1989, Conway 1990). Populations of Yuma clapper rails have undergone decline in the United States due to their limited distribution, and destruction and degradation of freshwater marsh habitat.

The California black rail is a small, sparrow-sized secretive rail, blackish above with white speckling, has a chestnut nape, grayish-black underparts, narrow white barring on the flanks, and a short black bill. The California black rail occurs in the lower Colorado River area from the Imperial Dam, south to the Mexican border, with smaller, isolated populations scattered from Marin and San Luis Obispo Counties in coastal California, southward to San Diego County, northwestern Baja California, and the lower Imperial Valley (Eddleman *et al* 1994, Small 1994). California black rails tend to favor mixed pickleweed (*Salicornia* sp.), cordgrass (*Spartina*

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foliosa), and bulrush marshes in coastal habitats; and bulrush, cattail, arrowweed (*Pluchea sericea*), and common threesquare (*Schoenoplectus pungens*) freshwater marshes in inland areas (Conway and Sulzman 2007, Small 1994). Black rails typically forage on aquatic and terrestrial invertebrates and seeds. Like the Yuma clapper rail, the California black rail has undergone decline due to habitat degradation and destruction. The population of California black rails along the Colorado River from Needles, California, to Yuma, Arizona, probably numbers between 75-100 individuals (Evens et al. 1991).

PROJECT LOCATION

The proposed Sempra Energy Line 6914 Loop project is located east of the City of Brawley and north of Interstate 8 in central Imperial County, and generally parallels State Route 111 (Figure 1). The proposed pipeline begins just south of Aten Road in El Centro and continues north for approximately twenty-two miles (37 kilometers) to the northern terminus just north of Quay Road, immediately northeast of Ramer Lake.

PROJECT SITE DESCRIPTION

The proposed pipeline crosses a variety of habitats, including alkali desert scrub, pasture, grassland, irrigated fields, urban and bare fields. A small patch of potential Yuma clapper rail/California black rail habitat is present in an agricultural drain at Cooley Road, just south of Aten Road. Vegetation in this drain is characterized by common reed (*Phragmites australis*), tamarisk (*Tamarix* sp.), and a few cattails (*Typha* sp.).

The proposed pipeline crosses the New River in the vicinity of Williams Road, and continues north along the east side of Ramer Lake. Emergent wetland habitat is present west of Kershaw Road to just north of Titsworth Road in the Ramer lake area. Most of this area is an ecotone that interfaces desert sink scrub with Ramer Lake proper. Vegetation in this reach is characterized by arrow weed (*Pluchea sericea*), common reed, and tamarisk. The topography of the entire area is relatively flat, and the elevation ranges from approximately 40 feet (17 meters) to 160 feet (70 meters) below Mean Sea Level.

METHODS

Three focused survey events for the Yuma clapper rail were conducted at least one week apart following the survey protocol approved by the USFWS (Conway 2006, Conway 2005). The three surveys were conducted on March 16th, April 10thand 11th, and April 30th, 2008. The surveys were initiated approximately two hours before sunset and lasted until dark. All potential Yuma clapper rail/California black rail habitat was surveyed. The survey on April 11th was conducted at sunrise. The surveys were conducted by stopping at approximate 240 foot (80 meter) intervals along the pipeline right-of-way and listening for clapper rails and other marsh birds for five-minutes. If rails were not detected, a digital vocalization, consisting of 30 seconds of California black rail followed by 30 seconds of silence, 30 seconds of least bittern (*Ixobrychus exillis*) followed by 30 seconds of silence, 30 seconds of Virginia rail (*Rallus limicola*) followed by 30 seconds of silence, and 30 seconds of Yuma clapper rail followed by 30 seconds of silence was played with an iPod and amplified speakers. A response was listened for during a one minute period following the recorded vocalizations before proceeding to the next station. Weather conditions during the three surveys are summarized in Table 1.

Table 1. Summary of Weather Conditions During Three Yuma Clapper Rail and California Black Rail Surveys at the Sempra Energy Line 6941 Loop Project Site, Imperial County, California, 2008.

Survey #	Date	Surveyor (Species) *	Time	Weather Conditions
1	03/16/08	JK (YCR/CBR)	1715-1945	0% overcast, 73-76°F, wind 5-7 mph
2A	04/10/08	JK, MD (YCR/CBR)	1730-1930	0% overcast, 73-75°F, wind 3-5 mph
2B	04/11/08	JK (YCB/CBR)	0555- 0625	0% overcast, 69-73°F, wind 3-5 mph
3	04/30/08	JK (YCRCBR)	1740-1955	0% overcast, 73-75°F, wind 7-10 mph

* JK-John Konecny; MD-Melanie Day; YCR-Yuma Clapper Rail; CBR-California Black Rail

RESULTS

No Yuma clapper rails or California black rails were detected during the three focused surveys of the Sempra Energy Line 6941 Loop project site in 2008. No federal or state listed endangered or threatened species were detected. Data sheets are included as Attachment 1. Burrowing owls (*Athene cunicularia*) were detected along the pipeline alignment south of Aten Road. No other sensitive species were detected.

DISCUSSION

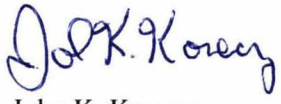
Focused surveys for the Yuma clapper rail and California black rail did not detect these species at the Sempra Energy pipeline site in 2008. While small pockets of potential Yuma clapper rail habitat do occur in the agricultural drain at the southern end of the project site, very little freshwater marsh is present in the survey area, and what is present could best be described as minimal. Likewise, there is a small patch of emergent marsh near the New River crossing. Much of the pipeline's reach above Williams Road is the interface of desert sink scrub and Ramer Lake proper with little emergent marsh present, and as such represents only minimal rail habitat.

California black rails are habitat specialists that require at least 1.25 acres (0.5 ha.) of emergent marsh, and shallow water less than one and one-half inches (two centimeters) in depth (Conway and Sulzman 2007, Eddleman 1994). Given those habitat requirements, California black rail habitat is not present in those areas surveyed along the pipeline alignment. California black rails have been reported in nearby Finney Lake (Evens 1991).

CERTIFICATION

I certify that the information in this survey report and attached exhibits fully and accurately represent my work. The results of focused surveys for listed species are typically considered valid for one year by the USFWS and CDFG. If you have any questions or require additional information, please contact me at (760) 489-5276, the letterhead address, or jkonecny@cox.net.

Sincerely,



John K. Konecny
Wildlife Biologist
TE837308-4

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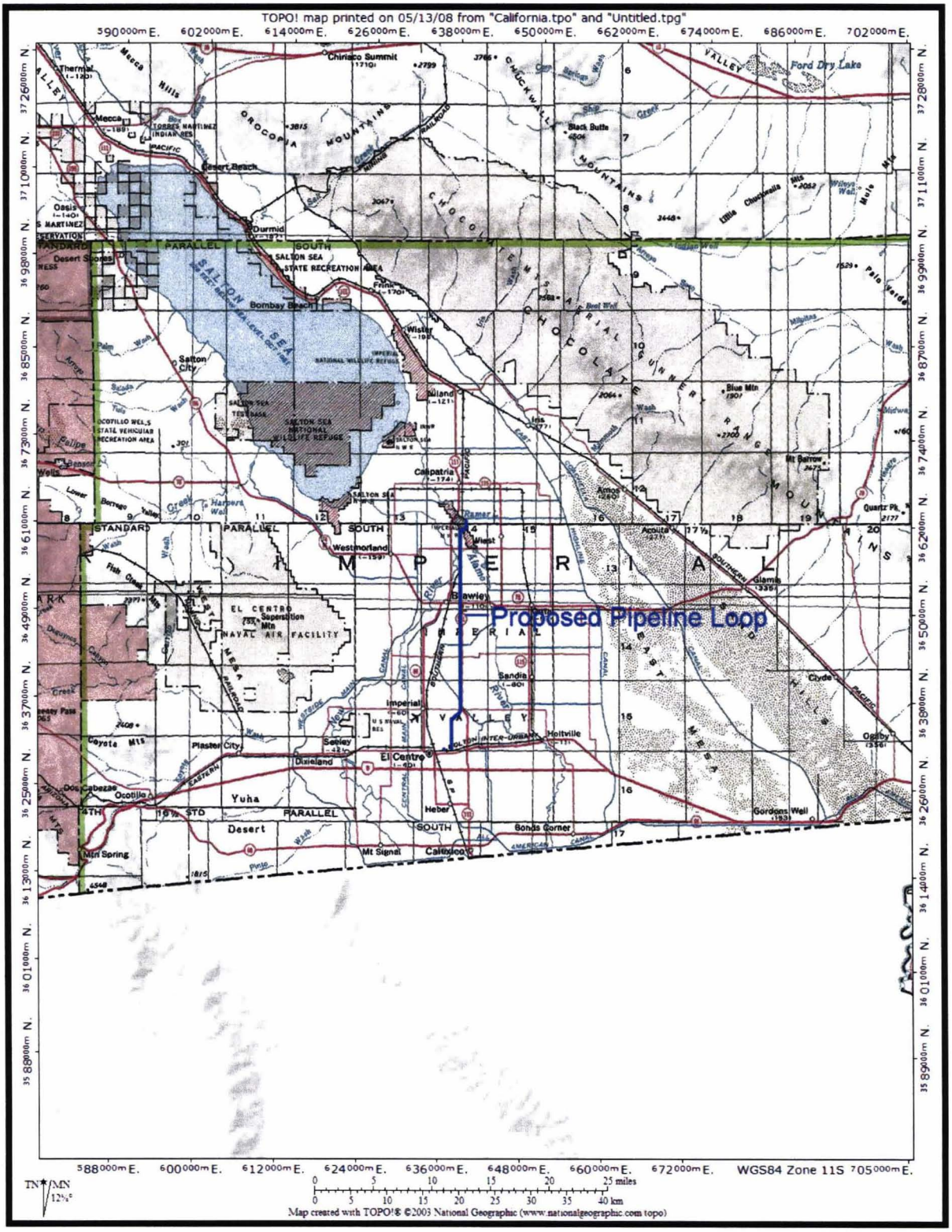

Figure 1. **Location of the General Vicinity Area for the Proposed Sempra Energy Line 6914 Loop Project, Imperial County, California, 2008.**

Attachment 1. Data Sheets

National Marsh Bird Monitoring Program Survey Data Sheet

Pg 1 of 1

Date *(eg 10-May-04)*: 16 March 2008

Name of marsh or route: Sempra Line 6941

Observer(s) *(list all)**: JK

Survey replicate #: 1

	Before	After
Temperature *(°F)*:	76	73
Wind speed *(mph)*:	5-7	5-7
Cloud cover *(%)*:	Ø	Ø
Precipitation *(see below)*:	Ø	Ø

**list all observers in order of their contribution to the data collected*

put an "S" in the appropriate column if the bird was seen, a "1" if the bird was heard, and "1S" if both heard and seen

Station#	Start Time (military)	Background noise	Species	Responded During: Before	Pass 0-1	Pass 1-2	Pass 2-3	Pass 3-4	Pass 4-5	BLRA 5-6	LEBI 6-7	VIRA 7-8	CLRA 8-9	After	Call Type(s)	Direction	Distance (meters)	Detected at a Previous Point	Comments
N8	1715	2	Ø													○			Ø
N7	1730	2	Ø													○			Ø
N6	1744	1	Ø													○			Ø
N5	1757	1	Ø													○			Ø
N4	1807	1	Ø													○			Ø
N3	1819	1	Ø													○			Ø
N2	1835	3	Ø													○			Ø
N1	1847	3	Ø													○			Ø
S1	1935	1	Ø													○			Ø
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Call Types: BLRA: *kicky-doo, grr, churt* CLRA: cltr, kburr, kek, khurrah LEBI: *coo, kak, ert* VIRA: *grunt, ticket, kicker*

If the call type is not one of the above listed types, describe the call in the comments column

Precipitation: light rain, rain, heavy rain, light snow, snow, heavy snow, fog, none

Background noise: 0 *no noise* 1 *faint noise* 2 *moderate noise (probably can't hear some birds beyond 100m)*

3 *loud noise (probably can't hear some birds beyond 50m)* 4 *intense noise (probably can't hear some birds beyond 25m)*

National Marsh Bird Monitoring Program Survey Data Sheet

Date *(eg 10-May-04)*: 10 April 2008

Name of marsh or route: Sempra Line 6941

Observer(s) *(list all)**: JK, MD

Survey replicate #: 1A

	Before	After
Temperature *(°F)*:	75	73
Wind speed *(mph)*:	3-5	3-5
Cloud cover *(%)*:	Ø	Ø
Precipitation *(see below)*:	Ø	Ø

**list all observers in order of their contribution to the data collected*

put an "S" in the appropriate column if the bird was seen, a "1" if the bird was heard, and "1S" if both heard and seen

Station#	Start Time (military)	Background noise	Species	Responded During: Before	Pass 0-1	Pass 1-2	Pass 2-3	Pass 3-4	Pass 4-5	BLRA 5-6	LEBI 6-7	VIRA 7-8	CLRA 8-9	After	Call Type(s)	Direction	Distance (meters)	Detected at a Previous Point	Comments
S1	1730	1	Ø													○			Ø
N8	1821	3	Ø													○			Ø
N7	1836	1	Ø													○			Ø
N6	1849	1	Ø													○			Ø
N5	1901	1	Ø													○			Ø
N4	1911	1	Ø													○			Ø
N3	1923	1	Ø													○			Ø
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Call Types: BLRA: *kicky-doo, grr, churt* CLRA: cltr, kburr, kek, khurrah LEBI: *coo, kak, ert* VIRA: *grunt, ticket, kicker*

If the call type is not one of the above listed types, describe the call in the comments column

Precipitation: light rain, rain, heavy rain, light snow, snow, heavy snow, fog, none

Background noise: 0 *no noise* 1 *faint noise* 2 *moderate noise (probably can't hear some birds beyond 100m)*

3 *loud noise (probably can't hear some birds beyond 50m)* 4 *intense noise (probably can't hear some birds beyond 25m)*

National Marsh Bird Monitoring Program Survey Data Sheet

Pg 1 of 1

Date *(eg 10-May-04)*: 11 April 2008

Name of marsh or route: Sempra Line 6941

Observer(s) *(list all)**: JH

Survey replicate #: 1B

	Before	After
Temperature *(°F)*:	69	73
Wind speed *(mph)*:	3-5	3-5
Cloud cover *(%)*:	Ø	Ø
Precipitation *(see below)*:	Ø	Ø

**list all observers in order of their contribution to the data collected*

put an "S" in the appropriate column if the bird was seen, a "1" if the bird was heard, and "1S" if both heard and seen

Station#	Start Time (military)	Background noise	Species	Responded During: Before	Pass 0-1	Pass 1-2	Pass 2-3	Pass 3-4	Pass 4-5	BLRA 5-6	LEBI 6-7	VIRA 7-8	CLRA 8-9	After	Call Type(s)	Direction	Distance (meters)	Detected at a Previous Point	Comments
N2	0555	1	Ø													○			Ø
N1	0615	1	Ø													○			Ø
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Call Types: BLRA: *kicky-doo, grr, churt* CLRA: cltr, kburr, kek, khurrah LEBI: *coo, kak, ert* VIRA: *grunt, ticket, kicker*

If the call type is not one of the above listed types, describe the call in the comments column

Precipitation: light rain, rain, heavy rain, light snow, snow, heavy snow, fog, none

Background noise: 0 *no noise* 1 *faint noise* 2 *moderate noise (probably can't hear some birds beyond 100m)*

3 *loud noise (probably can't hear some birds beyond 50m)* 4 *intense noise (probably can't hear some birds beyond 25m)*

National Marsh Bird Monitoring Program Survey Data Sheet

Pg 1 of 1

Date *(eg 10-May-04)*: 30 April 2008

Name of marsh or route: Sempra Line 6941

Observer(s) *(list all)**: JK

Survey replicate #: 3

	Before	After
Temperature *(°F)*:	75	73
Wind speed *(mph)*:	3-5	3-5
Cloud cover *(%)*:	Ø	Ø
Precipitation *(see below)*:	Ø	Ø

**list all observers in order of their contribution to the data collected*

put an "S" in the appropriate column if the bird was seen, a "1" if the bird was heard, and "1S" if both heard and seen

Station#	Start Time (military)	Background noise	Species	Responded During: Before	Pass 0-1	Pass 1-2	Pass 2-3	Pass 3-4	Pass 4-5	BLRA 5-6	LEBI 6-7	VIRA 7-8	CLRA 8-9	After	Call Type(s)	Direction	Distance (meters)	Detected at a Previous Point	Comments
N8	1740	3	Ø													○			Ø
N7	1753	1	Ø													○			Ø
N6	1809	1	Ø													○			Ø
N5	1822	1	Ø													○			Ø
N4	1834	1	Ø													○			Ø
N3	1846	1	Ø													○			Ø
N2	1859	1	Ø													○			Ø
N1	1911	1	Ø													○			Ø
S1	1945	1	Ø													○			Ø
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Call Types: BLRA: *kicky-doo, grr, churt* CLRA: cltr, kburr, kek, khurrah LEBI: *coo, kak, ert* VIRA: *grunt, ticket, kicker*

If the call type is not one of the above listed types, describe the call in the comments column

Precipitation: light rain, rain, heavy rain, light snow, snow, heavy snow, fog, none

Background noise: 0 *no noise* 1 *faint noise* 2 *moderate noise (probably can't hear some birds beyond 100m)*

3 *loud noise (probably can't hear some birds beyond 50m)* 4 *intense noise (probably can't hear some birds beyond 25m)*

45 Day Rep

FOCUSED SURVEY
YUMA CLAPPER RAIL
Hudson Ranch Geothermal I Plant Project
(Section 24; T11S, R13E; Niland 7.5 " USGS Quadrangle)
Imperial County, CA

Record Id 9683
County Imperial
Year 2008
Spp YCR(-)
Srv. Rpt.
D.B. DIC 9/15/08
GIS
L+R
File

Prepared for:

Environmental Management Associates, Inc.
588 Explorer Street
Brea, CA 92821

By

Arthur Davenport
Davenport Biological Services
P.O. Box 1692
Barstow, California 92312
619-729-4242

June 10, 2008

RECEIVED
SEP 15 2008
US FWS
CARLSBAD FIELD OFFICE CA

Introduction

Davenport Biological Services (DBS) was hired by Environmental Management Associates, Inc. to complete presence/absence surveys for endangered species near Niland, California (Figure 1). The surveys were completed within the project area of the Hudson Ranch Geothermal I Power Plant project site. Within this area, and a 200 meter buffer, a focused survey was completed for the Yuma clapper rail (*Rallus longirostris yumanensis*).

Yuma Clapper Rail
The Yuma clapper rail was listed as an endangered species under the Endangered Species Act of 1973, as amended, on 11 March 1967 (FR 32:4001). The Yuma clapper rail is also listed as threatened under California's Endangered Species Act.

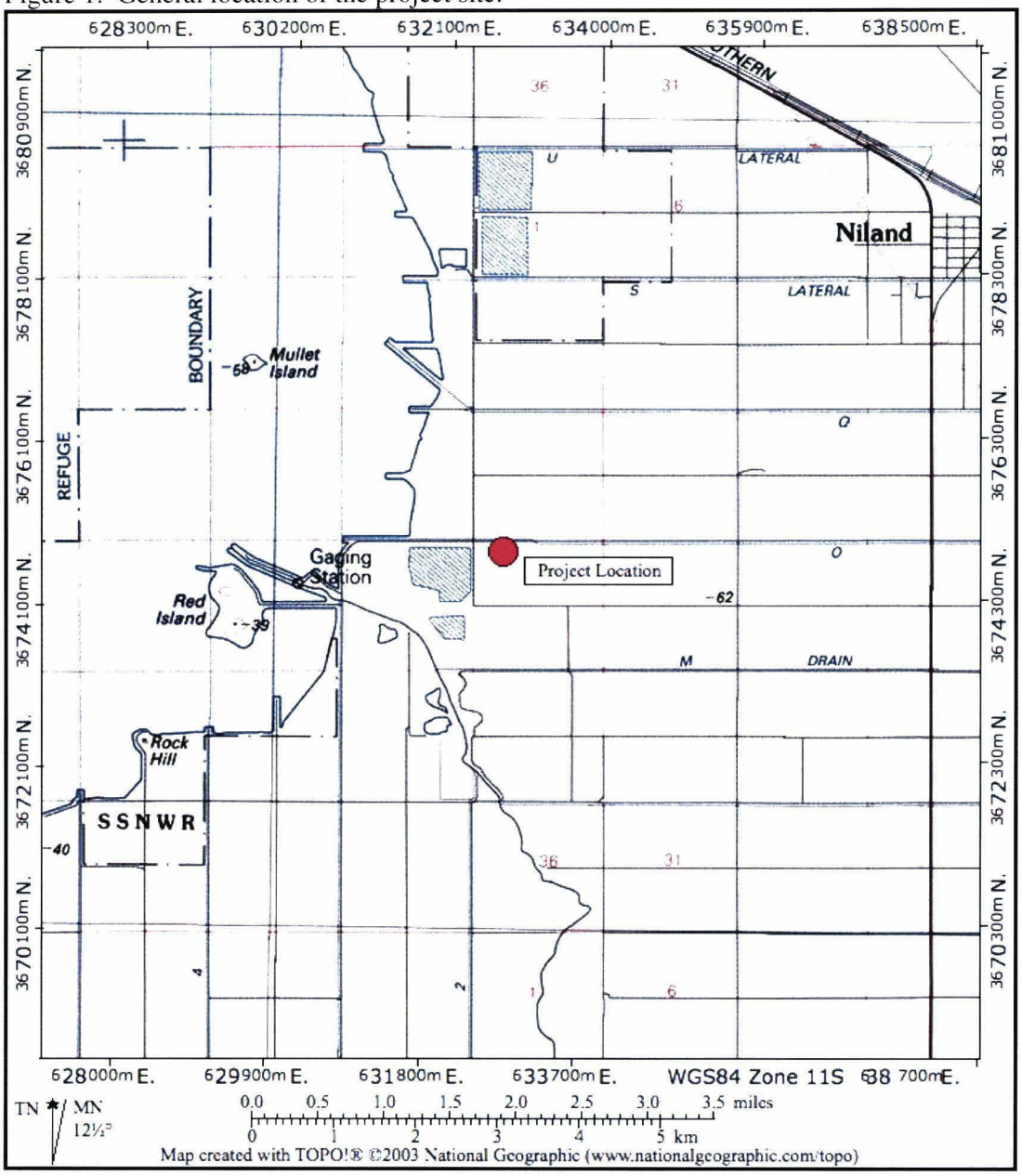
The Yuma clapper rail is common in Imperial County with local populations occurring at the Sony Bono National Wildlife Refuge, Imperial Wildlife Area, as well as within other patches of suitable marsh habitat throughout the valley. In 2007, 102 rails were detected at the Sony Bono National Wildlife Refuge and 398 detected within the Imperial Wildlife Area (USFWS unpub. data, 2008). Three pairs of Yuma clapper rails were detected in drains located approximately two miles east of the Imperial Wildlife Area (Davenport 2007). The habitat within the drains was narrow and dominated by cattail (*Typha latifolia*). The Yuma clapper rail occurs along the Colorado River and occurs as far north as Littlefield, Arizona (Gerald Braden, San Bernardino County Museum, pers. comm., 2008). It is important to note that one pair of Yuma clapper rails was detected at Walt's Place in 1992 (William Radke, USFWS, pers. comm., 2008). Walt's Place coincides with the project location.

Information regarding the migration patterns of Yuma clapper rails is contradictory. There is some indirect evidence that they move post breeding. However, other studies did not detect migration (Eddleman 1989). Yuma clapper rails begin pair formation in mid February. First nests of Yuma clapper rail have been documented in mid March. Peak nest initiation is in mid May (Eddleman 1989).

The Yuma clapper rail occupies marsh habitats including canals and drains where cover and food is available. Vegetative cover often consists of cattail (*Typha latifolia*) and bulrush (*Scirpus acutus*). This species has also been observed in wetlands where there is a canopy of tamarisk (*Tamarix ramosissima*), and an understory of cattails or other wetland plants (e.g., bullrush). The food of the clapper rail includes a variety of invertebrate species, including crayfish and insects.

The survey was completed under Federal Recovery Permit # TE802450-5

Figure 1. General location of the project site.



Methods

Field Survey

The focused survey was repeated five times, and the surveys were completed at least one week apart. During each of the five survey events, two survey passes were completed of all potentially suitable habitat on, and within, 200 meters of the project site. Thus, a total of 10 focused survey passes were completed during the course of this study. The two survey passes were spaced a minimum of 0.5 hours apart. During each survey pass, rails were listened for at sites spaced approximately 25 meters apart along the edge of the habitat. At each of these sites, a passive attempt to detect rails by their naturally occurring calls was completed for approximately 3 minutes. Following the listening for naturally occurring calls, two series of "kek" calls of the clapper rail were broadcast using an amplifier speaker (Mini Amplifier Speaker, RadioShack,

Cat. NO. 277-1008C). Following the broadcast of calls, responding rails were listened for during a two to three minute period of time prior to moving on to the next listening location. This method was repeated throughout the survey area.

Per the general annual census survey protocol for Yuma clapper rails, the first two surveys were completed between March 15 and May 15, 2008. The focused survey for Yuma clapper rails was initiated on 15 March 2008, and was completed on 17 April 2008. Morning surveys were initiated around 0700 and completed by 1000 hours and evening surveys were completed within two hours of sunset (Table 1). A sixth survey was also completed on 15 May 2008. This survey was completed in conjunction with a survey for the southwestern willow flycatchers (*Empidonax traillii extimus*) and consisted of only one survey pass.

Table 1. Shows date, survey time, and weather conditions during each survey pass.

Survey Date	Time	Temperature (F°)	Wind Speed (mph)	Cloud Cover (%)
	Start/Stop	Start/Stop	Start/Stop	
15 March 2008	0730/0930	55/60	5-10/5-10	0/0
24 March 2008	0700/0930	47/53	0/0	0/0
31 March 2008	0700/0930	51/58	0/0-1	0/0
6 April 2008	1800/2000	80/75	0-1/0-1	0/0
17 April 2008	0730/0930	66/68	0-1/1-5	0/0
15 May 2008	0730/0930	71/83	0-1/0-1	5/5

The species of all birds observed was recorded (Appendix 1).

Background Search
Information regarding the historic distribution of Yuma clapper rails in the vicinity of the proposed project was also reviewed. In this regard, information from the Sonny Bono National Refuge, Museum of Vertebrate Zoology, Berkley, and California Natural Diversity Data Base was reviewed.

Results

Background Search
The Yuma clapper rail was documented at the project site in 1992 (William Radke, US Fish and Wildlife Service, pers. comm., 2008). Other than this previous sighting, no other documentation of Yuma clapper rail for the site was found. However, Yuma clapper rails are known to currently exist within the Hazard Unit of the Sonny Bono National Wildlife Refuge. The Hazard Unit is located approximately 0.5 miles to the west of the project area. Additionally, additional Yuma clapper rails are known to exist within the Imperial Wildlife Area, which is located approximately two miles north of the project site.

Field Survey
Approximately 8.6 acres of suitable habitat was found to exist on site (Figures 2, 3, and 4). No Yuma clapper rails were observed or otherwise detected during this survey.

Figure 2. Shows border of project and location and amount of Yuma clapper rail habitat within project area.

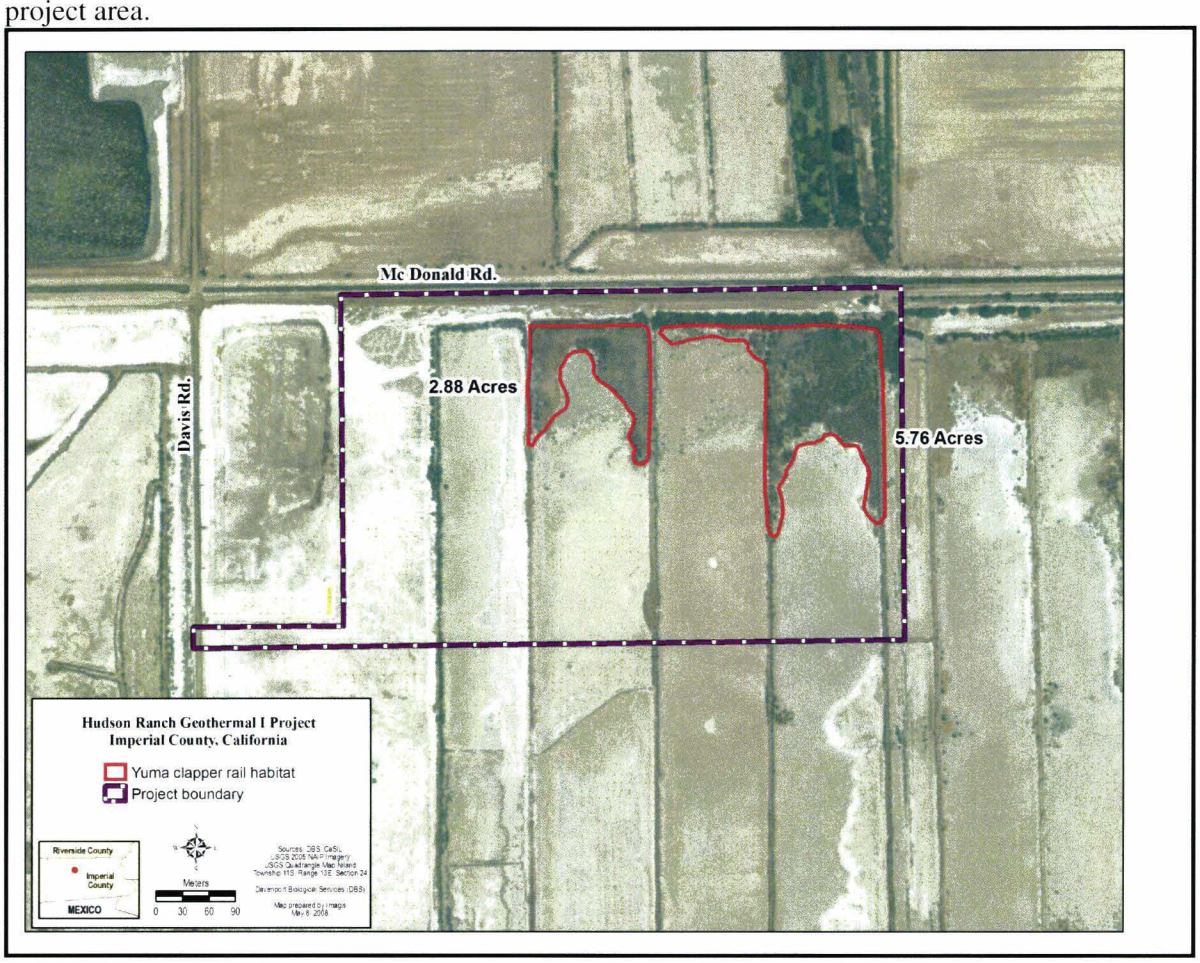


Figure 3. Shows border of project and location and amount of Yuma clapper rail habitat within project area.

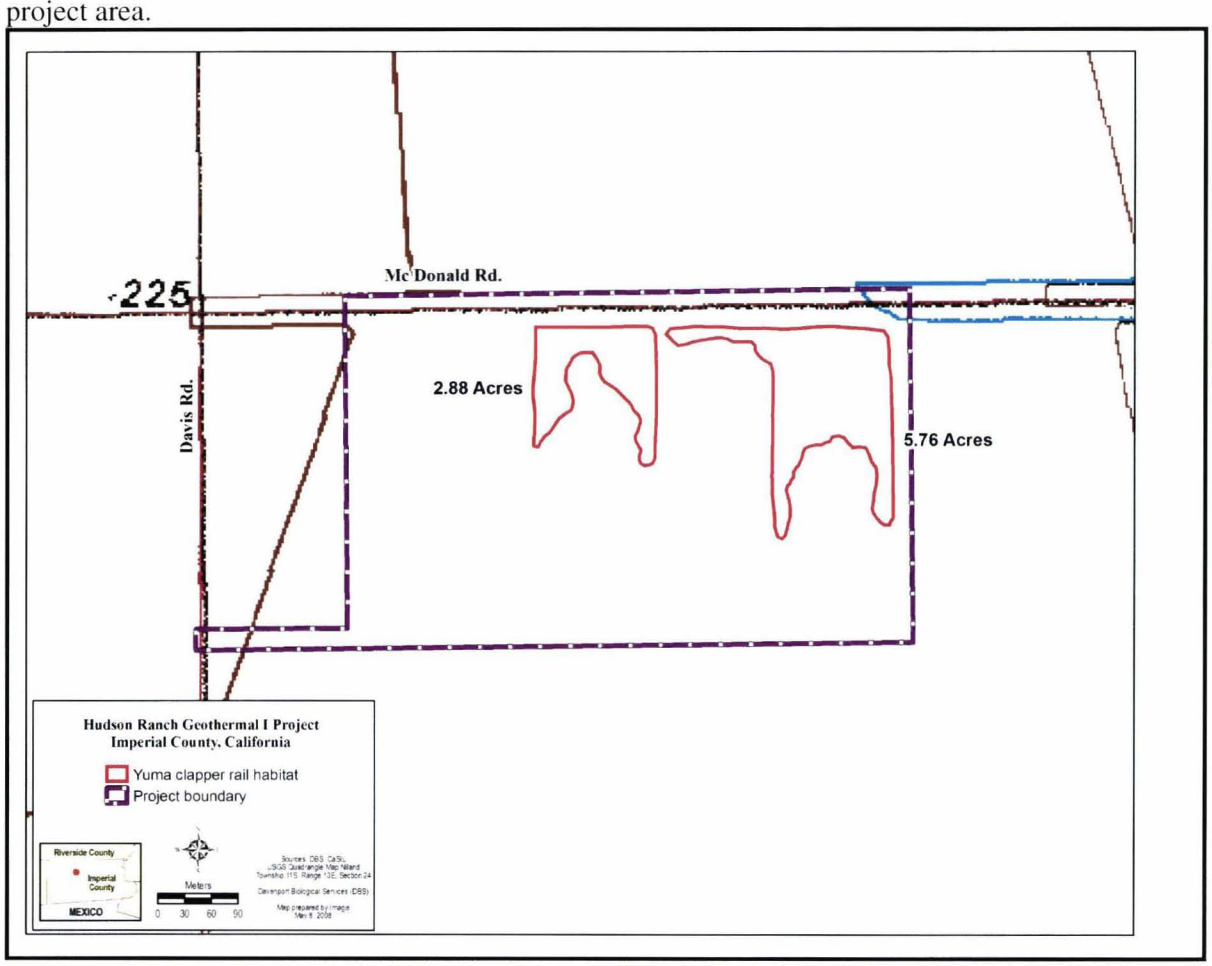


Figure 4. Shows condition of habitat found within project area during March (Photos take 15 March 2008).



Discussion

The absence of Yuma clapper rails is likely due to the changes in water availability that occurs at this site. Water is added to the ponds in the fall in anticipation of the waterfowl-hunting season. The ponds are then emptied or otherwise allowed to dry in the spring. Thus, nesting conditions for Yuma clapper rail declines rapidly due to the diminishing availability of water and food. These declining conditions likely discourage nesting attempts by the rails in this area.

Conclusion

During the 2008 nesting season, no Yuma clapper rails were detected on or within 200 meters of the project site. Thus, the site was determined to be unoccupied by Yuma clapper rails during the nesting season of 2008.

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Appendix 1. Animals observed within the survey area (based on direct observation and/or sign).

ANIMALS

INVERTEBRATES
Lepidoptera

Cabbage White	*Pieris rapae*
West Coast Lady	*Vanessa annabella*

VETEBRATES
Reptiles

Desert Spiney lizard	*Sceloporus magister*

Birds

Green Heron	*Butorides virescens*
Killdeer	*Charadrius vociferus*
Gull-billed Tern	*Gelochelidon nilotica*
Turkey Vulture	*Cathartes aura*
Northern Harrier	*Circus cyanus*
American Kestrel	*Falco sparverious*
Mourning Dove	*Zenaida macroura*
Anna's Hummingbird	*Calypte anna*
Western Wood-Pewee	*Contopus sordidulus*
Pacific-slope Flycatcher	*Empidonax difficillis*
Black Phoebe	*Sayornis nigricans*
Say's Phoebe	*Sayornis saya*
Western Kingbird	*Tyrannus verticalis*
Common Raven	*Corvus corax*
Northern Rough-wing Swallow	*Stelgidopteryx serripennis*
Barn Swallow	*Hirundo rustica*
Black-tailed Gnatcatcher	*Polioptila melanura*
Wilson's Warbler	*Wilsonia pusilla*
Yellow-Rumped Warbler	*Dendroica coronata*
Common Yellowthroat	*Geothlypis trichas*
Warbling Vireo	*Vireo gilvus*
Marsh Wren	*Cistothorus palustris*
Song Sparrow	*Melospiza melodia*
White-crowned Sparrow	*Zonotrichia albicollis*
Red-winged Blackbird	*Agelaius phoeniceus*
Brown-headed Cowbird	*Molothrus ater*
Lesser Goldfinch	*Carduelis psaltria*
House Finch	*Carpodacus mexicanus*
European Starling	*Sturnus vulgaris*

Mammals

Coyote	*Canis latrans*
Raccoon	*Procyon lotor*
Desert Cottontail	*Sylvilagus audoboni*

CERTIFICATION

I hereby certify that the statements furnished above present the data and information required for this biological evaluation, and that the facts, statements, and information presented are true and correct to the best of my knowledge. Fieldwork conducted for this assessment was performed by me. I certify that I have not signed a nondisclosure or consultant confidentiality agreement with the project applicant or applicant's representative and that I have no financial interest in the project.

Date: June 10, 2008 Signed: Ruth G. Davenport

Konecny Biological Services
Biological Consulting, Research, Conservation

September 4, 2008
08-04-B

EcoSystems Restoration Associates
8954 Rio San Diego Drive, Suite 610
San Diego, CA 92108

Attn: Mr. Tito Marchant

Re: Results of a Focused Survey for the Yuma Clapper Rail and California Black Rail at the Imperial Irrigation District's All American Canal Lining Project Wetland Enhancement Site, Imperial County, California, 2008.

Dear Mr. Marchant:

This letter report presents the results of focused surveys for the Yuma clapper rail (*Rallus longirostris yumanensis*), and California black rail (*Laterallus jamaicensis coturniculus*), at the Imperial Irrigation District's All American Canal Lining Project wetland enhancement site in Imperial County, California. The Yuma clapper rail is listed as an endangered species by the United States Fish and Wildlife Service (USFWS), and as a threatened species by the California Department of Fish and Game (CDFG). The California black rail is listed as a threatened species by CDFG.

Surveys for the Yuma clapper rail and California black rail were conducted following protocol established by Conway (2005), and guidance received from the USFWS Carlsbad Field Office (Carol Roberts pers.comm.). The surveys were conducted by wildlife biologist John Konecny, and assisted by EcoSystems Restoration Associates (ERA) biologists Patrick Del Pizzo, Travis Cooper, and Darin Busby. This activity is authorized by USFWS section 10(a) permit number TE837308-4, and CDFG Memorandum of Understanding.

INTRODUCTION

The Yuma clapper rail is a slender, tawny-breasted bird with grayish edges on brown centered back feathers, olive wing coverts, vertical white bars on the flanks, a white stripe over the eye, and a partially orange bill. The Yuma clapper rail occurs along the lower Colorado River in freshwater marsh dominated by cattails (*Typha* sp.), bulrush (*Scirpus* sp.), and common reed (*Phragmites australis*), from Needles, California, south to the Colorado River delta (Tomlinson and Todd 1973). Additional populations occur at the south end of the Salton Sea, and the Salt and Gila Rivers (Eddleman 1989). Yuma clapper rails forage primarily on crustaceans and minnows during the breeding season, and rely more on a diet of seeds and vegetation in the winter. Recent claims of migratory movement along the lower Colorado River could not be confirmed by radiotelemetry studies (Eddleman 1989, Conway 1990). Populations of Yuma clapper rails have undergone decline in the United States due to their limited distribution, and destruction and degradation of freshwater marsh habitat.

The California black rail is a small, sparrow-sized secretive rail, blackish above with white speckling, has a chestnut nape, grayish-black underparts, narrow white barring on the flanks, and a short black bill. The California black rail occurs in the lower Colorado River area from the Imperial Dam, south to the Mexican border, with smaller, isolated populations scattered from

Marin and San Luis Obispo Counties in coastal California, southward to San Diego County, northwestern Baja California, and the lower Imperial Valley (Eddleman *et al* 1994, Small 1994). California black rails tend to favor mixed pickleweed (*Salicornia* sp.), cordgrass (*Spartina foliosa*), and bulrush marshes in coastal habitats; and bulrush and cattail freshwater marshes in inland areas (Small 1994). Black rails typically forage on aquatic and terrestrial invertebrates and seeds. Like the Yuma clapper rail, the California black rail has undergone decline due to habitat degradation and destruction. The population of California black rails along the Colorado River from Needles, California, to Yuma, Arizona, probably numbers between 75-100 individuals (Evens et al. 1991).

PROJECT LOCATION

The All American Canal Lining Project enhancement area is located south of State Route 98, approximately 15 miles (25 kilometers) east of the City of Calexio, between Power Drops Three and Four on the north side of the All American Canal (Figure 1). Potential Yuma clapper rail and California black rail habitat exists in pockets on both the north and south sides throughout the area as the result of seepage from the earthen lined canal sides. Specifically, the survey area is located in Township 17 South, Range 17 East, Section 1; and Range 18 East, Section 6 of the Midway Well 7.5-minute quadrangle.

PROJECT SITE DESCRIPTION

The All American Canal is a man-made tributary of the Colorado River, and runs in an east-west direction just north of the United States/Mexico border. Access roads parallel the All American Canal on both the north and south sides. Emergent bulrush, cattails, and common reed (*Phragmites australis*) are present in varying densities along its length. In the Canal's reach between Power Drop Three and Four, seep wetlands characterized by cattails, bulrush, common reed, and scattered willow (*Salix* sp.) form extensive wetland areas. Recovery canals parallel the All American Canal on both sides in this reach, and ponded water is collected between the levee roads and the recovery canals. Upland vegetation throughout the reach is characterized by tamarisk (*Tamarix* sp.), arrowweed (*Pluchea sericea*), and quailbush (*Atriplex lentiformis*), with an occasional honey mesquite (*Prosopis glandulosa*), and creosote bush (*Larrea tridentate*). A dirt utility power line road parallels the recovery canal in this area on the north side, and bisects the 43 acre (17 hectare) enhancement area. Agricultural fields are present to the north of State Route 95, approximately four miles (6.5 km) west of the enhancement area. The topography of the entire area is relatively flat, and the elevation of the survey area ranges from approximately 105 feet (32 meters) to 95 feet (29 meters) above Mean Sea Level.

METHODS

Five focused survey events for the Yuma clapper rail and California black rail were conducted at least one week apart between March 18th and May 8th, 2008, following the survey protocol approved by the USFWS (Conway 2006, Conway 2005) and guidance provided by the USFWS Carlsbad Field Office (Carol Roberts pers. com.). Dusk surveys for the two species were conducted concurrently on two successive evenings on March 18th and 19th, and April 4th and 5th. A combination dawn and dusk survey event was conducted on April 21st and 22nd. Dawn survey events were conducted on May 1st and May 8th. Dawn surveys were initiated approximately 30 minutes prior to sunrise, approximately 0600, and continued until no later than 1000. Dusk surveys were initiated approximately two hours before sunset and continued until dark.

The surveys were conducted by stopping at fourteen points that are at approximately 270 foot (120 meters) intervals along the recovery canal road and in a circle around the 43 acre enhancement site (Figure 2) and listening for Yuma clapper rails and black rails for five minutes. If rails were not detected, a digital vocalization, consisting of 30 seconds of California black rail followed by 30 seconds of silence, 30 seconds of least bittern (*Ixobrychus exillis*) followed by 30 seconds of silence, 30 seconds of Virginia rail (*Rallus limicola*) followed by 30 seconds of silence, and 30 seconds of Yuma clapper rail followed by 30 seconds of silence was played with an iPod and amplified speakers. A response was listened for during a one minute period following the recorded vocalizations before proceeding to the next station. Weather conditions during the three surveys are summarized in Table 1. Copies of the rail data sheets are included as Attachment 1.

Table 1. Environmental Conditions During Five Yuma Clapper Rail and California Black Rail Surveys of the Imperial Irrigation District's All-American Canal Lining Project Wetland Enhancement Site, Imperial County, California, 2005.

Survey #	Date	Surveyor (Species) *	Time	Weather Conditions (OC = overcast)
1A	03/18/08	JK, PD, TC (YCR, CBR)	1704-1900	80-76F, wind 1-3 mph, 0% OC
1B	03/19/08	JK, PD, TC (YCR, CBR)	1710-1819	80-77F, wind 3-7 mph, 0% OC
2A	04/04/08	JK, TC (YCR, CBR)	1752-1910	86-84F, wind 3-7 mph, 0% OC
2B	04/05/08	JK (YCR, CBR)	1750-1851	86-85F, wind 4-10 mph, 0% OC
3A	04/21/08	JK, PD (YCR, CBR)	1745-1859	85-83F, wind 1-3 mph, 0 % OC
3C	04/22/08	JK. PD (YCR, CBR)	0559-0746	57-67F, wind 1-3 mph, 0 % OC
4	05/01/08	JK, PD, DB (YCR, CBR)	0620-0934	61-85F, wind 1-3 mph, 0 % OC
5	05/08/08	JK, PD	0612-0926	60-81F, wind 1-3 mph, 0 % OC

* JK-John Konecny; PD-Patrick Del Pizzo; TC-Travis Cooper; DB-Darin Busby
YCR-Yuma clapper rail; CBR-California black rail

RESULTS

Three California black rail territories and one Yuma clapper rail pair (Figure 3) were detected in the enhancement site marsh area in 2008 (Figure 3). The California black rails were detected during all five surveys, with three distinct individuals being present on April 5th and April 22nd. A single Yuma clapper rail was heard "kekking" in the enhancement area between the recovery canal and powerline service road during the second survey event on April 4th. A pair of Yuma clapper rails was heard "duetting" in the enhancement area during the third survey event on April 22nd. A single least bittern was observed and heard in the enhancement area during the fifth survey on May 8th. Several Virginia rails (*Rallus limicola*) and a few soras (*Porzana carolina*) were also detected in the survey area during every survey event.

DISCUSSION

California black rails have been detected in the area by several previous investigators and the trend has shown a decline in the numbers of this species in this reach. Eighty individuals were recorded by McCaskie in 1980, 30 to 50 individuals in 1984 by Kasprzyk (both in Evens *et al* 1991), and 18 individuals by Evens (1991). These surveys were conducted in March and April of their respective years. Yuma clapper rails have also been documented as occurring in the general area, with five to six individuals present in 1980 (Zembal, pers.com.). Konecny (2006) detected six California black rails and one Yuma clapper rail during the fall of 2005. In these studies, the majority of California black rails and all of the Yuma clapper rails have been detected on the

south side of the All American Canal. The decline in rail numbers is likely attributed to the reduction of wetland habitat in the area, due to the installation of pumps that pump seep water from the recovery canals back into the main canal.

One California black rail territory and no Yuma clapper rails were detected in the enhancement area in 2007 (Konecny 2007). The periphery of the marsh and water level had been manipulated in the enhancement process in 2006 and it is possible there was too much disturbance of the area for black rails to remain. It may also be that there were subtle changes in the depth or chemistry of the water in the marsh, affecting the black rails and their food supply.

The establishment of three California black rail territories and one Yuma clapper rail pair in the enhancement area would suggest that the enhancement is proceeding nicely. The finding of a least bittern and several Virginia rails in the same area weighs additional support that the enhancement process is on the road to success. With the continuing growth of the marsh from the enhancement process, the population of California black rails will hopefully increase as well, as long as the marsh maintains the habitat parameters described by Eddleman (1994), i.e. dominance of cattails and bulrush, stable water level with moist soil and water not exceeding one inch (3 centimeters), and maintenance of at least 4.5 acres (1.8 hectare) of preferred habitat per pair.

CERTIFICATION

I certify that the information in this survey report and attached exhibits fully and accurately represent my work. The results of focused surveys for listed species are typically considered valid for one year by the USFWS and CDFG. If you have any questions or require additional information, please contact me at (760) 489-5276, the letterhead address, or jkonecny@cox.net.

Sincerely,



John K. Konecny
Wildlife Biologist
TE837308-4

REFERENCES CITED

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Figure 1. Location of Yuma Clapper Rail and California Black Rail Survey Area (red cross hatched area) for the Imperial Irrigation District's All American Canal Lining Project Wetland Enhancement Site, Imperial County, California, 2008.

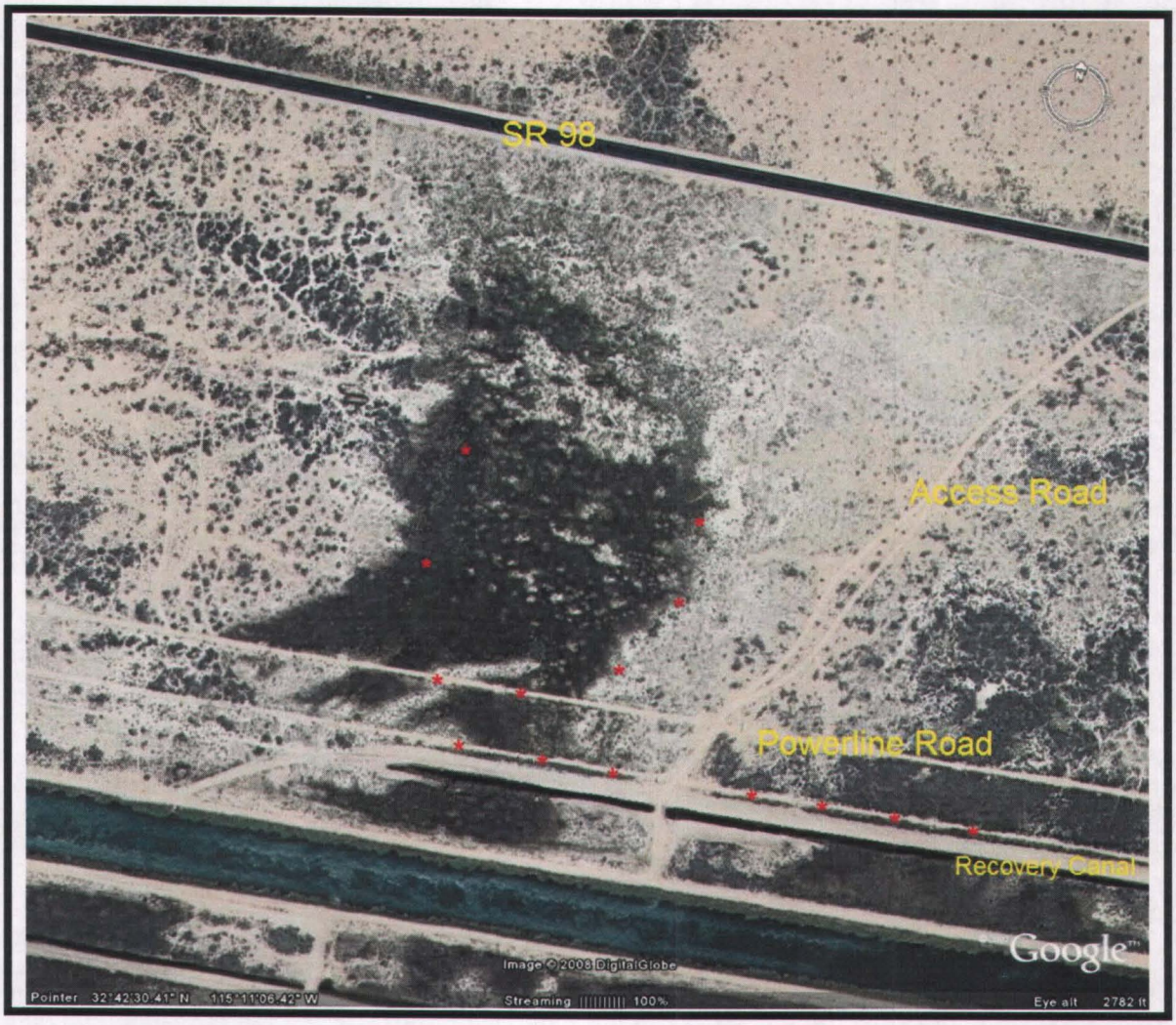

Figure 2. Location of the Fourteen Survey Point Locations (red asterisk) at the Yuma Clapper Rail and California Black Rail Survey Area for the Imperial Irrigation District's All American Canal Lining Project Wetland Enhancement Site, Imperial County, California, 2008.

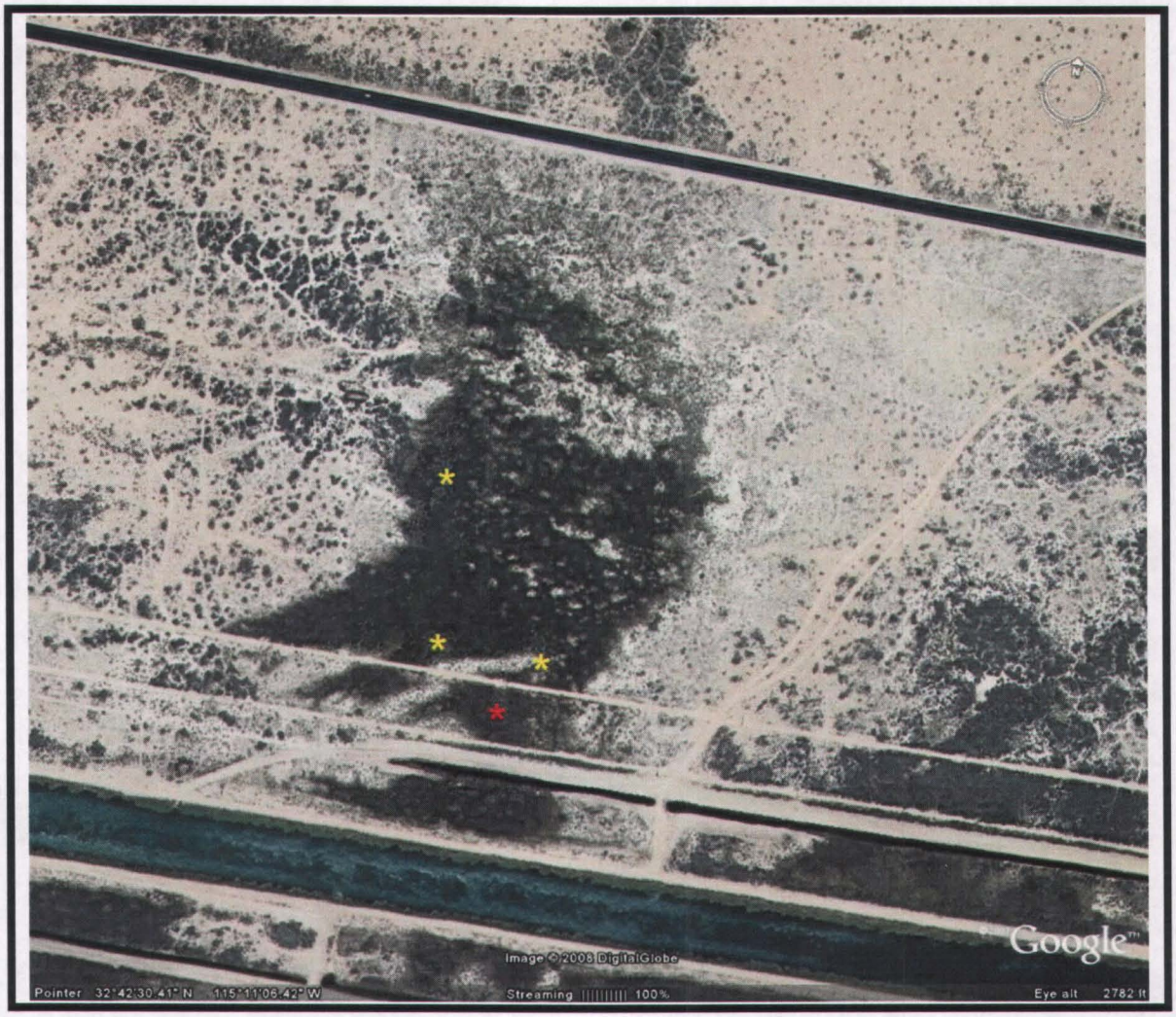

Figure 3. Location of the Three California Black Rail Territories (yellow asterisk) and Yuma Clapper Rail Pair (red asterisk) Detected During the Imperial Irrigation District's All American Canal Lining Project Wetland Enhancement Site Yuma Clapper Rail and California Black Rail Survey, Imperial County, California, 2008.

Attachment 1. Yuma Clapper Rail Data Sheets

National Marsh Bird Monitoring Program Survey Data Sheet

Date *(eg 10-May-04)*: 18 March, 2008

Name of marsh or route: IID Wetland

Observer(s) *(list all)**: John Konecny, Pat Del Pizzo, Travis Cooper

Survey replicate #: (1)

	Before	After
Temperature *(°F)*:	80	76
Wind speed *(mph)*:	1-3	1-3
Cloud cover *(%)*:	Ø	Ø
Precipitation *(see below)*:	Ø	Ø

**list all observers in order of their contribution to the data collected*

put an "S" in the appropriate column if the bird was seen, a "1" if the bird was heard, and "1S" if both heard and seen

Station#	Start Time (military)	Background noise	Species	Responded During: Before	Pass 0-1	Pass 1-2	Pass 2-3	Pass 3-4	Pass 4-5	BLRA 5-6	LEBI 6-7	VIRA 7-8	CLRA 8-9	After	Call Type(s)	Direction	Distance (meters)	Detected at a Previous Point	Comments
W5	1704	1	Ø													◯			Ø
W6	1715	1	Ø													◯			Ø
W7	1727	1	Ø													◯			Ø
																◯			
N9	1741	1	VIRA	1			1				1				ticker	Ⓝ	75		
			BLRA	1						1			1		Grr	Ⓝ	>100		
N8	1753	1	BLRA		1					1	1				Grr	Ⓝ	80		
N15	1807	1	Ø													◯			Ø
N14	1820	1	VIRA	1											ticker	Ⓦ	20		
N13	1832	1	VIRA							1					ticker	Ⓦ	50		
																◯			
E1	1849	1	Ø													◯			Ø
E2	1900	1	Ø													◯			Ø
																◯			
																◯			
																◯			
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Call Types: BLRA: *kicky-doo, grr, churt* CLRA: cltr, kburr, kek, khurrah LEBI: *coo, kak, ert* VIRA: *grunt, ticket, kicker*

If the call type is not one of the above listed types, describe the call in the comments column

Precipitation: light rain, rain, heavy rain, light snow, snow, heavy snow, fog, none

Background noise: 0 *no noise* 1 *faint noise* 2 *moderate noise (probably can't hear some birds beyond 100m)*
3 *loud noise (probably can't hear some birds beyond 50m)* 4 *intense noise (probably can't hear some birds beyond 25m)*

National Marsh Bird Monitoring Program Survey Data Sheet

Pg 1 of 3

Date *(eg 10-May-04)*: 19 March, 2008

Name of marsh or route: JJO Wetland

Observer(s) *(list all)**: JK, PD, TC

Survey replicate #: (1)

	Before	After
Temperature *(°F)*:	80	77
Wind speed *(mph)*:	3-7	3-7
Cloud cover *(%)*:	∅	∅
Precipitation *(see below)*:	∅	∅

**list all observers in order of their contribution to the data collected*

put an "S" in the appropriate column if the bird was seen, a "1" if the bird was heard, and "1S" if both heard and seen

Station#	Start Time (military)	Background noise	Species	Responded During: Before	Pass 0-1	Pass 1-2	Pass 2-3	Pass 3-4	Pass 4-5	BLRA 5-6	LEBI 6-7	VIRA 7-8	CLRA 8-9	After	Call Type(s)	Direction	Distance (meters)	Detected at a Previous Point	Comments
N10	1710	1	VIRA						1						Kicker	W	30		
N11	1738	1	VIRA			1						1			Kicker	W	70		
																			No N12
E2	1755	1	∅																∅
E3	1808	1	VIRA	1				1				1			Kicker	S	7100		
E4	1819	1	VIRA		1					1		1			Kicker	S	7100		

Call Types: BLRA: *kicky-doo, grr, churt* CLRA: cltr, kburr, kek, khurrah LEBI: *coo, kak, ert* VIRA: *grunt, ticket, kicker*

If the call type is not one of the above listed types, describe the call in the comments column

Precipitation: light rain, rain, heavy rain, light snow, snow, heavy snow, fog, none

Background noise: 0 *no noise* 1 *faint noise* 2 *moderate noise (probably can't hear some birds beyond 100m)*

3 *loud noise (probably can't hear some birds beyond 50m)* 4 *intense noise (probably can't hear some birds beyond 25m)*

National Marsh Bird Monitoring Program Survey Data Sheet

Date *(eg 10-May-04)*: 4 April, 2008

Name of marsh or route: IIO Wetland

Observer(s) *(list all)**: John Konecny, Travis Cooper

Survey replicate # (2)

	Before	After
Temperature *(°F)*:	86	84
Wind speed *(mph)*:	3-5	4-7
Cloud cover *(%)*:	Ø	Ø
Precipitation *(see below)*:	Ø	Ø

**list all observers in order of their contribution to the data collected*

put an "S" in the appropriate column if the bird was seen, a "1" if the bird was heard, and "1S" if both heard and seen

Station#	Start Time (military)	Background noise	Species	Responded During: Before	Pass 0-1	Pass 1-2	Pass 2-3	Pass 3-4	Pass 4-5	BLRA 5-6	LEBI 6-7	VIRA 7-8	CLRA 8-9	After	Call Type(s)	Direction	Distance (meters)	Detected at a Previous Point	Comments
E4	1753	1	Ø													O			Ø
E3	1803	1	Ø													O			Ø
E2	1815	1	Ø													O			Ø
E1	1826	1	Ø													O			Ø
																O			
W5	1842	1	CLRA	1											KeK	(N)	50		
			VIRA	1								1			ticher	(S)	7100		
W6	1856	1	Ø													O			Ø
W7	1910	1	VIRA									1				(SW)	75		
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Call Types: BLRA: *kicky-doo, grr, churt* CLRA: cltr, kburr, kek, khurrah LEBI: *coo, kak, ert* VIRA: *grunt, ticket, kicker*

If the call type is not one of the above listed types, describe the call in the comments column

Precipitation: light rain, rain, heavy rain, light snow, snow, heavy snow, fog, none

Background noise: 0 *no noise* 1 *faint noise* 2 *moderate noise (probably can't hear some birds beyond 100m)*

3 *loud noise (probably can't hear some birds beyond 50m)* 4 *intense noise (probably can't hear some birds beyond 25m)*

National Marsh Bird Monitoring Program Survey Data Sheet

Date *(eg 10-May-04)*: 5 April 2008
Name of marsh or route: 110 Wetland
Observer(s) *(list all)**: John Konecny
Survey replicate #: (1)

	Before	After
Temperature *(°F)*:	86	85
Wind speed *(mph)*:	4-7	7-10
Cloud cover *(%)*:	Ø	Ø
Precipitation *(see below)*:	Ø	Ø

**list all observers in order of their contribution to the data collected*
put an "S" in the appropriate column if the bird was seen, a "1" if the bird was heard, and "1S" if both heard and seen

Station#	Start Time (military)	Background noise	Species	Responded During: Before	Pass 0-1	Pass 1-2	Pass 2-3	Pass 3-4	Pass 4-5	BLRA 5-6	LEBI 6-7	VIRA 7-8	CLRA 8-9	After	Call Type(s)	Direction	Distance (meters)	Detected at a Previous Point	Comments
N9	1750	1	BLRA	1	1	1	1	1	1	1	1	1	1	1	K-doo	N	20		
			BLRA					1	1	1	1	1			K-doo	N	70		different bird
N8	1803	1	VIRA	1			1					1			ticker	N	10		
			BLRA			1	1	1	1	1	1	1			K-doo	N	7100		different bird
			BLRA	1	1	1	1	1	1	1	1	1	1	1	K-doo		7100		same as N9
N15	1821	1	Ø																Ø
N14	1837	1	VIRA			1					1				K-dick	E	10		
			BLRA	1	1	1	1	1	1	1	1	1	1	1	K-doo	E	7100		same as N8
N13	1851	1	Ø																Ø
																			No N12

Call Types: BLRA: *kicky-doo, grr, churt* CLRA: cltr, kburr, kek, khurrah LEBI: *coo, kak, ert* VIRA: *grunt, ticket, kicker*
If the call type is not one of the above listed types, describe the call in the comments column
Precipitation: light rain, rain, heavy rain, light snow, snow, heavy snow, fog, none
Background noise: 0 *no noise* 1 *faint noise* 2 *moderate noise (probably can't hear some birds beyond 100m)*
3 *loud noise (probably can't hear some birds beyond 50m)* 4 *intense noise (probably can't hear some birds beyond 25m)*

National Marsh Bird Monitoring Program Survey Data Sheet

Date *(eg 10-May-04)*: 21 April 2008

Name of marsh or route: IIO Wetland

Observer(s) *(list all)**: John Konecny, Pat Del Pizzo

Survey replicate #: (3)

	Before	After
Temperature *(°F)*:	85	83
Wind speed *(mph)*:	1-3	1-3
Cloud cover *(%)*:	Ø	Ø
Precipitation *(see below)*:	Ø	Ø

**list all observers in order of their contribution to the data collected*

put an "S" in the appropriate column if the bird was seen, a "1" if the bird was heard, and "1S" if both heard and seen

Station#	Start Time (military)	Background noise	Species	Responded During: Before	Pass 0-1	Pass 1-2	Pass 2-3	Pass 3-4	Pass 4-5	BLRA 5-6	LEBI 6-7	VIRA 7-8	CLRA 8-9	After	Call Type(s)	Direction	Distance (meters)	Detected at a Previous Point	Comments
E1	1745	1	Ø													◯			Ø
E2	1757	1	Ø													◯			Ø
E3	1808	1	Ø													◯			Ø
E4	1819	1	VIRA										1		ticker	(W)	>100		
																◯			
W5	1836	1	BLRA	1				1		1	1		1			(N)	40		
W6	1548	1	VIRA									1				(N)	60		
W7	1859	1	Ø													◯			Ø
																◯			
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Call Types: BLRA: *kicky-doo, grr, churt* CLRA: cltr, kburr, kek, khurrah LEBI: *coo, kak, ert* VIRA: *grunt, ticket, kicker*

If the call type is not one of the above listed types, describe the call in the comments column

Precipitation: light rain, rain, heavy rain, light snow, snow, heavy snow, fog, none

Background noise: 0 *no noise* 1 *faint noise* 2 *moderate noise (probably can't hear some birds beyond 100m)*
3 *loud noise (probably can't hear some birds beyond 50m)* 4 *intense noise (probably can't hear some birds beyond 25m)*

National Marsh Bird Monitoring Program Survey Data Sheet

Date *(eg 10-May-04)*: 22 April

Name of marsh or route: IID Wetland

Observer(s) *(list all)**: John Konecny, Pat Del Pizzo

Survey replicate #: 3

	Before	After
Temperature *(°F)*:	57	67
Wind speed *(mph)*:	1-3	1-3
Cloud cover *(%)*:	Ø	Ø
Precipitation *(see below)*:	Ø	Ø

**list all observers in order of their contribution to the data collected*

put an "S" in the appropriate column if the bird was seen, a "1" if the bird was heard, and "1S" if both heard and seen

Station#	Start Time (military)	Background noise	Species	Responded During: Before	Pass 0-1	Pass 1-2	Pass 2-3	Pass 3-4	Pass 4-5	BLRA 5-6	LEBI 6-7	VIRA 7-8	CLRA 8-9	After	Call Type(s)	Direction	Distance (meters)	Detected at a Previous Point	Comments
N8	0559	1	BLRA	1	1	1	1	1	1			1	1	1	K-doo	W	20		
			VIRA						1		1		1		ticker	E	60		
N9	0612	1	BLRA	1	1	1	1	1	1	1	1	1	1	1	K-doo	E	80		different than N8
			VIRA								1		1		grunt	W	90		
			YCR									1			duet	SE	7100		
N10	0637	1	BLRA	1	1	1	1	1	1	1	1	1	1	1	K-doo	S	>100		same as N8?
N11	0653		VIRA					1							grunt	N	40		
			BLRA							1	1	1			K-doo	S	>100		Sora
N15	0718	1	VIRA									1	1		ticker	W	70		
N14	0731	1	VIRA									1	1		ticker	S	20		Sora
N13	0746	1	VIRA										1		ticker	W	>100		
																			No N13

Call Types: BLRA: *kicky-doo, grr, churt* CLRA: cltr, kburr, kek, khurrah LEBI: *coo, kak, ert* VIRA: *grunt, ticket, kicker*

If the call type is not one of the above listed types, describe the call in the comments column

Precipitation: light rain, rain, heavy rain, light snow, snow, heavy snow, fog, none

Background noise: 0 *no noise* 1 *faint noise* 2 *moderate noise (probably can't hear some birds beyond 100m)*

3 *loud noise (probably can't hear some birds beyond 50m)* 4 *intense noise (probably can't hear some birds beyond 25m)*

National Marsh Bird Monitoring Program Survey Data Sheet

Date *(eg 10-May-04)*: 1 May 2008

Name of marsh or route: IIO Wetland

Observer(s) *(list all)**: John Konecny, Pat Del Pizzo, Devin Busby

Survey replicate #: (4)

	Before	After
Temperature *(°F)*:	61	85
Wind speed *(mph)*:	1-3	1-3
Cloud cover *(%)*:	Ø	Ø
Precipitation *(see below)*:	Ø	Ø

**list all observers in order of their contribution to the data collected*

put an "S" in the appropriate column if the bird was seen, a "1" if the bird was heard, and "1S" if both heard and seen

Station#	Start Time (military)	Background noise	Species	Responded During: Before	Pass 0-1	Pass 1-2	Pass 2-3	Pass 3-4	Pass 4-5	BLRA 5-6	LEBI 6-7	VIRA 7-8	CLRA 8-9	After	Call Type(s)	Direction	Distance (meters)	Detected at a Previous Point	Comments
E1	0620	1	Ø													◯			Ø
E2	0632	1	Ø													◯			Ø
E3	0643	1	Ø													◯			Ø
E4	0654	1	Ø													◯			Ø
																◯			
W5	0714	1	Ø													◯			Ø
W6	0726	1	BLRA		1								1	1	K-doo	Ⓝ	90		
W7	0738	1	BLRA					1	1	1	1	1	1	1	K-doo	Ⓝ	7100		same as W6
																◯			
N8	0759	1	BLRA	1											K-doo	Ⓝ	10		maybe same
			BLRA						1		1				K-doo	Ⓦ	40		" "
N9	0810	1	BLRA					1							K-doo	Ⓔ	90		different than N8
N10	0825	1	VIRA						1						oink	Ⓔ	10		
			VIRA									1			oink	Ⓔ	20		different than above
N11	0840	1	Ø													◯			Ø
N15	0906	1	Ø													◯			Ø
N14	0919	1	VIRA												ticle	Ⓦ	30		
N13	0934	1	Ø													◯			Ø, Sorg
																◯			
																◯			No NR
																◯			
																◯			
																◯			
																◯			
																◯			
																◯			

Call Types: BLRA: *kicky-doo, grr, churt* CLRA: cltr, kburr, kek, khurrah LEBI: *coo, kak, ert* VIRA: *grunt, ticket, kicker*

If the call type is not one of the above listed types, describe the call in the comments column

Precipitation: light rain, rain, heavy rain, light snow, snow, heavy snow, fog, none

Background noise: 0 *no noise* 1 *faint noise* 2 *moderate noise (probably can't hear some birds beyond 100m)*

3 *loud noise (probably can't hear some birds beyond 50m)* 4 *intense noise (probably can't hear some birds beyond 25m)*

National Marsh Bird Monitoring Program Survey Data Sheet

Pg 1 of 1

Date *(eg 10-May-04)*: 8 May 2008

Name of marsh or route: JID Wetland

Observer(s) *(list all)**: John Konecny, Pat Del Pizzo

Survey replicate #: (5)

	Before	After
Temperature *(°F)*:	60	81
Wind speed *(mph)*:	1-3	1-3
Cloud cover *(%)*:	Ø	Ø
Precipitation *(see below)*:	Ø	Ø

**list all observers in order of their contribution to the data collected*

put an "S" in the appropriate column if the bird was seen, a "1" if the bird was heard, and "1S" if both heard and seen

Station#	Start Time (military)	Background noise	Species	Responded During: Before	Pass 0-1	Pass 1-2	Pass 2-3	Pass 3-4	Pass 4-5	BLRA 5-6	LEBI 6-7	VIRA 7-8	CLRA 8-9	After	Call Type(s)	Direction	Distance (meters)	Detected at a Previous Point	Comments
E1	0612	1	Ø													○			Ø
E2	0623	1	Ø													○			Ø
E3	0633	1	Ø													○			Ø
E4	0644	1	Ø													○			Ø
																○			
W5	0701	1	BLRA			1	1								K-doo	W	100		
			LEBI					2	2	2	2		1		Kak	W	10		
W6	0713	1	BLRA		1				1	1	1	1			K-doo	W	10		Sora
			LEBI										1		Kak	W	>100		
W7	0728	1	Ø													○			Ø
																○			
N8	0745	1	BLRA	1	1	1	1	1	1	1	1	1	1	1	K-doo	NW	90		
N9	0758	1	BLRA	1	1	1									K-doo	W	40		different than above
N10	0815	1	Ø													○			Ø
N11	0830	1	VIRA	1						1	1	1	1	1	several	W	40		Sora
N15	0857	1	VIRA		1			1	1	1			1		several	W	20		Sora
N14	0913	1	VIRA										1		oink	W	10		
N13	0926	1	VIRA		1				1		1				ticker	W	10		
																○			
																○			No N12
																○			
																○			
																○			
																○			
																○			
																○			

Call Types: BLRA: *kicky-doo, grr, churt* CLRA: cltr, kburr, kek, khurrah LEBI: *coo, kak, ert* VIRA: *grunt, ticket, kicker*

If the call type is not one of the above listed types, describe the call in the comments column

Precipitation: light rain, rain, heavy rain, light snow, snow, heavy snow, fog, none

Background noise: 0 *no noise* 1 *faint noise* 2 *moderate noise (probably can't hear some birds beyond 100m)*

3 *loud noise (probably can't hear some birds beyond 50m)* 4 *intense noise (probably can't hear some birds beyond 25m)*

Certification

Determination of Absence of the Federally Endangered Yuma Clapper Rail (*Rallus longirostris yumanensis*) at the Earp, California to Parker, Arizona Bridge, San Bernardino County, California and La Paz County, Arizona

Record Id 10111
County San Bernardino
Year 2008
Spe YCR (−)
Srv. Rev. D.S. DK 5/14/09
GIS
L+E

Prepared for

Don Mitchell
ECORP Consulting
215 North 5th Street
Redlands, CA 92374

11 June 2008

I certify that the information in this survey report and attached exhibits fully and accurately represent my work.

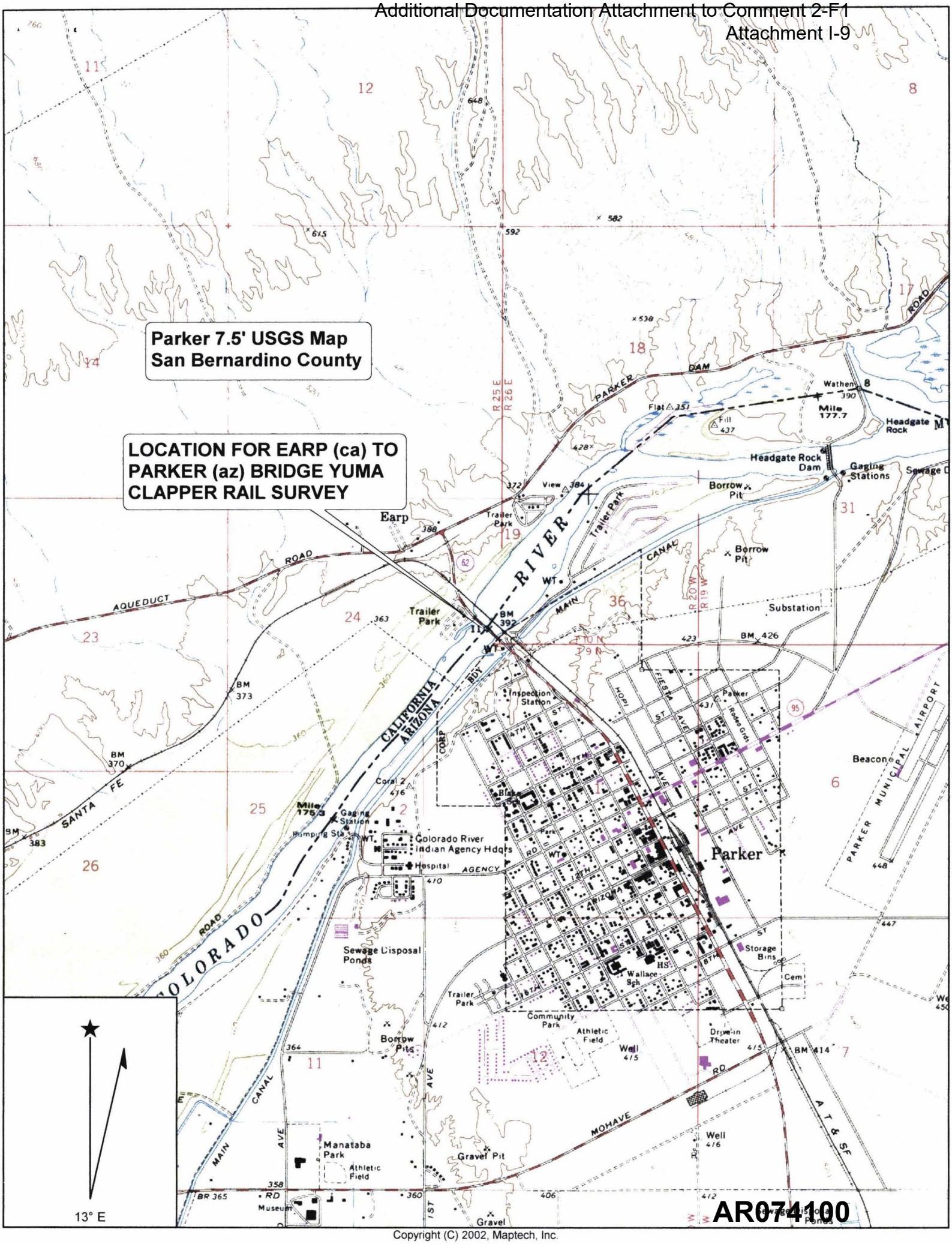
FWS Permit No. TE845541-10

16 February 2009

Permittee Signature

Date

RECEIVED
APR 22 2009
US FWS
CARLSBAD FIELD OFFICE CA



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SJM BIOLOGICAL CONSULTANTS

11 June 2008 SJMBC.753 (T.O.7)

Don Mitchell
ECORP Consulting
215 North 5th Street
Redlands, CA 92374

SUBJECT: Determination of absence of the federally endangered Yuma clapper rail (*Rallus longirostris yumanensis*) (YCR) at the Earp, California to Parker, Arizona bridge, located in San Bernardino County, California and western La Paz County, Arizona. The specific project location occurs in Section 24, Township 1 North, Range 25 East on the USGS Parker, Ariz.-Calif. 7.5 minute quadrangle map (Figures 1 and 2).

Dear Mr. Mitchell:

At the request of ECORP Consulting, Inc., SJM Biological Consultants (SJMBC) conducted a presence/absence survey for the Yuma clapper rail at the project site described above. The assessment was conducted on 5 and 6 April and 15 May 2008 by Stephen J. Montgomery, who holds a federal 10(a) (1) (A) permit (USFWS TE745541-10) to conduct protocol surveys for the YCR. The results of the field survey are presented below.

Yuma Clapper Rail Background

The YCR was classified as endangered by the U.S. Fish and Wildlife Service in March 1967, and by the California Department of Fish and Game as rare (later changed to "threatened") in 1971. The YCR breeds in marshes along the Colorado River from the California/Nevada border to the Colorado River Delta in Mexico. It also occurs in marsh habitats around the southern and southeastern portions of the Salton Sea, including the surrounding agricultural drains in this region, and the Salt and Gila Rivers in Arizona. Yuma clapper rails have declined due to the degradation and loss of freshwater marsh habitat throughout much of its relatively limited range. No critical habitat has been established for the species. Portions of the YCR population appear to migrate southward in winter months and may overwinter in Mexico (Anderson 1983; Eddleman 1989; Tomlinson and Todd 1973).

The YCR is typically associated with freshwater marsh habitats exhibiting stands of cattails (*Typha dominquez*) and/or rushes (*Scirpus* spp.), often with common reed

(*Phragmites australis*), interspersed with narrow channels of flowing water. In addition, the bird regularly uses the marsh-upland interface. Downed vegetation - which the rail regularly walks on when traversing deep water – also appears to be an important feature of occupied YCR habitat (Anderson 1983).

The YCR is an opportunistic forager and is known to feed on a variety of invertebrates (crustaceans, insects, spiders, etc.). However, it appears to prefer crayfish whenever available and may occasionally take other small animals such as fish and probably occasionally small rodents. Unlike other clapper rails, it is not restricted to salt water habitats.

Database and Previous Study Search

CNDDB records confirm several YCR occurrences approximately 1.6 miles (2.6 km) upstream of the Earp, California Highway 62 Bridge, near the Moovalya Lake/Headgate rock dam along the Colorado River. This CNDDB (2008) record reports that [Yuma clapper] "…..rails were known from here since 1946. Unknown numbers of rails responded to taped calls during a 1985 survey…..in 1987: 1 bird was detected; 1988: 6 birds detected; 1989: 4 birds detected; 1990: 1 pair detected."

As mentioned, YCR also occur at numerous locations along the Colorado River, at Parker Dam and downstream from the current project site (Anderson 1983; Eddleman 1989). A previous survey at the same project site failed to detect Yuma clapper rails (Konecny 2001, 2002).

Project Location and Description

The project area consists of the existing State Route 62 (SR-62) Colorado River Bridge that connects Earp, California and Parker, Arizona. The bridge occurs at an elevation of approximately 360 feet (110 meters) above mean sea level (AMSL) in the NW ¼ of the SE ¼ of the Parker 7.5-minute USGS Quad. The UTM coordinates (NAD83) near the center of the bridge are 0749000 East, 3783140 North (UTM Zone 11S). Caltrans-District 8 (Caltrans) proposes to replace the existing SR-62 Colorado River Bridge with a larger bridge at generally the same location. The proposed bridge would encompass one alignment with two slightly different bridge elevations.

Vegetation Communities and Habitat Conditions

Habitats within the project area include a variety of human disturbances, highly degraded river-edge aquatic/marsh vegetation, and one location with some emergent aquatic/marsh vegetation with low potential for YCR (**see photos in appendix**). The only area exhibiting emergent marsh vegetation – which is the general habitat required by YCR – and therefore any potential for YCR during April-May 2008 was the northwest shoreline at the western bridge-land contact point. This location exhibits (a) a small patch of mostly dry cat-tail (*Typha dominquez*), (b) a couple of similar small patches of live cat-tail and bulrush (*Scirpus sp.*), and a more extensive stand of a low-growing unidentified wetland-adapted grass. Westward

from this location is dry upland vegetation including tamarisk (*Tamarix ramosissima*), arrow weed (*Pluchea sericea*), and a variety of other terrestrial species. The westerly cat-tail stand (a) was dried out and not flooded on 15 May 2008; the easterly cat-tail/bulrush stands (b) were barely flooded during the April 2008 field visit, but completely dry on 15 May and during a subsequent drive-by on 2 June. Thus, their potential use by YCR was considered to be extremely low at all times.

A thin strip of vegetation occurs along the north east and southeast shorelines where the bridge contacts land. Heavy disturbance occurs to the east of the southeast bridge-land contact point, the thin strip of vegetation along the river's edge in this location including largely giant reed and arrow weed; this location has essentially no potential for YCR. The same basic condition prevails to the north of the bridge along the eastern side of the river, although there are numerous palm trees at river's edge in this area. An RV park occurs at the southwest shoreline immediately adjacent to and south of the bridge, and no aquatic vegetation is present at this location (a river-edge strip of aquatic vegetation does occur southward of the RV park some distance from the bridge). Thus, no potential for YCR exists at this location.

.

Figure 1. Highway 62 Colorado River Bridge Project Location

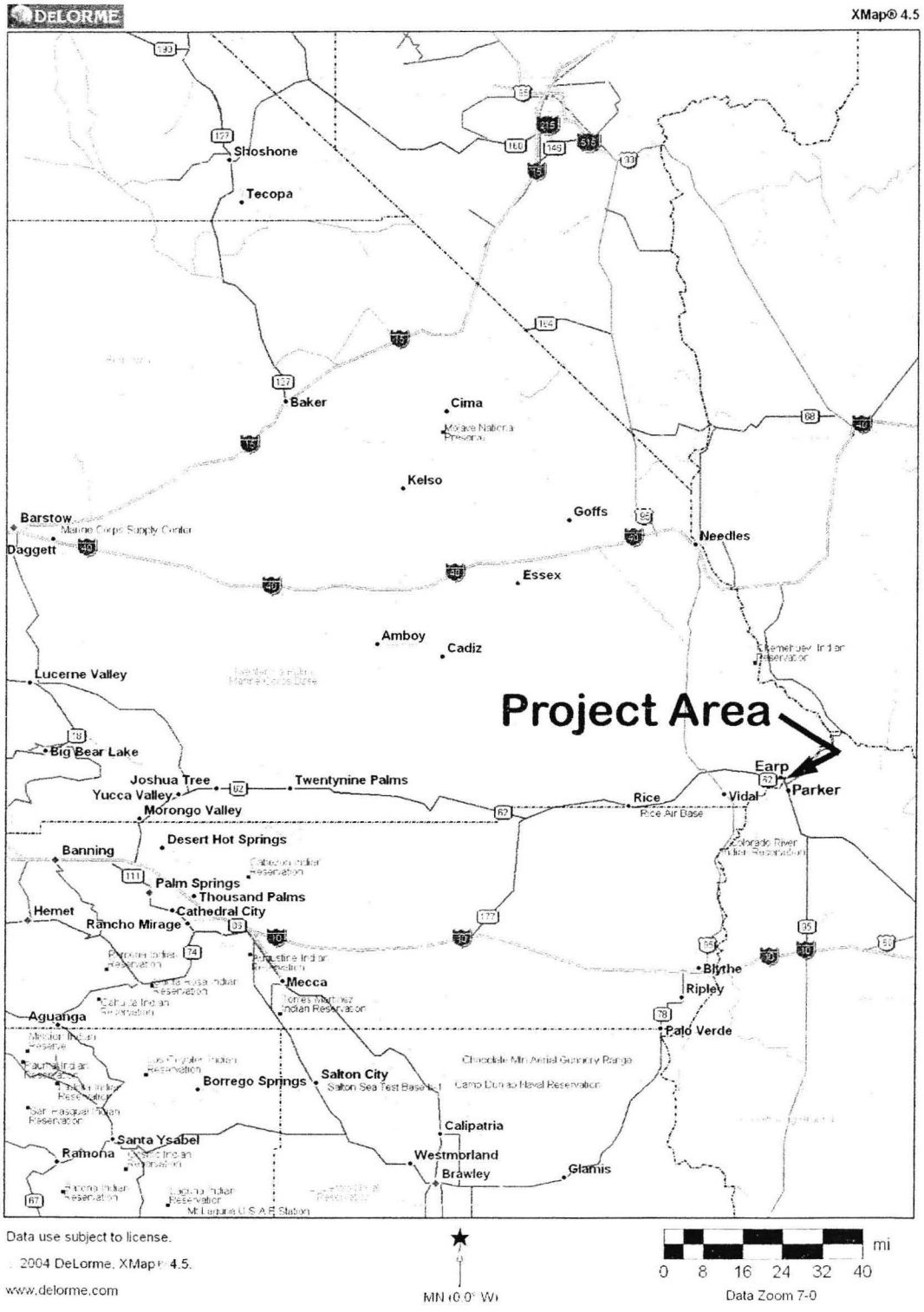
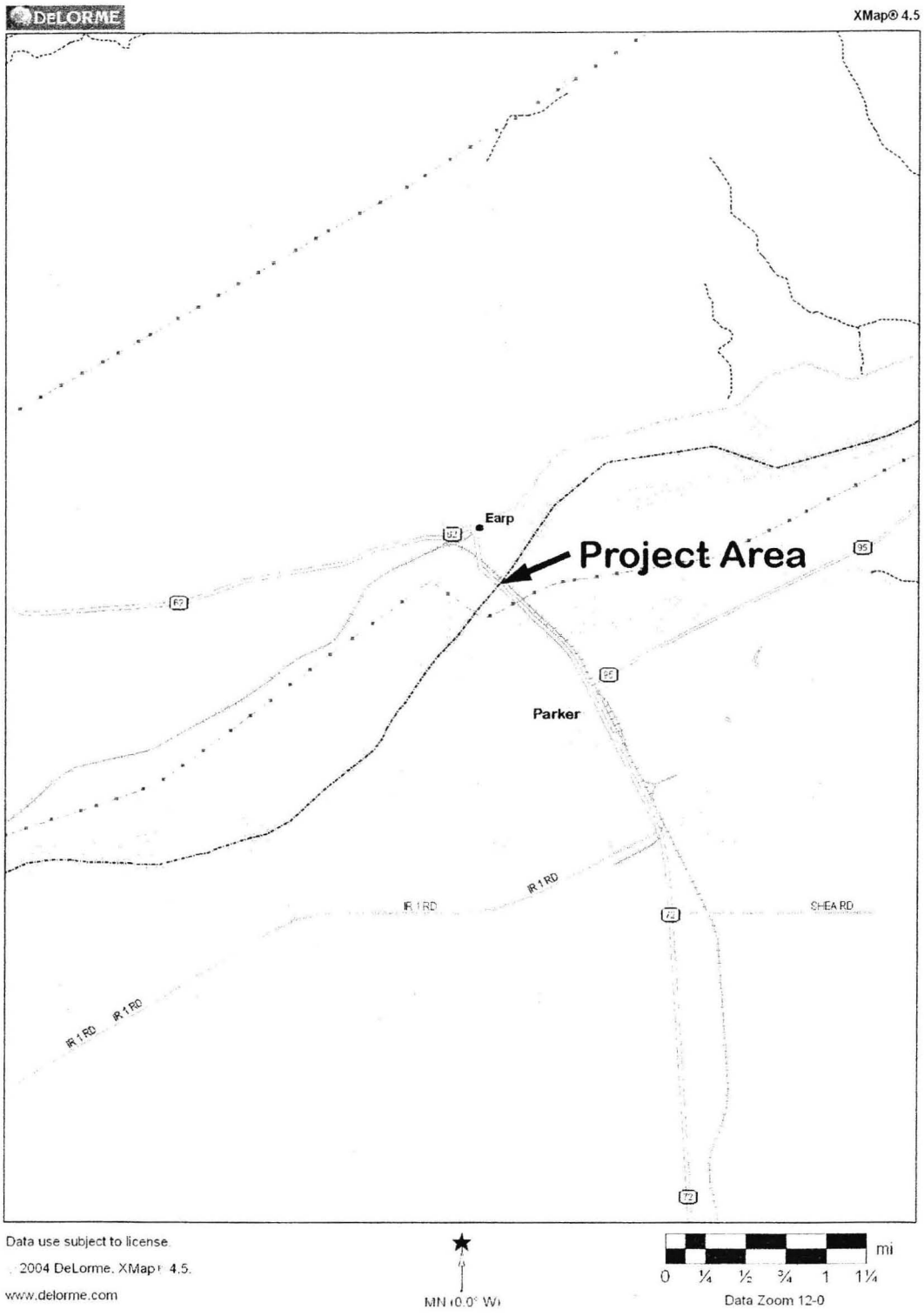


Figure 2. Highway 62 Colorado River Bridge Project Site



Methods

The survey protocols followed the basic methodology for detecting YCR issued by the Fish and Wildlife Service in 2002 (USFWS 2002). The deadline for surveys in those protocols was extended from the 15th to the end of May according to a 4 August 2004 telephone conversation with Leslie Fitzpatrick, the U.S. Fish and Wildlife Service biologist overseeing YCR surveys at that time (Phoenix, Arizona field office). The 2002 (with a 2004 survey date limit change) protocol requires at least two field visits between 15 March and the end of May. Both surveys were conducted during the final weeks of the survey season in May 2008. A more recent detailed survey protocol for North American marsh birds (Conway 2005) was issued but has not been universally accepted for YCR surveys; although it may become the primary protocol for all marsh birds in the future.

Two surveys were completed at the Parker Bridge by Stephen J. Montgomery on 5-6 April and 15 May 2008. Montgomery holds a U.S. Fish and Wildlife Service permit for Yuma clapper rails (TE745541-10). Both evening and morning surveys were conducted in order to maximize the likelihood of detecting any rails that might be present at the study site.

The survey encompassed the shoreline habitats in the immediate vicinity of the bridge as well as the marsh vegetation upstream and downstream from the drain to a distance of approximately 300 meters from the bridge. At each survey point, an initial period of 5 minutes was spent silently listening for clapper rail vocalizations. This silent period was followed by 30 seconds broadcasting clapper rail taped vocalizations (supplied by Phoenix, Arizona U.S. Fish and Wildlife Service Field Office) toward the drain marsh vegetation using a Johnny Stewart Game Caller, followed by one minute of silent listening, then 30 seconds of broadcasting tape calls, then one minute of silent listening, then ending with a final 30 seconds of broadcasting YCR calls followed by listening. The distance between listening/broadcasting points was approximately 50-70 meters. However, a major portion of the survey was conducted from the bridge itself near the bridge-land contact points, from which the loud tape vocalizations were broadcasted into the extant habitats near these four points.

Results

Weather conditions prevailing during the two field visits were warm and clear, as summarized below:

5 April - 1830 - clear skies, 2-5 mph wind, 80F (1750-1930 hrs)

6 April - 0610 - clear skies, 0 wind, 62F (0600-0650 hrs)

15 May - 0605 - high thin clouds (70%) - 0-3 mph winds - 70F (0600-0700 hrs)

No Yuma clapper rails were detected during the two protocol surveys. These results, and the negative results of the previous surveys at the same location several years ago (Konecny 2001, 2000), indicate that this species is absent at and in the immediate vicinity of the Parker Bridge project site. It follows that, under current conditions, YCR will not be affected by any bridge improvement/replacement activities. It should be noted that Yuma clapper rail survey reports are typically valid for a period of one year. However, considering the limited amount of low-quality habitat at this location, future surveys for this species would only be warranted if a noteworthy stand of emergent marsh vegetation colonized this site in the future. The regular fluctuations in river level produced by varying releases of water from the Parker Dam (upstream from the bridge) would be expected to strongly affect habitat conditions and therefore use by YCR in the project area.

No other marsh bird species were observed at the project site during the April and May field surveys. This is more evidence of the low quality of the extant habitat for YCR at this location.

Please contact me if you have any questions regarding this report or the associated field effort.

Sincerely,



Stephen J. Montgomery
Permitted Yuma Clapper Rail Biologist

SJM Biological Consultants
8455 Slayton Ranch Road
Flagstaff, Arizona 86004
(928) 527-1604

Literature Cited

Anderson, S.H. 1983. Yuma clapper rail recovery plan. Wyoming Coop. Research Unit. Laramie, Wyo.

[CNDDB] California Natural Diversity Database. 2008. California Department of Fish and Game. Rarefind Database. Version 3.1.0.

Conway, C.J. 2005. Standardized North American marsh bird monitoring protocols. Wildlife Research Report #2005-04. U.S. Geological Survey, Arizona Cooperative Fish and Wildlife Research Unit. Tucson, AZ.

Eddleman E. R. 1989. Biology of the Yuma Clapper Rail in the Southwestern U.S. and Northwestern Mexico. Final report submitted to the Bureau of Reclamation, Yuma Projects Office, and U.S. Fish and Wildlife Service Region 2. Intra-Agency agreement No. 4-AA-30-02060. 177pp.

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Konecny, J. 2000. Results of a Year 2000 Focused Survey for the Yuma Clapper Rail at the Proposed California State Route 62 Colorado River Bridge Replacement Site, Parker, Arizona. Prepared for Sapphos Environmental. Pasadena, CA

Tomlinson, R.E. and R.L Todd. 1973. Distribution of Two Western Clapper Rail Races as Determined by Responses to Taped Calls. Condor 75:177-183.

USFWS (U.S. Fish and Wildlife Service). 2002. Yuma Clapper Rail Survey Protocol. Phoenix, Arizona Field Office

Appendix A Site Photographs



Figure 1. SR-62 Colorado River Bridge, Southwest view (May, 2008).



Figure 2. SR-62 Colorado River Bridge, Southeast view (May, 2008).

Appendix A Site Photographs (continued)



Figure 3. SR-62 Colorado River Bridge, Southwest view (May, 2008).



Figure 4. SR-62 Colorado River Bridge, Southeast view (May, 2008).

Appendix A Site Photographs (continued)



Figure 5. SR-62 Colorado River Bridge, Southeast view (May, 2008).

California Native Species Field Survey Form

Mail to:
Natural Diversity Database
California Department of Fish and Game
1807 13th Street, Suite 202
Sacramento, CA 95814

For Office Use Only
Source Code _____ Quad Code _____
Elm Code _____ Occ. No. _____
EO Index No. _____ Map Index No. _____

Date of Field Work: 04 / 05 - 05-06 / 15 - 2008
month (mm) date (dd) year (yyyy)

Scientific Name: Rallus longirostris yumanensis
Common Name: Yuma clapper rail

Species Found? ☐ yes ☑ no — very minimal suitable habitat plus disturbance (if not, why?)
Total No. Individuals _____ Subsequent Visit? ☐ yes ☐ no
Is this an existing NDDB occurrence? _____ ☐ no ☐ unk.
Yes, Occ. #
Collection? If yes: _____ _____
Number Museum / Herbarium

Reporter: SJM Biological Consultants
Address: 8455 Slayton Ranch Rd
Flagstaff, AZ 86004
Email Address: steve@sjmbio.com
Phone: (928) 527-1604

Plant Information
Phenology: _____ % vegetative _____ % flowering _____ % fruiting

Animal Information
Age Structure: _____ # adults _____ # juveniles _____ # unknown
☐ breeding ☐ wintering ☐ burrow site ☐ rookery ☐ nesting ☐ other

Location (please also attach or draw map on back) Earp - Parker bridge, Hwy 62

County: San Bernardino Landowner / Mgr.: unknown
Quad Name: Parker, Ariz - Calif. 7.5' Elevation: ~360'
T 1N R 25 E 1/4 of _____ 1/4 of Section 24 T _____ R _____ 1/4 of _____ 1/4 of Section _____
UTM: Zone: 11S (10, 11) Datum: NAD83 (NAD83, NAD27, WGS84, other)
Source: GPS (GPS, map & type, etc.) Point Accuracy: _____ Meters
UTM Coordinates 749000 E 3783140 N

Habitat Description (plant communities, dominants, associates, substrates/soils, aspects/slope)
Highly degraded river-edge aquatic/marsh vegetation; one small patch of mostly dry cat-tail and a couple of similar small patches of live cat-tail and bulrush, a more extensive stand of low-growing unidentified wetland-adapted grass.
Other rare species?

Site Information Overall site quality: ☐ Excellent ☐ Good ☐ Fair ☑ Poor
Current / surrounding land use: SR-62
Visible disturbances / possible threats: RV park, trails,
Comments:

Determination: (check one or more, and fill in blanks)
☐ Keyed (cite reference): _____
☐ Compared with specimen housed at: _____
☐ Compared with photo / drawing in: _____
☐ By another person (name): _____
☐ Other: _____

Photographs: (check one or more) Slide Print
Plant / animal ☐ ☐
Habitat ☐ ☐
Diagnostic feature ☐ ☐
May we obtain duplicates at our expense? ☐ yes ☐ no

FG/WHDAB/1747 Rev. 11/99

The Effects of Fire on the Yuma Clapper Rail (*Rallus longirostris yumanensis*)

Record Id 10299
County Imperial
Year 2008
Spp YCR (+)
Srv. Rpt.
D.B. Due 7/13/09
RN 6-14-13
GIS [redacted]
L+R
File

2008 Annual Report

for

USFWS Endangered Species Permit # TE039466-1

Courtney J. Conway and Christopher P. Nadeau
USGS Arizona Cooperative Fish and Wildlife Research Unit
University of Arizona
325 Biological Sciences East, Tucson, Arizona 85721

RECEIVED
JUL 09 2009
US FWS
CARLSBAD FIELD OFFICE CA

Introduction:

The Yuma clapper rail (*Rallus longirostris yumanensis*) is a federally endangered species that occurs along the lower Colorado River, the Imperial Valley of California, the Colorado River delta, and along the west coast of Mexico. Ninety percent of the U.S. population exists in only 2 wetlands (Conway et al. 1993) and much existing wetland habitat remains unoccupied. Yuma clapper rails are ranked 6th out of 230 breeding bird species in Arizona based on their conservation need (Latta et al. 1999). To ensure long-term persistence of U.S. populations, we need to have effective management and mitigation activities that improve habitat quality and benefit Yuma clapper rail populations. One possible management activity that has been proposed to benefit Yuma clapper rail populations is prescribed burning in areas with decadent emergent vegetation (Conway et al. 1993). Historically, marsh habitats along the lower Colorado River were highly ephemeral with periodic flooding and natural fires eliminating decadent stands of emergent vegetation. These stochastic events resulted in areas of early successional emergent marsh habitat thought to be beneficial to rails (Conway 1990, Conway et al. 1993). Years of flood control and fire suppression has resulted in substantial areas of decadent emergent marsh habitat, but very little early successional emergent marsh along the lower Colorado River. Prescribed fire may be the best technique for creating early-successional emergent marsh habitat required to enhance populations of Yuma clapper rails. Indeed, prescribed fire has been repeatedly suggested as a promising conservation measure for restoring Yuma clapper rail populations (Conway et al. 1993, Conway 1995, Eddleman and Conway 1998, Conway and Eddleman 2000), but has yet to be evaluated. We conducted pre- and post-burn surveys in both burned and control marshes to examine the effects of fire on the abundance of rails and the quality of rail habitat.

Field Locations

Study Sites were located along the lower Colorado River in Arizona (Yuma and Mohave Counties) and California (Imperial County), and south of the Salton Sea in the Imperial Valley of California (Imperial County). We worked closely with Imperial National Wildlife Refuge, Havasu National Wildlife Refuge, and Sony Bono Salton Sea National Wildlife Refuge to conduct burns and marsh bird surveys at each refuge. Each burn occurred between 2003 and 2006. We did not conduct prescribed fires in 2008. We also surveyed marshes on other state and federally owned lands. See the attached maps which include all our study locations.

Methods:

We conducted call-broadcast surveys for rails in 4 types of study sites: sites recently burned by wildfire (n=7), non-burned (control) sites near each wildfire (n=14), sites recently burned by prescribed fire (n=19), and non-burned (control) sites near each prescribed burn (n=24). In 2008 at each study site, we conducted 1 survey between March and July. We used survey protocols that we developed based on our previous studies of marsh bird survey methods (Conway et al. 1993, Conway and Gibbs 2001, Conway et al. 2001) and on recommendations from a recent wetland bird monitoring workshop at the USGS Patuxent Wildlife Research Center (Ribic et al.1999). Surveys were conducted during mornings between one half-hour before sunrise until 10:00 am and in the evenings between 5:00 pm until dusk (one half-hour after sunset). All surveys

were conducted on days without rain and when wind speeds did not exceed 5 mph. Based on previous marsh bird survey work in the region, conditions during most (99%) mornings are favorable for surveys (i.e., without too much wind) whereas 42% of evenings are too windy for surveys.

Survey Results:

A summary of our survey results for 2008 are included in Appendix 1(including geographic coordinates for each survey site). Maps are included in Appendix 2. Preliminary analysis of survey data from 2003-2007 are promising. Numbers of Yuma clapper rails increased following fire and abundance was higher compared to control sites in the 2 years post-burn. We will continue to monitor burn and control sites in subsequent years to determine the long-term effects of fire on rails and the fire frequency needed to maintain optimal rail habitat.

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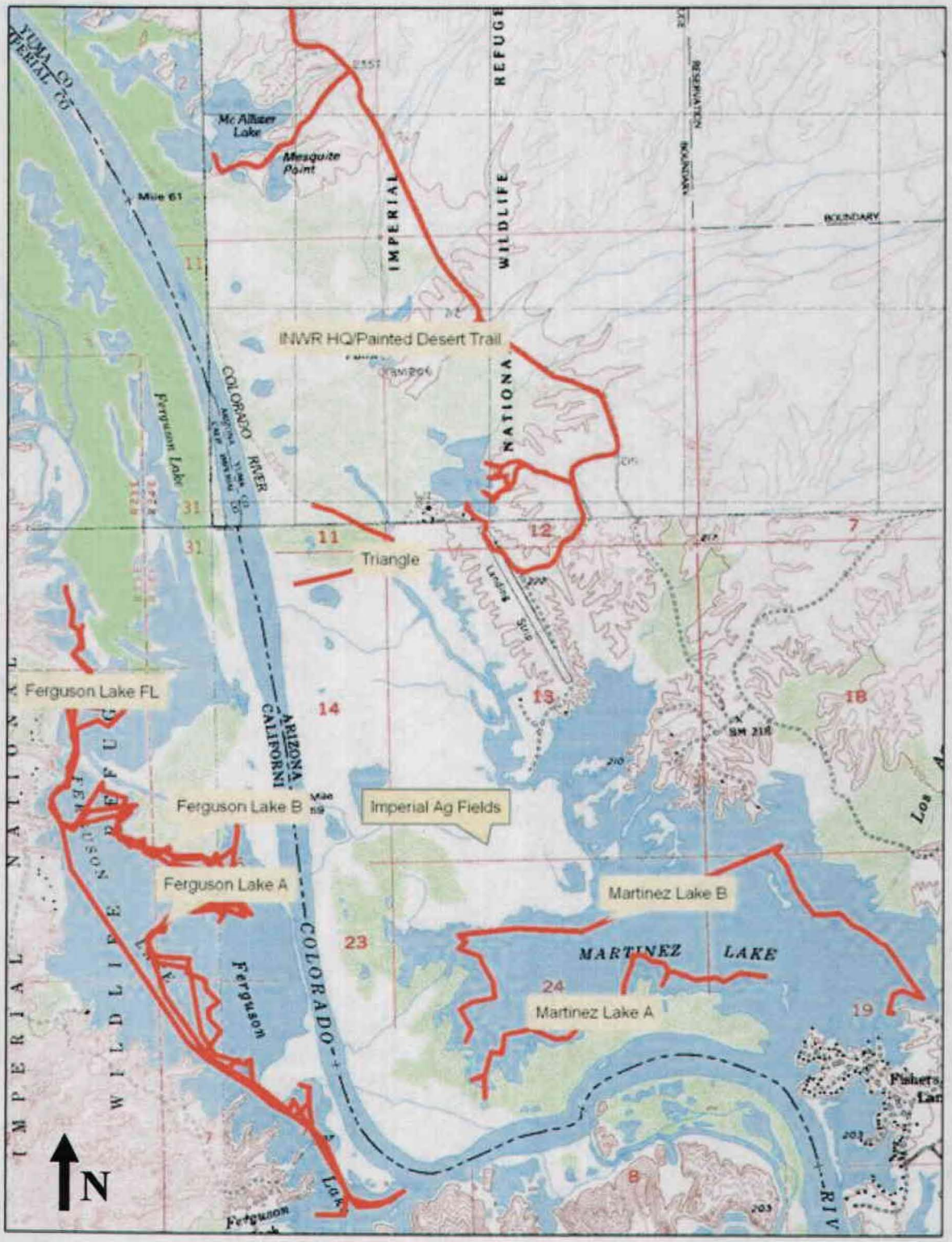
Appendix 1. Number of Yuma clapper rails counted at each survey site during the 2008 breeding season. Latitude and Longitude data were recorded in the North American Datum 1983.

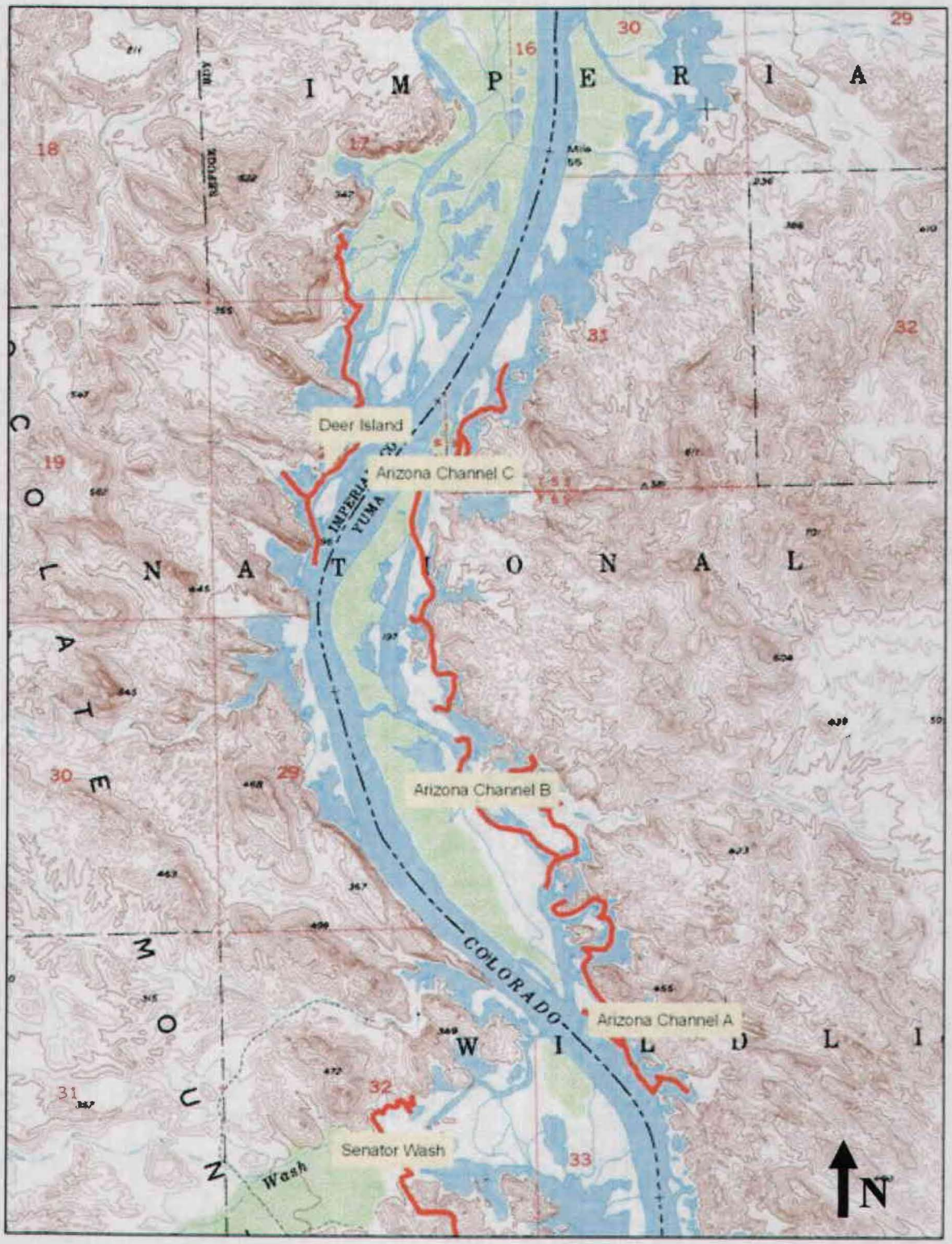
Site	Date	Observer	Latitude	Longitude	Total # of CLRAs Detected Per Survey (repeat detections included)
arizona channel a	26-Jun-08	Chris Nadeau	32.9169928571429	-114.465369285714	3
arizona channel c	26-Jun-08	Chris Nadeau	32.939050625	-114.473685	0
hidden shores boat a	21-Jun-08	Chris Nadeau	32.8922186666667	-114.456940666667	6
hidden shores boat b	25-Jun-08	Chris Nadeau	32.8885152941177	-114.462354117647	5
hidden shores boat c	24-Jun-08	Chris Nadeau	32.8934363636364	-114.458594545455	3
hidden shores boat d	22-Jun-08	Chris Nadeau	32.9000383333333	-114.459514166667	8
hidden shores marsh	03-Jun-08	Chris Nadeau	32.87372	-114.455841904762	2
hurricane ridge marsh	19-Jun-08	Chris Nadeau	32.90174	-114.484188	0
imperial dam road marsh a	08-Jun-08	Chris Nadeau	32.8659728571429	-114.482525714286	0
imperial dam road marsh b	08-Jun-08	Chris Nadeau	32.858525	-114.49279625	3
imperial dam road marsh c	20-Jun-08	Chris Nadeau	32.85787125	-114.49085625	2
imperial dam road marsh d	20-Jun-08	Chris Nadeau	32.8550733333333	-114.492508333333	0
inwr ag field 11	11-Jun-09	Chris Nadeau	32.9859933333333	-114.491168333333	3
inwr ag field 12	09-Jun-08	Chris Nadeau	32.983902	-114.492464	2
inwr ag field 13	27-May-08	Chris Nadeau	32.98285625	-114.49079	5
inwr ag field 14	10-Jun-08	Chris Nadeau	32.983195	-114.488391	1
inwr ag field 16	25-May-08	Chris Nadeau	32.9826473684211	-114.483314473684	9
inwr ag field 16	27-May-08	Chris Nadeau	32.9826473684211	-114.483314473684	7
inwr ag field 16	09-Jun-08	Chris Nadeau	32.9826473684211	-114.483314473684	7
inwr ag field 16	11-Jun-08	Chris Nadeau	32.9826473684211	-114.483314473684	2
inwr ag field 16	22-Jun-08	Chris Nadeau	32.9826473684211	-114.483314473684	6
inwr ag field 17	27-May-08	Chris Nadeau	32.98472	-114.482864444444	3
inwr ag field 18	27-Jun-08	Chris Nadeau	32.98472	-114.482864444444	3
inwr ag field 21	09-Jun-08	Chris Nadeau	32.98941	-114.4866725	6
inwr hq bunkhouse	17-Jun-08	Chris Nadeau	33.0012014285714	-114.485802857143	1
martinez lake a	12-Jun-08	Chris Nadeau	32.9769061538462	-114.479426923077	2
north mittry lake a	18-Jun-08	Chris Nadeau	32.8488484210526	-114.446155789474	14
north mittry lake b	19-Jun-08	Chris Nadeau	32.8583436842105	-114.450615263158	3
north mittry lake c	28-May-08	Chris Nadeau	32.8670516666667	-114.453364444444	4
painted desert trail	17-Jun-08	Chris Nadeau	33.0187833333333	-114.50146	0
senator wash	19-Jun-08	Chris Nadeau	32.91136375	-114.47726625	0
south mittry lake	16-Jun-08	Chris Nadeau	32.8338826666667	-114.445894	4
south of dredge ramp a	29-May-08	Chris Nadeau	32.8247561538462	-114.451288461538	0
south of dredge ramp b	20-Jun-08	Chris Nadeau	32.81951	-114.456381666667	1
squaw lake and south of squaw lake	11-Jun-08	Chris Nadeau	32.8948990909091	-114.470157272727	2
west pond a	02-Jun-08	Chris Nadeau	32.8802157894737	-114.478137894737	3
west pond b	30-May-08	Chris Nadeau	32.8793728571429	-114.48142	1

Appendix 2. Maps of survey sites.

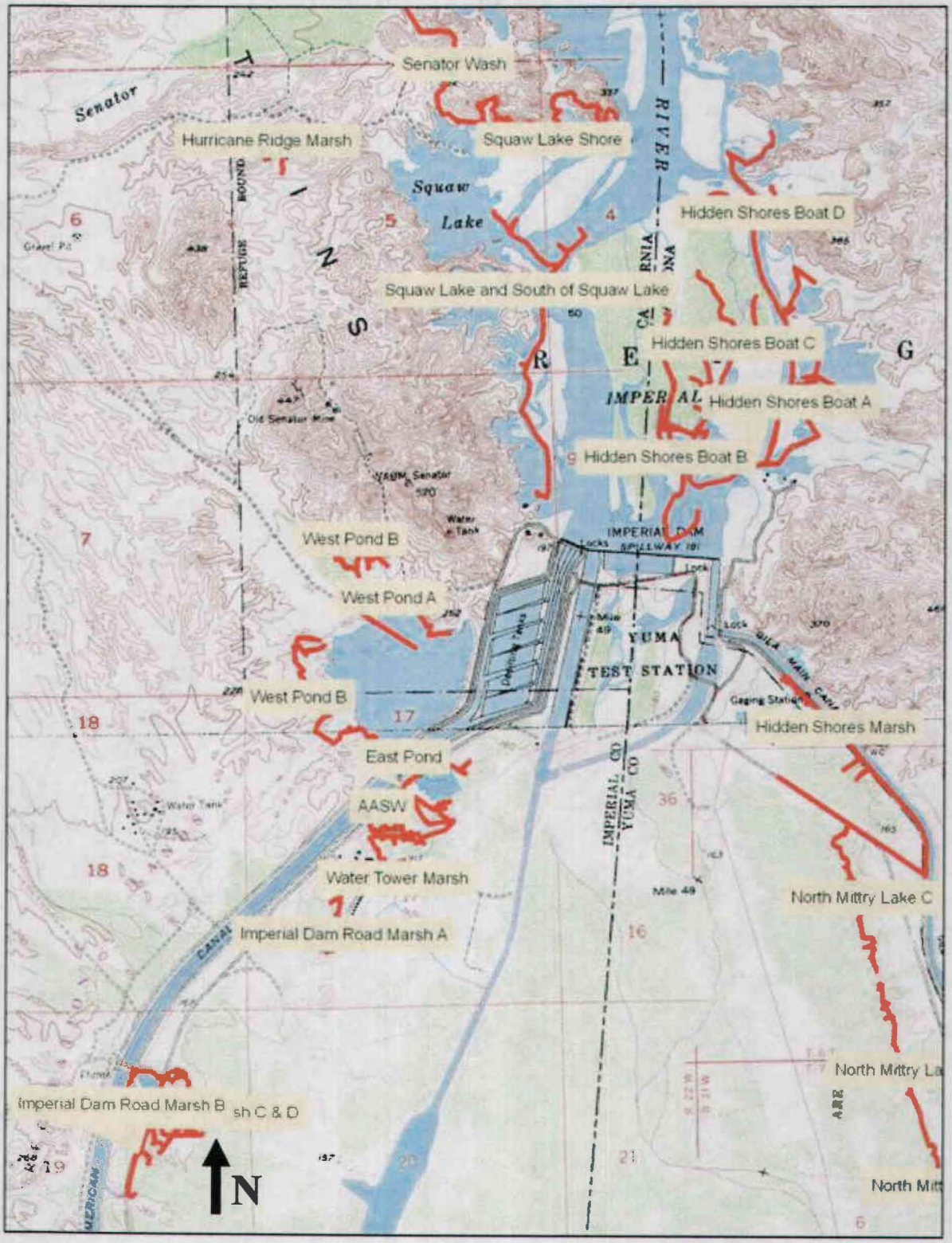
Lower Colorado River – Imperial National Wildlife Refuge



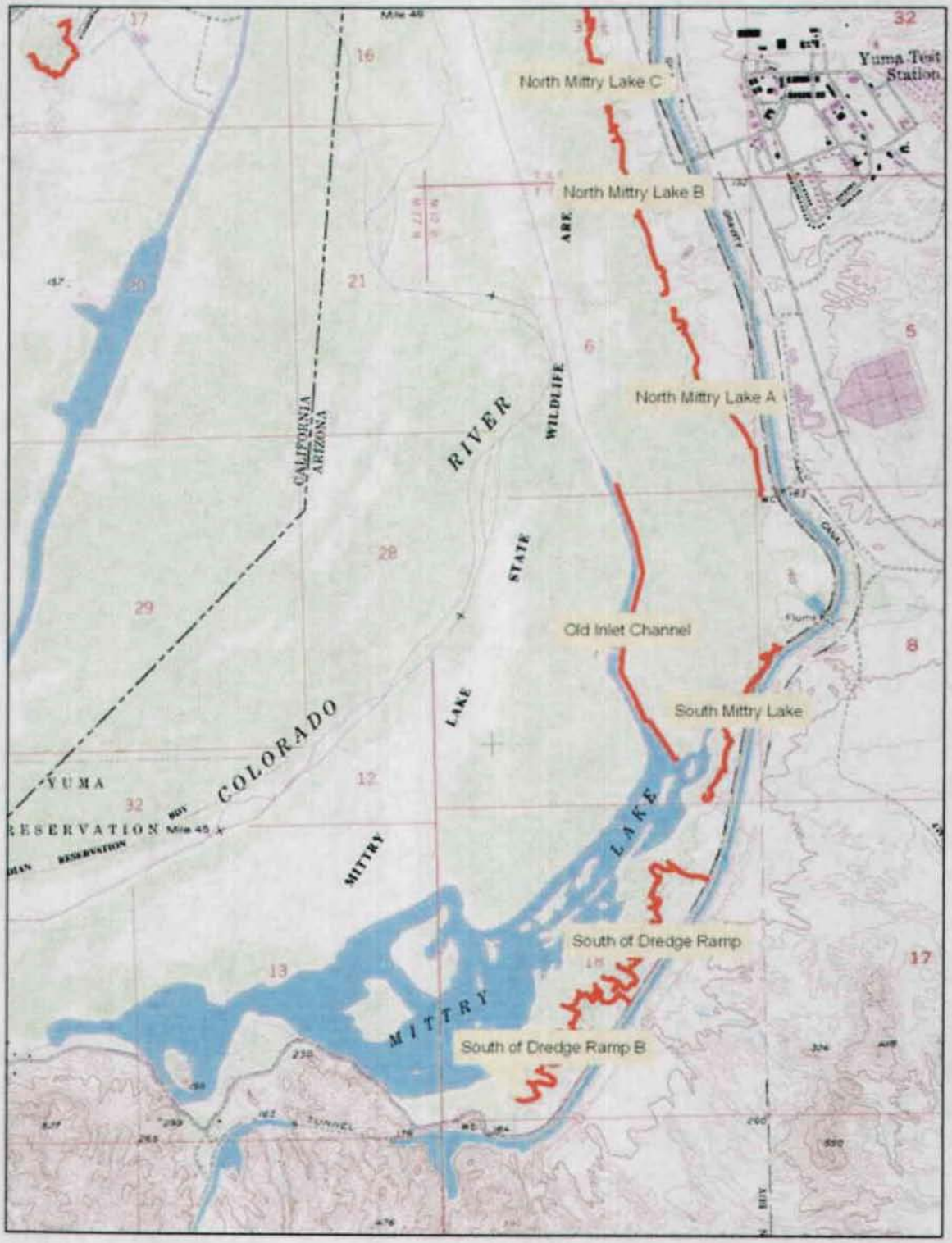
Lower Colorado River – Arizona Channel



Lower Colorado River – Imperial Reservoir



Lower Colorado River – North Mittry Lake



Record Id 10451
County Riverside
Year 2009
Spp YCR (+)
Srv. Rqr.
D.B. dlc 9/5/09
GIS monitoring data
L-I-R
File

United States Fish and Wildlife Service
6010 Hidden Valley Road
Carlsbad, CA 92009

August 24, 2009

Attn: Sandy Marquez, 10(a) Permit Coordinator

Re: Results of Protocol Surveys for Yuma Clapper Rail and California Black Rail at the Dos Palmas Core Marsh, Riverside County, California, 2009.

Dear Sandy:

The attached letter report presents the results of focused surveys for the Yuma Clapper Rail (*Rallus longirostris yumanensis*) and California Black Rail (*Laterallus jamaicensis coturniculus*) at the Dos Palmas Core Marsh in Riverside County, California. In that John Konecny, a WRI Research Associate, was the Lead Biologist on this project, we are submitting this 45-day report under his 10a permit requirement.

If you have any questions, please don't hesitate to call John or me.

Best regards,

Jeffrey L. Lincer, Ph.D.

Cc: John Konecny
Carla Scheidlinger, AMEC
Dave Bittner, WRI

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United States Fish and Wildlife Service
6010 Hidden Valley Road
Carlsbad, CA 92009

August 24, 2009

Attn: Sandy Marquez, 10(a) Permit Coordinator

Re: Results of Protocol Surveys for Yuma Clapper Rail and California Black Rail at the Dos Palmas Core Marsh, Riverside County, California, 2009.

Dear Dr. Lincer:

This letter report presents the results of focused surveys for the Yuma Clapper Rail (*Rallus longirostris yumanensis*), and California Black Rail (*Laterallus jamaicensis coturniculus*), at the Dos Palmas Core Marsh in Riverside County, California (Figure 1). The Yuma Clapper Rail is listed as an endangered species by the United States Fish and Wildlife Service (USFWS), and as a threatened species by the California Department of Fish and Game (CDFG). The California Black Rail is listed as a threatened species by CDFG.

These surveys were carried out as part of the Monitoring Plan for the Dos Palmas area as contracted by the San Diego County Water Authority (SDCWA) as part if its mitigation commitment for the Coachella Canal Lining Project (CCLP). Surveys for the Yuma Clapper Rail and California Black Rail were conducted following protocol developed in the Monitoring Plan (AMEC, 2009), which was approved by the USFWS as part of the review team for the biological monitoring project conducted for the San Diego County Water Authority (Carol Roberts pers. com.). The surveys were conducted under the authority of USFWS section 10(a) permits held by wildlife biologist John Konecny (TE837308-5), working as a WRI (Wildlife Research Institute) Research Associate, and by AMEC Earth &Environmental, Inc. (AMEC) biologists John Green (TE054011-2), Stephen Myers (TE804203-8), and Chet McGaugh (TE836517-5).

INTRODUCTION

The Yuma Clapper Rail occurs along the lower Colorado River in freshwater marsh dominated by cattails (*Typha* sp.), bulrush (*Scirpus* sp.), and common reed (*Phragmites australis*), from Needles, California, south to the Colorado River delta (Tomlinson and Todd 1973). Additional populations occur at the south end of the Salton Sea and along the Salt and Gila Rivers (Eddleman 1989), and are known to occur at Dos Palmas (AMEC 2008). Yuma Clapper Rails forage primarily on crustaceans and minnows during the breeding season, and rely more on a diet of seeds and vegetation in the winter. Populations of Yuma Clapper Rails have undergone decline in the United States due to their limited distribution, and destruction and degradation of freshwater marsh habitat.

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The California Black Rail is a small, sparrow-sized secretive rail, blackish above with white speckling, a chestnut nape, grayish-black underparts, narrow white barring on the flanks, and a short black bill. The California Black Rail occurs in the lower Colorado River area from the Imperial Dam, south to the Mexican border, with smaller, isolated populations scattered from Marin and San Luis Obispo counties in coastal California, southward to San Diego County, northwestern Baja California, and the lower Imperial Valley (Eddleman *et al* 1994, Small 1994), and is known to occur at Dos Palmas (AMEC 2008). California Black Rails tend to favor mixed pickleweed (*Salicornia* sp.), cordgrass (*Spartina foliosa*), and bulrush marshes in coastal habitats; and bulrush and cattail freshwater marshes in inland areas (Small 1994). California Black Rails typically forage on aquatic and terrestrial invertebrates and seeds. Like the Yuma Clapper Rail, the California Black Rail has undergone decline due to habitat degradation and destruction.

PROJECT LOCATION

The Dos Palmas Core Marsh is located within the Dos Palmas Area of Critical Environmental Concern (ACEC) to the east of Highway 111 near the north end of the Salton Sea (Figure 1). It is known to be habitat for the Yuma Clapper Rail and California Black Rail, as surveys for these species were conducted in 2006 and 2007 (AMEC 2008). This survey was conducted at essentially the same sampling stations that were used in the previous study.

PROJECT SITE DESCRIPTION

The Dos Palmas Core Marsh is located in the Dos Palmas ACEC. It is a marsh of approximately 150 acres. Vegetation includes emergent bulrush, cattails, and common reed (*Phragmites australis*), which are present in varying densities throughout the marsh. In addition, there are stands of salt cedar or tamarisk (*Tamarix* sp.) and saltgrass (*Distichlis spicata*) along the margins of the marsh. Upland vegetation adjacent to the marsh is characterized by tamarisk, arrowweed (*Pluchea sericea*), and quailbush (*Atriplex lentiformis*), with an occasional honey mesquite (*Prosopis glandulosa*), and patches of saltgrass and salt crusts. The topography of the entire area is relatively flat; with water flowing through the marsh from seeps and springs to the north, and concentrating into Salt Creek at the outflow of the marsh to the south. The elevation of the survey area ranges from approximately -120 feet (- 36 meters) to -134 feet (-41 meters) below Mean Sea Level.

METHODS

Three focused surveys for the Yuma Clapper Rail and California Black Rail were conducted according to the protocol detailed in the Monitoring Plan developed for the SDCWA (AMEC, 2009), which was approved by the USFWS as part of the review team (Carol Roberts pers. com.). Protocols follow guidance in Conway (2008). A dusk survey for the two species was conducted concurrently on March 19th. Dawn surveys were conducted on April 17, and May 13, 2009. The dusk surveys were initiated approximately two hours before sunset at about 1630 and continued until dark at 1900. Dawn surveys were initiated roughly 30 minutes prior to sunrise, at approximately 0630, and continued until no later than 0930. Weather conditions and other details of the surveys are presented in Table 1.

The surveys were conducted by three surveyors working simultaneously. A total of 21 survey stations were used, which are approximately 490 - 650 feet (150-200 meters) apart along the north, west, and east margins of the marsh (Figure 2). All surveyors followed an identical protocol. Surveys were conducted for California Black Rail first. Passive listening was conducted for two minutes initially, followed by 30 seconds of broadcast "grr" calls and 30 seconds of

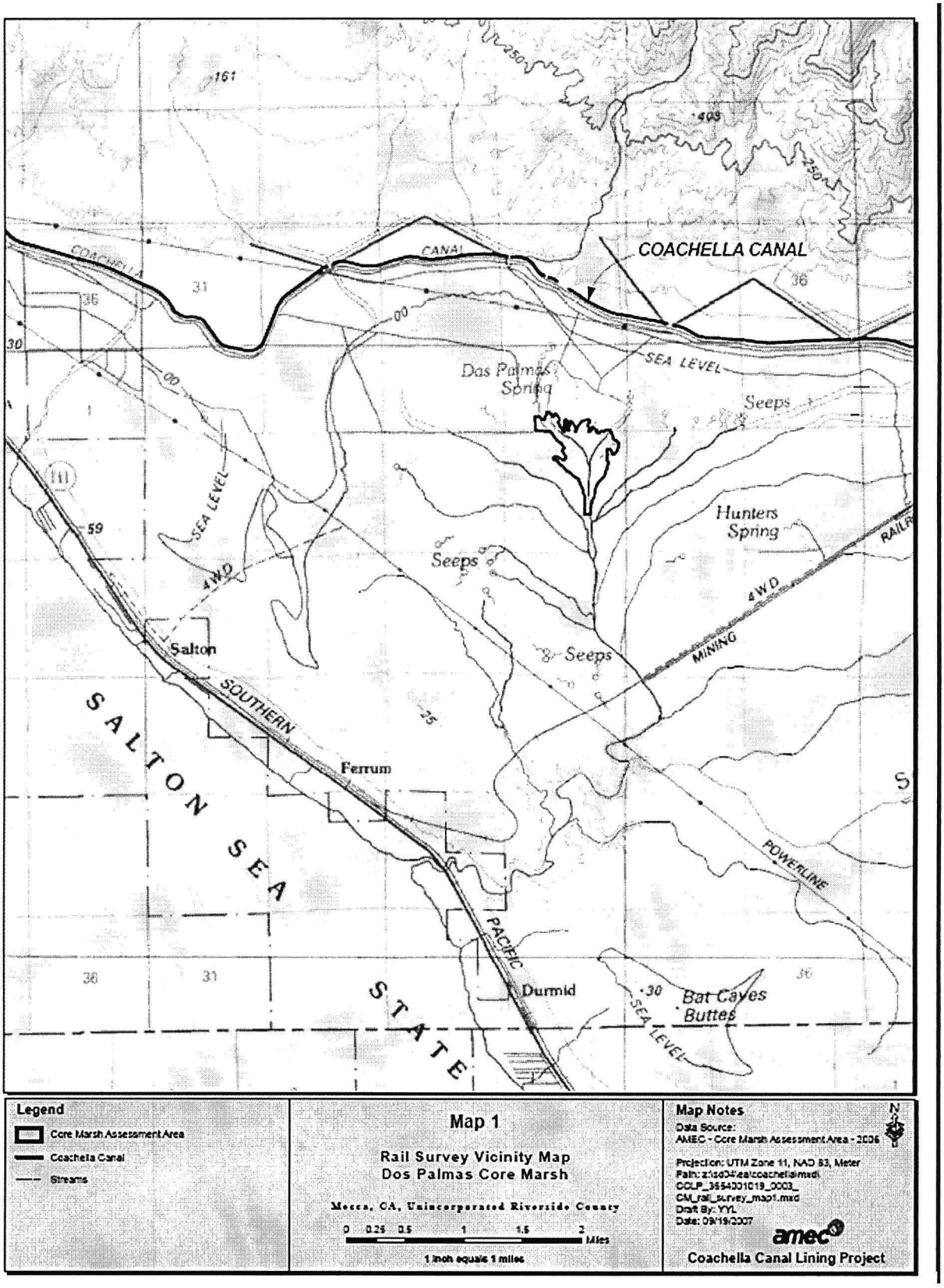

Figure 1. Location of Dos Palmas Core Marsh in Riverside County, CA.

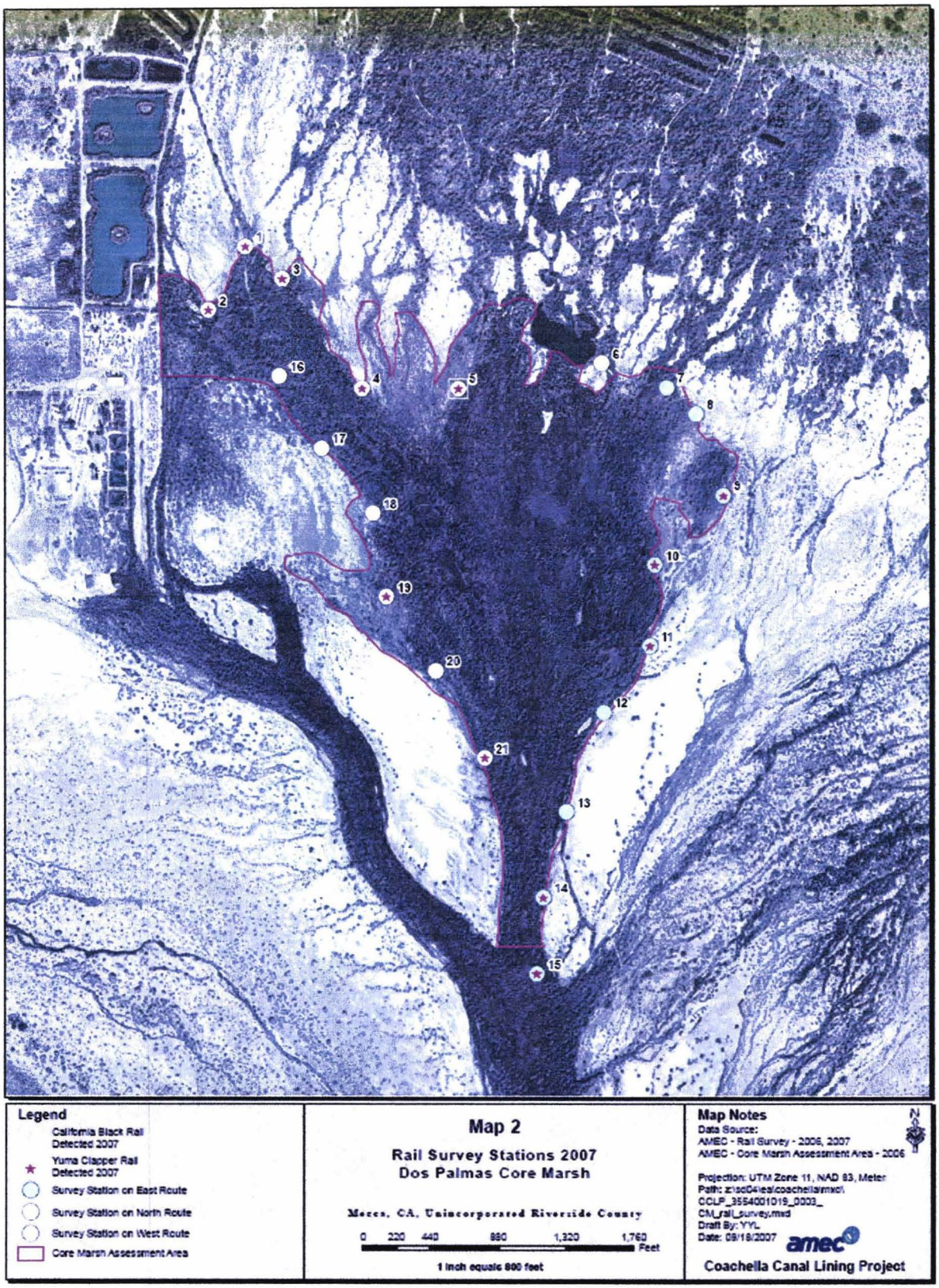

Figure 2. Location of the survey stations in the Dos Palmas Core Marsh. Essentially the same stations were used in the 2006, 2007, and 2009 surveys.

Table 1. Environmental conditions during three Yuma Clapper Rail and California Black Rail surveys of the Core Marsh of the Dos Palmas ACEC in Riverside County, California, 2009.

Survey #	Date	Surveyor*	Time	Weather Conditions (OC = overcast)
1	03/19/09	JK, JG, SM	1610-1905	72-90F, wind 1-3 mph, 20% OC
2	04/17/09	JK, JG, CM	0710-0952	49-76F, wind 0-7 mph, 0% OC
3	05/13/09	JK, JG, CM	0620-0926	67-87F, wind 0-3 mph, 0 % OC

* JK-John Konecny; JG-John Green; SM-Steve Myers; CM-Chet McGaugh

silence, then an additional 30 seconds of "grr" and 30 seconds of silence. Then 30 seconds of "kik-kic-kerr" call was broadcast, followed by 30 seconds of silence, and an additional 30 seconds of "kik-kic-kerr" call followed by 30 seconds of silence. The survey for Yuma Clapper Rail followed this sequence. Two minutes of passive listening was followed by 1 one-minute call broadcast, one minute of silence, another minute of broadcast, and five minutes of silence.

RESULTS

Both Yuma Clapper Rails and California Black Rails were detected in the Core Marsh during these surveys. The survey results are shown in Table 2.

DISCUSSION

Rail surveys were conducted in the past in the Core Marsh in 2006 and 2007. Table 3 below summarizes these results, and indicates the survey stations where the rails were detected. The location of the survey stations has remained essentially the same for all years, including 2009. It can be seen that there were fewer Yuma Clapper Rails detected in 2009 than in 2007, although more than in 2006. California Black Rail presence was the same. Fewer sampling stations detected rails of either species in 2009 than in 2007, and the distribution of both species of rails has changed somewhat. During 2009, the best rail habitat appears to be associated with station 4, and stations 8-11. Figure 2 shows these stations to be in the north and east portions of the marsh. The eastern portions of the marsh appeared to be unoccupied by rails in 2009, and it was the subjective impression of the surveyors, three of whom had been involved in the 2006 and 2007 surveys, that the marsh edge was drier in 2009 in these areas than it had been in previous years. It is also noted that a fire burned most of the marsh to the water line in April 2008, and this may have modified the quality of the habitat. In addition, the fire has at least temporarily converted a stand of tamarisk to the west into marsh habitat, and this may have modified the distribution of the rails in 2009.

Table 2. Rail census data in the Dos Palmas Core Marsh in 2009.

Location	3/19/2009 [1]		4/17/2009 [2]		5/13/2009 [3]	
	YCR [4]	CBR [5]	YCR	CBR	YCR	CBR
1						
2						
3					1	
4			3		1	
5						
6						
7					1	
8					1	
9					1	
10						
11	1	1	1			
121						
13						
14						
15						
16	1					
17	1					
18						
19						
20						
21						
TOTAL	**3**	**1**	**4**	**0**	**5**	**0**

[1] Konecny (WRI), Green (AMEC), and Myers (AMEC)
[2] Konecny (WRI), Green (AMEC), and McGaugh (AMEC)
[3] Konecny (WRI), Green (AMEC), and McGaugh (AMEC)
[4] Yuma Clapper Rail
[5] California Black Rail

Table 3. Rail census data in the Dos Palmas Core Marsh in 2006 and 2007.

Station	YCR 2006	YCR 2007	CBR 2006	CBR 2007
1	---	A, M	---	---
2	---	A, M	---	---
3	---	M	---	---
4	---	M	---	---
5	---	A, M	---	A
6	A	---	---	---
7	A	---	---	---
8	A	---	---	---
9	---	A, M	---	---
10	A	A	---	---
11	J	M	---	---
12	---	---	---	---
13	A	---	---	---
14	---	A	---	---
15	---	A, M	---	---
16	---	---	---	---
17	M	---	---	---
18	---	---	---	---
19	M	M	---	---
20	---	---	---	---
21	---	A	---	---
TOTAL	8	17	0	1

A = April
M = May
J = June

CERTIFICATION

We certify that the information in this survey report and attached exhibits fully and accurately represent our work. If you have any questions or require additional information, please contact me at (760) 789-3992.

Sincerely,

John K. Konecny
Wildlife Biologist
TE837308-5

John Green
Wildlife Biologist
TE054011-2

Stephen Myers
Wildlife Biologist
TE804203-8

Chester McGaugh
Wildlife Biologist
TE836517-5

Cc: Jeffrey L. Lincer, Ph.D., WRI Research Director

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AMEC Earth & Environmental. 2009. Monitoring Plan for Coachella Canal Lining Project Biomonitoring Project. Prepared for: San Diego County Water Authority. Project No. 8151001100.

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Rec 10698
County Imperial
Year 2010
Spp YCR (-)
Srv. Rpt.
D.B. OK 2/17/11
GIS
Ltr
Rpt

Konecny Biological Services
Biological Consulting, Research, Conservation

June 7, 2010

US Fish and Wildlife Service
Attn: Recovery Permit Coordinator
6010 Hidden Valley Road, Suite 100
Carlsbad, CA 92011

Re: Results of a Focused Survey for the Yuma Clapper Rail and California Black Rail at the New River and Wildcat Channel Adjacent to the Seeley County Water District Wastewater Treatment Plant, Imperial County, California, 2010

Dear Recovery Permit Coordinator:

This letter report presents the results of focused surveys for the Yuma clapper rail (*Rallus longirostris yumanensis*) and California black rail (*Laterallus jamaicensis coturniculus*) at the New River and within Wildcat Channel adjacent to the Wastewater Treatment Plant just west of the City of Seeley, Imperial County, California. The Yuma clapper rail is listed as an endangered species by the United States Fish and Wildlife Service (USFWS) and as a threatened species by the California Department of Fish and Game (CDFG). CDFG also considers the Yuma clapper rail to be a fully protected species. The California black rail is listed as a threatened species and a fully protected species by CDFG.

Surveys for the Yuma clapper rail and California black rail were conducted following the protocol approved by the USFWS (USFWS 2006), and included adding three additional surveys to conform with the recommendations that the Clapper Rail Study team provided to the USFWS (CLST 2009). The surveys were conducted by wildlife biologist John Konecny. This activity is authorized by USFWS section 10(a) permit number TE837308-5, and CDFG Memorandum of Understanding.

INTRODUCTION

The Yuma clapper rail is a slender, tawny-breasted bird with grayish edges on brown centered back feathers, olive wing coverts, vertical white bars on the flanks, a white stripe over the eye, and a partially orange bill. The Yuma clapper rail occurs along the lower Colorado River in freshwater marsh dominated by cattails (*Typha* sp.), bulrush (*Scirpus* sp.), and common reed (*Phragmites australis*), from Needles, California south to the Colorado River delta (Tomlinson and Todd 1973). Additional populations occur at the south end of the Salton Sea, and the Salt and Gila Rivers (Eddleman 1989). Yuma clapper rails breed between March and July. Yuma clapper rails forage primarily on crustaceans and minnows during the breeding season, and rely more on a diet of seeds and vegetation in the winter. Recent claims of migratory movement along the lower Colorado River could not be confirmed by radiotelemetry studies (Eddleman 1989, Conway 1990). Populations of Yuma clapper rails have undergone decline in the United States due to their limited distribution, and destruction and degradation of freshwater marsh habitat.

The California black rail is a small, sparrow-sized secretive rail, blackish above with white speckling. It has a chestnut nape, grayish-black underparts, narrow white barring on the flanks, and a short black bill. The California black rail occurs in the lower Colorado River area from the Imperial Dam south to the Mexican border, with smaller, isolated populations scattered from

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Marin and San Luis Obispo Counties in coastal California southward to San Diego County, northwestern Baja California, and the lower Imperial Valley (Eddleman *et al* 1994, Small 1994). California black rails tend to favor mixed pickleweed (*Salicornia* sp.), cordgrass (*Spartina foliosa*), and bulrush marshes in coastal habitats; and bulrush, cattail, arrowweed (*Pluchea sericea*), and common threesquare (*Schoenoplectus pungens*) freshwater marshes in inland areas (Conway and Sulzman 2007, Small 1994). Black rails breed between April and August. Black rails typically forage on aquatic and terrestrial invertebrates and seeds. Like the Yuma clapper rail, the California black rail has undergone decline due to habitat degradation and destruction. The population of California black rails along the Colorado River from Needles, California to Yuma, Arizona, probably numbers between 75-100 individuals (Evens et al. 1991).

PROJECT LOCATION

The New River and Wildcat Channel, adjacent to the Wastewater Treatment Plant are located immediately west of the City of Seeley in southern Imperial County (Figure 1). The survey area is located in the New River, just north of the Evan Hewes Highway. Specifically, the Wastewater Treatment Plant and survey area are located in Township 13 South, Range 12 East, and in Sections 68 and 106 of the Seeley, California 7.5 minute quadrangle.

PROJECT SITE DESCRIPTION

The area in the vicinity of the New River and the Wildcat Channel, located adjacent to the Seeley County Water District Wastewater Treatment Plant, supports a variety of habitats, including alkali desert scrub, irrigated fields, freshwater marsh, and arrowweed scrub. Vegetation in the New River and its banks is characterized by a band of emergent common reed and invasive tamarisk (*Tamarix* sp.), with a few small patches of embedded freshwater marsh. The riverine community transitions upland into alkali desert scrub characterized by arrow weed, and honey mesquite (*Prosopis glandulosa*). The alkali desert scrub in the survey area has a relatively high degree of disturbance.

The Wildcat Channel is located north of the Wastewater Treatment Plant and continues eastward for approximately 800 feet (244 meters1) from its confluence with the New River. The vegetation in this channel is primarily arrow weed and tamarisk, with a large patch of cattails in the approximate center. The topography of the New River floodplain in the project area is relatively flat, and the elevation ranges from minus 40 feet (-12 meters) to minus 80 feet (-24 meters) below Mean Sea Level.

METHODS

Six focused survey events for the Yuma clapper rail were conducted one week apart following the survey protocol approved by the USFWS (USFWS 2006) and Clapper Rail Study Team (CRST 2009). Each survey had a dawn and dusk component. The six surveys were conducted on April 4, 10, 17, 24 and 25, May 1 and May 15 and 16, 2010. Survey stations were established at approximately 300 foot (92 meters) intervals along the New River and Wildcat Channel for a total of nineteen stations. All potential Yuma clapper rail and California black rail habitat within this reach was surveyed.

The surveys were conducted by stopping at all stations and passively listening for Yuma clapper rails, California black rails, and other marsh birds during the first five-minutes. If rails were not detected, a digital vocalization, consisting of 30 seconds of California black rail followed by 30 seconds of silence, 30 seconds of least bittern (*Ixobrychus exillis*) followed by 30 seconds of silence, 30 seconds of Virginia rail (*Rallus limicola*) followed by 30 seconds of silence, and 30 seconds of Yuma clapper rail followed by 30 seconds of silence was played with an iPod and

amplified speakers. A response was listened for during a one minute period following the recorded vocalizations before proceeding to the next station. Environmental conditions during the six surveys are summarized in Table 1.

Table 1. Summary of Environmental Conditions During Six Yuma Clapper Rail and California Black Rail Surveys at the New River and Wildcat Channel adjacent to the Seeley County Water District Wastewater Treatment Plant, Imperial County, California, 2010.

Survey #	Date	Surveyor (Species) *	Time	Weather Conditions
1A	04/04/2010	JK (YCR/CBR)	0550-0920	20% overcast, 59-63°F, wind 7-10 mph
1B	04/04/2010	JK(YCR/CBR)	1700-1945	10% overcast, 69-55°F, wind 15-18 mph
2A	04/10/2010	JK (YCB/CBR)	0545- 0930	0%overcast,49-66°F, wind 5-7 mph
2B	04/10/2010	JK (YCR/CBR)	1710-1940	0% overcast, 58-71°F, wind 10-15 mph
3A	04/17/2010	JK (YCR/CBR)	0550-0920	0% overcast, 59-75°F, wind 5-7 mph
3B	04/17/2010	JK (YCR/CBR)	1705-1925	0% overcast, 86-80°F, wind 7-10 mph
4A	04/24/2010	JK (YCR/CBR)	1710-1755	0% overcast, 82-79°F, wind 5-7 mph
4B	04/25/2010	JK (YCR/CBR)	0550-0830	0% overcast, 88-69°F, wind 7-10 mph
5A	05/01/2010	JK (YCR/CBR)	1715-1935	0% overcast, 76-71°F, wind 10-15 mph
5B	05/02/2010	JK (YCR/CBR)	0600-0840	0% overcast, 62-77°F, wind 10-15 mph
6A	05/15/2010	JK (YCR/CBR)	1720-1950	0% overcast, 93-86°F, wind 7-10 mph
6B	05/16/2010	JK (YCR/CBR)	0550-0820	0% overcast, 60-75°F, wind 5-7 mph

* JK-John Konecny; YCR-Yuma Clapper Rail; CBR-California Black Rail

RESULTS

No Yuma clapper rails or California black rails were detected in the survey area during the six focused surveys in 2010. No other federal or state listed endangered or threatened species were detected. No other sensitive species were detected.

DISCUSSION

Focused surveys for the Yuma clapper rail and California black rail in the New River and the Wildcat Channel adjacent to the Seeley County Water District Wastewater Treatment Plant, were negative. Yuma clapper rails prefer dense stands of cattails and bulrushes intermixed with some open water. They have also been detected in dense stands of common reed (Anderson and Ohmart 1985). It would appear that the emergent vegetation in the New River and Wildcat Channel in the vicinity of the Seeley County Water District Wastewater Treatment Plant, while dense, is relatively narrow and is primarily tamarisk (Photos 1, 2 in Appendix 1). Prey availability, such as small fish and crustaceans may also be a problem in this area due to poor water quality. No crayfish shells, a preferred prey item of the Yuma clapper rail, were found in the area. No Yuma clapper rails or California black rails were found in the cattail patch in the side channel. Appropriate cattail vegetation is present in this area, although very little water is present. No forage items were found in this area.

California black rails are habitat specialists that require at least 1.25 acres (0.5 hectares) of emergent marsh and shallow water that is less than one and one-half inches (two centimeters) in depth (Conway and Sulzman 2007, Eddleman 1994). Given those habitat requirements, California black rail habitat is not present in the survey area. California black rails have been reported further south on the New River, south of Interstate 8 (Evens 1991).

CERTIFICATION

I certify that the information in this survey report and attached exhibits fully and accurately represent my work. The results of focused surveys for listed species are typically considered valid for one year by the USFWS and CDFG. If you have any questions or require additional information, please contact me at (760) 489-5276, the letterhead address, or jkonecny@cox.net.

Sincerely,

John K. Konecny
Wildlife Biologist
TE837308-5

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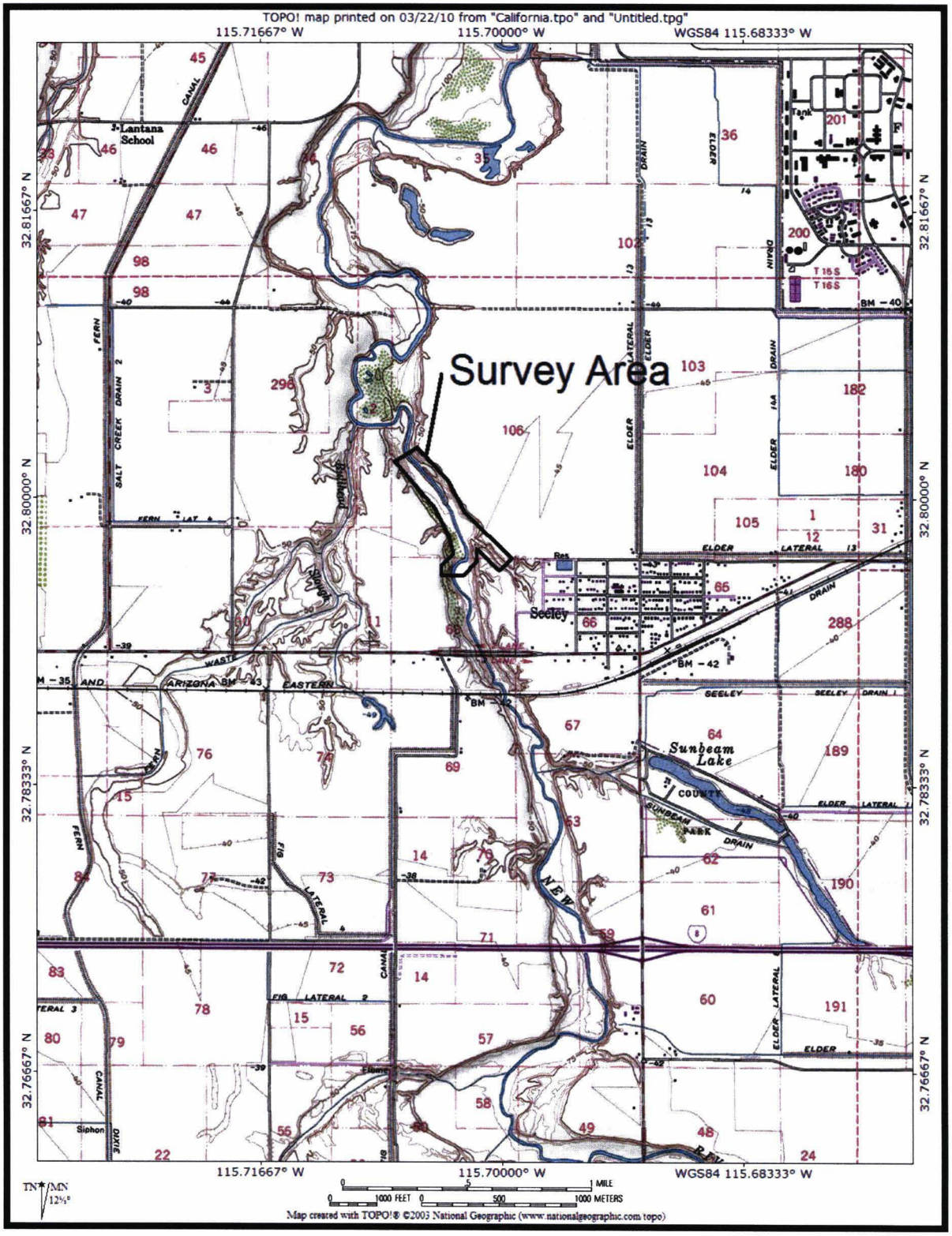

Figure 1. Location of the Yuma Clapper Rail and California Black Rail Survey Area at the New River and Wildcat Channel adjacent to the Seeley County Water District Wastewater Treatment Plant, Imperial County, California, 2010.

10701
County Riverside
Year 2009
Spp YCR (+)
Srv. Rpt. DC 3/30/10
D.B.
GIS T.M.K. 5-25-10
Ltr
File

Konecny Biological Services

Biological Consulting, Research, Conservation

August 24, 2009

United States Fish and Wildlife Service
6010 Hidden Valley Road
Carlsbad, CA 92009

Attn: Sandy Marquez, 10(a) Permit Coordinator

Re: Results of Protocol Surveys for Yuma Clapper Rail and California Black Rail at the Dos Palmas Core Marsh, Riverside County County, California, 2009.

Dear Dr. Lincer:

This letter report presents the results of focused surveys for the Yuma Clapper Rail (*Rallus longirostris yumanensis*), and California Black Rail (*Laterallus jamaicensis coturniculus*), at the Dos Palmas Core Marsh in Riverside County, California (Figure 1). The Yuma Clapper Rail is listed as an endangered species by the United States Fish and Wildlife Service (USFWS), and as a threatened species by the California Department of Fish and Game (CDFG). The California Black Rail is listed as a threatened species by CDFG.

These surveys were carried out as part of the Monitoring Plan for the Dos Palmas area as contracted by the San Diego County Water Authority (SDCWA) as part if its mitigation commitment for the Coachella Canal Lining Project (CCLP). Surveys for the Yuma Clapper Rail and California Black Rail were conducted following protocol developed in the Monitoring Plan (AMEC, 2009) which was approved by the USFWS as part of the review team for the biological monitoring project conducted for the San Diego County Water Authority. (Carol Roberts pers. com.). The surveys were conducted under the authority of USFWS section 10(a) permits held by wildlife biologist John Konecny (TE837308-4), working as a WRI (Wildlife Research Institute) Research Associate, and by AMEC Earth &Environmental, Inc.(AMEC) biologists John Green (TE054011-2), Stephen Myers (TE804203-8), and Chet McGaugh (TE836517-5).

INTRODUCTION

The Yuma Clapper Rail occurs along the lower Colorado River in freshwater marsh dominated by cattails (*Typha* sp.), bulrush (*Scirpus* sp.), and common reed (*Phragmites australis*), from Needles, California, south to the Colorado River delta (Tomlinson and Todd 1973). Additional populations occur at the south end of the Salton Sea, and along the Salt and Gila Rivers (Eddleman 1989), and is known to occur at Dos Palmas (AMEC 2008). Yuma Clapper Rails forage primarily on crustaceans and minnows during the breeding season, and rely more on a diet of seeds and vegetation in the winter. Populations of Yuma Clapper Rails have undergone decline in the United States due to their limited distribution, and destruction and degradation of freshwater marsh habitat.

The California Black Rail is a small, sparrow-sized secretive rail, blackish above with white speckling, a chestnut nape, grayish-black underparts, narrow white barring on the flanks, and a short black bill. The California Black Rail occurs in the lower Colorado River area from the Imperial Dam, south to the Mexican border, with smaller, isolated populations scattered from Marin and San Luis Obispo counties in coastal California, southward to San Diego County, northwestern Baja California, and the lower Imperial Valley (Eddleman *et al* 1994, Small 1994),

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Tel: (760) 489-5276 E-mail: jkonecny@cox.net

and is known to occur at Dos Palmas (AMEC 2008). California Black Rails tend to favor mixed pickleweed (*Salicornia* sp.), cordgrass (*Spartina foliosa*), and bulrush marshes in coastal habitats; and bulrush and cattail freshwater marshes in inland areas (Small 1994). California Black Rails typically forage on aquatic and terrestrial invertebrates and seeds. Like the Yuma Clapper Rail, the California Black Rail has undergone decline due to habitat degradation and destruction.

PROJECT LOCATION

The Dos Palmas Core Marsh is located within the Dos Palma Area of Critical Environmental concern (ACEC) to the east of Highway 111 near the north end of the Salton Sea (Figure 1). It is known to be habitat for the Yuma Clapper Rail and California Black Rail, as surveys for these species were conducted in 2006 and 2007 (AMEC 2008). This survey was conducted at essentially the same sampling stations that were used in the previous study.

PROJECT SITE DESCRIPTION

The Dos Palmas Core Marsh is located in the Dos Palmas ACEC. It is a marsh of approximately 150 acres. Vegetation includes emergent bulrush, cattails, and common reed (*Phragmites australis*) which are present in varying densities throughout the marsh. In addition, there are stands of salt cedar or tamarisk (*Tamarix* sp.) and saltgrass (*Distichlis spicata*) along the margins of the marsh. Upland vegetation adjacent to the marsh is characterized by tamarisk, arrowweed (*Pluchea sericea*), and quailbush (*Atriplex lentiformis*), with an occasional honey mesquite (*Prosopis glandulosa*), and patches of saltgrass (*Distichlis spicata*) and salt crusts. The topography of the entire area is relatively flat; with water flowing through the marsh from seeps and springs to the north, and concentrating into Salt Creek at the outflow of the marsh to the south. The elevation of the survey area ranges from approximately -120 feet (- 36 meters) to -134 feet (-41 meters) below Mean Sea Level.

METHODS

Three focused surveys for the Yuma Clapper Rail and California Black Rail were conducted according to the protocol detailed in the Monitoring Plan developed for the SDCWA (AMEC, 2009), which was approved by the USFWS as part of the review team. (Carol Roberts pers. com.). Protocols follow guidance in Conway (2008). A dusk survey for the two species was conducted concurrently on March 19th. Dawn surveys were conducted on April 17, and May 13, 2009. The dusk surveys were initiated approximately two hours before sunset at about 1630 and continued until dark at 1900. Dawn surveys were initiated roughly 30 minutes prior to sunrise, at approximately 0630, and continued until no later than 0930. Weather conditions and other details of the surveys are presented in Table 1.

The surveys were conducted by three surveyors working simultaneously. A total of 21 survey stations were used, which are approximately 490 - 650 feet (150-200 meters) apart along the north, west, and east margins of the marsh (Figure 2). All surveyors followed an identical protocol. Surveys were conducted for California Black Rail first. Passive listening was conducted for two minutes initially, followed by 30 seconds of broadcast "grr" calls and 30 seconds of silence, then an additional 30 seconds of "grr" and 30 seconds of silence. Then 30 seconds of "kik-kic-kerr" call was broadcast, followed by 30 seconds of silence, and an additional 30 seconds of "kik-kic-kerr" call followed by 30 seconds of silence. The survey for Yuma Clapper Rail followed this sequence. Two minutes of passive listening was followed by 1 one-minute call broadcast, one minute of silence, another minute of broadcast, and five minutes of silence. Weather conditions during the three surveys are summarized in Table 1.

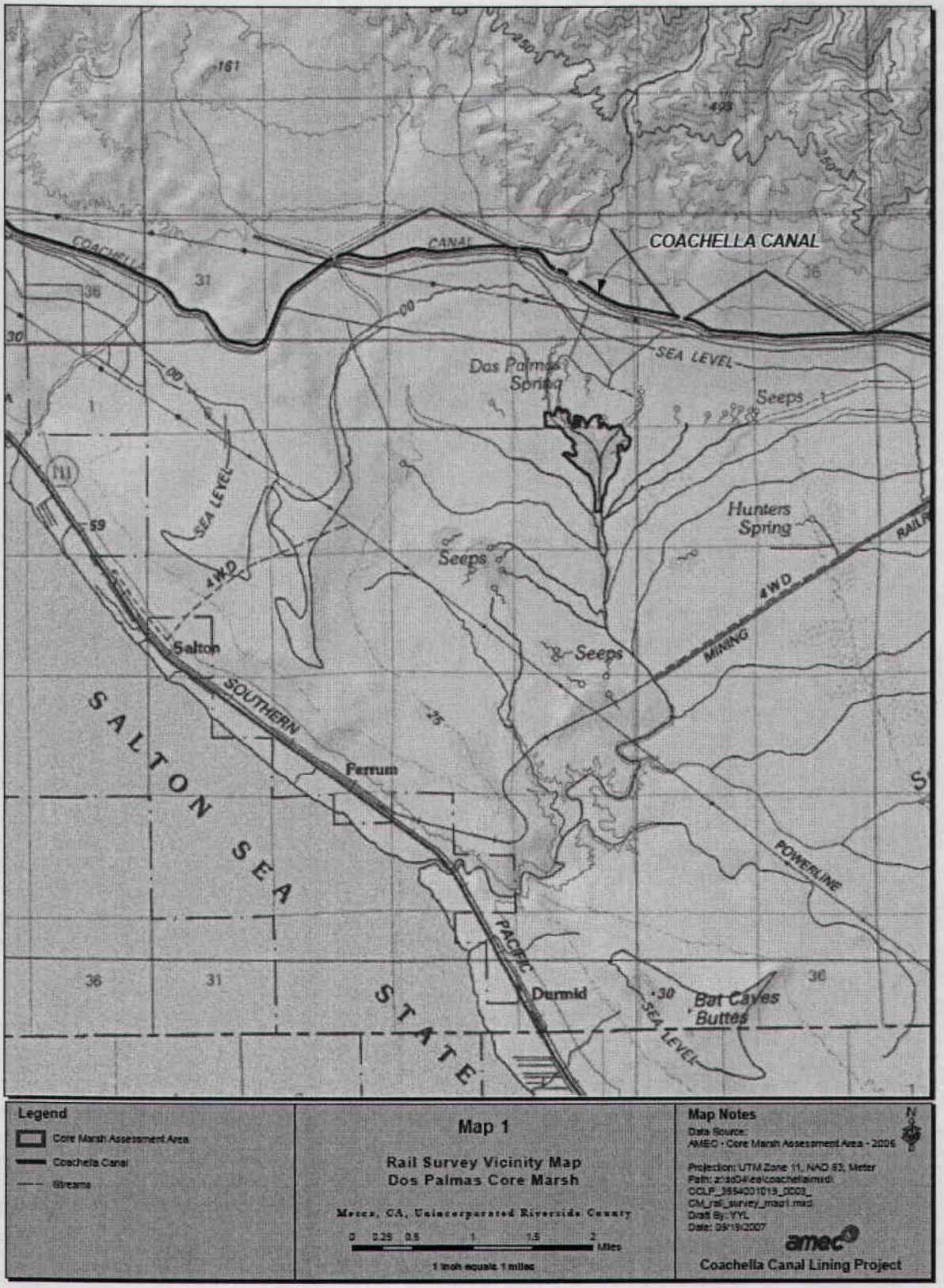

Figure 1. Location of Dos Palmas Core Marsh in Riverside County, CA.

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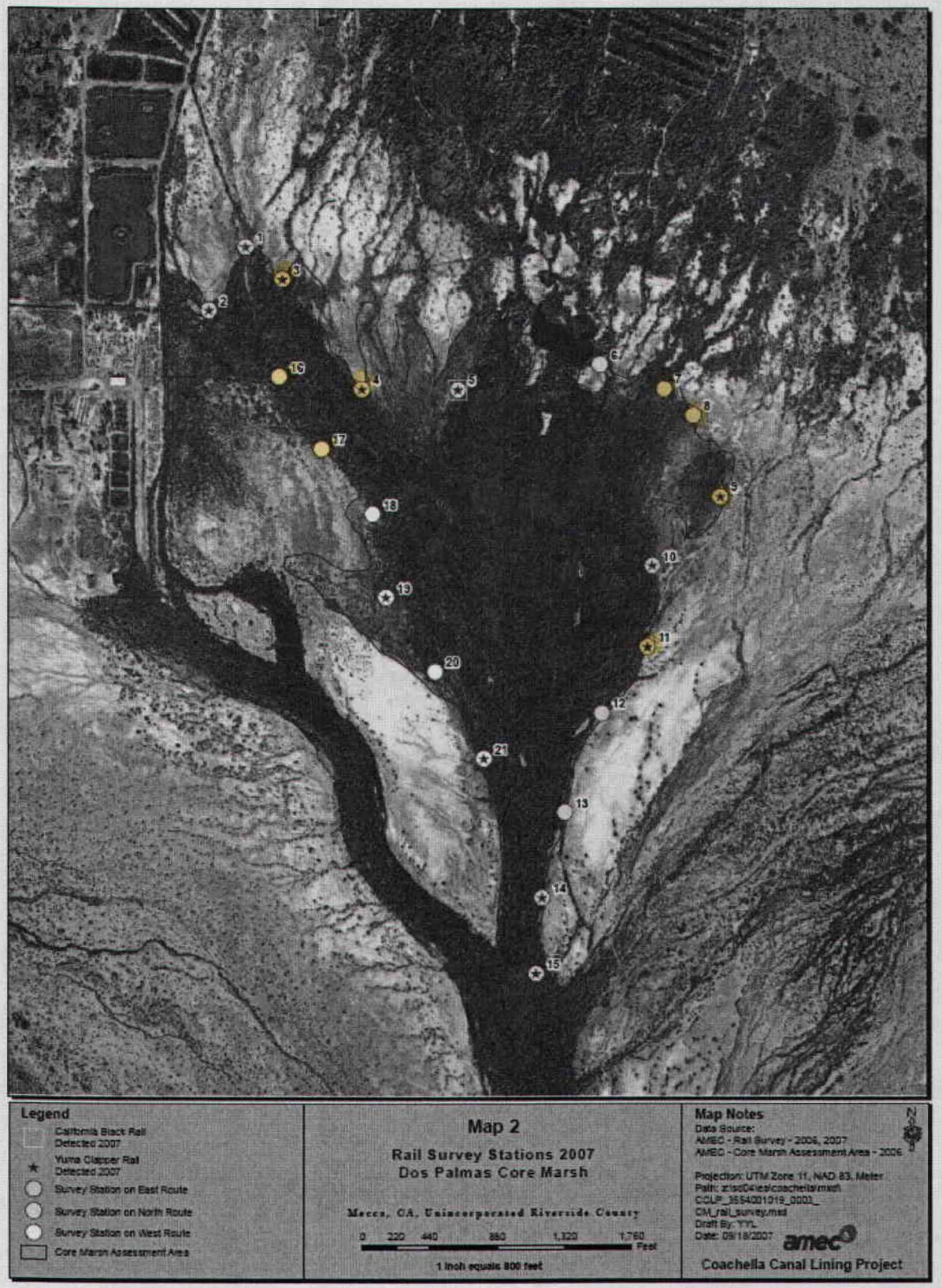


Figure 2. Location of the survey stations in the Dos Palmas Core Marsh. Essentially the same stations were used in the 2006, 2007, and 2009 surveys.

Table 1. Environmental conditions during three Yuma Clapper Rail and California Black Rail surveys of the Core Marsh of the Dos Palmas ACEC in Riverside County, California, 2009.

Survey #	Date	Surveyor*	Time	Weather Conditions (OC = overcast)
1	03/19/09	JK, JG, SM	1610-1905	72-90F, wind 1-3 mph, 20% OC
2	04/17/09	JK, JG, CM	0710-0952	49-76F, wind 0-7 mph, 0% OC
3	05/13/09	JK, JG, CM	0620-0926	67-87F, wind 0-3 mph, 0 % OC

* JK-John Konecny; JG-John Green; SM – Steve Myers; CM-Chet McGaugh

RESULTS

Both Yuma Clapper Rails and California Black Rails were detected in the Core Marsh during these surveys. The survey results are shown in Table 2.

Table 2. Rail census data in the Dos Palmas Core Marsh in 2009.

Rail Census Data 2009

Location	3/19/2009[1]		4/17/2009[2]		5/13/2009[3]	
	YCR[4]	CBR[5]	YCR	CBR	YCR	CBR
1						
2						
3					1	
4			3		1	
5						
6						
7					1	
8					1	
9					1	
10						
11	1	1	1			
121						
13						
14						
15						
16	1					
17	1					
18						
19						
20						
21						
TOTAL	**3**	**1**	**4**	**0**	**5**	**0**

[1] Konecny (WRI), Green (AMEC), and Myers (AMEC)
[2] Konecny (WRI), Green (AMEC), and McGaugh (AMEC)
[3] Konecny (WRI), Green (AMEC), and McGaugh (AMEC)
[4] Yuma Clapper Rail
[5] California Black Rail

DISCUSSION

Rail surveys were conducted in the past in the Core Marsh in 2006 and 2007. Table 3 below summarizes these results, and indicates the survey stations where the rails were detected. The location of the survey stations has remained essentially the same for all years, including 2009.

Table 3. Rail census data in the Dos Palmas Core Marsh in 2006 and 2007.

Station	YCR 2006	YCR 2007	CBR 2006	CBR 2007
1	---	A, M	---	---
2	---	A, M	---	---
3	---	M	---	---
4	---	M	---	---
5	---	A, M	---	A
6	A	---	---	---
7	A	---	---	---
8	A	---	---	---
9	---	A, M	---	---
10	A	A	---	---
11	J	M	---	---
12	---	---	---	---
13	A	---	---	---
14	---	A	---	---
15	---	A, M	---	---
16	---	---	---	---
17	M	---	---	---
18	---	---	---	---
19	M	M	---	---
20	---	---	---	---
21	---	A	---	---
TOTAL	8	17	0	1

A = April
M = May
J = June

It can be seen that there were fewer Yuma Clapper Rails detected in 2009 than in 2007, although more than in 2006. California Black Rail presence was the same. Fewer sampling stations detected rails of either species in 2009 than in 2007, and the distribution of both species of rails has changed somewhat. During 2009, the best rail habitat appears to be associated with stations 4, and station 8-11. Figure 2 shows these stations to be in the north and east portions of the marsh. The eastern portions of the marsh appeared to be unoccupied by rails in 2009, and it was the subjective impression of the surveyors, three of whom had been involved in the 2006 and 2007 surveys, that the marsh edge was drier in 2009 in these areas than it had been in previous years. It is also noted that a fire burned most of the marsh to the water line in April 2008, and this may have modified the quality of the habitat. In addition, the fire has at least temporarily converted a stand of tamarisk to the west into marsh habitat, and this may have modified the distribution of the rails in 2009.

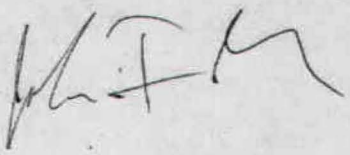
AR074147

CERTIFICATION

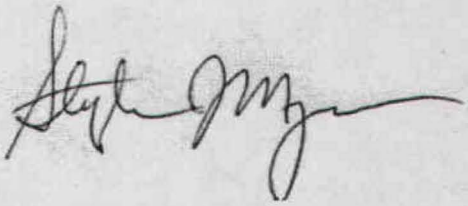
We certify that the information in this survey report and attached exhibits fully and accurately represent our work. If you have any questions or require additional information, please contact me at (760) 489-5276, the letterhead address, or jkonecny@cox.net.

Sincerely,

John K. Konecny
Wildlife Biologist
TE837308-4



John Green
Wildlife Biologist
TE054011-2



Stephen Myers
Wildlife Biologist
TE804203-8



Chester McGaugh
Wildlife Biologist
TE836517-5

If you have any questions or require additional information, please contact me at (760) 489-5276, the letterhead address, or jkonecny@cox.net.

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Permit # 16790
County San Diego
Year 2010
LFL
Srv. Rpt. DL 2/17/11
D.B.

Konecny Biological Services
Biological Consulting, Research, Conservation

January 26, 2011

US Fish and Wildlife Service
Attn: Recovery Permit Coordinator
6010 Hidden Valley Road, Suite 100
Carlsbad, CA 92011

Re: Results of a Focused Survey for the Light-footed Clapper Rail at the Inns at Bridgecreek Site, City of Oceanside, San Diego County, California, 2010.

Dear Recovery Permit Coordinator:

This letter report presents the results of a focused survey for the light-footed clapper rail (*Rallus longirostris levipes*) at the Inns at Bridgecreek site in the City of Oceanside, north-coastal San Diego County, California. The light-footed clapper rail is listed as an endangered species by the U.S. Fish and Wildlife Service (USFWS) and the California Department of Fish and Game (CDFG).

Surveys for the light-footed clapper rail were conducted by wildlife biologist Mr. John Konecny. The surveys were conducted in accordance with the recommendations provided to the USFWS by the Clapper Rail Study Team (2009). This activity is authorized by Konecny Biological Services's (KBS) USFWS section 10(a) permit number TE837308-5, and a CDFG Memorandum of Understanding.

INTRODUCTION

The light-footed clapper rail is a slender, tawny-breasted bird with grayish edges on brown centered back feathers, olive wing coverts, vertical white bars on the flanks, a white stripe over the eye, and a partially orange bill. Light-footed clapper rail occurred historically along the coast of southern California from Carpinteria Marsh in Santa Barbara County south to San Quintín, Baja California, Mexico (Grinnell and Miller 1944, USFWS 1994).

The light-footed clapper rail is a permanent resident of coastal salt marsh traversed by tidal sloughs, usually characterized by cordgrass (*Spartina foliosa*) and pickleweed (*Salicornia* spp.) (Grinnell and Miller 1944, USFWS 1994). Light-footed clapper rails have also nested in freshwater marsh characterized by cattails (*Typha* sp.) and bulrush (*Scirpus* sp.) at Buena Vista, Agua Hedionda, Batiquitos, San Elijo, and San Dieguito Lagoons in San Diego County (Zembal *et al* 2007); and in spiny rush (*Juncus acutus*) at Naval Air Station (NAS) Point Mugu. There is very limited evidence for inter-marsh movement by light-footed clapper rails.

Populations of light-footed clapper rails have undergone decline in the United States due to the rail's limited distribution and destruction and degradation of coastal salt marsh habitat. The statewide light-footed clapper rail population in 2010 was reported to be 372 pairs in 19 marshes (Zembal *et al* 2010). This represents the third largest number of rails in recent history, an increase of 16% over the 2009 total, but 16% lower than the all time high count in 2007. Fifty-six percent of these pairs were found in two coastal salt marsh complexes at Upper Newport Bay and the Tijuana Marsh National Wildlife Refuge (NWR). Six other marshes at NAS Point Mugu, Batiquitos Lagoon, San Elijo Lagoon, Seal Beach NWR, Los Penaquitos Lagoon, and San Dieguito had between 10 and 36 pairs, representing an additional 33 % of the state total. The remaining 11 marshes had between one had nine pairs, accounting for the final 11% of the state total.

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Zembal and Massey (1986) have shown that paired light-footed clapper rails can be detected "clappering" throughout the year, but have a bimodal peak in vocalizing during mid-February to mid-April and again in September to October. The initial peak in vocalizing corresponds to the onset of breeding season. In contrast to "clappering", single male and female "kekking" is highly seasonal, almost exclusively occurring between February and June.

PROJECT LOCATION

The proposed Inns at Bridgecreek project site is located just north of Buena Vista Creek, south of State Route 78, and immediately east of Jefferson Street in the City of Oceanside California (Figure 1). The site is located in the southern portion of the city of Oceanside along the city of Oceanside and city of Carlsbad jurisdictional boundary. The light-footed clapper rail survey area is bounded on the west side by Jefferson Street and continues eastward for approximately 1,700-feet (518-meters). Specifically, the proposed Inns at Bridgecreek project site is located within Township 11 South, Range 4 West, and in Section 32 of the U.S. Geological Survey San Luis Rey 7.5-minute quadrangle.

PROJECT SITE DESCRIPTION

The light-footed clapper rail survey area is located in the reach of Buena Vista Creek that has its western terminus at the Jefferson Street Bridge, and continues eastward for 1,700 feet to its eastern terminus. Buena Vista Lagoon proper is located immediately west of the survey area. A shopping center borders the entire south side of Buena Vista Creek and is separated from the Creek by a wire fence. A pump station is present north of the creek on the west side and the rest of the Inns at Bridgecreek site is disturbed habitat.

This reach of Buena Vista Creek is primarily freshwater marsh characterized by cattails (*Typha* sp.) with smaller pockets of embedded bulrush (*Scirpus* sp.). Mule-fat scrub characterized by mule-fat (*Baccharis salicifolia*), and southern willow scrub characterized by arroyo willow are also scattered throughout the reach. A thin band of Diegan coastal sage scrub is present between Buena Vista Creek proper and the disturbed upland. Elevation of the survey area is approximately zero to 20 feet (8 meters) above mean sea level.

METHODS

Six focused light-footed clapper rail survey events were conducted at least five days apart over the entire 1,700-foot reach of Buena Vista Creek between April 9 and May 9, 2010. Dawn surveys were conducted on April 16th, 23rd, and May 9th. Dusk surveys were conducted on April 9th and 30th, and May 3rd. The surveys were conducted in accordance with the recommendations provided to the USFWS by the Clapper Rail Study Team (2009). A summary of the environmental conditions on the six survey dates is provided in Table 1 below.

Table 1. Summary of Weather Conditions During Six Light-footed Clapper Rail Surveys for the Proposed Inns at Bridgecreek Site at Buena Vista Creek, City of Carlsbad, California, 2010.

Survey #	Date	Surveyor (Species)*	Time	Weather Conditions
1	04/09/2010	JK (LFCR)	1630-1940	100% overcast, 63-59°F, wind 7-10 mph
2	04/16/2010	JK (LFCR)	0630-0945	100% overcast, 56-60°F, wind 3-5 mph
3	04/23/2010	JK, (LFCR)	0625-0955	100% overcast, 48-54°F, wind 5-9 mph

4	04/30/2010	JK (LFCR)	1645-2000	40% overcast, 67-59°F, wind 10-15 mph
5	05/03/2010	JK (LFCR)	1650-2010	50% overcast, 69-62°F, wind 5-10 mph
6	05/09/2010	JK (LFCR)	0610-0925	100% overcast, 60-62°F, wind 7-10 mph

* JK-John Konecny; LFCR-Light-footed Clapper Rail

The surveys were conducted by walking the north side of Buena Vista Creek and stopping at stations approximately 100-feet (30-meters) apart and listening for vocalizing light-footed clapper rails. If rails were not detected passively, a digital call-prompt of the light-footed clapper rail "dueting" was played with an iPod and amplified speakers at 30-second intervals. A response was listened for approximately ten minutes before proceeding to the next survey station.

RESULTS and DISCUSSION

No light-footed clapper rails were detected during the six focused surveys in 2010.

Described as "formerly common in all coastal marshes" by Grinnell and Miller (1944), the light-footed clapper rail has never been a common bird species at nearby Buena Vista Lagoon. Since the light-footed clapper rail range-wide survey was initiated in 1980, light-footed clapper rails were not detected at Buena Vista Lagoon until 1991 when two pairs were present. The subpopulation continued to increase in size with the high total of nine pairs being present in 2009. Six pairs were detected in 2010.

The light-footed clapper rail will likely continue to inhabit the freshwater marsh at Buena Vista Lagoon and the numbers may continue to increase depending on the reproductive success of the pairs that were identified in 2010. Because of its close proximity to Buena Vista Lagoon and contiguity with the Lagoon habitat, the freshwater marsh of Buena Vista Creek east of Jefferson Street may be refugia for dispersing light-footed clapper rails, or if the subpopulation continues to grow may be an expanded breeding area.

CERTIFICATION

I certify that the information in this survey report and attached exhibits fully and accurately represent my work. The results of focused surveys for listed species are typically considered valid for one year by the USFWS and CDFG. If you have any questions or require additional information, please call me at (760) 489-5276.

Sincerely,

John K. Konecny
Wildlife Biologist
TE837308-5

REFERENCES CITED

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Zembal, R., S. Hoffman, and J. Konecny. 2010. Status and Distribution of the Light-footed Clapper Rail in California, 2010 Season. Report to California Department of Fish and Game, for the Clapper Rail Recovery Fund. 20pp.

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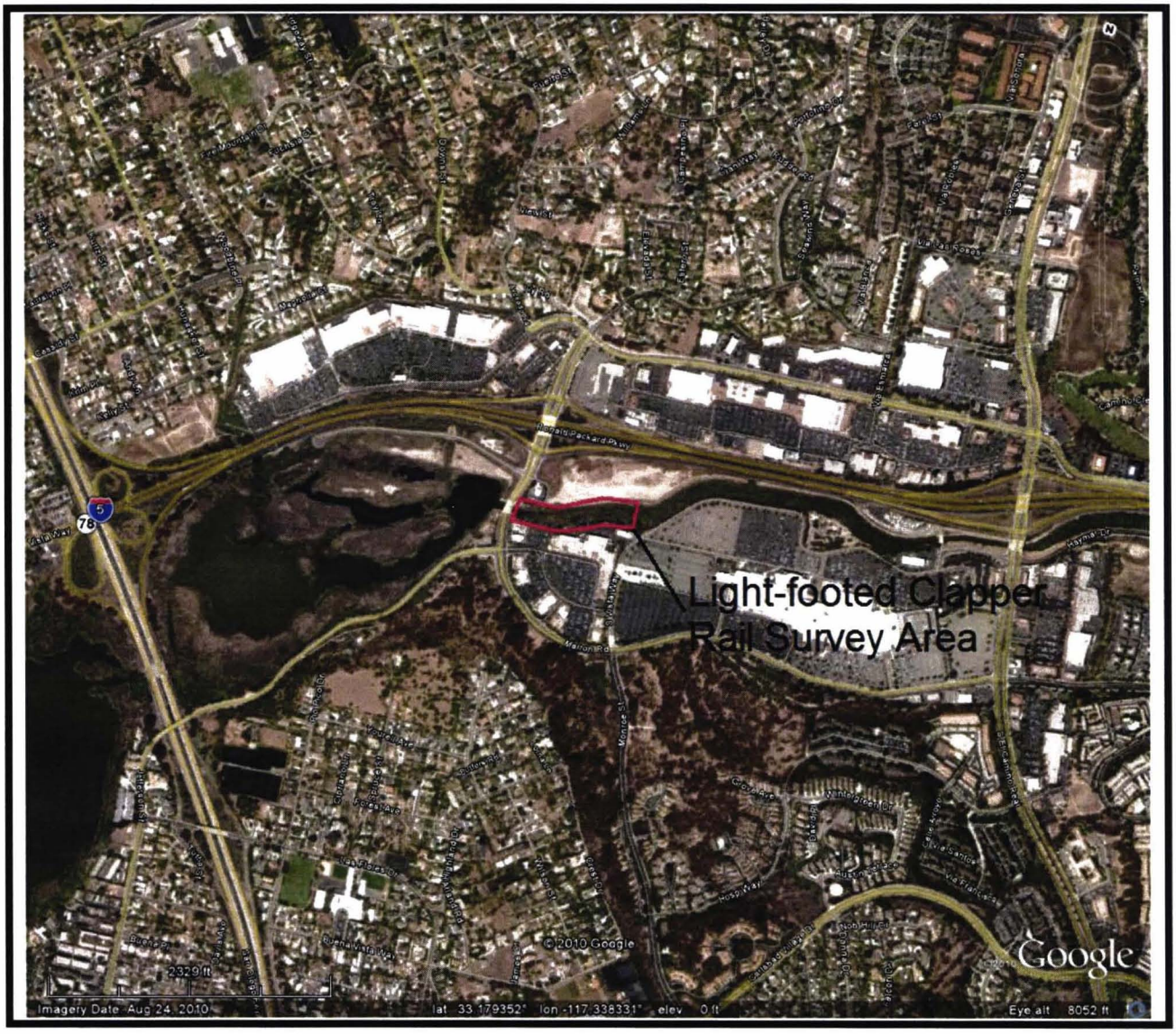

Figure 1. Location of the Light-footed Clapper Rail Survey Area for the Proposed Inns at Bridgecreek Project Site at Buena Vista Creek, City of Oceanside, San Diego County, California, 2010.

Record Id 10830
County Imperial
Year 2007
Spp YCR (+)
Srv. Rpt
D.B. DL 5/24/10
GIS Monitoring
L+R
File

The Effects of Fire on the Yuma Clapper Rail

2007 Annual Report

for

USFWS Endangered Species Permit # TE039466-1

Courtney J. Conway and Christopher P. Nadeau
USGS Arizona Cooperative Fish and Wildlife Research Unit
University of Arizona
325 Biological Sciences East, Tucson, Arizona 85721

Introduction:

The Yuma clapper rail (*Rallus longirostris yumanensis*) is a federally endangered species that occurs along the lower Colorado River, the Imperial Valley of California, the Colorado River delta, and along the west coast of Mexico. Ninety percent of the U.S. population exists in only 2 wetlands (Conway et al. 1993) and much existing wetland habitat remains unoccupied. Yuma clapper rails are ranked 6th out of 230 breeding bird species in Arizona based on their conservation need (Latta et al. 1999). To ensure long-term persistence of U.S. populations, we need to have effective management and mitigation activities that improve habitat quality and benefit Yuma clapper rail populations. One possible management activity that has been proposed to benefit Yuma clapper rail populations is prescribed burning in areas with decadent emergent vegetation (Conway et al. 1993). Historically, marsh habitats along the lower Colorado River were highly ephemeral with periodic flooding and natural fires eliminating decadent stands of emergent vegetation. These stochastic events resulted in areas of early successional emergent marsh habitat thought to be beneficial to rails (Conway 1990, Conway et al. 1993). Years of flood control and fire suppression has resulted in substantial areas of decadent emergent marsh habitat, but very little early successional emergent marsh along the lower Colorado River. Prescribed fire may be the best technique for creating early-successional emergent marsh habitat required to enhance populations of Yuma clapper rails. Indeed, prescribed fire has been repeatedly suggested as a promising conservation measure for restoring Yuma clapper rail populations (Conway et al. 1993, Conway 1995, Eddleman and Conway 1998, Conway and Eddleman 2000), but has yet to be evaluated. We conducted pre- and post-burn surveys in both burned and control marshes to examine the effects of fire on the abundance of rails and the quality of rail habitat.

Field Locations

Study Sites were located along the lower Colorado River in Arizona (Yuma and Mohave Counties) and California (Imperial County), and south of the Salton Sea in the Imperial Valley of California (Imperial County). We worked closely with Imperial National Wildlife Refuge, Havasu National Wildlife Refuge, and Sony Bono Salton Sea National Wildlife Refuge to conduct burns and marsh bird surveys at each refuge. Each burn occurred between 2003 and 2006. We did not conduct prescribed fires in 2007. We also surveyed marshes on other state and federally owned lands. See the attached maps which include all our study locations.

Methods:

We conducted call-broadcast surveys for rails in 4 types of study sites: sites recently burned by wildfire (n=7), non-burned (control) sites near each wildfire (n=14), sites recently burned by prescribed fire (n=19), and non-burned (control) sites near each prescribed burn (n=24). In 2007 at each study site, we conducted 1 survey between March and July. We used survey protocols that we developed based on our previous studies of marsh bird survey methods (Conway et al. 1993, Conway and Gibbs 2001, Conway et al. 2001) and on recommendations from a recent wetland bird monitoring workshop at the USGS Patuxent Wildlife Research Center (Ribic et al.1999). Surveys were conducted during mornings between one half-hour before sunrise until 10:00 am and in the evenings between 5:00 pm until dusk (one half-hour after sunset). All surveys

were conducted on days without rain and when wind speeds did not exceed 5 mph. Based on previous marsh bird survey work in the region, conditions during most (99%) mornings are favorable for surveys (i.e., without too much wind) whereas 42% of evenings are too windy for surveys.

Survey Results:

A summary of our survey results for 2007 are attached (including UTM coordinates for each survey point). Preliminary analysis of survey data from 2003-2006 are promising. Numbers of Yuma clapper rails increased following fire and abundance was higher compared to control sites in the 2 years post-burn. We will continue to monitor burn and control sites in subsequent years to determine the long-term effects of fire on rails and the fire frequency needed to maintain optimal rail habitat.

Literature Cited:

Conway, C. J. 1990. Seasonal changes in movements and habitat use by three sympatric species of rails. M.S. Thesis, University of Wyoming, Laramie.

Conway, C. J., W. R. Eddleman, S. H. Anderson, and L. R. Hanebury. 1993. Seasonal changes in Yuma clapper rail vocalization rate and habitat use. J. Wildl. Manage. 57:282-290.

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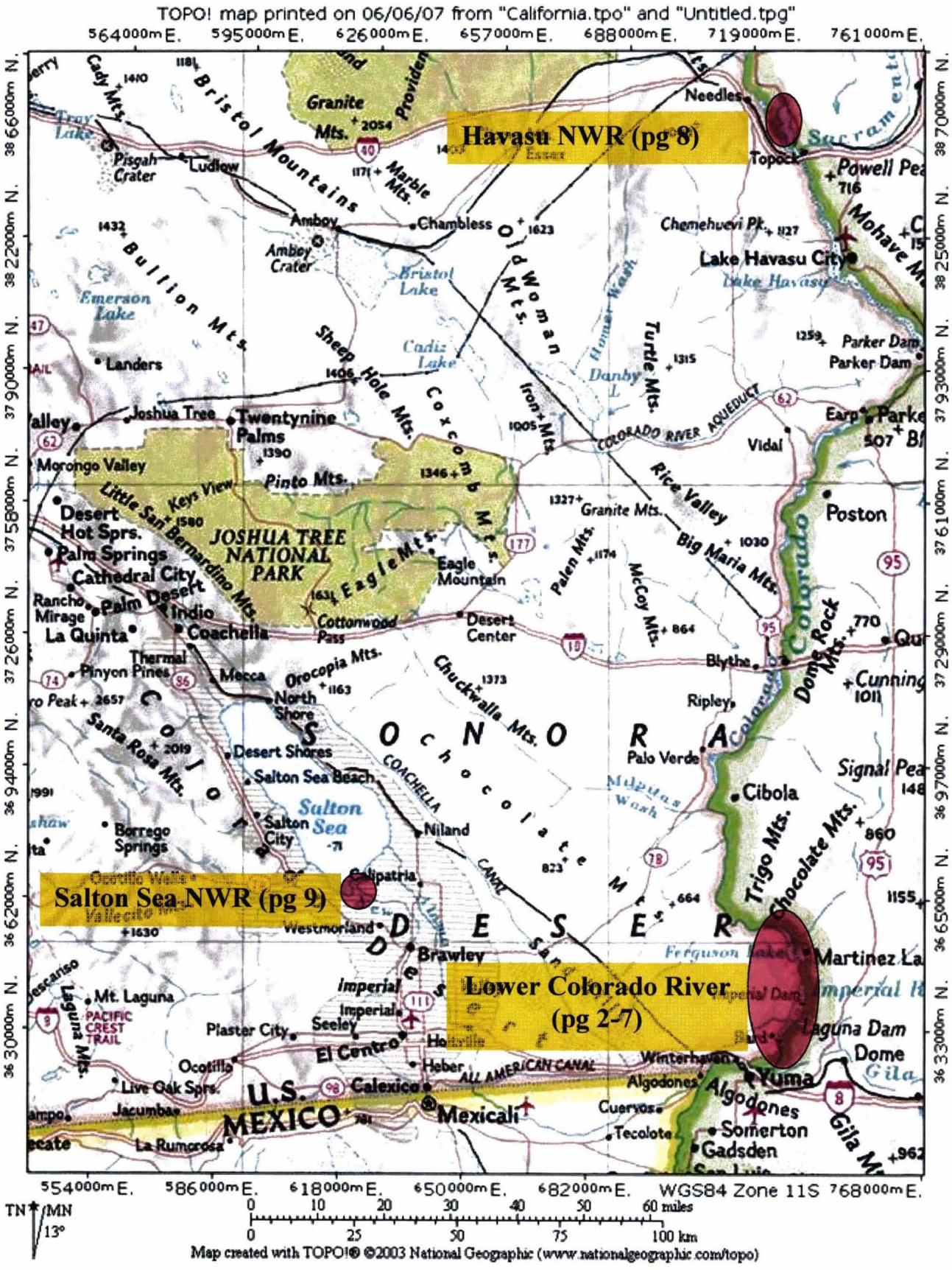
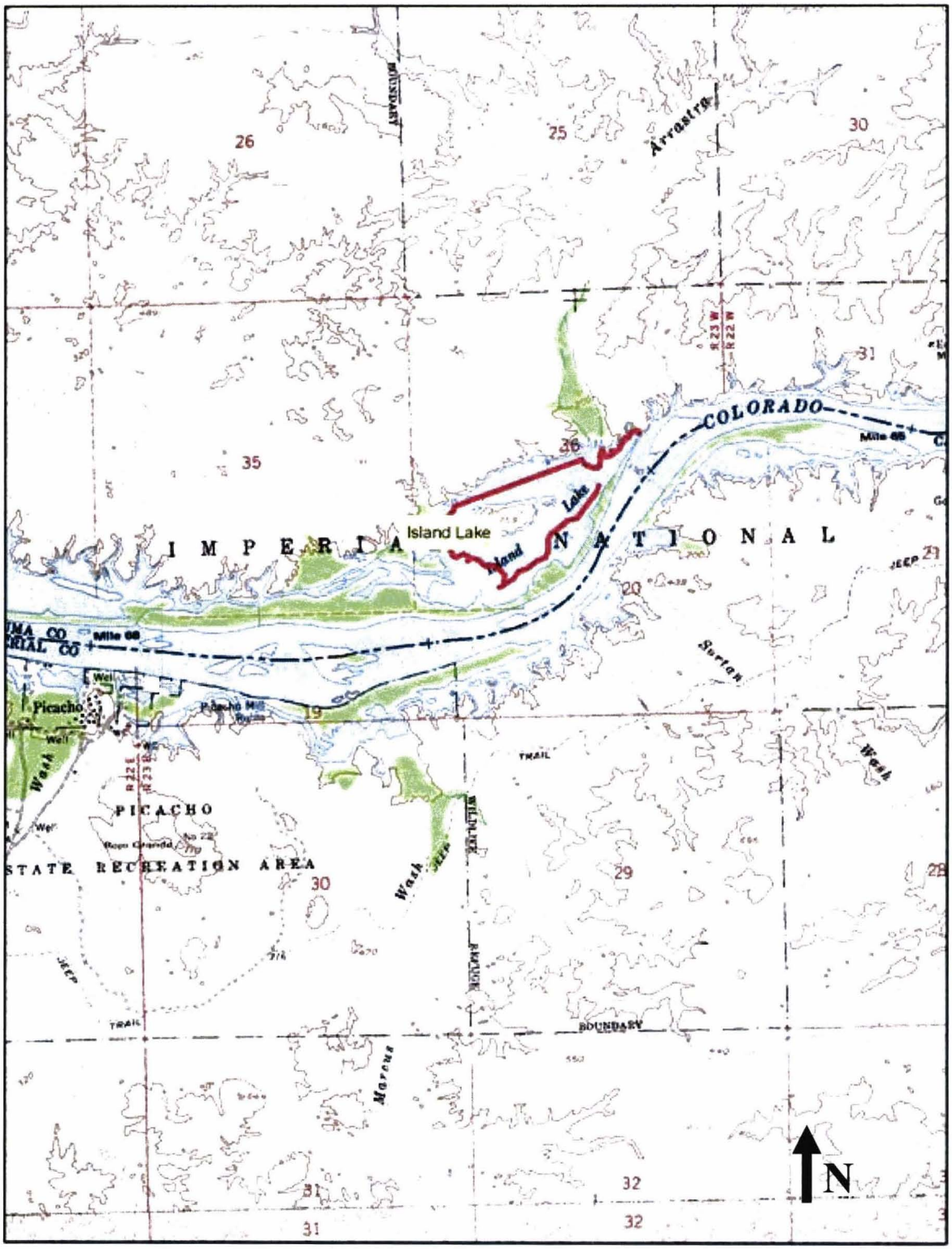
Ribic, C.A., S. Lewis, S. Melvin, J. Bart, and B. Peterjohn. 1999. Proceedings of the Marsh bird monitoring workshop. USFWS Region 3 Administrative Report, Fort Snelling, MN.

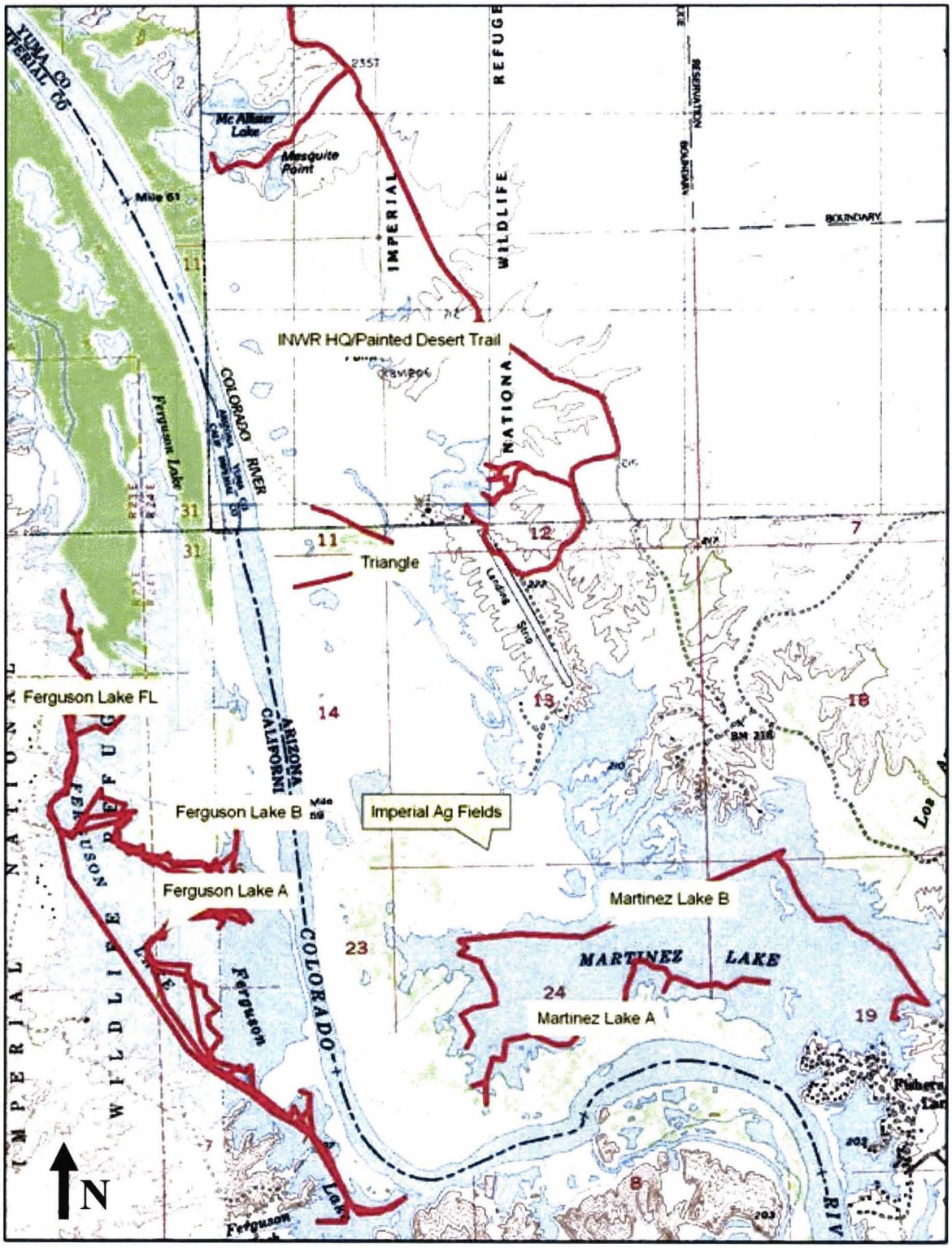
General Survey Location Map



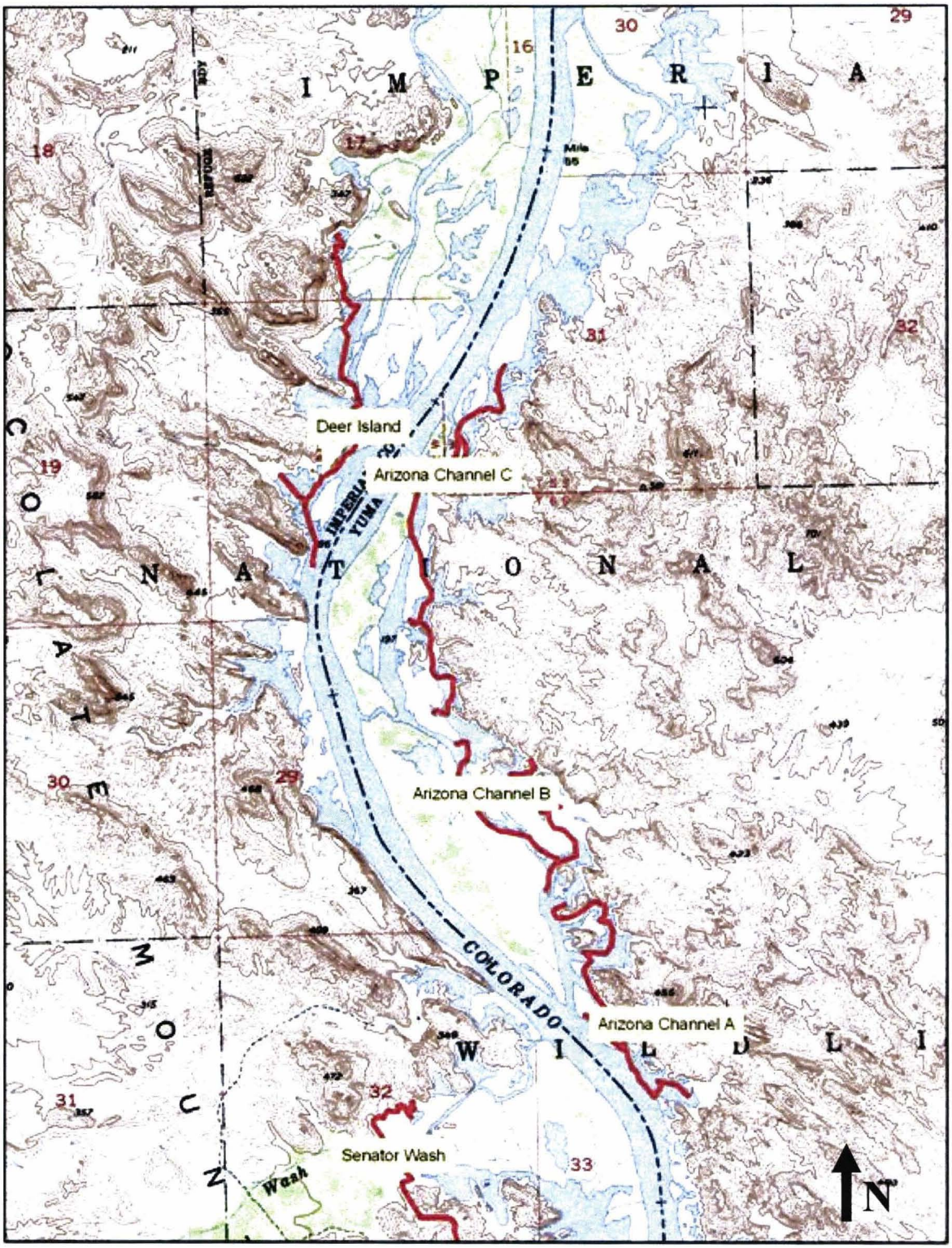
Lower Colorado River – Island Lake



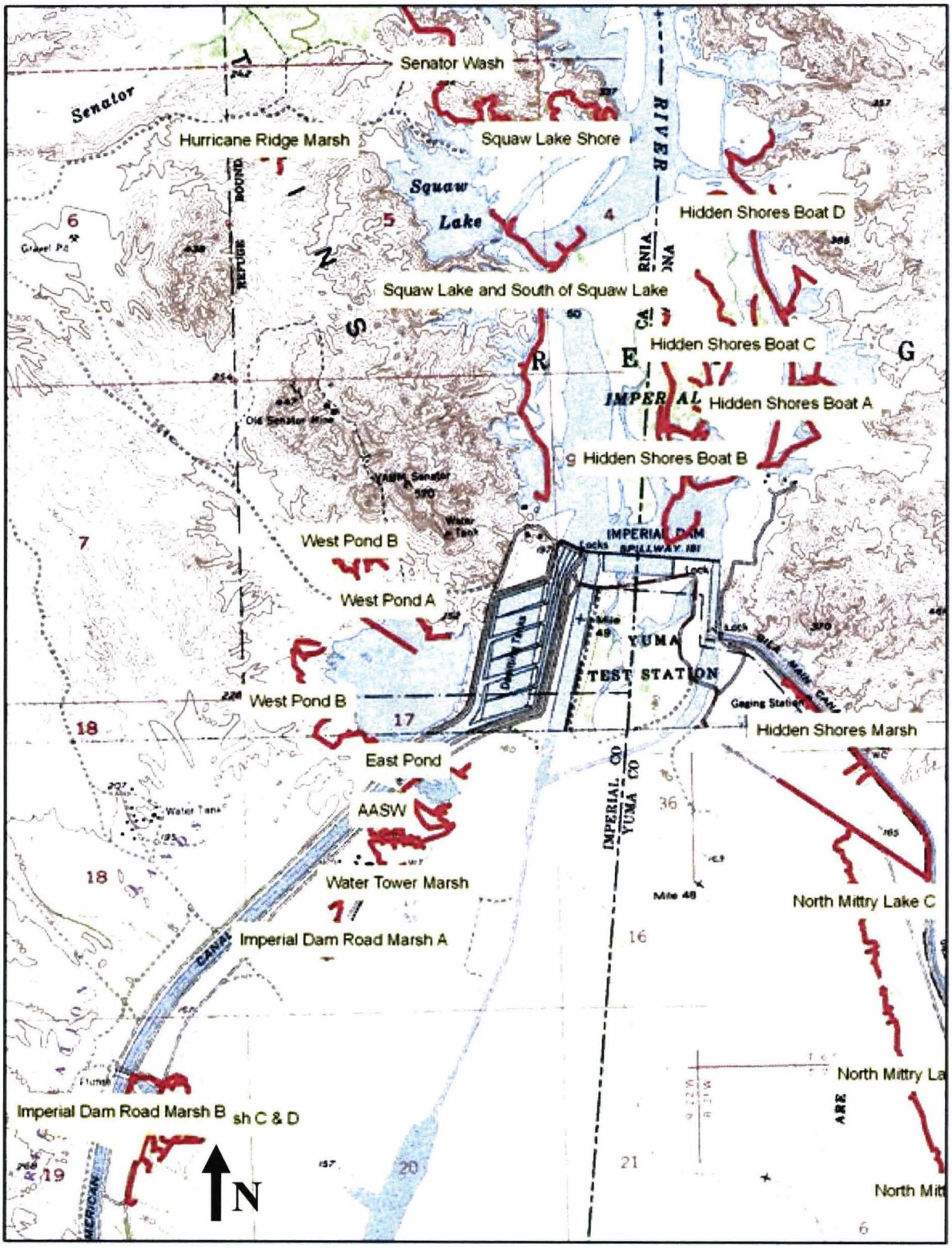
Lower Colorado River – Imperial National Wildlife Refuge



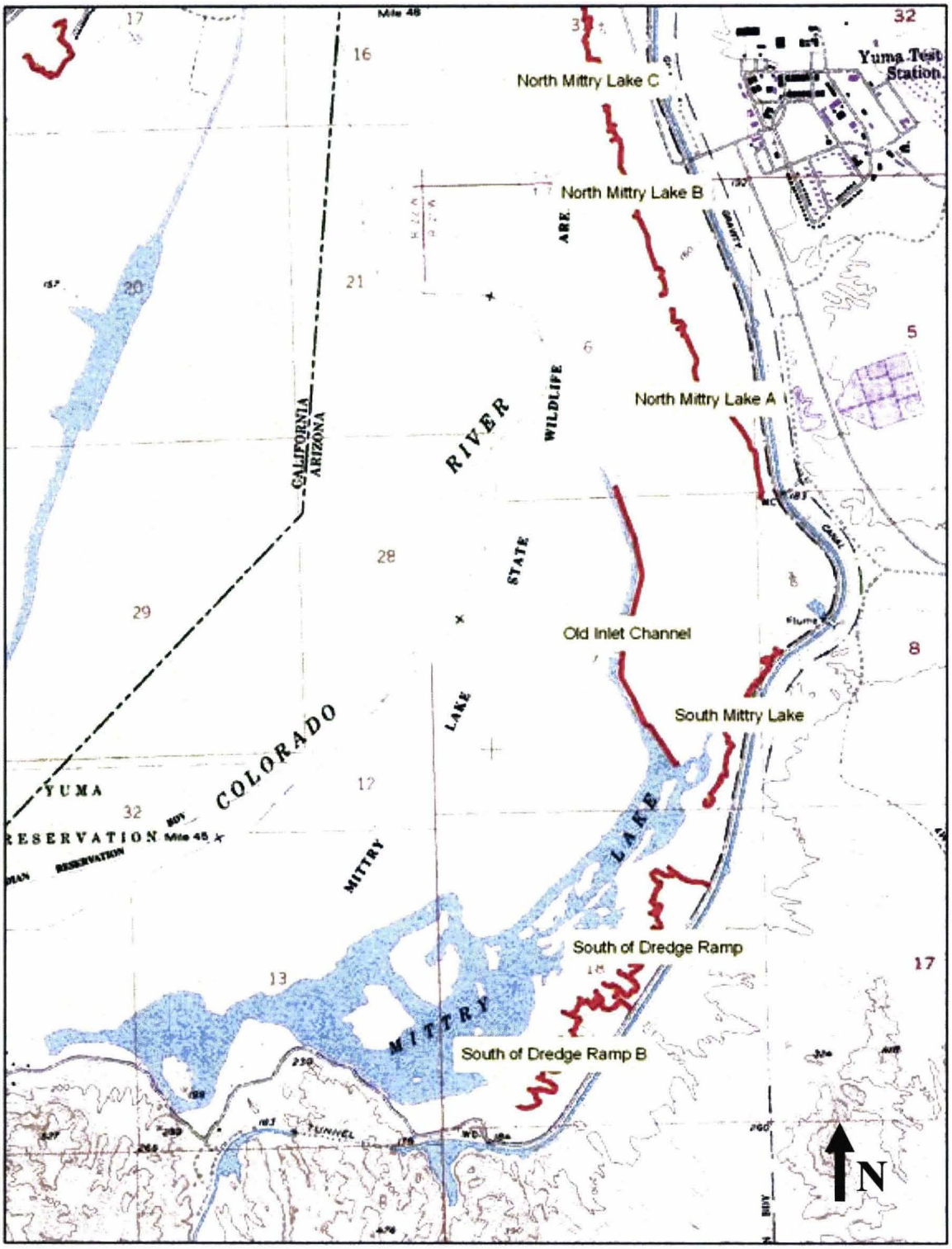
Lower Colorado River – Arizona Channel



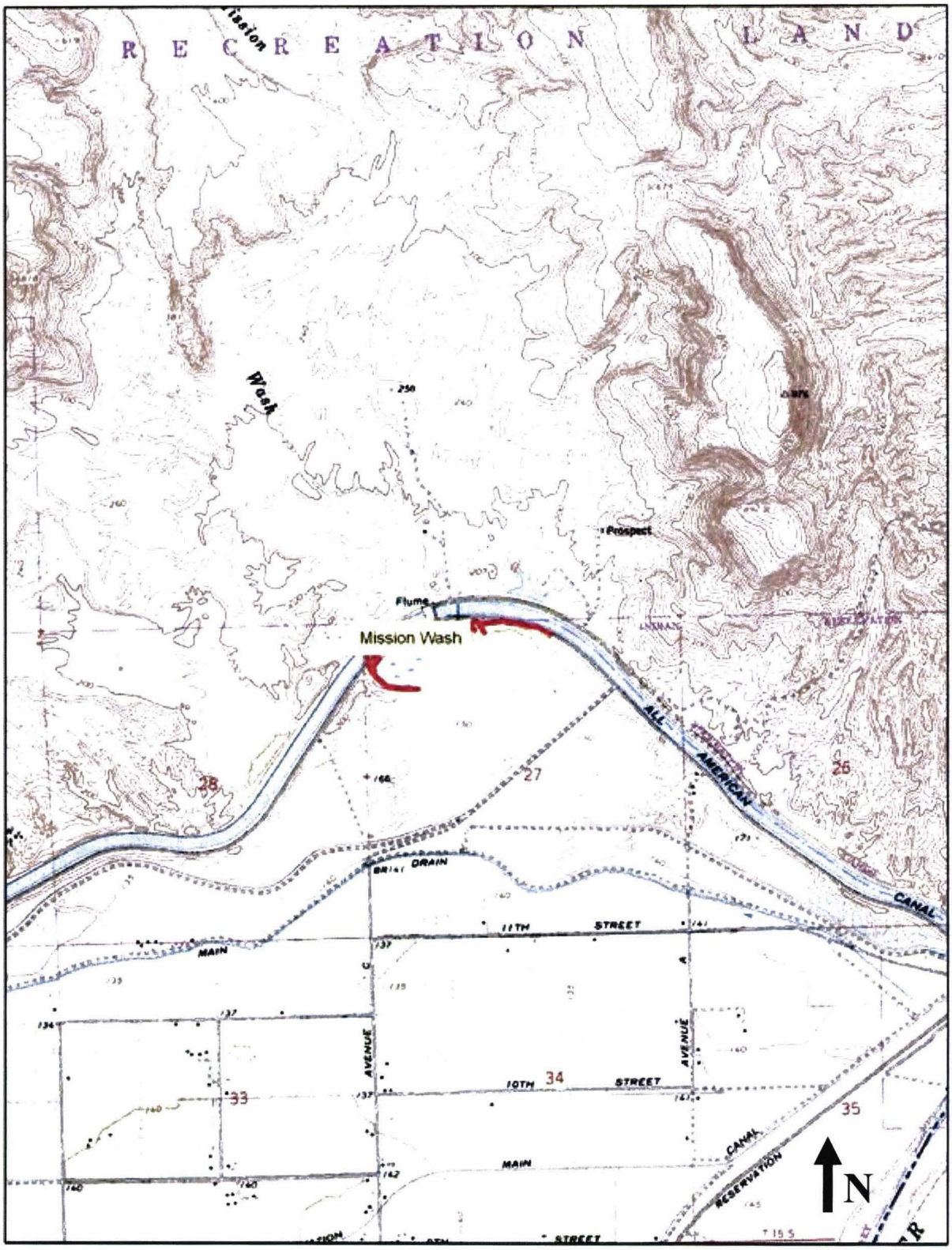
Lower Colorado River – Imperial Reservoir



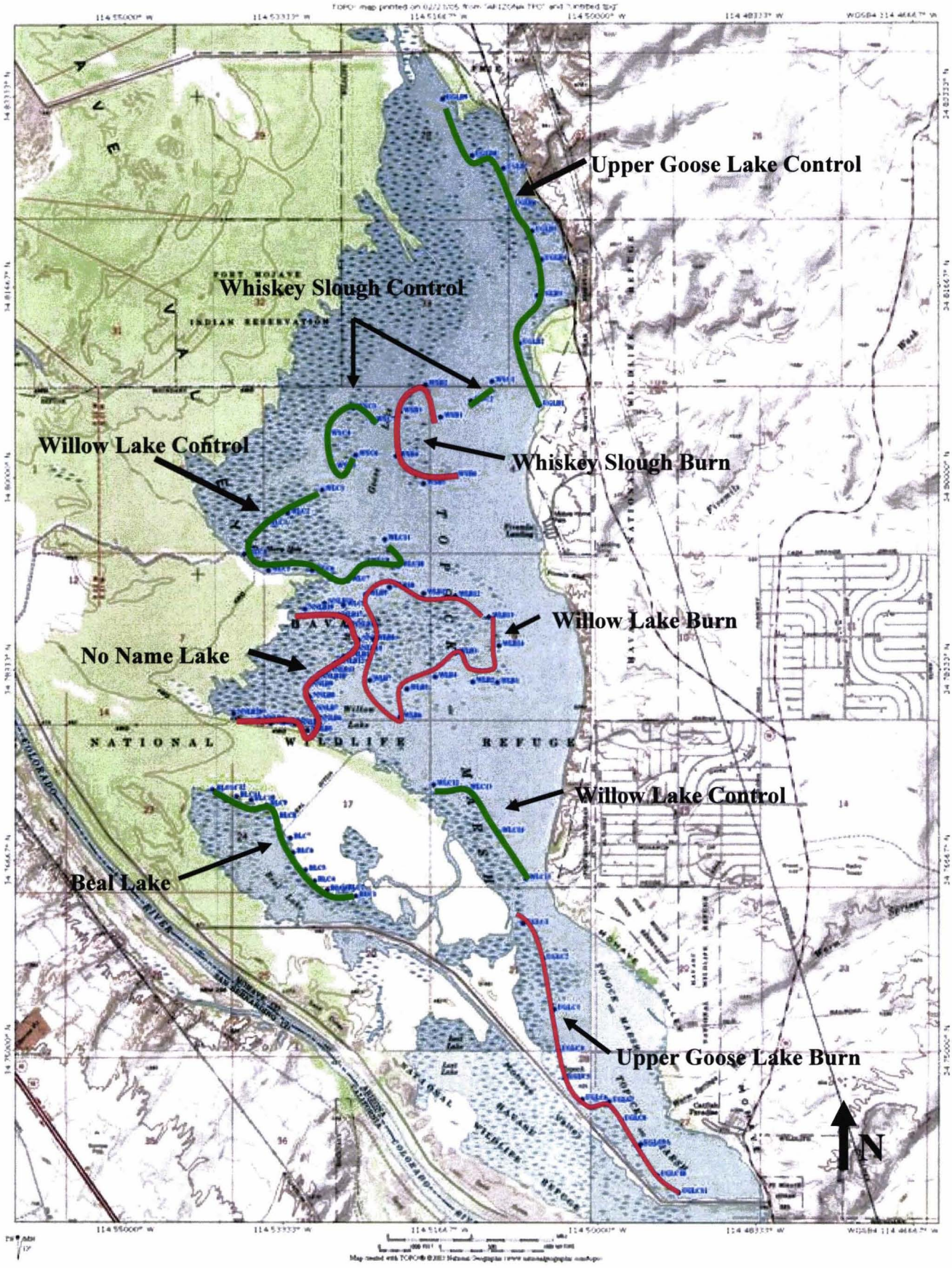
Lower Colorado River – North Mittry Lake

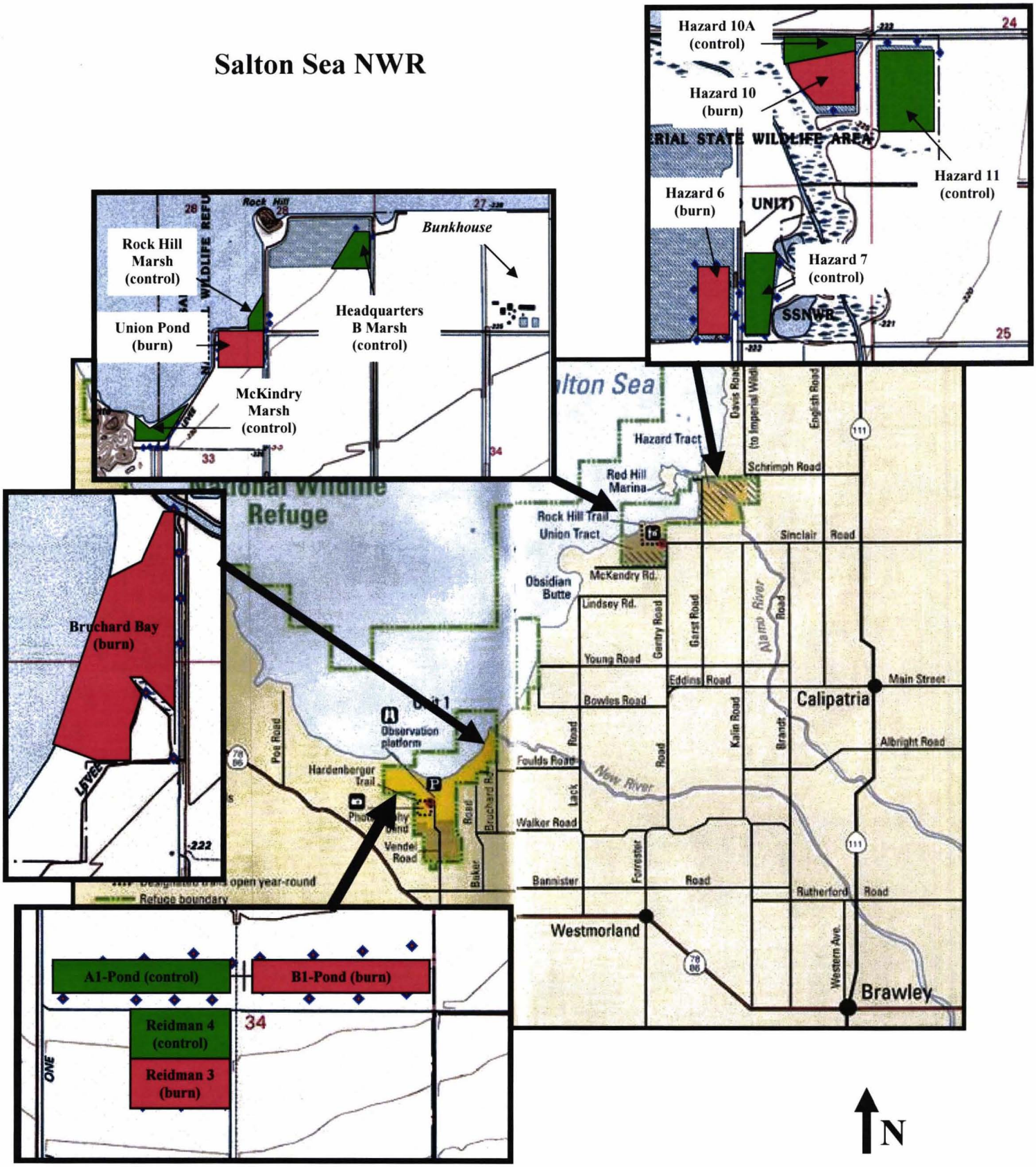


Lower Colorado River – Mission Wash



Havasu NWR


Upper Goose Lake Control
Whiskey Slough Control
Willow Lake Control
Whiskey Slough Burn
Willow Lake Burn
No Name Lake
Willow Lake Control
Beal Lake
Upper Goose Lake Burn
N


Salton Sea NWR
Hazard 10A (control)
Hazard 10 (burn)
Hazard 11 (control)
Hazard 6 (burn)
Hazard 7 (control)
SSNWR
Rock Hill Marsh (control)
Union Pond (burn)
Bunkhouse
Headquarters B Marsh (control)
McKindry Marsh (control)
Hazard Tract
Red Hill Marina
Rock Hill Trail
Union Tract
Obsidian Butte
McKendry Rd.
Lindsey Rd.
Young Road
Eddins Road
Bowles Road
Foulds Road
Walker Road
Bannister
Westmorland
Calipatria
Main Street
Albright Road
Rutherford Road
Brawley
Sinclair Road
Schrimph Road
English Road
Davis Road
Garst Road
Gentry Road
Alamo River
New River
Kalin Road
Lack Road
Forrester Road
Western Ave.
Bruchard Bay (burn)
Observation platform
Hardenberger Trail
Poe Road
Bruchard Road
Vendel Road
Baker Road
Refuge boundary
A1-Pond (control)
B1-Pond (burn)
Reidman 4 (control)
Reidman 3 (burn)
N

2007CLRASurveySummary.xls

Site	Year	Date	Observer	Total # of CLRAs Detected Per Survey (repeat detections included)
a-1 pond	2007	15-May-07	Meaghan Conway	49
b-1 pond	2007	16-May-07	Meaghan Conway	28
beal lake	2007	26-May-07	Chris Nadeau	1
bruchard bay	2007	11-May-07	Meaghan Conway	12
hazard 10	2007	17-May-07	Meaghan Conway	7
hazard 11	2007	17-May-07	Meaghan Conway	3
hazard 6	2007	09-May-07	Meaghan Conway	13
hazard 7	2007	09-May-07	Meaghan Conway	1
headquarters marsh	2007	10-May-07	Meaghan Conway	4
hidden shores boat a	2007	21-May-07	Chris Nadeau	2
hidden shores boat b	2007	13-May-07	Chris Nadeau	11
hidden shores boat c	2007	25-Apr-07	Meaghan Conway	19
hidden shores marsh	2007	30-Mar-07	Meaghan Conway	7
imperial dam road marsh a	2007	24-Apr-07	Meaghan Conway	1
imperial dam road marsh a	2007	25-Apr-07	Meaghan Conway	2
imperial dam road marsh b	2007	24-Apr-07	Meaghan Conway	1
imperial dam road marsh b	2007	25-Apr-07	Meaghan Conway	5
imperial dam road marsh c	2007	06-Apr-07	Meaghan Conway	2
imperial dam road marsh c	2007	17-Apr-07	Meaghan Conway	1
imperial dam road marsh d	2007	17-Apr-07	Meaghan Conway	0
inwr ag field 10-27	2007	15-May-07	Chris Nadeau	0
inwr ag field 11	2007	17-Apr-07	Meaghan Conway	8
inwr ag field 12	2007	18-Apr-07	Meaghan Conway	11
inwr ag field 13	2007	09-Apr-07	Meaghan Conway	20
inwr ag field 14	2007	30-Apr-07	Meaghan Conway	2
inwr ag field 14	2007	15-May-07	Chris Nadeau	6
inwr ag field 16	2007	17-Apr-07	Meaghan Conway	0
inwr ag field 17	2007	09-Apr-07	Meaghan Conway	0
inwr ag field 21	2007	18-Apr-07	Meaghan Conway	2
inwr hq bunkhouse	2007	30-Apr-07	Meaghan Conway	0
martinez lake a	2007	01-May-07	Meaghan Conway	8
no name lake	2007	25-May-07	Chris Nadeau	6
north mittry lake a	2007	12-Apr-07	Meaghan Conway	10
north mittry lake a	2007	15-May-07	Chris Nadeau	5
north mittry lake a	2007	16-May-07	Chris Nadeau	10
north mittry lake b	2007	10-Apr-07	Meaghan Conway	5
north mittry lake c	2007	23-Apr-07	Meaghan Conway	6
painted desert trail	2007	30-Apr-07	Meaghan Conway	0
reidman 3	2007	14-May-07	Meaghan Conway	38
reidman 4	2007	14-May-07	Meaghan Conway	26
senator wash	2007	10-Apr-07	Meaghan Conway	1
south mittry lake	2007	23-Apr-07	Meaghan Conway	8
south of dredge ramp a	2007	24-Apr-07	Meaghan Conway	1
south of dredge ramp b	2007	11-Apr-07	Meaghan Conway	1
union pond	2007	10-May-07	Meaghan Conway	22
upper goose lake burn	2007	22-May-07	Chris Nadeau	7
upper goose lake control	2007	24-May-07	Chris Nadeau	3

west pond a	2007	02-Apr-07	Meaghan Conway	2
west pond b	2007	03-Apr-07	Meaghan Conway	4
whiskey slough burn	2007	25-May-07	Chris Nadeau	1
whiskey slough control	2007	25-May-07	Chris Nadeau	0
willow lake burn	2007	24-May-07	Chris Nadeau	7
willow lake control	2007	21-May-07	Chris Nadeau	5

2007CLRASurveySummary.xls

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College of Agriculture and Life Sciences

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U.S. Fish and Wildlife Service
Regional Office
Division of Endangered Species-Permits
P.O. Box 1306
Albuquerque, New Mexico 87103

Carlsbad Fish and Wildlife Office
6010 Hidden Valley Road
Carlsbad, California 92009

Arizona Ecological Services Field Office
2321 W. Royal Palm Road, Suite 103
Phoenix Arizona, 85021-4951

10 December 2007

Dear Cooperator,

The following report is being submitted to fulfill the requirements of Federal Fish and Wildlife Permit number TE039466-1. This permit was issued to the Arizona Cooperative Fish and Wildlife Research Unit to conduct call-broadcast surveys for Yuma clapper rail and California black rail along the Lower Colorado River and All American Canal in Arizona and California and on the Salton Sea NWR in California. In 2007 we conducted surveys at 505 points. Each point received 1 point-count survey between March 30 and May 26. Point count surveys ranged from 6-10 minutes in length and included both a 3-5 minute silent period and 3-5 minute call-broadcast period. All detections of primary marsh bird species were recorded, including detections of Yuma clapper rail.

In total we recorded 394 detections of Yuma clapper rails. These numbers could include multiple detections of the same individuals. The results of our survey efforts are summarized in the enclosed Excel spread sheet and the word document.

Although it is suggested in the permit, copies of field datasheets were not included with this report due to the volume of data collected. Copies of the approximately 1500 datasheets may be obtained upon request.

Sincerely,

Christopher Nadeau
Wildlife Biologist
University of Arizona
325 Biological Sciences East
Tucson, Arizona 85721
(520) 626-8912

AR074174

The Effects of Fire on the Yuma Clapper Rail (*Rallus longirostris yumanensis*)

Record Id 10831
County Imperial
Year 2009
Spp YCR (+)
Srv. Rpt.
D.B. DL 5/24/10
RN 6-18-13
GIS
L+R
File

2009 Annual Report

for

USFWS Endangered Species Permit # TE039466-1

Courtney J. Conway and Christopher P. Nadeau
USGS Arizona Cooperative Fish and Wildlife Research Unit
University of Arizona
325 Biological Sciences East, Tucson, Arizona 85721

Introduction:

The Yuma clapper rail (*Rallus longirostris yumanensis*) is a federally endangered species that occurs along the lower Colorado River, the Imperial Valley of California, the Colorado River delta, and along the west coast of Mexico. Ninety percent of the U.S. population exists in only 2 wetlands (Conway et al. 1993) and much existing wetland habitat remains unoccupied. Yuma clapper rails are ranked 6th out of 230 breeding bird species in Arizona based on their conservation need (Latta et al. 1999). To ensure long-term persistence of U.S. populations, we need to have effective management and mitigation activities that improve habitat quality and benefit Yuma clapper rail populations. One possible management activity that has been proposed to benefit Yuma clapper rail populations is prescribed burning in areas with decadent emergent vegetation (Conway et al. 1993). Historically, marsh habitats along the lower Colorado River were highly ephemeral with periodic flooding and natural fires eliminating decadent stands of emergent vegetation. These stochastic events resulted in areas of early successional emergent marsh habitat thought to be beneficial to rails (Conway 1990, Conway et al. 1993). Years of flood control and fire suppression has resulted in substantial areas of decadent emergent marsh habitat, but very little early successional emergent marsh along the lower Colorado River. Prescribed fire may be the best technique for creating early-successional emergent marsh habitat required to enhance populations of Yuma clapper rails. Indeed, prescribed fire has been repeatedly suggested as a promising conservation measure for restoring Yuma clapper rail populations (Conway et al. 1993, Conway 1995, Eddleman and Conway 1998, Conway and Eddleman 2000), but has yet to be evaluated. We conducted pre- and post-burn surveys in both burned and control marshes to examine the effects of fire on the abundance of rails and the quality of rail habitat.

Field Locations

Study Sites were located along the lower Colorado River in Arizona (Yuma and Mohave Counties) and California (Imperial County), and south of the Salton Sea in the Imperial Valley of California (Imperial County). We worked closely with Imperial National Wildlife Refuge, Havasu National Wildlife Refuge, and Sony Bono Salton Sea National Wildlife Refuge to conduct burns and marsh bird surveys at each refuge. Each burn occurred between 2003 and 2009. One site (hazard 7) was burned during the spring of 2009 by the Salton Sea National Wildlife Refuge. We also surveyed marshes on other state and federally owned lands. See the attached maps which include all our study locations (Appendix 2).

Methods:

We conducted call-broadcast surveys for rails in 2 types of study sites: sites recently burned (n=20) and non-burned (control) sites near each burn site (n=49). In 2009 at each study site, we conducted 1-9 replicate surveys between February and July. We used survey protocols that we developed based on our previous studies of marsh bird survey methods (Conway et al. 1993, Conway and Gibbs 2001, Conway et al. 2001, Conway 2009) and on recommendations from a recent wetland bird monitoring workshop at the USGS Patuxent Wildlife Research Center (Ribic et al.1999). Surveys were conducted during mornings between one half-hour before sunrise until 10:00 am and in the evenings between 5:00 pm until dusk (one half-hour after sunset). All surveys were

conducted on days without rain and when wind speeds did not exceed 10 mph. Based on previous marsh bird survey work in the region, conditions during most (99%) mornings are favorable for surveys (i.e., without too much wind) whereas 42% of evenings are too windy for surveys.

Survey Results:

A summary of our survey results for 2009 are included in Appendix 1(including geographic coordinates for each survey route). The format of this summary was developed through extensive phone and email conversations with USFWS staff. Results summarized by point are available upon request. Maps are included in Appendix 2.

Preliminary analysis of survey data from 2003-2007 are promising. Numbers of Yuma clapper rails increased following fire and abundance was higher compared to control sites in the 2 years post-burn. We will continue to monitor burn and control sites in subsequent years to determine the long-term effects of fire on rails and the fire frequency needed to maintain optimal rail habitat.

Literature Cited:

Conway, C. J. 1990. Seasonal changes in movements and habitat use by three sympatric species of rails. M.S. Thesis, University of Wyoming, Laramie.

Conway, C. J. 2009. Standardized North American Marsh Bird Monitoring Protocols, version 2009-2. Wildlife Research Report #2009-02. U.S. Geological Survey, Arizona Cooperative Fish and Wildlife Research Unit, Tucson, AZ.

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Latta, M. J., C. J. Beardmore, and T. E. Corman. 1999. Arizona Partners in Flight Bird Conservation Plan, Version 1.0. Nongame and Endangered Wildlife Program Technical Report 142. Arizona Game and Fish Department, Phoenix, Arizona.

Ribic, C.A., S. Lewis, S. Melvin, J. Bart, and B. Peterjohn. 1999. Proceedings of the

Marsh bird monitoring workshop. USFWS Region 3 Administrative Report, Fort Snelling, MN.

Appendix 1. Number of Yuma clapper rails counted during each survey at each route during the 2009 breeding season. Latitude and Longitude data were recorded in the North American Datum 1983 and represent the average Latitude and Longitude of the survey route.

Site	Date	Observer	Location		Total Number of CLRA Detected Per Survey (repeats excluded)
			Latitude	Longitude	
a-1 pond	27-Apr-09	Mark Ogonowski	33.0833211	-115.713418	27
a-1 pond	03-Jun-09	Emma Gerald	33.0833211	-115.713418	29
aasw	19-May-09	Mark Ogonowski	32.8711379	-114.478076	1
all american canal and southern lcr	07-May-09	Jeff Liechty	32.8029971	-114.538807	0
all american canal and southern lcr	15-May-09	Jeff Liechty	32.8029971	-114.538807	0
all american canal and southern lcr	22-May-09	Jeff Liechty	32.8029971	-114.538807	0
all american canal and southern lcr	01-Jun-09	Kelly Morris	32.8029971	-114.538807	0
arizona channel c	05-May-09	Jeff Liechty	32.9413327	-114.472738	0
arizona channel c	14-May-09	Jeff Liechty	32.9413327	-114.472738	1
b-1 pond	02-Jun-09	Emma Gerald	33.0834978	-115.704736	25
beal lake	07-May-09	Chris Nadeau	34.7685031	-114.533232	0
beal lake	18-Jun-09	Jeff Liechty	34.7685031	-114.533232	3
Borrow Pit Area_lm	20-May-09	Mark Ogonowski	33.213739	-115.568022	0
Borrow Pit Area_lm	24-May-09	Mark Ogonowski	33.213739	-115.568022	0
Borrow Pit Area_lm	28-May-09	Mark Ogonowski	33.213739	-115.568022	0
Borrow Pit Area_sm	21-May-09	Mark Ogonowski	33.206333	-115.563819	0
Borrow Pit Area_sm	25-May-09	Mark Ogonowski	33.206333	-115.563819	0
Borrow Pit Area_sm	29-May-09	Mark Ogonowski	33.206333	-115.563819	0
BR 456 Injection Pad	28-Jul-09	Mark Ogonowski	33.194728	-115.562661	3
BR456	30-Apr-09	Mark Ogonowski	33.200039	-115.581231	2
BR456	14-May-09	Mark Ogonowski	33.200039	-115.581231	3
BR456	27-May-09	Mark Ogonowski	33.200039	-115.581231	3
bruchard bay	03-Jun-09	Emma Gerald	33.1054083	-115.684127	8
deer island	09-Apr-09	Chris Nadeau	32.9449227	-114.479919	2
east pond	04-May-09	Jeff Liechty	32.8721825	-114.475696	0
Gila River Dome Valley East	03-Jun-09	Kelly Morris	32.7585833	-114.369858	2
Gila River Dome Valley West	03-Jun-09	Kelly Morris	32.6974973	-114.289635	0
Gila River Dome Valley West	04-Jun-09	Kelly Morris	32.6974973	-114.289635	0
Gila River EM	16-Jun-09	Kelly Morris	32.730506	-113.93146	0
Gila River North Gila Valley	10-Jun-09	Kelly Morris	32.7379427	-114.451424	4
Gila River Tacna Valley	16-Jun-09	Kelly Morris	32.718204	-113.982354	0
Gila River Wellton Valley	11-Jun-09	Kelly Morris	32.7109727	-114.106521	1
hazard 10	08-Jun-09	Emma Gerald	33.1963783	-115.58284	19
hazard 11	08-Jun-09	Emma Gerald	33.1977867	-115.577123	4
hazard 6	02-Jun-09	Emma Gerald	33.1856663	-115.590121	26
hazard 7	02-Jun-09	Emma Gerald	33.1860617	-115.587055	14
headquarters marsh	13-Apr-09	Jeff Liechty	33.181615	-115.615995	2
headquarters marsh	04-Jun-09	Emma Gerald	33.181615	-115.615995	1
hidden shores boat a	10-Apr-09	Chris Nadeau	32.8922187	-114.456941	2
hidden shores boat a	10-Apr-09	Mark Ogonowski	32.8922187	-114.456941	3
hidden shores boat a	25-May-09	Jeff Liechty	32.8922187	-114.456941	0

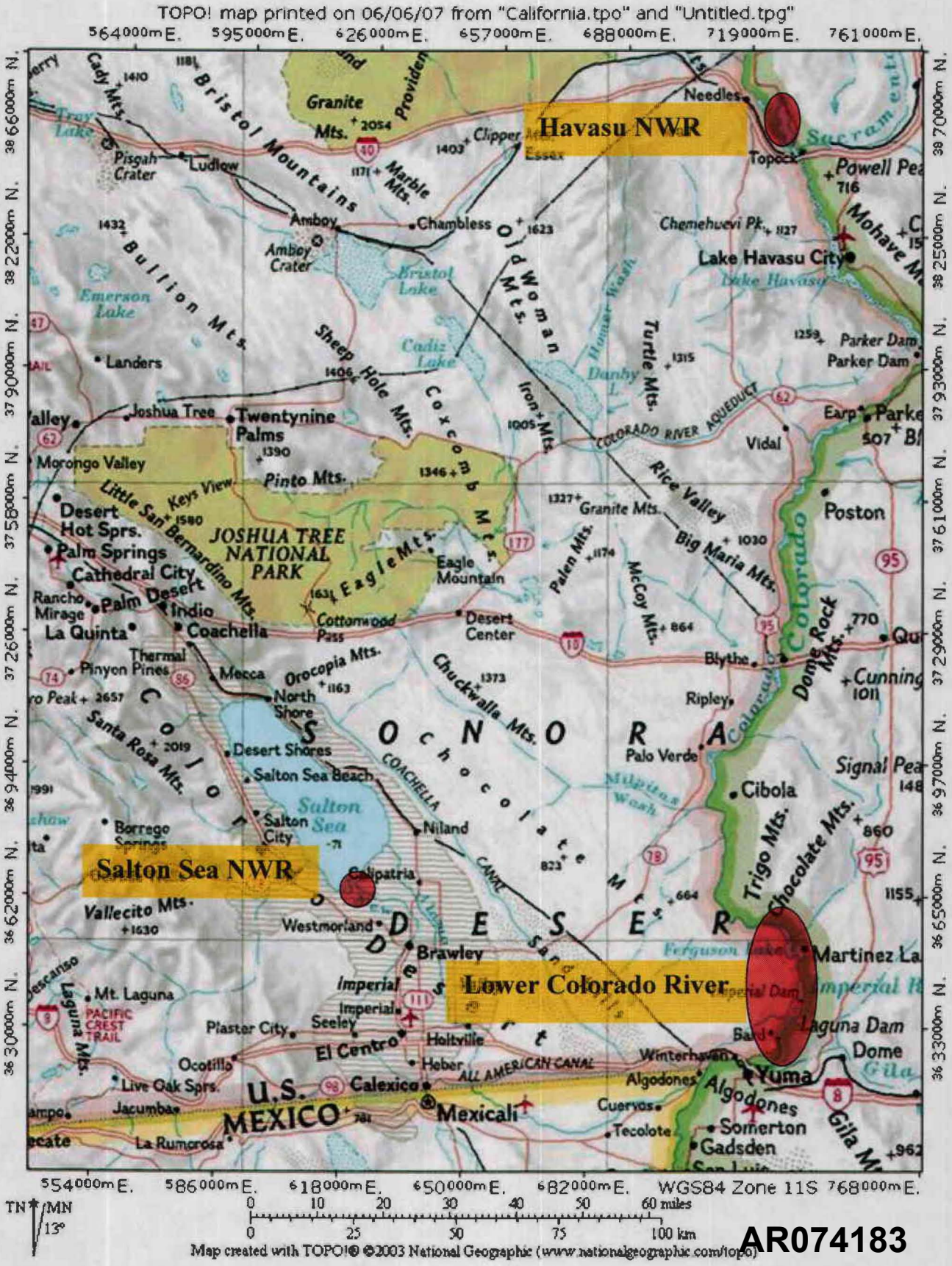
hidden shores boat b	29-Apr-09	Jeff Liechty	32.8883822	-114.462217	4
hidden shores boat b	13-May-09	Mark Ogonowski	32.8883822	-114.462217	8
hidden shores boat c	21-Apr-09	Jeff Liechty	32.8933196	-114.458329	8
hidden shores boat c	14-May-09	Mark Ogonowski	32.8933196	-114.458329	4
hidden shores boat c	22-May-09	Mark Ogonowski	32.8933196	-114.458329	1
hidden shores boat d	22-Apr-09	Jeff Liechty	32.8986276	-114.461541	1
hidden shores marsh	04-May-09	Jeff Liechty	32.8735422	-114.45586	3
hidden shores marsh	18-May-09	Jeff Liechty	32.8735422	-114.45586	7
hurricane ridge marsh	13-May-09	Jeff Liechty	32.90174	-114.484188	0
hurricane ridge marsh	21-May-09	Jeff Liechty	32.90174	-114.484188	0
IID-1	17-Mar-09	Chris Nadeau			6
IID-1	14-Apr-09	Jeff Liechty			12
IID-1	29-Apr-09	Mark Ogonowski			21
IID-2	18-Mar-09	Chris Nadeau			6
IID-2	17-Apr-09	Jeff Liechty			1
IID-2	28-Apr-09	Mark Ogonowski			2
IID-3	19-Mar-09	Chris Nadeau			0
IID-3	16-Apr-09	Jeff Liechty			7
IID-3	30-Apr-09	Mark Ogonowski			6
IID-4	20-Mar-09	Chris Nadeau			0
IID-4	13-Apr-09	Jeff Liechty			0
IID-4	1-May-09	Mark Ogonowski			3
imperial dam road marsh a	29-Apr-09	Jeff Liechty	32.86609	-114.482533	0
imperial dam road marsh b	29-Apr-09	Jeff Liechty	32.858525	-114.492796	2
inwr ag field 12	20-May-09	Mark Ogonowski	32.983902	-114.492464	9
inwr ag field 13	14-May-09	Jeff Liechty	32.9828563	-114.49079	4
inwr ag field 13	21-May-09	Mark Ogonowski	32.9828563	-114.49079	2
inwr ag field 16	20-Feb-09	Chris Nadeau	32.9829573	-114.483396	16
inwr ag field 16	19-Mar-09	Chris Nadeau	32.9829573	-114.483396	13
inwr ag field 16	09-Apr-09	Chris Nadeau	32.9829573	-114.483396	22
inwr ag field 16	20-Apr-09	Jeff Liechty	32.9829573	-114.483396	20
inwr ag field 16	24-Apr-09	Jeff Liechty	32.9829573	-114.483396	10
inwr ag field 16	12-May-09	Jeff Liechty	32.9829573	-114.483396	19
inwr ag field 16	25-May-09	Jeff Liechty	32.9829573	-114.483396	11
inwr ag field 16	11-Jun-09	Jeff Liechty	32.9829573	-114.483396	8
inwr ag field 16	06-Jul-09	Kelly Morris	32.9829573	-114.483396	10
inwr ag field 17	14-May-09	Jeff Liechty	32.98472	-114.482864	6
inwr ag field 17	21-May-09	Mark Ogonowski	32.98472	-114.482864	10
inwr ag field 18	28-Apr-09	Jeff Liechty	32.98548	-114.483267	10
inwr ag field 18	14-May-09	Mark Ogonowski	32.98548	-114.483267	10
inwr ag field 18	15-Jun-09	Angela Whitney	32.98548	-114.483267	3
inwr ag field 18	07-Jul-09	Mark Ogonowski	32.98548	-114.483267	7
inwr ag field 21	20-May-09	Mark Ogonowski	32.98941	-114.486673	13
island lake	19-Jun-09	Kelly Morris	33.0321537	-114.586184	0
island lake	03-Jul-09	Kelly Morris	33.0321537	-114.586184	0
island lake	10-Jul-09	Kelly Morris	33.0321537	-114.586184	0
martinez lake b	20-Apr-09	Jeff Liechty	32.9803629	-114.469903	1
martinez lake b	11-May-09	Jeff Liechty	32.9803629	-114.469903	3

mckindry marsh	03-Jun-09	Emma Gerald	33.1699514	-115.631173	0
meers point and south river channel	06-May-09	Jeff Liechty	32.9566879	-114.474789	0
meers point and south river channel	19-May-09	Jeff Liechty	32.9566879	-114.474789	3
meers point and south river channel	20-May-09	Jeff Liechty	32.9566879	-114.474789	5
no name lake	06-May-09	Chris Nadeau	34.7826105	-114.530282	3
no name lake	28-May-09	Jeff Liechty	34.7826105	-114.530282	4
no name lake	17-Jun-09	Angela Whitney	34.7826105	-114.530282	4
north california channel	08-May-09	Jeff Liechty	32.9562482	-114.474315	1
north california channel	21-May-09	Mark Ogonowski	32.9562482	-114.474315	3
north california channel	30-May-09	Angela Whitney	32.9562482	-114.474315	6
north inwr boat	06-May-09	Jeff Liechty	33.0300139	-114.584905	7
north inwr boat	26-May-09	Jeff Liechty	33.0300139	-114.584905	0
north inwr boat	01-Jun-09	Kelly Morris	33.0300139	-114.584905	0
north mittry lake b	13-May-09	Jeff Liechty	32.8583937	-114.450634	10
north mittry lake c	24-Apr-09	Jeff Liechty	32.8670039	-114.453372	7
north mittry lake c	12-May-09	Jeff Liechty	32.8670039	-114.453372	3
north mittry lake c	21-May-09	Jeff Liechty	32.8670039	-114.453372	0
north mittry lake c	22-May-09	Jeff Liechty	32.8670039	-114.453372	6
reidman 3	29-Apr-09	Mark Ogonowski	33.079425	-115.711813	39
reidman 4	29-Apr-09	Mark Ogonowski	33.08197	-115.71163	20
rock hill marsh	04-Jun-09	Emma Gerald	33.1769525	-115.623045	5
senator wash	13-May-09	Jeff Liechty	32.9113638	-114.477266	1
senator wash	21-May-09	Jeff Liechty	32.9113638	-114.477266	0
south of dredge ramp b	10-Apr-09	Jeff Liechty	32.8190357	-114.456863	0
south of dredge ramp b	27-Apr-09	Jeff Liechty	32.8190357	-114.456863	2
south of dredge ramp b	19-May-09	Jeff Liechty	32.8190357	-114.456863	0
squaw lake and south of squaw lake	17-Apr-09	Mark Ogonowski	32.8948991	-114.470157	11
squaw lake and south of squaw lake	28-Apr-09	Jeff Liechty	32.8948991	-114.470157	0
squaw lake and south of squaw lake	12-May-09	Mark Ogonowski	32.8948991	-114.470157	0
squaw lake and south of squaw lake	18-May-09	Jeff Liechty	32.8948991	-114.470157	0
squaw lake shore	23-Apr-09	Jeff Liechty	32.9029338	-114.469773	0
squaw lake shore	05-May-09	Jeff Liechty	32.9029338	-114.469773	3
union pond	13-Apr-09	Jeff Liechty	33.1754983	-115.625036	10
union pond	04-Jun-09	Emma Gerald	33.1754983	-115.625036	7
upper goose lake burn	28-May-09	Jeff Liechty	34.8207367	-114.509173	1
upper goose lake burn	17-Jun-09	Jeff Liechty	34.8207367	-114.509173	1
upper goose lake control	29-May-09	Jeff Liechty	34.7472125	-114.500039	0
upper goose lake control	18-Jun-09	Angela Whitney	34.7472125	-114.500039	0
water tower marsh	04-May-09	Jeff Liechty	32.8696082	-114.478108	0
west pond a	02-Jun-09	Kelly Morris	32.8802158	-114.478138	1
west pond b	01-May-09	Jeff Liechty	32.8793729	-114.48142	1
whiskey slough burn	29-May-09	Jeff Liechty	34.8034717	-114.518482	0
whiskey slough burn	21-Jun-09	Jeff Liechty	34.8034717	-114.518482	1
whiskey slough control	29-May-09	Jeff Liechty	34.8047129	-114.522394	0
whiskey slough control	21-Jun-09	Jeff Liechty	34.8047129	-114.522394	1
willow lake burn	17-Jun-09	Jeff Liechty	34.7853436	-114.517712	1
willow lake control	05-May-09	Chris Nadeau	34.7935582	-114.529238	4
willow lake control	27-May-09	Jeff Liechty	34.7935582	-114.529238	0

willow lake control	16-Jun-09	Jeff Liechty	34.7935582	-114.529238	1
willow lake south burn	05-May-09	Chris Nadeau	34.7701175	-114.512405	0
willow lake south burn	27-May-09	Jeff Liechty	34.7701175	-114.512405	0
willow lake south burn	16-Jun-09	Jeff Liechty	34.7701175	-114.512405	0

Appendix 2. Maps of survey sites.

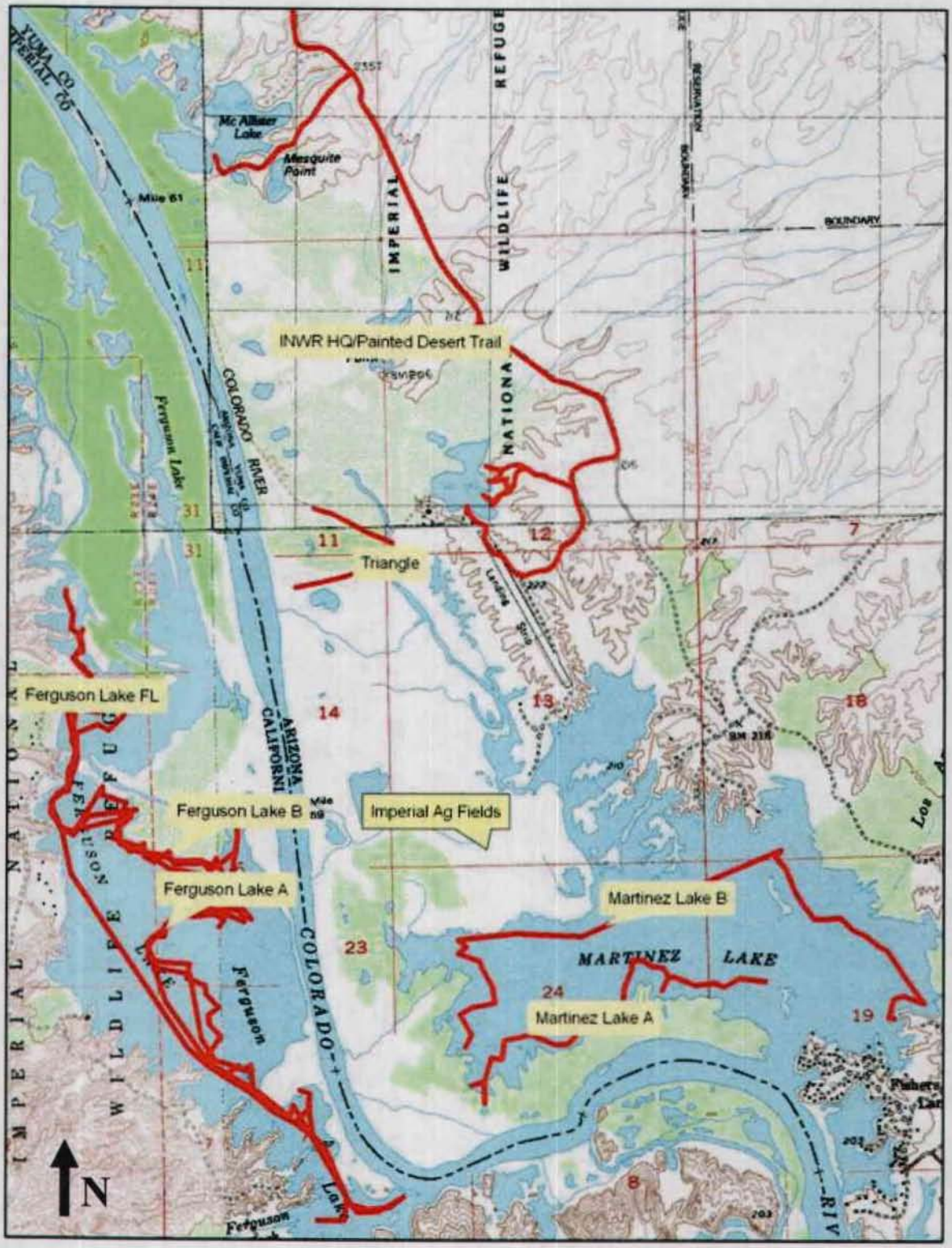
General Survey Location Map



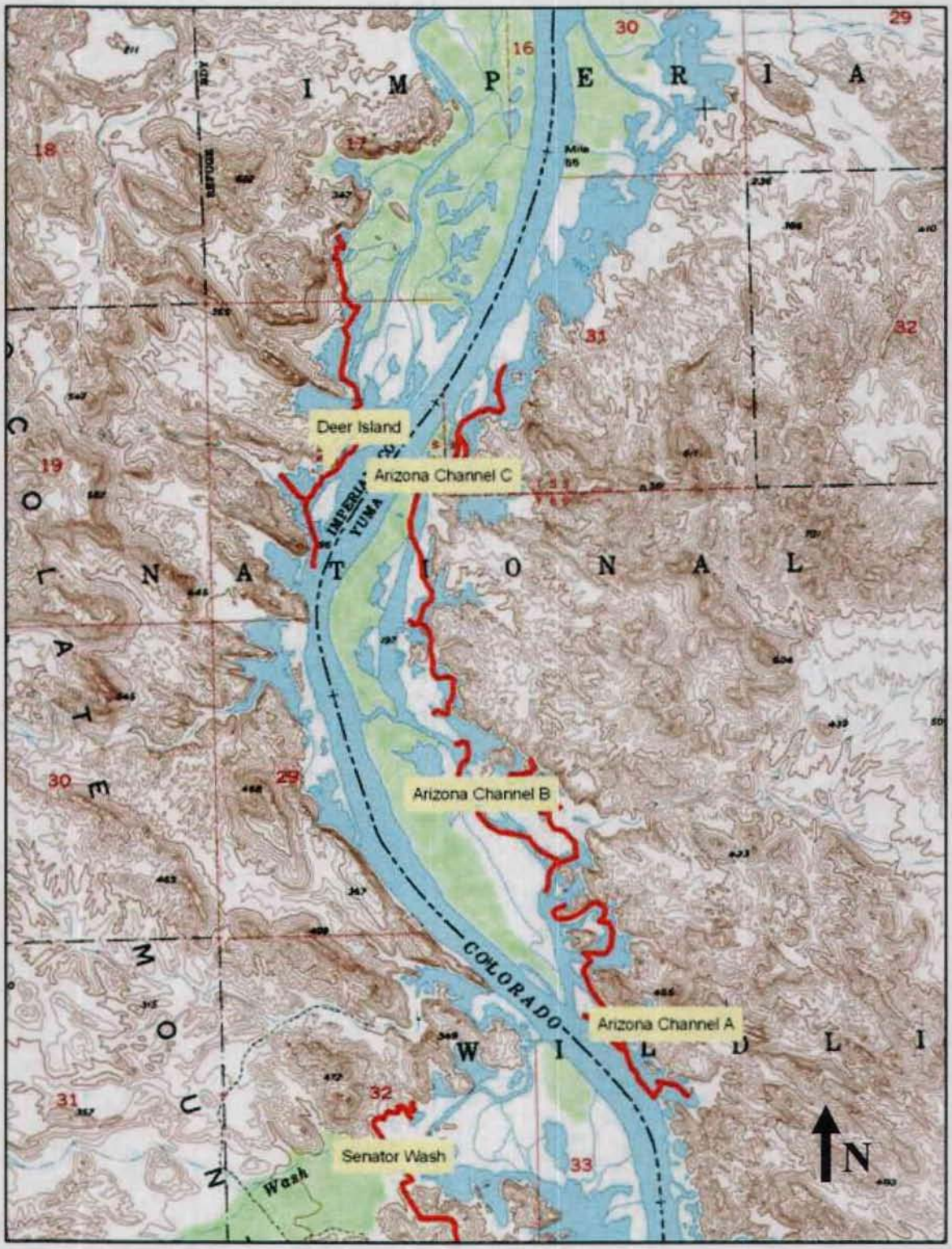
Lower Colorado River – Island Lake



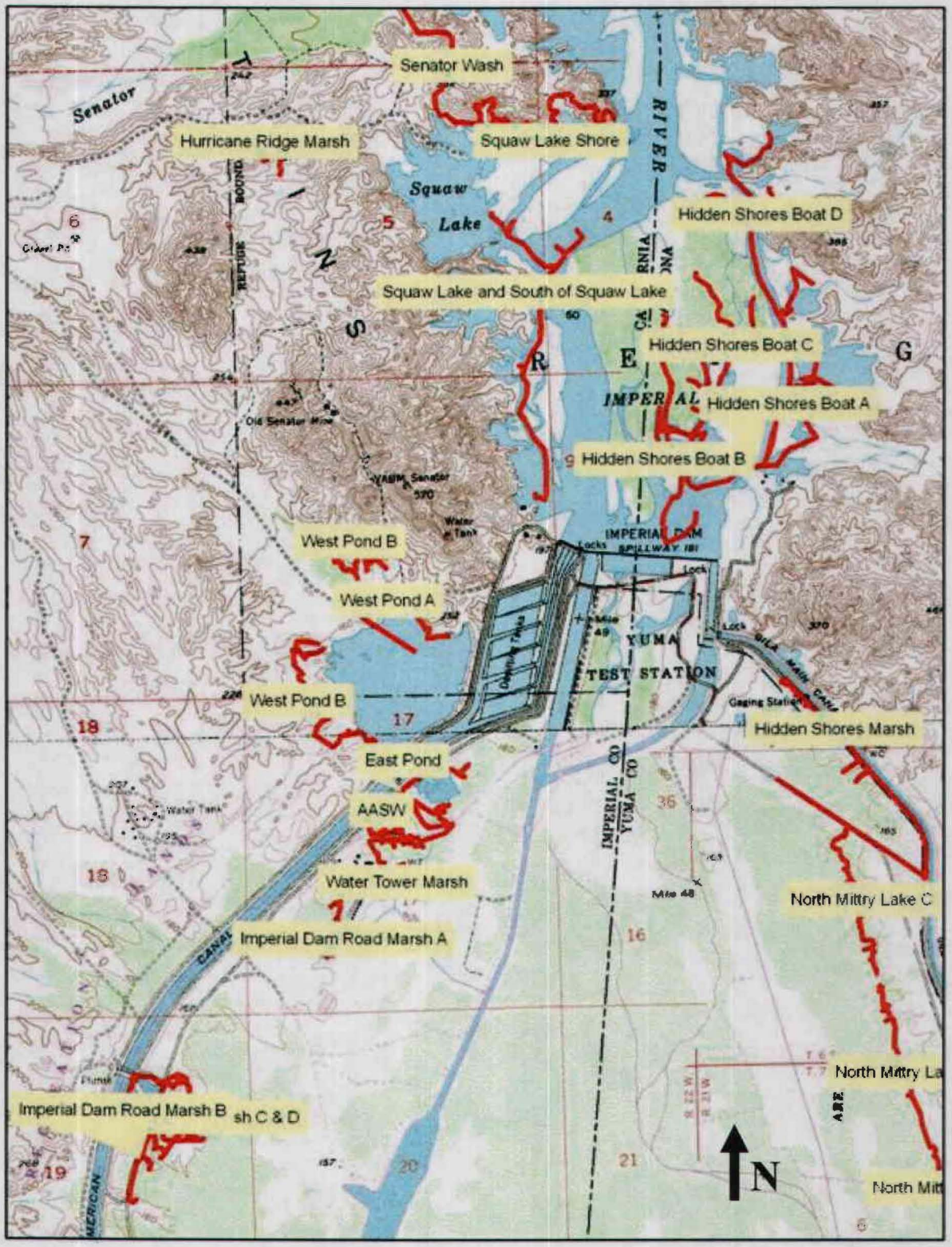
Lower Colorado River – Imperial National Wildlife Refuge



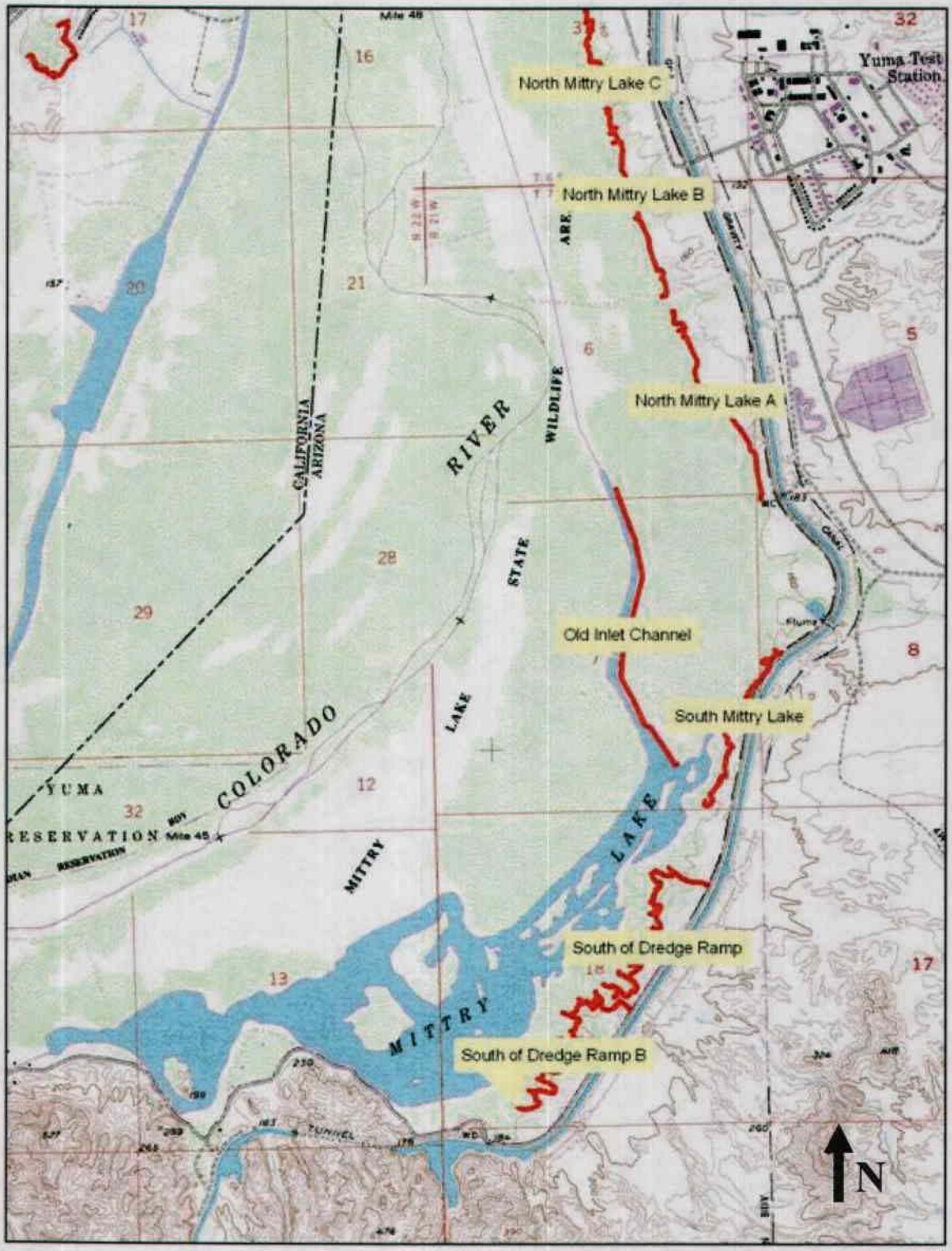
Lower Colorado River – Arizona Channel



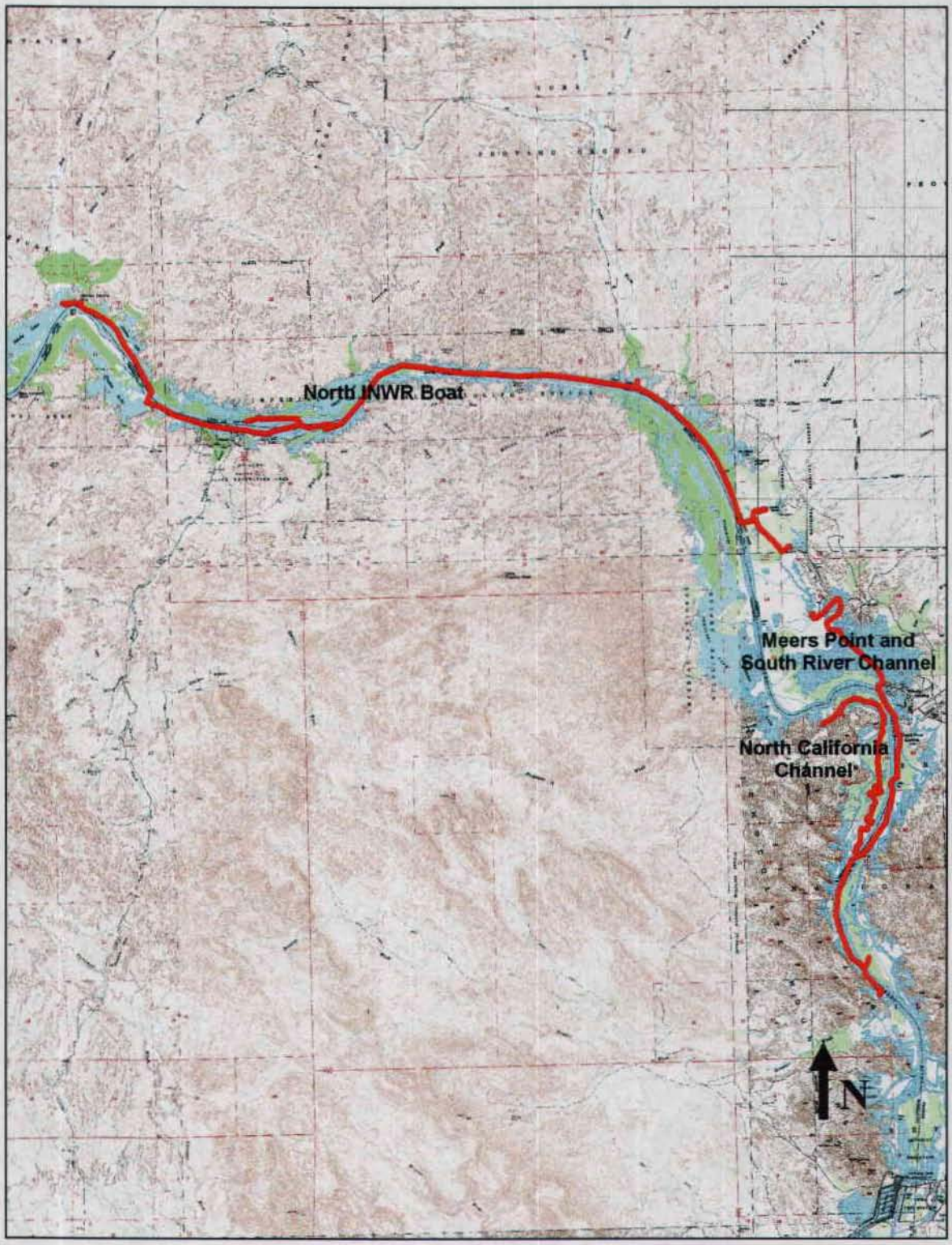
Lower Colorado River – Imperial Reservoir



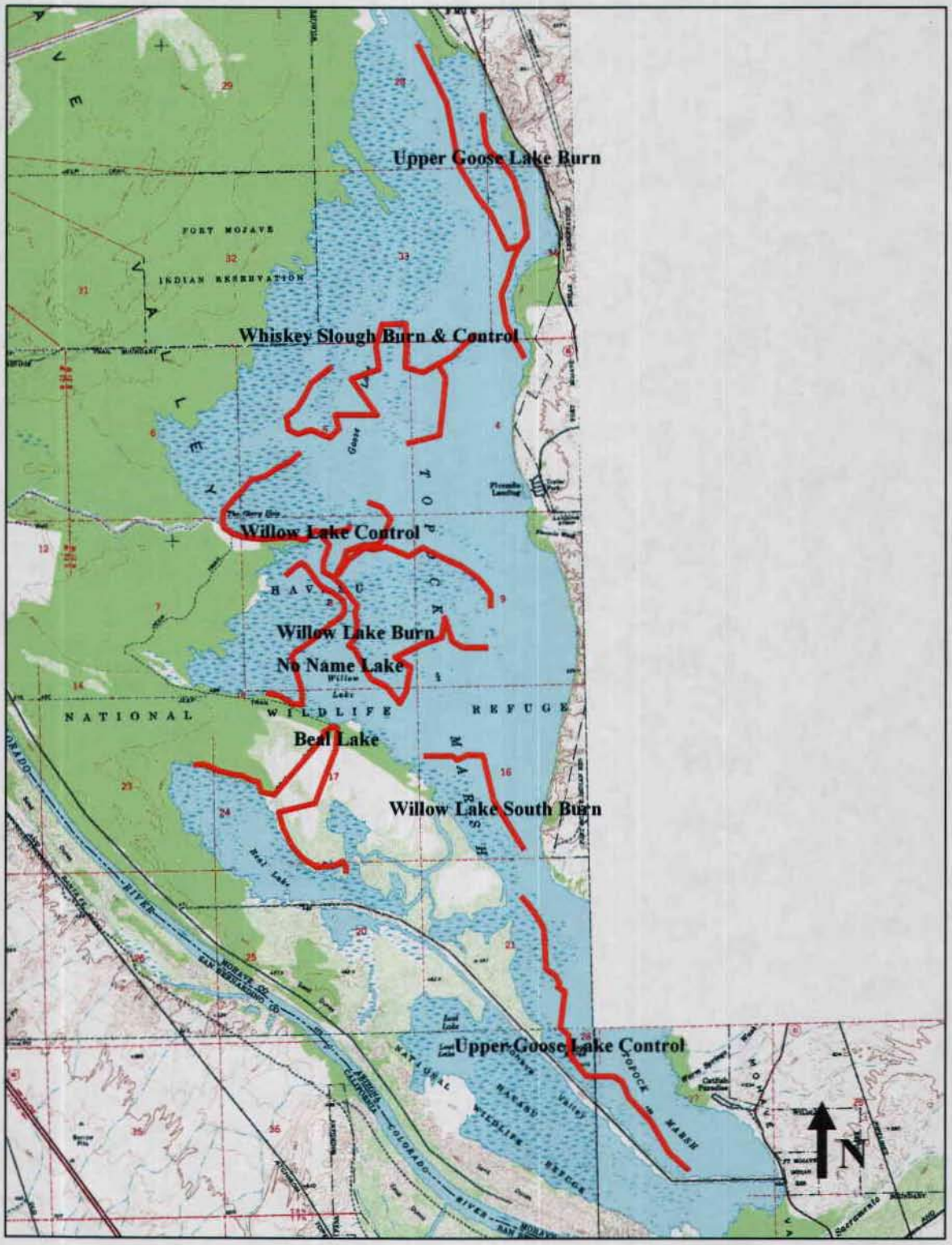
Lower Colorado River – North Mittry Lake



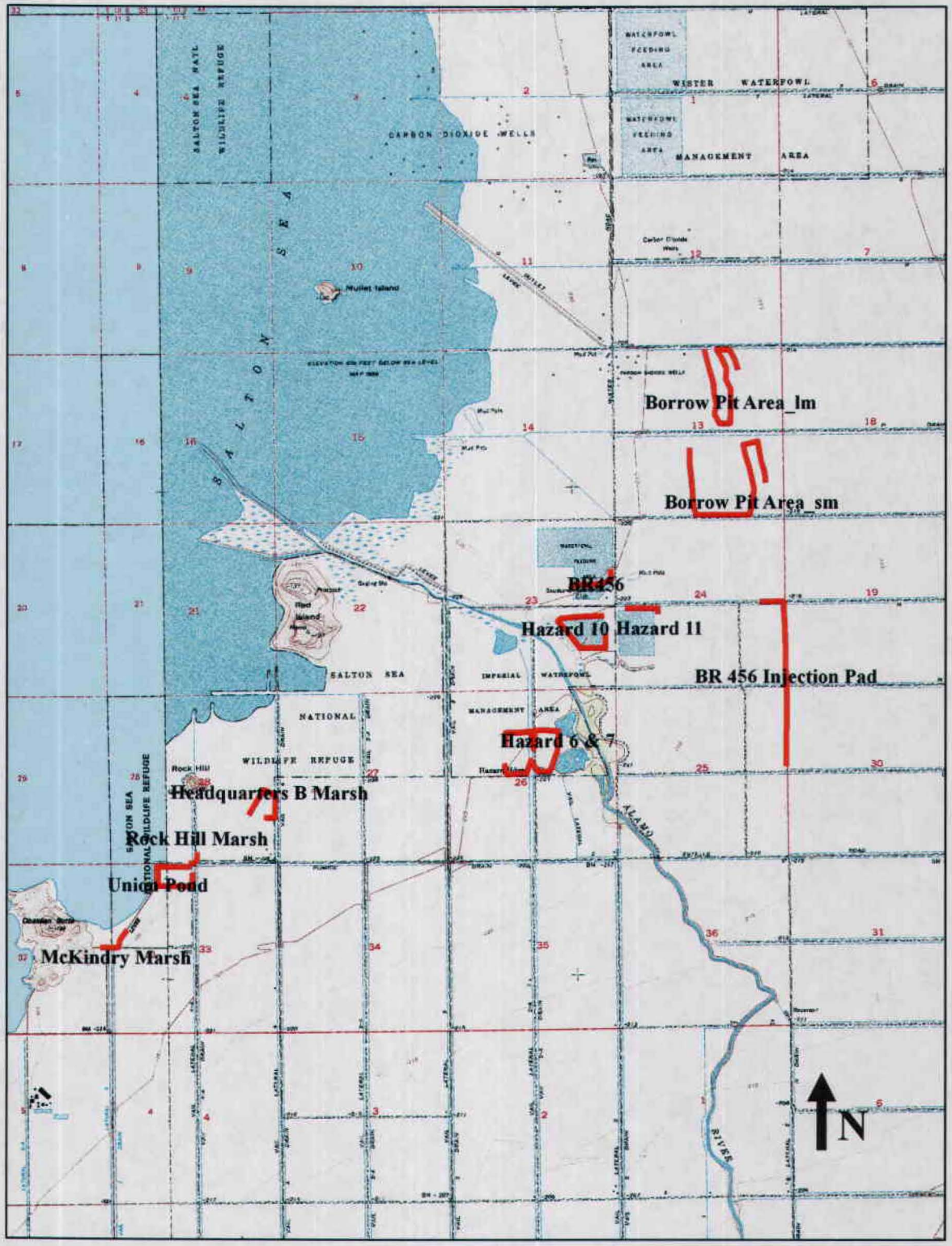
Lower Colorado River – 2009 New Routes



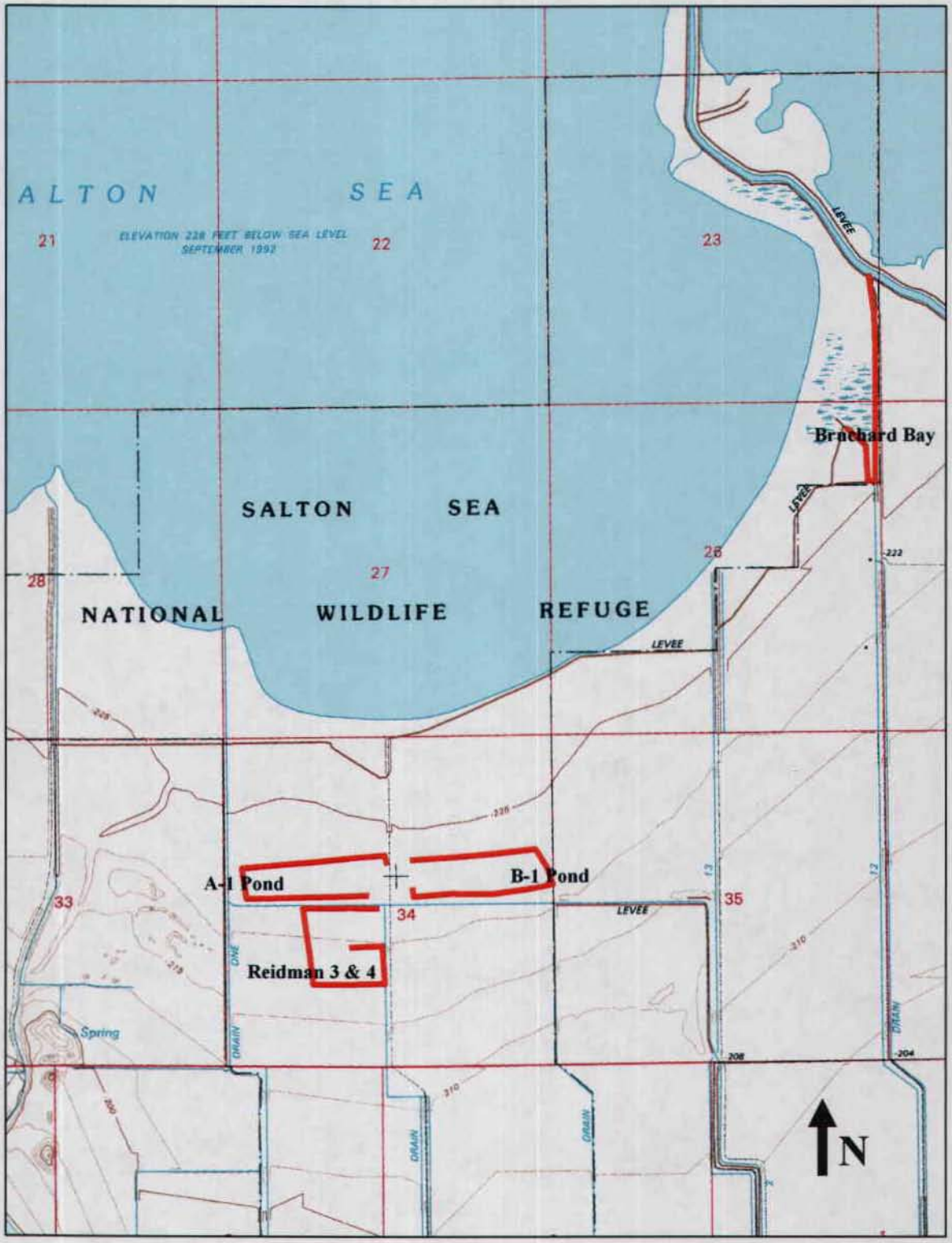
Havasu National Wildlife Refuge



Salton Sea National Wildlife Refute – Headquarters/Hazard Units



Salton Sea National Wildlife Refute – Unit 1



039466

THE UNIVERSITY OF ARIZONA.

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College of Agriculture and
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U.S. Fish and Wildlife Service
Regional Office
Division of Endangered Species-Permits
P.O. Box 1306
Albuquerque, New Mexico 87103

Carlsbad Fish and Wildlife Office
6010 Hidden Valley Road
Carlsbad, California 92009

Arizona Ecological Services Field Office
2321 W. Royal Palm Road, Suite 103
Phoenix Arizona, 85021-4951

15 December 20009

Dear Cooperator,

The following report is being submitted to fulfill the requirements of Federal Fish and Wildlife Permit number TE039466-1. This permit was issued to the Arizona Cooperative Fish and Wildlife Research Unit to conduct call-broadcast surveys for Yuma clapper rails in Arizona and California.

We conducted surveys at 856 points in 2009. Each point received 1-9 point-count surveys between March and July. All detections of primary marsh bird species were recorded, including detections of Yuma clapper rail. In total we recorded 666 detections of Yuma clapper rails. These numbers could include multiple detections of the same individuals. A summary of our results is included in the attached report.

Although it is suggested in the permit, copies of field datasheets were not included with this report due to the volume of data collected. Copies of the approximately 2000 datasheets may be obtained upon request.

Sincerely,

Christopher Nadeau
Wildlife Biologist
University of Arizona
325 Biological Sciences East
Tucson, Arizona 85721
(520) 626-8912



Record Id 10984
County Imperial
Year 2010
Spp YCR (+) "Detected South of the project site"
Srv. Rpt.
D.B. SC 9/16/10
GIS RN 1-7-11
L+R
File

FOCUSED SURVEY
YUMA CLAPPER RAIL
Simbol Mining Development Project
(Section 24; T11S, R13E; Niland 7.5' USGS Quadrangle)
Imperial County, CA

Prepared for:

Environmental Management Associates, Inc.
588 Explorer Street
Brea, CA 92821

By

Arthur Davenport
Davenport Biological Services
P.O. Box 1692
Barstow, California 92312
619-729-4242

July 6, 2010


RECEIVED
SEP 15 2010
US FWS
CARLSBAD FIELD OFFICE CA

Introduction

Davenport Biological Services (DBS) was hired by Environmental Management Associates, Inc. to complete presence/absence surveys for endangered species near Niland, California (Figure 1). The surveys were completed within the project area of the Simbol Mining Development Project site. Within this area, and a 100-meter buffer, a focused survey was completed for the Yuma clapper rail (*Rallus longirostris yumanensis*).

Yuma Clapper Rail
The Yuma clapper rail was listed as an endangered species under the Endangered Species Act of 1973, as amended, on 11 March 1967 (FR 32:4001). The Yuma clapper rail is also listed as threatened under California's Endangered Species Act.

The Yuma clapper rail is common in Imperial County with local populations occurring at the Sony Bono National Wildlife Refuge, Imperial Wildlife Area, as well as within other patches of suitable marsh habitat throughout the valley. In 2007, 102 rails were detected at the Sony Bono National Wildlife Refuge and 398 detected within the Imperial Wildlife Area (USFWS unpub. data, 2008). Three pairs of Yuma clapper rails were detected in drains located approximately two miles east of the Imperial Wildlife Area (Davenport 2007). The habitat within the drains was narrow and dominated by cattail (*Typha latifolia*). The Yuma clapper rail occurs along the Colorado River and occurs as far north as Littlefield, Arizona (Gerald Braden, San Bernardino County Museum, pers. comm., 2008). It is important to note that one pair of Yuma clapper rails was detected at Walt's Place in 1992 (William Radke, USFWS, pers. comm., 2008). Walt's Place coincides with the project location.

Information regarding the migration patterns of Yuma clapper rails is contradictory. There is some indirect evidence that they move post breeding. However, other studies did not detect migration (Eddleman 1989). Yuma clapper rails begin pair formation in mid February. First nests of Yuma clapper rail have been documented in mid March. Peak nest initiation is in mid May (Eddleman 1989).

The Yuma clapper rail occupies marsh habitats including canals and drains where cover and food is available. Vegetative cover often consists of cattail (*Typha latifolia*) and bulrush (*Scirpus acutus*). This species has also been observed in wetlands where there is a canopy of tamarisk (*Tamarix ramosissima*), and an understory of cattails or other wetland plants (e.g., bullrush). The food of the clapper rail includes a variety of invertebrate species, including crayfish and insects.

The survey was completed under Federal Recovery Permit # TE802450-6

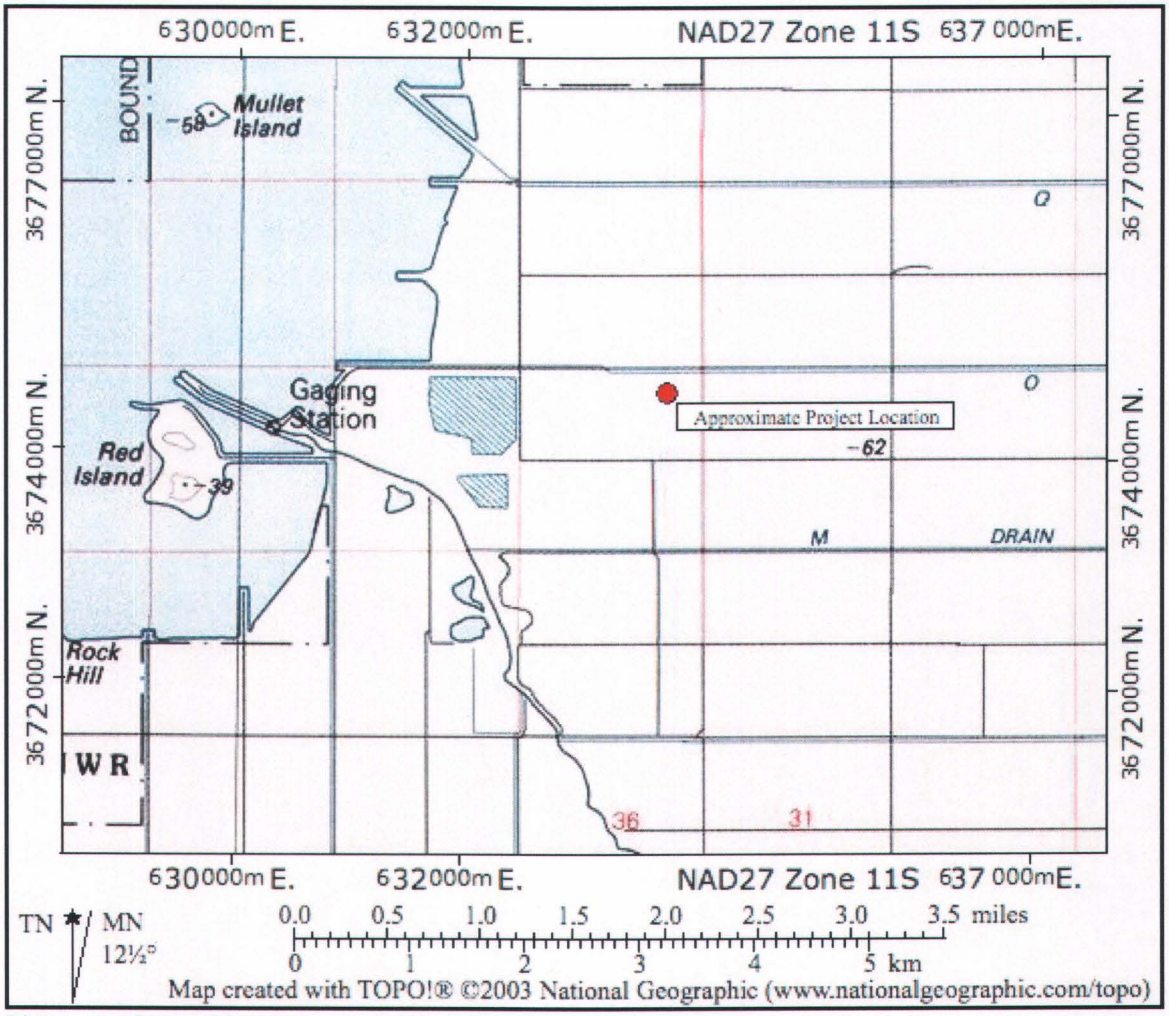

Figure 1. General location of the project site.

Methods

Field Survey

The focused survey was repeated five times, and the surveys were completed at least one week apart. During each of the five survey events, two survey passes were completed of all potentially suitable habitat on, and within, 100 meters of the project site. Thus, a total of 10 focused survey passes were completed during the course of this study. The two daily survey passes were spaced a minimum of 0.5 hours apart. During each survey pass, rails were listened for at sites spaced approximately 25 meters apart along the edge of the habitat. At each of these sites, a passive attempt to detect rails by their naturally occurring calls was completed for approximately 3 minutes. Following the listening for naturally occurring calls, two series of "kek" calls of the clapper rail were broadcast using an amplifier speaker (Mini Amplifier Speaker, RadioShack, Cat. NO. 277-1008C). Following the broadcast of calls, responding rails were listened for during a two to three minute period of time prior to moving on to the next listening location. This method was repeated throughout the survey area.

Per the general annual census survey protocol for Yuma clapper rails, the first two surveys were completed between March 15 and May 15, 2008. The focused survey for Yuma clapper rails was initiated on 12 April 2010, and was completed on 10 May 2010. Morning surveys were initiated around 0630 and completed by 1030 hours. No evening surveys were completed (Table 1).

Table 1. Shows date, survey time, and weather conditions during each survey pass.

Survey Date	Time	Temperature (F°)	Wind Speed (mph)	Cloud Cover (%)
	Start/Stop	Start/Stop	Start/Stop	Start/Stop
12 April 2010	0730/1130	63/63	1-3/0-1	10/90
20 April 2010	0730/1030	71/84	0-1/0-3	5/5
26 April 2010	0630/1030	56/73	0-1/0-1	0/0
3 May 2010	0700/1000	58/71	0/0-1	0/0
10 May 2010	0630/1030	58/73	1-5/0-2	0/0

The species of all birds observed was recorded (Appendix 1).

Background Search
Information regarding the historic distribution of Yuma clapper rails in the vicinity of the proposed project was also reviewed. In this regard, information from the Sonny Bono National Refuge, Museum of Vertebrate Zoology, Berkley, and California Natural Diversity Data Base was reviewed.

Results

Background Search
The Yuma clapper rail was documented at the project site in 1992 (William Radke, US Fish and Wildlife Service, pers. comm., 2008). Other than this previous sighting, no other documentation of Yuma clapper rail for the site was found. However, Yuma clapper rails are known to currently exist within the Hazard Unit of the Sonny Bono National Wildlife Refuge. The Hazard Unit is located approximately 0.5 miles to the west of the project area. Additionally, additional Yuma clapper rails are known to exist within the Imperial Wildlife Area, which is located approximately two miles north of the project site.

Field Survey
Approximately 42 acres of suitable habitat was found to exist on site (Figures 2, 3, and 4). No Yuma clapper rails were observed or otherwise detected on site during this survey. At least one, possibly two Yuma clapper rails were detected just south of the site (Table 2; Figures 2 & 3).

Table 2. Shows locations of where Yuma clapper rails were detected during this survey.

Location	Date	Easting	Northing
1	12 April 2010	0633558	3674150
2	26 April 2010	0633175	3674180

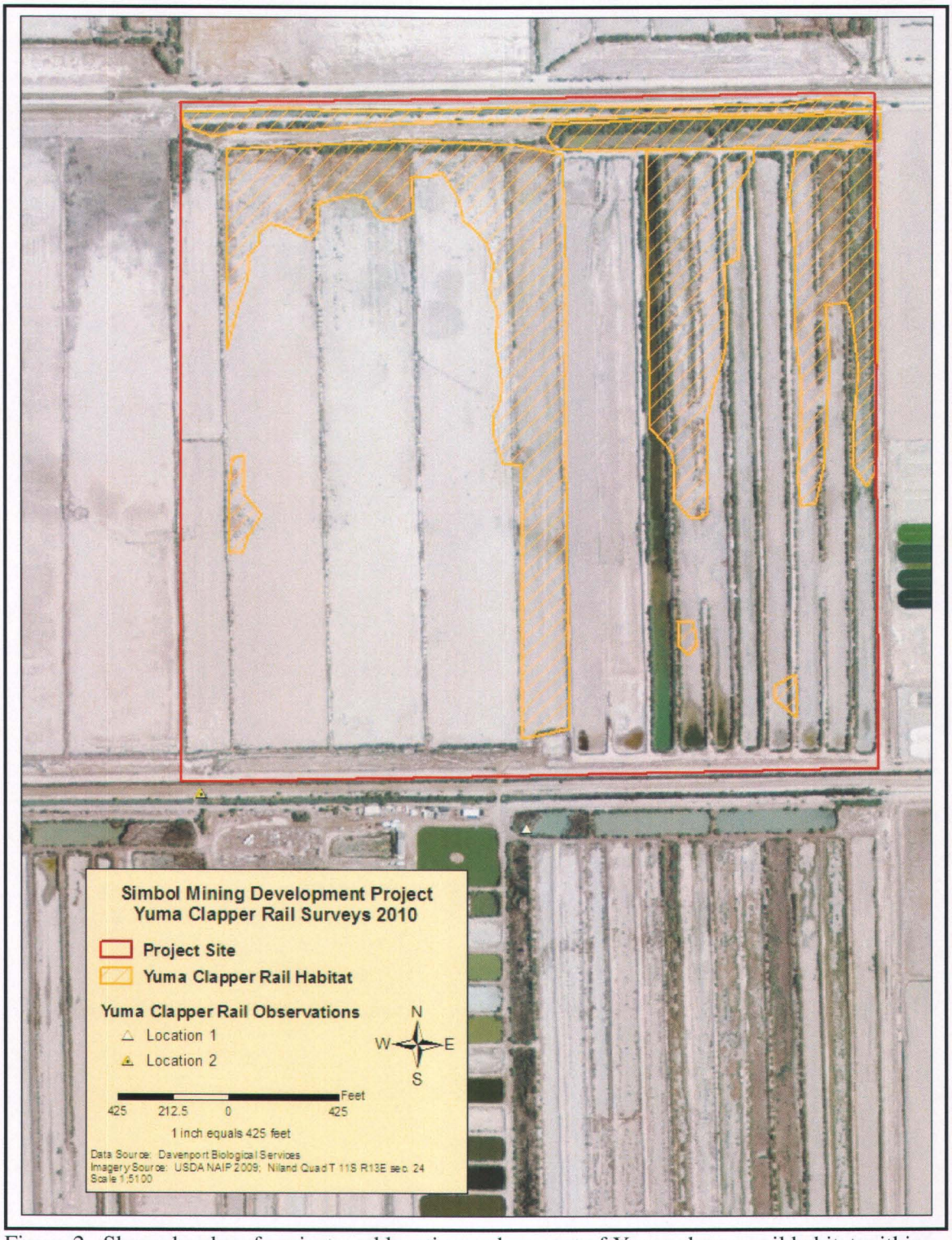

Figure 2. Shows border of project, and location and amount of Yuma clapper rail habitat within project area, as well as locations adjacent to the project where Yuma clapper rails were detected.

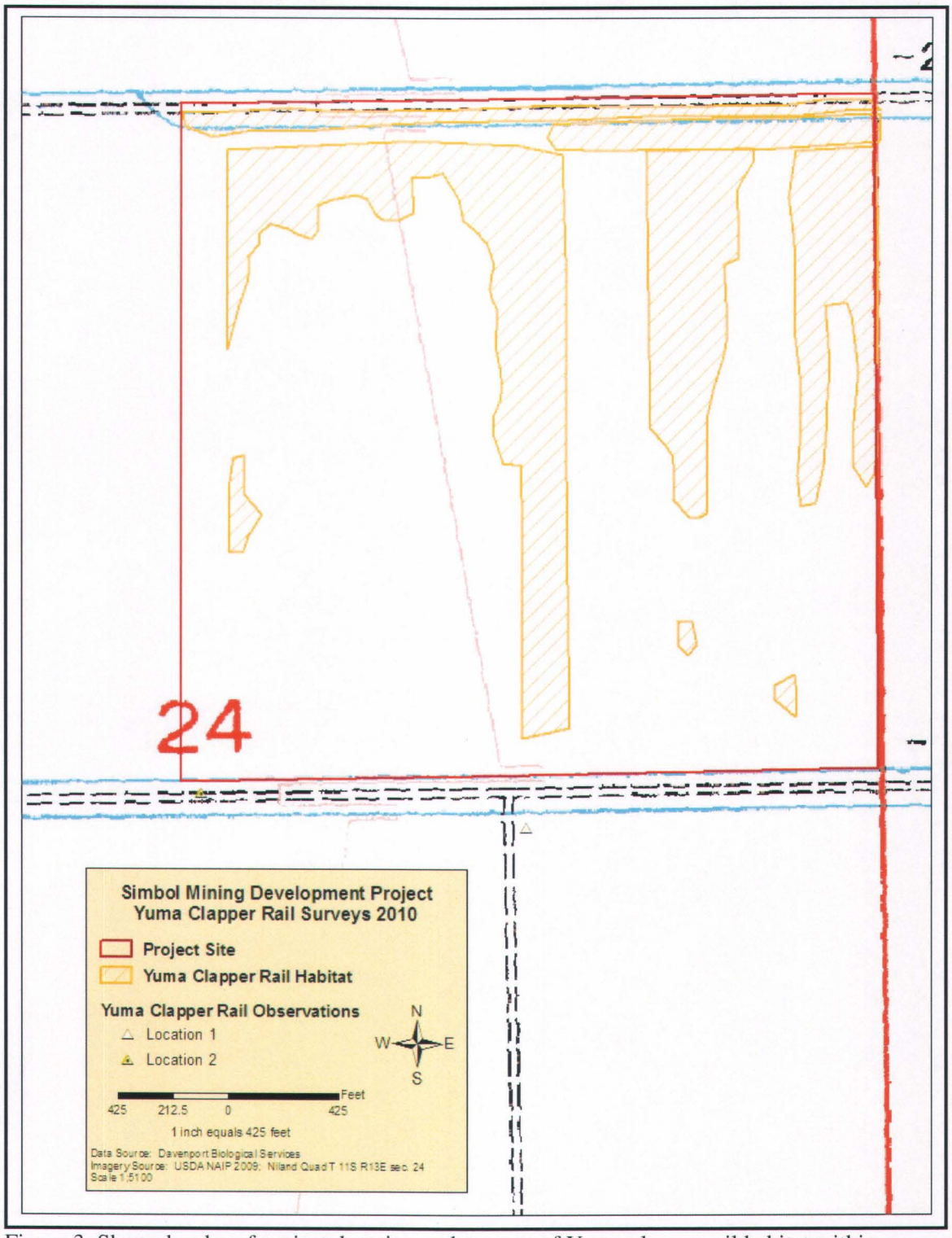

Figure 3. Shows border of project, location and amount of Yuma clapper rail habitat within project area, as well as locations adjacent to the project where Yuma clapper rails were detected.



Figure 4. Shows condition of habitat found within project area during April (Photos taken 12 April 2010).

Discussion

The absence of Yuma clapper rails on site is likely due to the significant changes in water availability that occurs at this site. Water is added to the ponds in the fall in anticipation of the waterfowl-hunting season. The ponds are then emptied or otherwise allowed to dry in the spring. Thus, nesting conditions for Yuma clapper rails declines rapidly due to the diminishing availability of water and food resources. These declining conditions likely discourage nesting attempts by the rails in this area (Figure 5). The presence of the vegetated canal on the north side of the survey area also provided habitat for the green heron, marsh wren, and Yuma clapper rail. This habitat, as well as the some inundated, tamarisk lined, ponds could have provided habitat for the Yuma clapper rail. However, no Yuma clapper rails were detected during this survey.

The Yuma clapper rails detected sites located south of the project site were located within marsh habitat located on the south side of Schrimpf Road. Because these two detections occurred on different dates, they may represent one or two individual birds.

Sixty-six species of birds were detected within the survey area during this survey. The number of species declined as migrants moved on to nesting areas and the ponds dried. Resident species adapted to dry conditions remained on site. These species included Abert's towhee, black-tailed gnatcatcher, Verdin, western kingbird, and burrowing owl. Additional species associated with the vegetated canal included the black phoebe, green heron, snowy egret, great egret, and cattle egret.



Figure 5. Shows dry condition of rail habitat on May 7, 2010.

Conclusion

During the 2010 nesting season, no Yuma clapper rails were detected on site. However, at least one, possibly two, Yuma clapper rails were detected south of the project site during this survey. Thus, although the site was determined to be unoccupied by Yuma clapper rails during the nesting season of 2010, adjacent habitat was found to be occupied by this species.

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Appendix 1
Animals observed within the survey area (based on direct observation and/or sign)

ANIMALS

VETEBRATES

Reptiles

Desert Spiney Lizard	*Sceloporus magister*
Western Whiptail Lizard	*Aspidoscelis tigris*

Birds

Pied-billed Grebe	*Podilymbus podiceps*
Great Blue Heron	*Ardea herodias*
Great Egret	*Ardea alba*
Snowy Egret	*Egretta thula*
Cattle Egret	*Bubulcus ibis*
Green Heron	*Butorides virescens*
Black-crowned Night-heron	*Nycticorax nycticorax*
White-faced Ibis	*Plegadis chihi*
Turkey Vulture	*Cathartes aura*
Northern Harrier	*Circus cyaneus*
American Kestrel	*Falco sparverious*
Mallard	*Anas platyrhynchos*
Blue-winged Teal	*Anas discors*
Cinnamon Teal	*Anas cyanoptera*
Green-winged Teal	*Anas crecca*
American Wigeon	*Anas americana*
American Coot	*Fulica americana*
Sora	*Porzana carolina*
Yuma Clapper Rail	*Rallus longirostris yumanensis*
Killdeer	*Charadrius vociferus*
Black-necked Stilt	*Himantopus mexicanus*
American Avocet	*Recurvirostra americana*
Greater Lellowlegs	*Tringa melanoleuca*
Least Sandpiper	*Calidris minutilla*
Western Sandpiper	*Calidris mauri*
Spotted Sandpiper	*Actitis macularia*
Long-billed Dowitcher	*Limnodromus scolopaceus*
Short-billed Dowitcher	*Limnodromus griseus*
Wandering Tatler	*Heteroscelus incanus*
Wilson's Snipe	*Gallinago delicata*
Gull-billed Tern	*Gelochelidon nilotic*
Mourning Dove	*Zenaida macroura*
White-winged Dove	*Zenaida asiatica*
Eurasian Collared-Dove	*Streptopelia decaocto*
Greater Roadrunner	*Geococcyx californianus*
Burrowing Owl	*Athene cunicularia*
Anna's Hummingbird	*Calypte anna*
Pacific-slope Flycatcher	*Empidonax difficillis*

Animals observed within the survey area (based on direct observation and/or sign)(Cont.)

Willow Flycatcher	*Empidonax traillii*
Black Phoebe	*Sayornis nigricans*
Say's Phoebe	*Sayornis saya*
Western Kingbird	*Tyrannus verticalis*
Loggerhead Shrike	*Lanius ludovicianus*
Common Raven	*Corvus corax*
Northern Rough-wing Swallow	*Stelgidopteryx serripennis*
Tree Swallow	*Tachycineta bicolor*
Barn Swallow	*Hirundo rustica*
Black-tailed Gnatcatcher	*Polioptila melanura*
Verdin	*Auriparus flaviceps*
Wilson's Warbler	*Wilsonia pusilla*
Yellow-Rumped Warbler	*Dendroica coronata*
Common Yellowthroat	*Geothlypis trichas*
Marsh Wren	*Cistothorus palustris*
Abert's Towhee	*Pipilo aberti*
Northern Mockingbird	*Mimus polyglottus*
Song Sparrow	*Melospiza melodia*
White-crowned Sparrow	*Zonotrichia albicollis*
Black-headed Grosbeak	*Pheucticus melanocephalus*
Western Meadowlark	*Sturnella neglecta*
Red-winged Blackbird	*Agelaius phoeniceus*
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*
Brown-headed Cowbird	*Molothrus ater*
Lesser Goldfinch	*Carduelis psaltria*
House Finch	*Carpodacus mexicanus*
Great-tailed Grackle	*Quiscalus mexicanus*
European Starling	*Sturnus vulgaris*

Mammals

Coyote	*Canis latrans*
Raccoon	*Procyon lotor*
Desert Cottontail	*Sylvilagus audoboni*

CERTIFICATION

I hereby certify that the statements furnished above present the data and information required for this biological survey, and that the facts, statements, and information presented are true and correct to the best of my knowledge. Fieldwork was completed by Arthur E. Davenport of Davenport Biological Services.

Date: July 6, 2010 Signed: Arth E. Davenport

Report Id 11211
County Imperial
Year 2010
Spp YCR (-)
Srv. Rpt. Dc 2/17/11
D.B.
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Konecny Biological Services
Biological Consulting, Research, Conservation

May 25, 2010

Melanie Day, Biologist
Southern California Gas Company
1981 W. Lugonia Avenue (SC8031)
Redlands, CA 92374-9796

Re: Results of a Focused Survey for the Yuma Clapper Rail, California Black Rail, and Western Burrowing Owl at the Alamo River Crossing of the Proposed Southern California Gas Company Line 6001 Relocation/Replacement , Imperial County, California, 2010 (Project number 5988).

Dear Ms. Day:

This letter report presents the results of focused surveys for the Yuma clapper rail (*Rallus longirostris yumanensis*), California black rail (*Laterallus jamaicensis coturniculus*), and western burrowing owl (*Athene cunicularia hypugaea*) at the Alamo River Crossing of the proposed Southern California Gas (SCG) Company Line 6001 Relocation/Replacement crossing site near the City of Brawley, Imperial County, California. The Yuma clapper rail is listed as an endangered species by the United States Fish and Wildlife Service (USFWS) and as a threatened species by the California Department of Fish and Game (CDFG). CDFG also considers the Yuma clapper rail to be a fully protected species. The California black rail is listed as a threatened species and a fully protected species by CDFG. The western burrowing owl is considered to be a California Species of Special Concern (CSSC), Second Priority by CDFG (CDFG 2008).

Surveys for the Yuma clapper rail and California black rail were conducted following protocol approved by the USFWS (USFWS 2006), and adding three additional surveys to conform with the recommendations that the Clapper Rail Study team provided to the USFWS (CLST 2009). The surveys were conducted by wildlife biologist John Konecny. This activity is authorized by USFWS section 10(a) permit number TE837308-5, and CDFG Memorandum of Understanding. Surveys for the western burrowing owl were conducted following the survey protocol recommended by The California Burrowing Owl Consortium (1997).

INTRODUCTION

The Yuma clapper rail is a slender, tawny-breasted bird with grayish edges on brown centered back feathers, olive wing coverts, vertical white bars on the flanks, a white stripe over the eye, and a partially orange bill. The Yuma clapper rail occurs along the lower Colorado River in freshwater marsh dominated by cattails (*Typha* sp.), bulrush (*Scirpus* sp.), and common reed (*Phragmites australis*), from Needles, California south to the Colorado River delta (Tomlinson and Todd 1973). Additional populations occur at the south end of the Salton Sea, and the Salt and Gila Rivers (Eddleman 1989). Yuma clapper rails breed between March and July. Yuma clapper rails forage primarily on crustaceans and minnows during the breeding season, and rely more on a diet of seeds and vegetation in the winter. Recent claims of migratory movement along the lower Colorado River could not be confirmed by radiotelemetry studies (Eddleman 1989, Conway 1990). Populations of Yuma clapper rails have undergone decline in the United States due to their limited distribution, and destruction and degradation of freshwater marsh habitat.

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The California black rail is a small, sparrow-sized secretive rail, blackish above with white speckling, has a chestnut nape, grayish-black underparts, narrow white barring on the flanks, and a short black bill. The California black rail occurs in the lower Colorado River area from the Imperial Dam south to the Mexican border, with smaller, isolated populations scattered from Marin and San Luis Obispo Counties in coastal California southward to San Diego County, northwestern Baja California, and the lower Imperial Valley (Eddleman *et al* 1994, Small 1994). California black rails tend to favor mixed pickleweed (*Salicornia* sp.), cordgrass (*Spartina foliosa*), and bulrush marshes in coastal habitats; and bulrush, cattail, arrowweed (*Pluchea sericea*), and common threesquare (*Schoenoplectus pungens*) freshwater marshes in inland areas (Conway and Sulzman 2007, Small 1994). Black rails breed between April and August. Black rails typically forage on aquatic and terrestrial invertebrates and seeds. Like the Yuma clapper rail, the California black rail has undergone decline due to habitat degradation and destruction. The population of California black rails along the Colorado River from Needles, California to Yuma, Arizona, probably numbers between 75-100 individuals (Evens et al. 1991).

The western burrowing owl is a small, long-legged, brown and white mottled ground dwelling owl of the order Strigeformes. These owls require open fields with adequate food supply for foraging habitat, low vegetative cover to allow owls to watch for predators, and adequate roosting sites. The nesting season is from February through August, with most pairs usually fledging four or five young. After the nesting season, most owls in California remain throughout the winter as year-round residents and owls from others areas augment resident California populations.

Burrowing owls in California historically ranged from the Central Valley and coastal areas of Marin County south to the Mexican border, and were sparsely distributed in the desert areas of the northeastern and southeastern portions of the state. Burrowing owl density has increased in certain areas of its range with intensive agriculture, such as in the Imperial Valley, southern Central Valley, and lower Colorado River Valley. Once a widely distributed and common grassland bird, burrowing owl populations have been declining significantly in California for at least the last half century, especially in the Fresno area, and also in Los Angeles, Santa Barbara, Orange, and San Diego Counties. A survey of the State population from 1991 through 1993 revealed approximately 9,266 pairs of owls, with 71% of those owls in the Imperial Valley (DeSante 1996). The Center for Biological Diversity petitioned CDFG to list the California population of the western burrowing owl as an endangered or threatened species (Center for Biological Diversity 2003). The petition was rejected by CDFG.

PROJECT LOCATION

The Alamo River crossing point for the proposed SCG Company Line 6001 Relocation/Replacement is approximately seven miles (11 kilometers (km)) northeast of the City of Westmorland and four miles (6 km) south of the City of Calipatria in central Imperial County (Figure 1). The Alamo River crossing point is located east of State Route 111, on the southern end of CDFG's Finney-Ramer Wildlife Unit, where Kershaw Road crosses the Alamo River. Specifically, the Alamo River crossing point is located in Township 13 South, Range 14 East, and in Section 3 of the Westmorland East, California 7.5 minute quadrangle.

PROJECT SITE DESCRIPTION

The area in the vicinity of the Alamo River and Kershaw Road supports a variety of habitats, including alkali desert scrub, pasture, irrigated fields, common reed freshwater marsh, and arrowweed scrub. Vegetation in the Alamo River and its banks is characterized by a band of emergent common reed and invasive tamarisk (*Tamarix* sp.). The riverine community transitions upland into alkali desert scrub characterized by arrow weed, and honey mesquite (*Prosopis glandulosa*). The SGC gas line replacement project site is adjacent to the paved Kershaw Road.

The alkali desert scrub southeast of the Kershaw Road Bridge has a relatively high degree of disturbance. The topography of the Alamo River floodplain in the project area is relatively flat, and the elevation of the Alamo River crossing point is 170 feet (52 meters) below Mean Sea Level.

METHODS

Six focused survey events for the Yuma clapper rail were conducted one week apart following the survey protocol approved by the USFWS (USFWS 2006) and Clapper Rail Study Team (CRST 2009). The six surveys were conducted on April 3, 11, 18, and 25, and May 2 and 8, 2010. The surveys on April 11 and 18 were conducted at dawn. The remaining four surveys were conducted at dusk. An increase in the number of call prompting station was requested by the Resource Agencies, so six call prompting stations were established along the Alamo River; three of these stations separated by approximately 200 feet (61 meters), covered an area approximately 400 feet (122 meters) upstream (west), and three stations covered the same distance downstream (east) of Kershaw Road, for a total reach of approximately 850 feet (260 meters). All potential Yuma clapper rail and California black rail habitat within this reach was surveyed.

The surveys were conducted by stopping at six stations and passively listening for Yuma clapper rails, California black rails, and other marsh birds during the first five-minutes. If rails were not detected, a digital vocalization, consisting of 30 seconds of California black rail followed by 30 seconds of silence, 30 seconds of least bittern (*Ixobrychus exillis*) followed by 30 seconds of silence, 30 seconds of Virginia rail (*Rallus limicola*) followed by 30 seconds of silence, and 30 seconds of Yuma clapper rail followed by 30 seconds of silence was played with an iPod and amplified speakers. A response was listened for during a one minute period following the recorded vocalizations before proceeding to the next station.

The area was also surveyed for western burrowing owl following the rail surveys on four of the dates. These surveys were conducted by visually inspecting the area for owls, burrows, and scat. No call prompting for owls was attempted. Environmental conditions during the six surveys are summarized in Table 1.

Table 1. Summary of Environmental Conditions During Six Yuma Clapper Rail and California Black Rail Surveys at the Alamo River Crossing of the Proposed Southern California Gas Line 6001 Relocation/Replacement, Imperial County, California, 2010.

Survey #	Date	Surveyor (Species) *	Time	Weather Conditions
1	04/03/2010	JK (YCR/CBR/BO)	1730-1910	10% overcast, 68-66°F, wind 7-10 mph
2	04/11/2010	JK(YCR/CBR/BO)	0600-0735	0% overcast, 59-62°F, wind 8-12 mph
3	04/18/2010	JK (YCB/CBR/BO)	0550- 0720	0%overcast,62-68-79°F, wind 8-14 mph
4	04/25/2010	JK (YCR/CBR/BO)	1720-1830	0% overcast, 89-87°F, wind 5-8 mph
5	05/02/2010	JK (YCR/CBR/BO)	1715-1845	0% overcast, 85-83°F, wind 8-12 mph
6	05/08/2010	JK (YCR/CBR)	1715-1845	0% overcast, 92-89°F, wind 8-14 mph

* JK-John Konecny; YCR-Yuma Clapper Rail; CBR-California Black Rail; BO-Burrowing Owl

RESULTS

No Yuma clapper rails or California black rails were detected in the survey area during the six focused surveys in 2010. No other federal or state listed endangered or threatened species were detected. One burrowing owl was detected in the survey area (Figure 2). Least bitterns were detected in the survey area, west of the Railroad Tracks. The least bittern is considered a CSSC,

Second Priority by CDFG. No other sensitive species were detected. Photos of the site are included as Appendix 1.

DISCUSSION

Focused surveys for the Yuma clapper rail and California black rail did not detect these species in the proposed SCG Company pipeline survey area in 2010. Yuma clapper rails prefer dense stands of cattails and bulrushes intermixed with some open water. They have also been detected in dense stands of common reed (Anderson and Ohmart 1985). It would appear that the emergent vegetation in the vicinity of the Kershaw Road Bridge, while dense, is relatively narrow and may not be deep enough to support this species; and has a very high density of inter-mixed tamarisk (Photos 1, 2, and 3 in Appendix 1). Prey availability, such as small fish and crustaceans may also be a problem in this area due to poor water quality. No crayfish shells, a preferred prey item of the Yuma clapper rail, were found in the area.

California black rails are habitat specialists that require at least 1.25 acres (0.5 hectares) of emergent marsh and shallow water that is less than one and one-half inches (two centimeters) in depth (Conway and Sulzman 2007, Eddleman 1994). Given those habitat requirements, California black rail habitat is not present in the survey area. California black rails have been reported in nearby Finney Lake (Evens 1991).

One burrowing owl was detected in the survey area in 2010. An active burrow was detected near the owl (Photo 4 in Appendix 1). The owl was very light in color suggesting a male. No female owl was observed, but it could have been in the burrow incubating eggs or tending to young. There is also a large mound present southeast of the Kershaw Road Bridge that has several conspicuous burrows very much like those of burrowing owls. The burrow entrances had spider webs across them and there was no sign of whitewash or food items which suggest the burrows were unused in 2010. These burrows may have been used by owls prior to 2009, and they may be used by burrowing owls at some time in the future. The burrows may also be from kit fox (*Vulpes macrotis*) or round-tail ground squirrel (*Spermophilus tereticaudus*).

CERTIFICATION

I certify that the information in this survey report and attached exhibits fully and accurately represent my work. The results of focused surveys for listed species are typically considered valid for one year by the USFWS and CDFG. If you have any questions or require additional information, please contact me at (760) 489-5276, the letterhead address, or jkonecny@cox.net.

Sincerely,

John K. Konecny

John K. Konecny
Wildlife Biologist
TE837308-5

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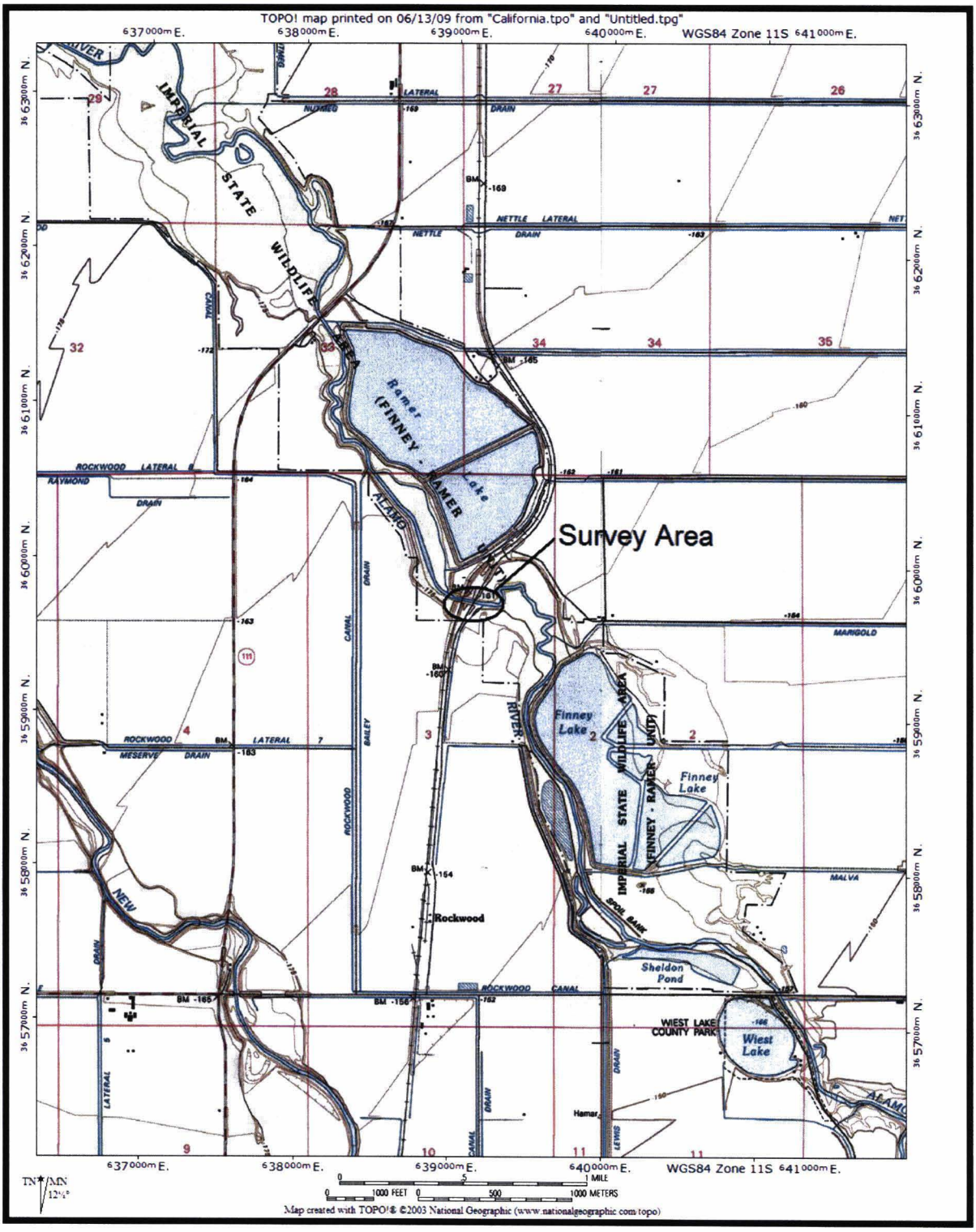

Figure 1. Location of the Yuma Clapper Rail, California Black Rail, and Western Burrowing Owl Survey Area at the Alamo River Crossing for the Proposed Southern California Gas Line 6001 Relocation/Replacement, Imperial County, California, 2010.

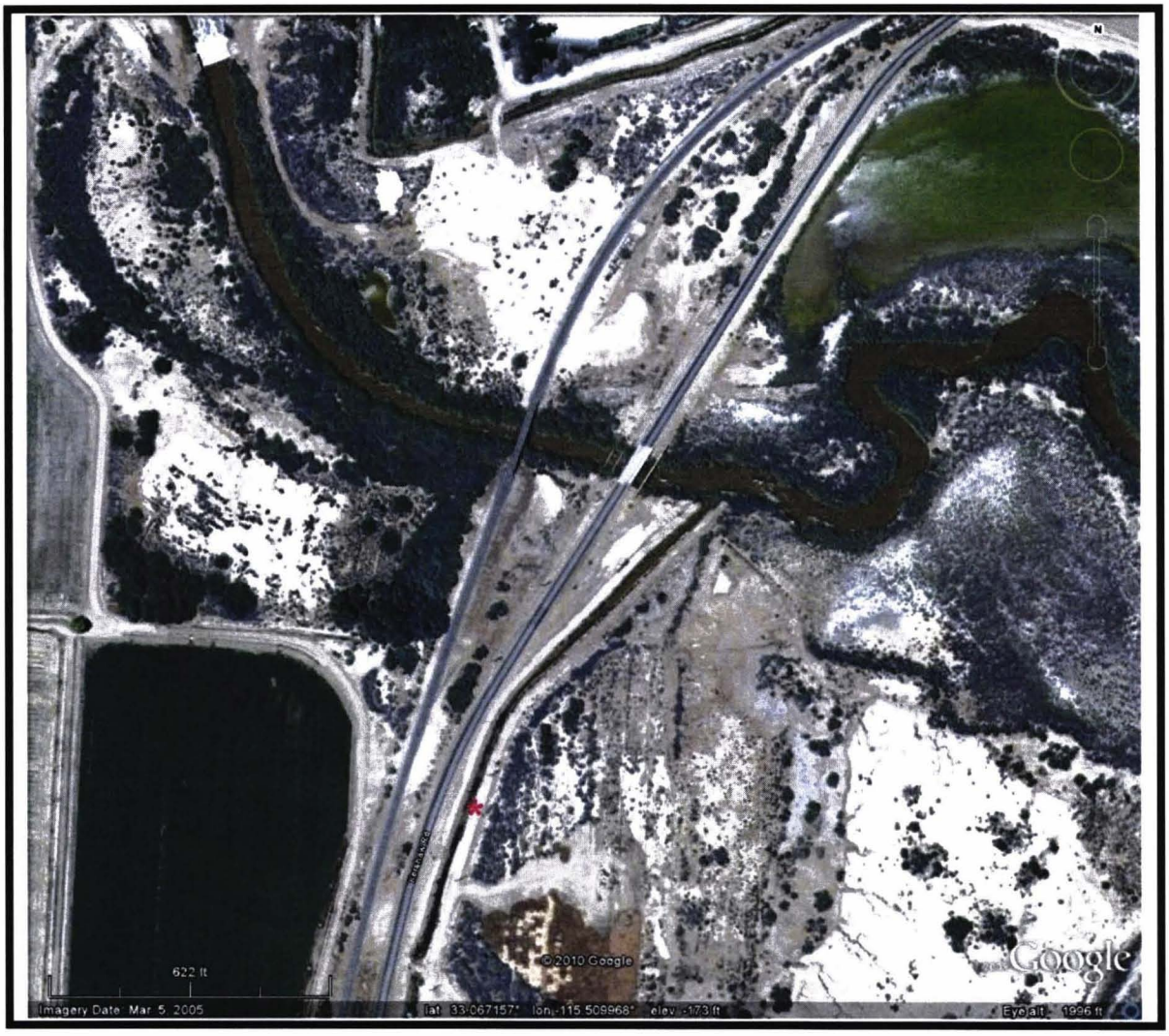

Figure 2. Location of the Western Burrowing Owl and Burrow (red asterisk) Detected in the Survey Area at the Alamo River Crossing for the Proposed Southern California Gas Line 6001Relocation/Replacement, Imperial County, California, 2010.

Appendix 1. Photographs of the Site



Photo 1. West End of Yuma Clapper Rail Survey Area (from Railroad Bridge)



Photo 2. Center of Yuma Clapper Rail Survey Area (from Railroad Bridge)

Appendix 1 Continued. Photographs of the Site

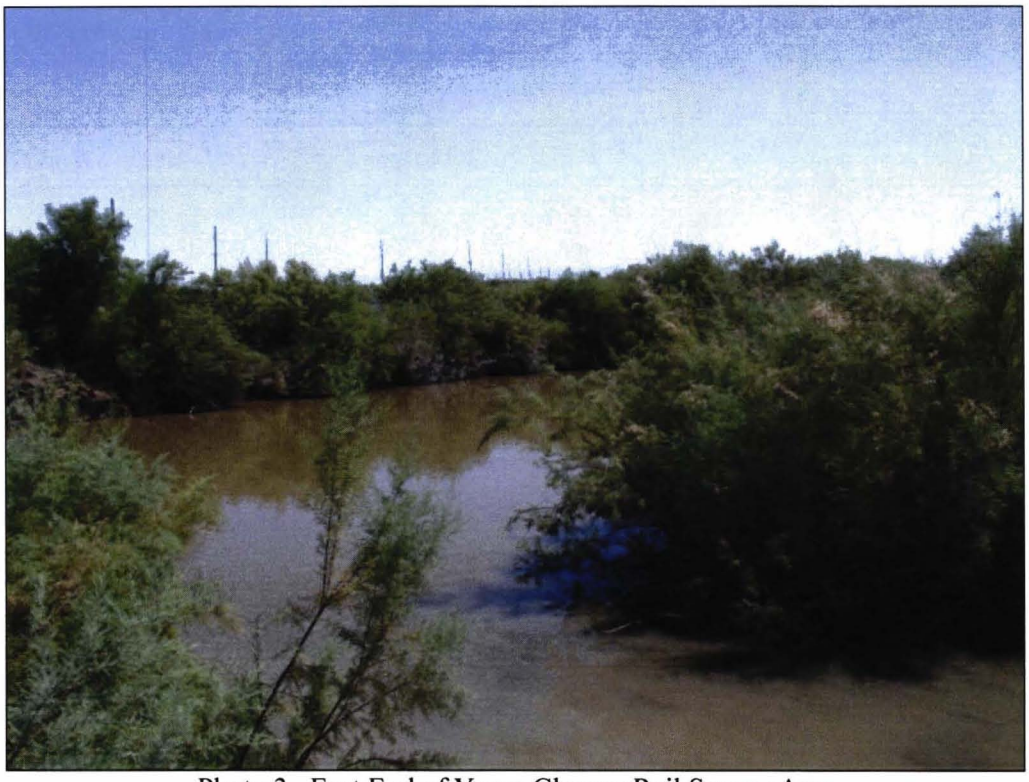

Photo 3. East End of Yuma Clapper Rail Survey Area



Photo 4. Burrowing Owl and Burrow in the South End of Survey Area

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1420 Kettner Boulevard
Suite 500
San Diego, CA 92101
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Record # 11693
County San Diego
Year 2011
SWF (-) YCR (-)
Spp LBV (+)
Srv. Rpt.
D.B. 11/24/11
GIS T.M.K 12-2-11
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October 24, 2011

Erin McCarthy
Recovery Permit Coordinator
Carlsbad Fish and Wildlife Office
6010 Hidden Valley Road, Suite 101
Carlsbad, California 92011

RE: 2011 Morrison Property Mitigation Site Southwestern Willow Flycatcher 45-Day Summary Report, San Diego County, California

Dear Ms. McCarthy:

In compliance with the Special Terms and Conditions for Endangered and Threatened Wildlife Species Permit TE-820658-5, AECOM submits this letter report summarizing the results of protocol surveys conducted during 2011 for the federally listed endangered southwestern willow flycatcher (*Empidonax traillii extimus*) (SWFL) within the Morrison Property Mitigation Site. Surveys were conducted on behalf of the California Department of Transportation (Caltrans) District 11.

Project Description

The Morrison Property Mitigation Site (Morrison property) is located within the San Luis Rey Corridor adjacent to State Route (SR) 76 (Figure 1). Caltrans has been conducting restoration activities within the property for impacts to riparian scrub/forest resulting from the SR-76 Melrose to Mission Project. Protocol-level surveys for SWFL are a requirement of the restoration plan for this work (Mission RCD and Dendra 2009). As an environmental consultant, AECOM has been contracted by Caltrans to conduct protocol-level surveys for SWFL within the boundaries of the property (Figure 2).

Site Description

The property occurs within and adjacent to the San Luis Rey River corridor, which runs east/west, parallel to and south of SR-76. It is situated west of Interstate 15 and immediately south of SR-76 between Gird Road and Star Track Way in unincorporated San Diego County. The property is surrounded by agricultural lands, limited residential development, equestrian lands, disturbed habitat, and riparian forest. Additionally, the entire property occurs within the North County Subarea Planning Area of the County of San Diego Multi-Species Conservation Program. Within the North County Multiple Species Conservation Program, the entire property is located within the Pre-Approved Mitigation Area.

Topography of the property is generally flat, with elevations averaging 300 feet. The San Luis Rey River floodplain is dominated by two soils—riverwash and Tujunga sand—with 0 to 5% slopes. Both of these soil types are excessively drained sands that are rapidly permeable. Soils outside of the San Luis Rey River are mostly sandy loams, along with other loams and small amounts of clays. Several vegetation communities occur within the property. Riverine, wetland, and waters are the dominant land cover types within the property and are composed of riparian scrub, riparian forest, riparian woodland, open water,

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and nonvegetated waters. Upland vegetation communities include coastal scrub, chaparral, oak woodland, nonnative grassland, and native grasslands and meadows. Ruderal, exotic, and developed land cover types also occur and include urban/developed, general agriculture, and nonnative vegetation. Currently, habitat enhancement and restoration activities are occurring within the property.

The entire property was considered suitable to support SWFL; thus, the total survey area surveyed for SWFL is approximately 123.6 acres.

Background Information

SWFL, a subspecies of willow flycatcher (*Empidonax traillii*), was listed by the California Department of Fish and Game (CDFG) as endangered in California in 1991 (CDFG 1991) as part of the state endangered listing of the full species (willow flycatcher). SWFL was also federally listed as endangered in 1995 (USFWS 1995). This subspecies can only be separated from other willow flycatcher subspecies in the field geographically by breeding range. SWFL breeds in New Mexico, Arizona, Southern California, Nevada, Utah, and possibly west Texas (Rourke et al. 1999). According to Unitt (2004), fewer than 90 pairs breed in San Diego County. In 2005, the U.S. Fish and Wildlife Service (USFWS) issued the final ruling to designate critical habitat for SWFL, which includes portions of San Diego County (USFWS 2005). No critical habitat occurs within the property.

The primary factor responsible for the decline of SWFL is habitat loss, exacerbated by nest predation and brood parasitism by brown-headed cowbirds (*Molothrus ater*) (BHCO) (Rourke et al. 1999). SWFL is a neotropical migrant that breeds in riparian forests with a distinct vegetation structure: a dense understory where nests are built, a moderately closed canopy, and an open foraging area at midstory. SWFL breeding habitat is also characterized by actively changing hydrology, frequently including standing water, but also dry areas that have flooded within the past few years and retain the appropriate vegetation structure. In California, less than 5% of appropriate riparian habitat remains from its previous extent when California achieved statehood in 1850 (Kus 2003).

SWFL begin arriving on breeding territories in San Diego County in early May, but the northern subspecies (*E. t. brewsteri*) may migrate through southern breeding areas through mid-June. Both male and female migrant willow flycatchers frequently sing, and determining whether an individual is a resident (SWFL) or a migrant (willow flycatcher) cannot be accomplished from a single detection. Therefore, a survey protocol for SWFL has been adopted by USFWS (Sogge et al. 2010).

During SWFL surveys in 2006 and 2007 for the SR-76 Expansion Project, AECOM (formerly EDAW) detected both the willow flycatcher and SWFL within and adjacent to the Morrison property (EDAW 2006, 2007).

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Survey Methodology

A habitat assessment for SWFL was not conducted prior to starting surveys, as AECOM previously conducted surveys within the property for the SR-76 East Expansion project. Based on prior knowledge of the property and a review of current aerial topography, it was confirmed that the entire property is suitable to survey for SWFL.

AECOM biologists Brennan Mulrooney (permitted), Andrew Fisher (permitted), and Jimmy McMorran (supervised) conducted surveys in 2011 under Endangered Species Permit TE-820658-5. SWFL surveys followed the current survey protocol adopted by USFWS (Sogge et al. 2010). The SWFL survey area depicted in Figure 3 was surveyed once during the first survey period (May 15 through May 31), twice during the second survey period (June 1 through June 24), and twice during the third survey period (June 25 through July 17). Surveys were conducted at least 5 days apart between dawn and 11 a.m. Biologists walked through suitable habitat, stopping frequently to listen. After a few minutes of passive listening, if no SWFL were heard, a playback recording of SWFL calls was played (active surveys) to elicit a response from SWFL within or adjacent to the property.

As allowed under the relevant endangered species permits, the survey activity "takes" the SWFL through harassment with playback of recorded SWFL vocalizations. No individual SWFL were captured.

Protocol-level SWFL surveys were conducted between May 26 and July 14, 2011, within the Morrison property in areas of suitable SWFL habitat (Table 1). During survey 1 on May 26, 2011, the entire survey area (approximately 123.6 acres) was surveyed; however, subsequent surveys were conducted on 2 separate days, and the survey area was divided into two areas (east and west; Figure 3). This division of the survey area allowed for a more thorough survey of the property. Approximately 61.04 acres were surveyed in the eastern survey area and approximately 62.56 acres were surveyed in the western survey area.

Results

No willow flycatcher or SWFL were detected. Table 1 details each survey, including the date, survey period, personnel and permitted biologist, time, weather conditions, and observations. Field data are provided in Appendix A, and a complete list of all wildlife detected is provided in Appendix B.

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Table 1
Southwestern Willow Flycatcher Protocol Surveys
Dates, Personnel, Weather Conditions, and Results

Date	Survey Period	Surveyors	Time	Weather Conditions	WIFL Detected	SWFL Detected
05/26/11	1	Brennan Mulrooney,* Jimmy McMorran**	0535–1027	Start: 58°F, wind 0–2 mph, 100% cover End: 78°F, wind 4–7 mph, 0% cover	none	none
06/09/11 West	2	Brennan Mulrooney,* Jimmy McMorran**	0515–1030	Start: 60°F, wind 0 mph, 100% cover End: 66°F, wind 0–5 mph, 100% cover	none	none
06/10/11 East	2	Andrew Fisher,* Jimmy McMorran**	0525–1045	Start: 61°F, wind 0–1 mph, 100% cover End: 65°F, wind 0–2 mph, 100% cover	none	none
06/17/11 West	3	Brennan Mulrooney,* Jimmy McMorran**	0520–1000	Start: 59°F, wind 0–2 mph, 100% cover End: 67°F, wind 2–5 mph,100% cover	none	none
06/22/11 East	3	Brennan Mulrooney,* Jimmy McMorran**	0520–1000	Start: 61°F, wind 0–2 mph, 100% cover End: 68°F, wind 0–2 mph, 100% cover	none	none
07/07/11 West	4	Brennan Mulrooney,* Jimmy McMorran**	0515–0945	Start: 69°F, wind 0 mph, 0% cover End: 81°F, wind 2 mph, 0% cover	none	none
07/08/11 East	4	Brennan Mulrooney,* Jimmy McMorran**	0530–0930	Start: 64°F, wind 0 mph, 0% cover End: 84°F, wind 2 mph, 0% cover	none	none
07/13/11 West	5	Brennan Mulrooney,* Jimmy McMorran**	0530 –1000	Start: 61°F, wind 0 mph, 100% cover End: 73°F, wind 2–5 mph,100% cover	none	none
07/14/11 East	5	Brennan Mulrooney,* Jimmy McMorran**	0525–1000	Start: 66°F, wind 2–5 mph, 100% cover End: 68°F, wind 2–5 mph,100% cover	none	none

* Permitted SWFL biologist
** Supervised biologist
SWFL = southwestern willow flycatcher; WIFL = willow flycatcher

The federally endangered least Bell's vireo (*Vireo bellii pusillus*) (LBV) was detected throughout the survey area during all five SWFL surveys. Additionally, the California state endangered western yellow-billed cuckoo (*Coccyzus americanus occidentalis*) (YBCU) was detected and photographed (State of California 2011). YBCU were detected during surveys 4 and 5 in the western survey area. During survey 4, one individual was heard vocalizing and then observed in a tall cottonwood tree (*Populus* sp.). During survey 5, two YBCU were heard close to each other and eventually were both observed within the cottonwoods and willows (*Salix* sp.), and also in flight. It was not confirmed whether these YBCU were a pair or migrants. In addition to the state status of YBCU, this species is also currently a

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candidate species for federal listing by USFWS. The locations of LBV and YBCU detected are depicted in Figure 3.

In addition to the presence of LBV and YBCU mentioned above, three additional wildlife species with special status were detected during focused SWFL surveys within or adjacent to SWFL survey areas: white-tailed kite (*Elanus leucurus*; state fully protected species), yellow warbler (*Dendroica petechia*; state species of special concern), and yellow-breasted chat (*Icteria virens*; state species of special concern). Locations of these species are depicted in Figure 3, with the exception of yellow warbler, which was detected in large numbers throughout the property.

BHCO (known willow flycatcher/SWFL brood parasites) were detected during all five surveys, and their numbers are detailed in Table 2. A maximum of six were detected on July 13 and 14, 2011. All BHCO detections are depicted in Figure 4.

Table 2
Summary of Brown-Headed Cowbird Observations by Survey Period

Survey Period	Survey Date	Number of BHCO Individuals Detected
1	05/26/11	1
2	06/09/11	4
2	06/10/11	4
3	06/17/11	3
3	06/22/11	5
4	07/07/11	3
4	07/08/11	5
5	07/13/11	6
5	07/14/11	6

Discussion

Protocol-level surveys for SWFL yielded no sign of willow flycatcher or SWFL, contrary to surveys conducted in 2006 and 2007. However, the property does provide foraging and breeding habitat suitable for both migrating willow flycatcher and SWFL, respectively. Although not detected, it cannot be determined with certainty that willow flycatcher/SWFL did not use the property as stopover habitat at some point during their northbound migration. In combination with the existing suitable foraging and breeding habitat, the restoration and enhancement of the habitat within the Morrison property would only increase the possibilities for SWFL to breed within the property in the future.

AECOM

If you have any questions or comments regarding this report, please contact me at (619) 233-1454.

Sincerely,

James McMorran
Wildlife Biologist
james.mcmorran@aecom.com

Attachments: Figure 1 – Regional Map
Figure 2 – Vicinity Map
Figure 3 – Special-Status Species Detected
Figure 4 – Brown-Headed Cowbirds Detected
Appendix A – Field Data Collected during 2011 Southwestern Willow Flycatcher Surveys
Appendix B – Wildlife Species Detected during 2011 Southwestern Willow Flycatcher Surveys

60214655-2 2011 Morrison Prop Mitigation_SWFL 45-Day Rpt

AECOM

Ms. Erin McCarthy
Recovery Permit Coordinator
October 24, 2011
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Certification Statement

Biologists who conducted SWFL surveys for the Morrison Property Mitigation Site certify that the information in this survey report fully and accurately represents the work performed by AECOM biologists. Signatures of current AECOM biologists as listed in Table 1 who conducted and participated in protocol-level surveys (May 24 through July 11, 2011) are included below. The results of protocol-level surveys for listed species are typically considered valid for 1 year by the resource agencies.

James McMorran
Wildlife Biologist

Brennan Mulrooney
Wildlife Biologist

Andrew Fisher
Wildlife Biologist

FIGURES



Source: Bing Maps 2011

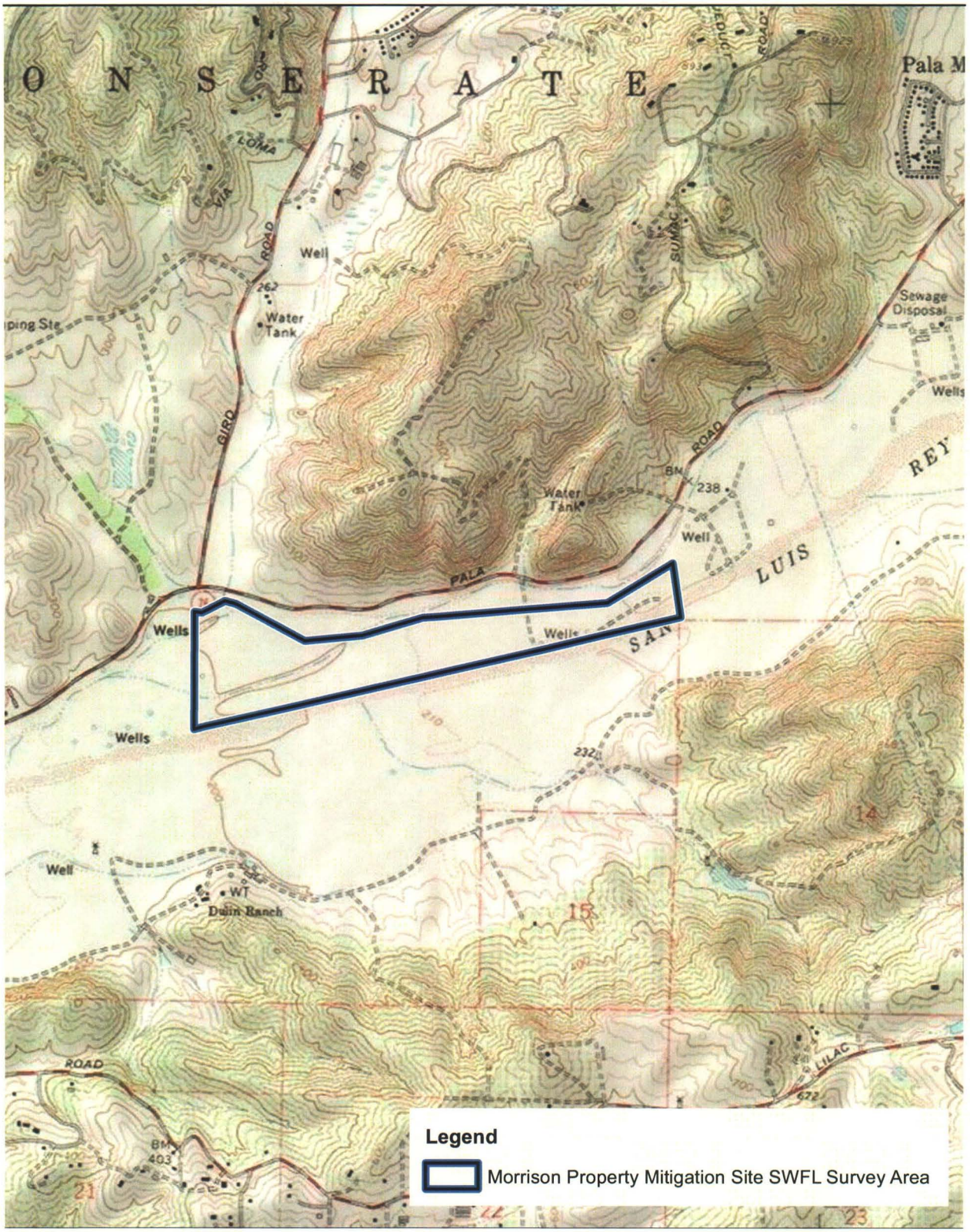
16 8 0 16 Miles

Scale: 1:1,000,000 1 inch = 16 miles

Figure 1
Regional Map

2011 Morrison Property Mitigation Site Southwestern Willow Flycatcher 45-Day Report

Path: P:\2011\60214655\06GIS\6.3_Layout\fig 1_BingRoadMaps_8x11.mxd, 10/12/2011, leej



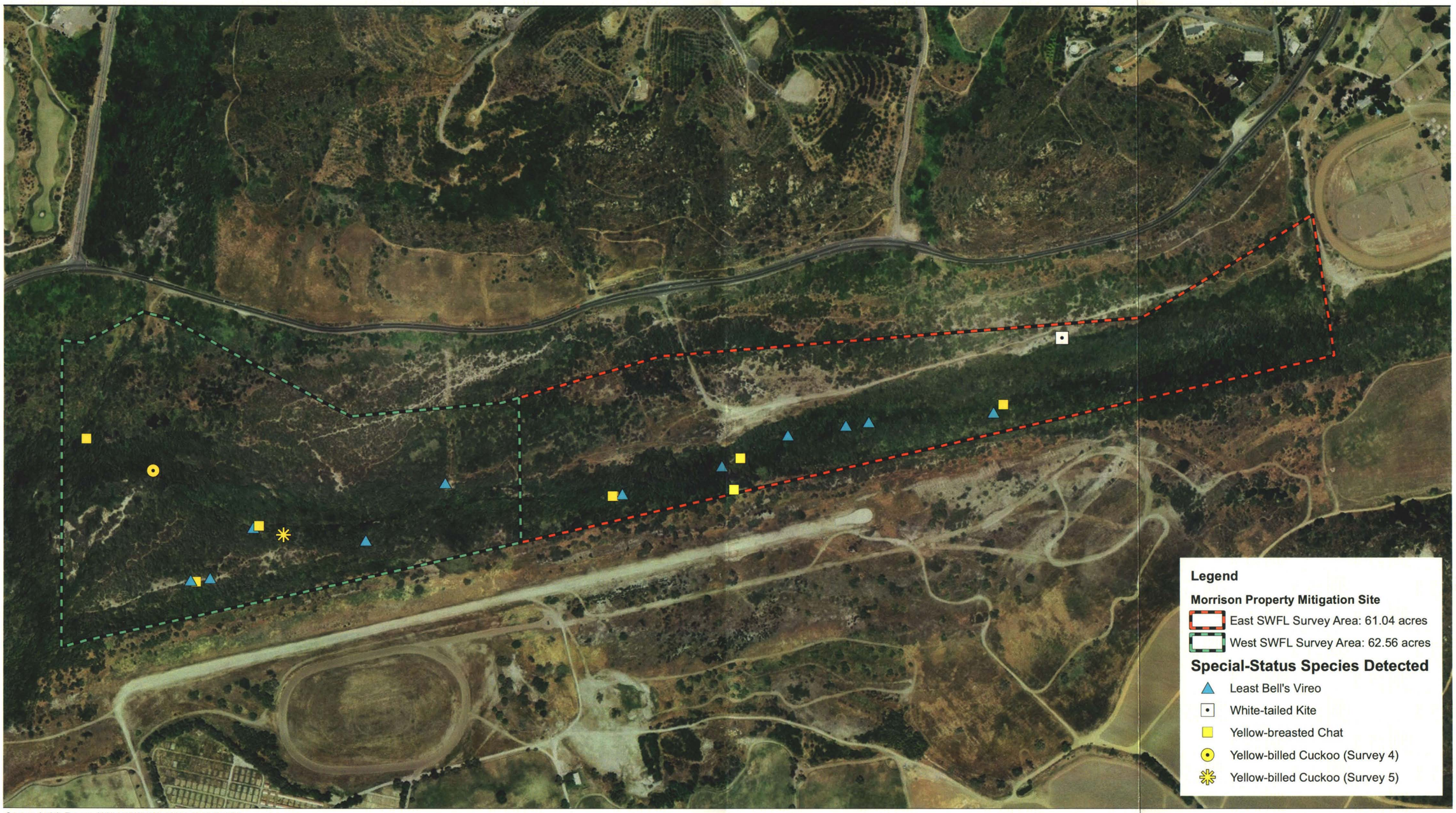
Source: USGS 7.5' Topo Quad Bonsall 1975

2,000 1,000 0 2,000 Feet

Scale: 1:24,000 1 inch = 2,000 feet

Figure 2
Vicinity Map

Path: P:\2011\60214655\06GIS\6.3_Layout\SWFL\fig2_VicinityMap.mxd, 10/11/2011, leej



Source: Aerials Express 2010; EDAW 2006, 2007; AECOM 2011

500 250 0 500 Feet

Scale: 1:6,000; 1 inch = 500 feet

Figure 3
Sensitive Species Detected during Southwestern Willow Flycatcher Surveys

Path: P:\2011\60214655\06GIS\6.3_Layout\SWFL\fig3_SWFL_SurveyObs.mxd, 10/11/2011, leej



Source: Aerials Express 2010; EDAW 2006, 2007; AECOM 2011

500 250 0 500 Feet

Scale: 1:6,000; 1 inch = 500 feet

Figure 4
Brown-headed Cowbirds Detected

Path: P:\2011\60214655\06GIS\6.3_Layout\SWFL\fig4_BCH_Obs.mxd, 10/12/2011, leej

APPENDIX A

FIELD DATA COLLECTED DURING 2011 SOUTHWESTERN WILLOW FLYCATCHER SURVEYS

SWFL SURVEYS

Recorder: BMJ Add'l Person: JMC GPS Unit: _____
Project: Morrison Survey Section: _____ Map #: _____
Date: 5/26/11 Survey Type: SWFL Survey 1 of 5
Time Start: 0535 Time End: 1027

Start: T: 57.8 CC: 100% Wind Sp/Dir: 2.3 E General Weather Condition: cool
End: T: 78.1 CC: 02 Wind Sp/Dir: 6.7 W General Weather Condition: warm

Map/GPS #	Time	Species	Age	Sex	Point Type	Comments
		SOSP	A J U	M F U		
MYBCHJM001		YBCH	A J U	M F U		
		TRES	A J U	M F U		
		HOWR	A J U	M F U		
		SPTO	A J U	M F U		
		BUSH	A J U	M F U		
		CORA	A J U	M F U		
		AMCR	A J U	M F U		
		WTKI	A J U	M F U		
		BANO	A J U	M F U		
		BLGR	A J U	M F U		
		BHGR	A J U	M F U		
		RSHA	A J U	M F U		
		YWAR	A J U	M F U		
		OCWA	A J U	M F U		
		COYE	A J U	M F U		
		CALT	A J U	M F U		
		MALL	A J U	M F U		
		BEWR	A J U	M F U		
		WESJ	A J U	M F U		
		PSFL	A J U	M F U		
MBHCOJM001	0641	BHCO	A J U	M F U		
		AMGO	A J U	M F U		
		HOFI	A J U	M F U		
		SWTH	A J U	M F U		
		RWBL	A J U	M F U		
		COGD	A J U	M F U		
		MODO	A J U	M F U		
		WREN	A J U	M F U		
		BCNH	A J U	M F U		
		LEGO	A J U	M F U		

SWFL SURVEYS

Recorder: BMW Project: MORRISON Survey Section:
Date: 5/26/11 Survey Type: SWFL Map #:

#	Time	Species	Age	Sex	Point Type	Comments
		GREG	A J U	M F U		
		ATFL	A J U	M F U		
		VIRA	A J U	M F U		
		AMKE	A J U	M F U		
		NWJD	A J U	M F U		
		PSWS	A J U	M F U		
		ANHU	A J U	M F U		
		COHA	A J U	M F U		
		LBV	A J U	M F U		
MLBVIJM001	0555	LBVI	A J U	M F U		
MLBVIJM002	0714	LBVI	A J U	M F U		
MLBVIJM004		LBVI	A J U	M F U		
MLBVIJM005	0859	LBVI	A J U	M F U		
MLBVIJM006	0911	LBVI	A J U	M F U		
MYBCHJM002	0833	YBCH	A J U	M F U		
MYBCHJM003	0853	YBCH	A J U	M F U		
MYBCHJM004	0945	YBCH	A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		

Comments:
Total # adult SWFL: 0
Total # juvenile SWFL: 0
Total # ~~CACH~~ SWFL: 0
Total # BHCO: 1

NO SWFL DETECTED

SWFL SURVEYS

WEST

Recorder: JMC Add'l Person: BMU (Permitted) GPS Unit: GARMIN 14
Project: MORRISON Survey Section: WEST Map #: —
Date: 6/9/2011 Survey Type: SWFL Survey 2 of 5
Time Start: 0515 Time End: 1030

Start: T: 60° CC: 100% Wind Sp/Dir: CALM General Weather Condition: —
End: T: 66° CC: 100% Wind Sp/Dir: 0-5 SW General Weather Condition: —

Map/GPS #	Time	Species	Age	Sex	Point Type	Comments
		SOSP	A J U	M F U		
		AMCR	A J U	M F U		
		TRES	A J U	M F U		
		YWAR	A J U	M F U		
		BLGR	A J U	M F U		
		HOWR	A J U	M F U		
		WTKI	A J U	M F U		
		HOFI	A J U	M F U		
		OCWA	A J U	M F U		
		WREN	A J U	M F U		
		NOWO	A J U	M F U		
MLBV1001-6-9	0545	LBVI	A J U	M F U		
		SPTO	A J U	M F U		
		BHGR	A J U	M F U		
		RSHA	A J U	M F U		
		SWTH	A J U	M F U		
		COHA	A J U	M F U		
MBHC0001-6-9	0604	BHCO	(A) J U	(M) F U		
MBHC0002-6-9	0648	BHCO	A J U	M F U		
		PSFL	A J U	M F U		
MYBCH001-6-9		YBCH	A J U	M F U		
MBHC0003-6-9	0719	BHCO	A J U	M F U		
		AMGO	A J U	M F U		
MBHC0004-6-9	0736	BHCO	(A) J U	M (F) U		
		VIRA	A J U	M F U		
MLBV1002-6-9	0844	LBVI	(A) J U	(M) F U		
		HUVI	A J U	M F U		
		LEGO	A J U	M F U		
		DOWO	A J U	M F U		
		CLSW	A J U	M F U		
		NUME	A J U	M F U		NUTMEG MANNIKIN

AR074235

SWFL SURVEYS

Recorder: _____ Project: _____ Survey Section: _____
Date: _____ Survey Type: _____ Map #: _____

#	Time	Species	Age	Sex	Point Type	Comments
		HRWS	A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		

Comments:
Total # adult SWFL: 0
Total # juvenile SWFL: 0
Total # CAGN SWFL: 0
Total # BHCO: 4

NO SWFL DETECTED

5 WF [redacted] SURVEYS

Recorder: JMC Add'l Person: AF1 (Permitted) GPS Unit: GARMIN 14
Project: SR-710 Mitigation Survey Section: Map #:
Date: 6/10/11 Survey Type: ~~LBVI~~ 5 WFL Survey 2 of 5
Time Start: 0525 Time End:

EAST

Start: T: 61°F CC: 100 Wind Sp/Dir: 1 SW General Weather Condition: Overcast
End: T: 65°F CC: 100 Wind Sp/Dir: 2 W General Weather Condition: Overcast

Map/ GPS #	Time	Species	Age	Sex	Point Type	Comments
		BHGR	A J U	M F U		
		SWTH	A J U	M F U		
		YWAR	A J U	M F U		
		OCWA	A J U	M F U		
		ATFL	A J U	M F U		
		SPTO	A J U	M F U		
		CALT	A J U	M F U		
		RSHA	A J U	M F U		
		AMCR	A J U	M F U		
		WREN	A J U	M F U		
		RWBL	A J U	M F U		
		LEGO	A J U	M F U		
MYBCH001-6-10	0559	YBCH	(A) J U	M F (U)		
MLBVI001-6-10	0600	LBVI	(A) J U	(M) F U		
MBHCO001-6-10	0622	BHCO	(A) J U	M (F) U		
MYBCH002-6-10	0624	YBCH	(A) J U	M F (U)		
MLBVI002-6-10	0629	LBVI	A J U	M F U		
		NUNU	A J U	M F U		
		COHA	A J U	M F U		
		DOWO	A J U	M F U		
		TRES	A J U	M F U		
		WAVI	A J U	M F U		
		PSFL	A J U	M F U		
		BEWR	A J U	M F U		
		HUVI	A J U	M F U		
MLBVI003-6-10	0722	LBVI	(A) J U	(M) F U		
MBHCO002-6-10	0742	BHCO	(A) J U	M (F) U		
		ANHU	A J U	M F U		
		COGD	A J U	M F U		
MLBVI004-6-10	0802	LBVI	(A) J U	(M) F U		

SWFL ~~EBV~~ SURVEYS

Recorder: JMC Project: Monson Property Survey Section: _____
Date: 6-10-11 Survey Type: ~~EBV~~ SWFL Map #: _____

Map/ GPS #	Time	Species	Age	Sex	Point Type	Comments
		AMGO	A J U	M F U		
MRHC00016-10		BHCO	A J U	M F U		
" "			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		

Comments:
Total # adult SWFL: 0
Total # juvenile SWFL: 0
Total # ~~EBV~~ SWFL pairs: 0
Total # BHCO: 4

0 SWFL

AR074238

SWFL SURVEYS

WEST

Recorder: JMC | Add'l Person: BMW (Permitted) | GPS Unit: GARMIN 14
Project: MORRISON | Survey Section: WEST | Map #:
Date: 6/17/2011 | Survey Type: SWFL | Survey 3 of 5
Time Start: 0520 | Time End: 1000

Start: T: 59° CC: 100% Wind Sp/Dir: 0-2 SOUTH General Weather Condition:
End: T: 67° CC: 100% Wind Sp/Dir 2-5 Southwest General Weather Condition:

Map/GPS #	Time	Species	Age	Sex	Point Type	Comments
MBHCO 001-0617		BHCO	A J U	M F U		
		BTGR	A J U	M F U		
		YNAR	A J U	M F U		
		NUMA	A J U	M F U		NUTMEG MANNIKIN
		AMCR	A J U	M F U		
		VIRA	A J U	M F U		
		RWBL	A J U	M F U		
		COYE	A J U	M F U		
		SPTO	A J U	M F U		
		LBVI	A J U	M F U		
		SWTH	A J U	M F U		
		YBCH	A J U	M F U		
		OCWA	A J U	M F U		
		PSFL	A J U	M F U		
		AMGO	A J U	M F U		
		MAWR	A J U	M F U		
		WREN	A J U	M F U		
		RSHA	A J U	M F U		
		NOFL	A J U	M F U		
		WEST	A J U	M F U		
		NUWO	A J U	M F U		
		DOWO	A J U	M F U		
		ATFL	A J U	M F U		
		CORA	A J U	M F U		
		HOWR	A J U	M F U		
		LEGO	A J U	M F U		
		NOFL	A J U	M F U		
		HUVI	A J U	M F U		
		BCHU	A J U	M F U		
		COHA	A J U	M F U		
MBHC0002-0617		BHCO	A J U	M F U		TWO ♀

SWFL SURVEYS

Recorder: JMC Project: MARANA W Survey Section: _____
Date: 6/20/2011 Survey Type: 1 SWFL Map #: _____

#	Time	Species	Age	Sex	Point Type	Comments
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		

Comments:
Total # adult SWFL: 0
Total # juvenile SWFL: 0
Total # ~~CACH~~ SWFL: 0
Total # BHCO: 3

N/O SWFL DETECTED

AR074240

SWFL SURVEYS

EAST

Recorder: JMC Add'l Person: BMU (Permitted) GPS Unit: GARMIN004
Project: MORRISON Survey Section: EAST Map #:
Date: 6/22/11 Survey Type: SWFL Survey 3 of 5
Time Start: 0520 Time End: 1000

Start: T: 61° CC: 100% Wind Sp/Dir: 0-2 NW General Weather Condition: overcast
End: T: 68° CC: 100% Wind Sp/Dir: 0-2 NW General Weather Condition: overcast

Sp/GPS #	Time	Species	Age	Sex	Point Type	Comments
		YBCH	A J U	M F U		IIII
		LBVI	A J U	M F U		IIII I
		BHGR	A J U	M F U		
		CALT	A J U	M F U		
		AMCR	A J U	M F U		
		OCWA	A J U	M F U		
		COYE	A J U	M F U		
		SWTH	A J U	M F U		
		SOSP	A J U	M F U		
		RWBL	A J U	M F U		
		HOFI	A J U	M F U		
		CWREN	A J U	M F U		
		NUWO	A J U	M F U		
		BEWR	A J U	M F U		
		CATH	A J U	M F U		
		DOWO	A J U	M F U		
		LEGO	A J U	M F U		
1BHC0001-0622		BHCO	A J U	M F U		
		RTHA	A J U	M F U		
		SPTO	A J U	M F U		
1BHC0002-0622		BHCO	A J U	M F U		2 1M, 1F
		HUVI	A J U	M F U		
		BUSH	A J U	M F U		
		AMGO	A J U	M F U		
1BHC0003-0622		BHCO	A J U	M F U		2
		BUGR	A J U	M F U		
TEMPID-0622	0823	EMPID SP	A J U	M F U		Heard giving WHIT no visual therefore not ided to WIFL
		PSFL	A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		

SWFL SURVEYS

Recorder: _____ Project: _____ Survey Section: _____
Date: _____ Survey Type: _____ Map #: _____

#	Time	Species	Age	Sex	Point Type	Comments
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		

Comments:
Total # adult SWFL: 0
Total # juvenile SWFL: 0
Total # CAGN SWFL: 0
Total # BHCO: 5

NO SWFL/WIFL DETECTED

WHIT CALL HEARD; HOWEVER NO VISUAL WAS MADE & WILL NOT BE ID'ED TO WIFL

AR074242

SWFL SURVEYS

WEST

Recorder: BMU Add'l Person: JMC GPS Unit: 014
Project: Morrison SWFL Survey Section: WEST Map #:
Date: 7/9/11 Survey Type: SWFL Survey 4 of 5
Time Start: 0515 Time End: 0945

Start: T: 69 CC: 0% Wind Sp/Dir: 0 - General Weather Condition: Nice
End: T: 81 CC: 5% Wind Sp/Dir: 2 - W General Weather Condition: Warm

Map/GPS #	Time	Species	Age	Sex	Point Type	Comments
		ATFL	A J U	M F U		
		NUWO	A J U	M F U		
		WREN	A J U	M F U		
		CALT	A J U	M F U		
		AMCR	A J U	M F U		
		BEWR	A J U	M F U		
		LBVI	A J U	M F U		
		SWTH	A J U	M F U		
		BUSH	A J U	M F U		
		CATH	A J U	M F U		
		COYE	A J U	M F U		
		YBCH	A J U	M F U		
		BHGR	A J U	M F U		
		OCWA	A J U	M F U		
		YWAR	A J U	M F U		
		RSHA	A J U	M F U		
		AMGO	A J U	M F U		
		PSFL	A J U	M F U		
		SPTO	A J U	M F U		
		DOWO	A J U	M F U		
MBHCO 001-0707		BHCO	A J U	M F U		3
		MAWR	A J U	M F U		
		CODO	A J U	M F U		
		CLSW	A J U	M F U		
		RWBL	A J U	M F U		
		HUVI	A J U	M F U		
		NOFL	A J U	M F U		
		YBCU	A J (U)	M F (U)		probable adult seen and heard calling
		WSBNU	A J U	M F U		
		HOOR	A J U	M F U		
		LEGO	A J U	M F U		

3 total BHCO
0 total SWFL
1 total YBCU

AR074243

SWFL SURVEYS

Recorder: BMW Add'l Person: JMC GPS Unit: 014
Project: Morrison SWFL Survey Section: EAST Map #:
Date: 7/8/11 Survey Type: SWFL Survey 4 of 5
Time Start: 0550 Time End: 2930

EAST

Start: T: 64 CC: 0% Wind Sp/Dir: D - General Weather Condition: FINE
End: T: 94 CC: 0% Wind Sp/Dir: 2, W General Weather Condition: WARM

Map/GPS #	Time	Species	Age	Sex	Point Type	Comments
		AMCR	A J U	M F U		
		LEGO	A J U	M F U		
		WREN	A J U	M F U		
		ATFL	A J U	M F U		
		YWAR	A J U	M F U		
		BUSH	A J U	M F U		
		LBVI	A J U	M F U		
		WEST	A J U	M F U		
		BHGR	A J U	M F U		
		YBCH	A J U	M F U		
		COVE	A J U	M F U		
		BLGR	A J U	M F U		
MBHC0001-0708		BHCO	A J U	M F U		♂ 2
		~~YBCH~~	A J U	M F U		
		HUVI	A J U	M F U		
		HOFI	A J U	M F U		
		BEWR	A J U	M F U		
		HOWR	A J U	M F U		
		SWTH	A J U	M F U		
		COGD	A J U	M F U		
		DCWA	A J U	M F U		
		PSFL	A J U	M F U		
		NUWO	A J U	M F U		
		BCWO	A J U	M F U		
		COHA	A J U	M F U		
MBHC0002-0708		BHCO	A J U	M F U		2
MBHC0003-0708		BHCO	A J U	M F U		1
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		

5 total BHCO
0 total SWFL

AR074244

SWFL SURVEYS

Recorder: JNC Add'l Person: BMV (Permitted) GPS Unit: 014
Project: Morrison Survey Section: _____ Map #: _____
Date: 7/12/11 Survey Type: SWFL Survey 5 of 5 WEST
Time Start: 0530 Time End: 1000

Start: T: 60° CC: 100% Wind Sp/Dir: CALM General Weather Condition: overcast
End: T: 71° CC: 60% Wind Sp/Dir: 3-7 West General Weather Condition: p. cloudy

Map/GPS #	Time	Species	Age	Sex	Point Type	Comments
		VWAR	A J U	M F U		
		LBVI	A J U	M F U		
		COVE	A J U	M F U		
		SOSP	A J U	M F U		
		AMCR	A J U	M F U		
		BEWR	A J U	M F U		
		BUSH	A J U	M F U		
		GTOW	A J U	M F U		
		WREN	A J U	M F U		
		LEGO	A J U	M F U		
		VIRA	A J U	M F U		
		AMGO	A J U	M F U		
		PSFL	A J U	M F U		
		RSHA	A J U	M F U		
		DCWO	A J U	M F U		
		EATO	A J U	M F U		
		HOVI	A J U	M F U		
		HOWR	A J U	M F U		
		SPTO	A J U	M F U		
BHCO001-0713	0653	BHCO	A J U	M F U		2♂, 1♀
		COGR	A J U	M F U		
YBCU001-0713	0735	YBCU	A J U	M F U		TWO INDIVIDUALS!! PAIR
MYBCH001-0713	0744	YBCH	A J U	M F U		
		SWTH	A J U	M F U		
MBHCO002-0713		BHCO	A J U	M F U		2M, 1F = 3
		CATH	A J U	M F U		
		BCHU	A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		
			A J U	M F U		

BHCO TOTAL 6
SWFL TOTAL 0
VREO TOTAL

AR074245

SWFL SURVEYS

Recorder: JMC Add'l Person: BMU (Permitted) GPS Unit: 014
Project: Morrison Survey Section: EAST Map #:
Date: 7/14/11 Survey Type: SWFL Survey 5 of 5
Time Start: 0525 Time End: 1000

EAST

Start: T: 61° CC: 100% Wind Sp/Dir: CALM General Weather Condition: Overcast
End: T: 73° CC: 100% Wind Sp/Dir: 2-5 West General Weather Condition: Overcast

Map/GPS #	Time	Species	Age	Sex	Point Type	Comments
		SOSP	A J U	M F U		
		COVE	A J U	M F U		
		BHCO	A J U	M F U		
		LEGO	A J U	M F U		
		YWAR	A J U	M F U		
		BUSH	A J U	M F U		
		WPEW	A J U	M F U		
		YBCH	A J U	M F U		
		AMRO	A J U	M F U		
		OCWA	A J U	M F U		
		ATFL	A J U	M F U		
		HOFI	A J U	M F U		
		BEWR	A J U	M F U		
		HAWI	A J U	M F U		
		WEST	A J U	M F U		
		BFL	A J U	M F U		
		LRVI	A J U	M F U		MANY
MBHC0001-0714		BHCO	A J U	M F U		3
MBHC0002-0714		BHCO	A J U	M F U		2 ♂, 1 fledgling being fed by YWAR –
		SWTH	A J U	M F U		
		RSHA	A J U	M F U		
		CLSW	A J U	M F U		
		WTSW	A J U	M F U		
		BUSH	A J U	M F U		
		BCHU	A J U	M F U		
		CAFI	A J U	M F U		
		VIRA	A J U	M F U		
		DOWO	A J U	M F U		
		SPTO	A J U	M F U		
			A J U	M F U		
			A J U	M F U		

BHCO TOTAL 6
SWFL TOTAL 0

AR074246

APPENDIX B

WILDLIFE SPECIES DETECTED DURING 2011 SOUTHWESTERN WILLOW FLYCATCHER SURVEYS

Appendix B
Wildlife Species Detected during 2011 Southwestern Willow Flycatcher Surveys

Family	Scientific Name	Common Name
BIRDS		
ANSERIFORMES: Anatidae		
	Anas platyrhynchos	Mallard
GALLIFORMES: Odontophoridae		
	Callipepla californica	California Quail
SULIFORMES: Phalacrocoracidae		
	*Phalacrocorax auritus**	Double-crested Cormorant
PELECANIFORMES: Pelecanidae		
	*Pelecanus erythrorhynchos**	American White Pelican
	Pelecanus occidentalis	Brown Pelican
PELECANIFORMES: Ardeidae		
	Ardea alba[+]	Great Egret
	Nycticorax nycticorax[+]	Black-crowned Night-Heron
ACCIPITRIFORMES: Accipitridae		
	Elanus leucurus[3]	White-tailed Kite
	Accipiter cooperii[+]	Cooper's Hawk
	Buteo lineatus	Red-shouldered Hawk
	Buteo jamaicensis	Red-tailed Hawk
FALCONIFORMES: Falconidae		
	Falco sparverius	American Kestrel
GRUIFORMES: Rallidae		
	Rallus limicola	Virginia Rail
COLUMBIFORMES: Columbidae		
	Zenaida macroura	Mourning Dove
	Columbina passerina	Common Ground-Dove
CUCULIFORMES: Cuculidae		
	Coccyzus americanus occidentalis[2]	Western Yellow-billed Cuckoo
	Geococcyx californianus	Greater Roadrunner
STRIGIFORMES: Tytonidae		
	Tyto alba	Barn Owl

AR074248

Family	Scientific Name	Common Name
STRIGIFORMES: Strigidae		
	Bubo virginianus	Great Horned Owl
APODIFORMES: Apodidae		
	Aeronautes saxatalis	White-throated Swift
APODIFORMES: Trochilidae		
	Archilochus alexandri	Black-chinned Hummingbird
	Calypte anna	Anna's Hummingbird
PICIFORMES: Picidae		
	Picoides nuttallii[+]	Nuttall's Woodpecker
	Picoides pubescens	Downy Woodpecker
	Colaptes auratus	Northern Flicker
PASSERIFORMES: Tyrannidae		
	Contopus sordidulus	Western Wood-Pewee
	Empidonax difficilis	Pacific-slope Flycatcher
	Sayornis nigricans	Black Phoebe
	Myiarchus cinerascens	Ash-throated Flycatcher
	Tyrannus vociferans	Cassin's Kingbird
PASSERIFORMES: Vireonidae		
	Vireo bellii pusillus[1,2]	Least Bell's Vireo
	Vireo huttoni	Hutton's Vireo
	Vireo gilvus	Warbling Vireo
PASSERIFORMES: Corvidae		
	Aphelocoma californica	Western Scrub-Jay
	Corvus brachyrhynchos	American Crow
	Corvus corax	Common Raven
PASSERIFORMES: Hirundinidae		
	Tachycineta bicolor	Tree Swallow
	Stelgidopteryx serripennis	Northern Rough-winged Swallow
	Petrochelidon pyrrhonota	Cliff Swallow
	Hirundo rustica	Barn Swallow
PASSERIFORMES: Aegithalidae		
	Psaltriparus minimus	Bushtit
PASSERIFORMES: Sittidae		
	Sitta carolinensis	White-breasted Nuthatch
PASSERIFORMES: Troglodytidae		
	Thryomanes bewickii	Bewick's Wren
	Troglodytes aedon	House Wren
	Cistothorus palustris	Marsh Wren

AR074249

Family	Scientific Name	Common Name
PASSERIFORMES: Sylviidae		
	Chamaea fasciata	Wrentit
	Catharus ustulatus	Swainson's Thrush
PASSERIFORMES: Mimidae		
	Toxostoma redivivum	California Thrasher
PASSERIFORMES: Sturnidae		
	Sturnus vulgaris	European Starling
PASSERIFORMES: Parulidae		
	Oreothlypis celata	Orange-crowned Warbler
	Geothlypis trichas	Common Yellowthroat
	*Setophaga petechia**	Yellow Warbler
	*Icteria virens**	Yellow-breasted Chat
PASSERIFORMES: Emberizidae		
	Pipilo maculatus	Spotted Towhee
	Melozone crissalis	California Towhee
	Melospiza melodia	Song Sparrow
PASSERIFORMES: Cardinalidae		
	Pheucticus melanocephalus	Black-headed Grosbeak
	Passerina caerulea	Blue Grosbeak
PASSERIFORMES: Icteridae		
	Agelaius phoeniceus	Red-winged Blackbird
	Molothrus ater	Brown-headed Cowbird
PASSERIFORMES: Fringillidae		
	Carpodacus mexicanus	House Finch
	Spinus psaltria	Lesser Goldfinch
	Spinus tristis	American Goldfinch
PASSERIFORMES: Passeridae		
	Passer domesticus	House Sparrow
Passeriformes Estrildidae		
	Lonchura punctulata	Nutmeg Manniken

[1]Federally threatened or endangered species
[2]State threatened or endangered species
[3]State fully protected species
*State species of special concern
+State special animal

AR074250

amec

FOCUSED SURVEYS FOR CALIFORNIA BLACK RAIL AND YUMA CLAPPER RAIL
CALTRANS AGREEMENT NO. 8A1820 TASK ORDER NO. 12
RECONSTRUCT SALT CREEK BRIDGE

Record Id 11824
County Riverside
Year 2011
Spp YCR (-)
Srv. Rpt. D.B. 2/28/12
GIS

Submitted to:
State of California
Department of Transportation

Submitted by:
AMEC Earth & Environmental, Inc.
Riverside, California

Report author: Chet McGaugh

July 2011

AMEC Project No. 1055402012

RECEIVED
FEB 10 201
US FWS
CARLSBAD FIELD ICE CA

Caltrans
Focused Surveys For California Black Rail Andyuma Clapper Rail
Caltrans Agreement No. 8A1820 Task Order No. 12
Reconstruct Salt Creek Bridge
AMEC Project No. 1055402012
July 2011

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1.0 INTRODUCTION

This report presents the results of focused surveys for California Black Rail (*Laterallus jamaicensis*) and Yuma Clapper Rail (*Rallus longirostris yumanensis*) conducted by AMEC ornithologists at the Salt Creek Bridge. The Salt Creek Bridge crosses Salt Creek on Highway 111 approximately 1.5 mile north of the RiversideCounty line, between mileposts 1.35 and 1.57 (Figure 1).

The Reconstruct Salt Creek Bridge project (Caltrans #56-236) is covered in the Coachella Valley Multiple Species Conservation Plan (CVMSHCP, Section 7.2.2.). Both the California Black rail and the Yuma Clapper Rail are listed species, with federal Endangered species designation (Yuma Clapper Rail) and State of California "threatened" species designations (California Black Rail and Yuma Clapper Rail). These species are two of eleven bird species covered in the CVMSHCP, and occur in the Dos Palmas Conservation Area, including the Salt Creek drainage. The Reconstruct Salt Creek Bridge project site is in the Dos Palmas Conservation Area.

A habitat assessment was conducted by Chet McGaugh, Stephen J. Myers, and John F. Green, AMEC ornithologists with the federal and California permits required for conducting activities, including focused surveys for listed species. The habitat assessment was conducted concurrent with focused surveys for the California Black Rail and Yuma Clapper Rail, as these rail species are known to occur in the Dos Palmas Conservation Area. Josh Jaffery, Caltrans Project Coordinator, was present during the initial habitat assessment by McGaugh. Myers conducted a plant survey following the focused rail survey of 27 April; those results are included in the "Habitat Assessment for Sensitive Riparian and Marsh Birds – Caltrans Agreement No. 08A1820 Task Order 12" submitted to Caltrans in May 2011 (AMEC 2011).

2.0 BACKGROUND

2.1 Yuma Clapper Rail (*Laterallus longirostris yumanensis*)

The Yuma Clapper Rail, one of 21 subspecies of the widespread Clapper Rail (*Rallus longirostris*) is a federally-listed Endangered species and a California–listed Threatened species. Population declines have been attributed to destruction and degradation of marsh habitat.

The CVMCHCP area contains the northernmost edge of the Yuma Clapper Rail range, with known (at least formerly) "populations" along the Whitewater River (= Coachella Valley Stormwater Channel) including the Whitewater River delta at the north end of the Salton Sea, and Dos Palmas and the mouth of Salt Creek (Garrett and Dunn 1981). Other drainages into the Salton Sea also provide (at least potentially) habitat for Yuma Clapper Rails.

Habitat for Yuma Clapper Rails typically contains cattails (*Typha domingensis*), California bulrush (*Scirpus californicus*), and common reed (*Phragmites communis*). Water depth is an important characteristic of habitat, with preferred depths of 6.5 – 20 cm. Vegetation density,

edges, and decaying vegetation "mats" are characteristics affecting mobility and access to nest sites and foraging areas. California Black Rails may be found in the same habitats as Yuma Clapper Rail. These habitat components (especially common reed) are common in the Dos Palmas Conservation Area, including the mouth of Salt Creek near the project site, and Yuma Clapper Rails have been detected at the mouth of Salt Creek, though there has perhaps not been a detection in 15+ years.

2.2 California Black Rail (*Laterallus jamaicensis*)

California Black Rails, being considerably smaller than Yuma Clapper Rail tend to be found in slightly more arid areas with water depth less than 2.5 cm. More than 90% of Conserved Habitat for California Black Rail in the Plan area is in the Dos Palmas Conservation Area; however, there is one record of the species at the mouth of Salt Creek, Recent surveys by AMEC indicate that Yuma Clapper Rails are considerably more common than California Black Rails at Dos Palmas. Habitat in the Coachella Valley Stormwater Channel is included in the Conserved Habitat designation, and accounts for approximately 10% of the total Conserved Habitat.

California bulrush (*Scirpus californicus*), three square bulrush (*Scirpus americanus*), and cattails (*Typha domengensis*) are typical plants of California Black Rail habitat. Cattail leaf blades may be used in nest even when cattails aren't a dominant species in the habitat. California Black Rails and Yuma Clapper Rails may coexist in the same marshes. The "partitioning" of habitat is likely based on water depth and relative aridity. Habitats contiguous with California Black Rail include desert fan-palm oasis, arrowweed scrub, tamarisk scrub, and southern arroyo willow riparian forest.

3.0 PERSONNEL

AMEC ornithologists John F. Green (federal permit (TE054011-5) Chet McGaugh (federal permit TE836517-5), and Stephen J. Myers (federal permit TE804203-9) conducted each survey (see Table 1, below). These biologists are listed as "authorized individuals" permitted to conduct research on listed rail species in an attachment to Stephen Myers California Department of Fish and Game Scientific Collecting Permit (SC-001951) revised on 3 March 2011.

These AMEC ornithologists have conducted rail surveys in the Dos Palmas core marsh, upstream of the Salt Creek Bridge, in four breeding seasons, and in freshwater marsh outliers associated with the Coachella Canal leakage. and have detected Yuma Clapper Rails and California Black Rail at the Dos Palmas marsh in each of the breeding seasons of 2006, 2007, 2009, and 2011. Single California Black Rails were detected in 2007 and 2009. The Coachella Canal marsh outliers were surveyed in 2003 by McGaugh; California Black Rails were detected.

4.0 METHODOLOGY

A habitat assessment was conducted by Chet McGaugh, Stephen J. Myers, and John F. Green, AMEC ornithologists with the federal and California permits required for conducting activities, including focused surveys for listed species. The habitat assessment was conducted concurrent with focused surveys for the California Black Rail and Yuma Clapper Rail, as these rail species are known to occur in the Dos Palmas Conservation Area. Josh Jaffery, Caltrans Project Coordinator, was present during the initial habitat assessment by McGaugh. Myers conducted a plant survey following the focused rail survey of 27 April; those results are included in the "Habitat Assessment for Sensitive Riparian and Marsh Birds – Caltrans Agreement No. 08A1820 Task Order 12" submitted to Caltrans in May 2011 (AMEC 2011).

Standard rail survey protocol, for both California Black Rail (Conway *et al.*2001) and Yuma Clapper Rail (U.S Dept. of the Interior –Fish and Wildlife Service 2000), were followed during the 2011 surveys. The protocols ares based on the knowledge that at certain times of the year (during the breeding cycle), and at certain times of the day (pre-dawn), rails are more likely to be responsive (and therefore detectable), to the broadcast of their specific vocalizations. Rails may respond, and answer to broadcast of specific calls as well as the calls of other marsh birds.

AMEC ornithologists broadcast calls from six points during each surveys (Figure 2). These points were established on the morning of the first survey (2 April), and were selected based on habitat quality within the project area. Marsh habitat is limited and patchy throughout the project area (see Photographic Exhibits), and as the season progressed the habitat patches dried.

A standard fifteen minute digital recording was played. Each surveyor used iPods and external speakers to provide ample volume. The recording is a combination of Black Rail calls followed by a combination of Clapper Rail calls. Within the series of calls, periods of silence provide listening time.

5.0 RESULTS

Table 1 presents the results of three focused rail surveys conducted in 2011. Surveys for California Black Rail and Yuma Clapper Rail were conducted simultaneously. Recorded vocalizations were broadcast at six "broadcast stations" shown in Figure 2.

Weather was favorable, with each survey conducted on clear and calm mornings. Traffic and railroad noise was minimal and did not affect the results.

Neither California Black Rails or Yuma Clapper Rails were detected. The more common rail species, Sora (*Porzana carolina*) and Virginia Rail (*Rallus limicola*) were also not detected. Appendix A is a list of forty-seven (47)birds observed during the habitat assessment and the focused surveys. Spring migration in the Salton Sink was peaking at the time of John Green's survey (27 May) as evidenced by the variety of warblers, flycatchers, and other passerines.

Table 1.
Focused Surveys for California Black Rail and Yuma Clapper Rail in 2011.

Date &Time	Weather	Biologist	Calif. Black Rail	Yuma Clapper Rail
2 April 2011 0550 - 0730	56-71F, clear, calm	McGaugh	No	No
27 April 2011 0607 - 0738	61-71F, clear, calm	Myers	No	No
27 May 2011 0556 - 0755	69-81F, clear calm	Green	No	No

6.0 CONCLUSION

Based on the negative results of the focused surveys, AMEC concludes that neither California Black Rail or Yuma Clapper Rail are present in the Reconstruct Salt Creek project area in 2011. These results are valid for one year. If the project has not been implemented before the 2012 survey season (March 2012) updated surveys will be necessary.

7.0 REFERENCES AND LITERATURE CITED

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Caltrans
Focused Surveys For California Black Rail Andyuma Clapper Rail
Caltrans Agreement No. 8A1820 Task Order No. 12
Reconstruct Salt Creek Bridge
AMEC Project No. 1055402012
July 2011

FIGURES

Caltrans
Focused Surveys For California Black Rail Andyuma Clapper Rail
Caltrans Agreement No. 8A1820 Task Order No. 12
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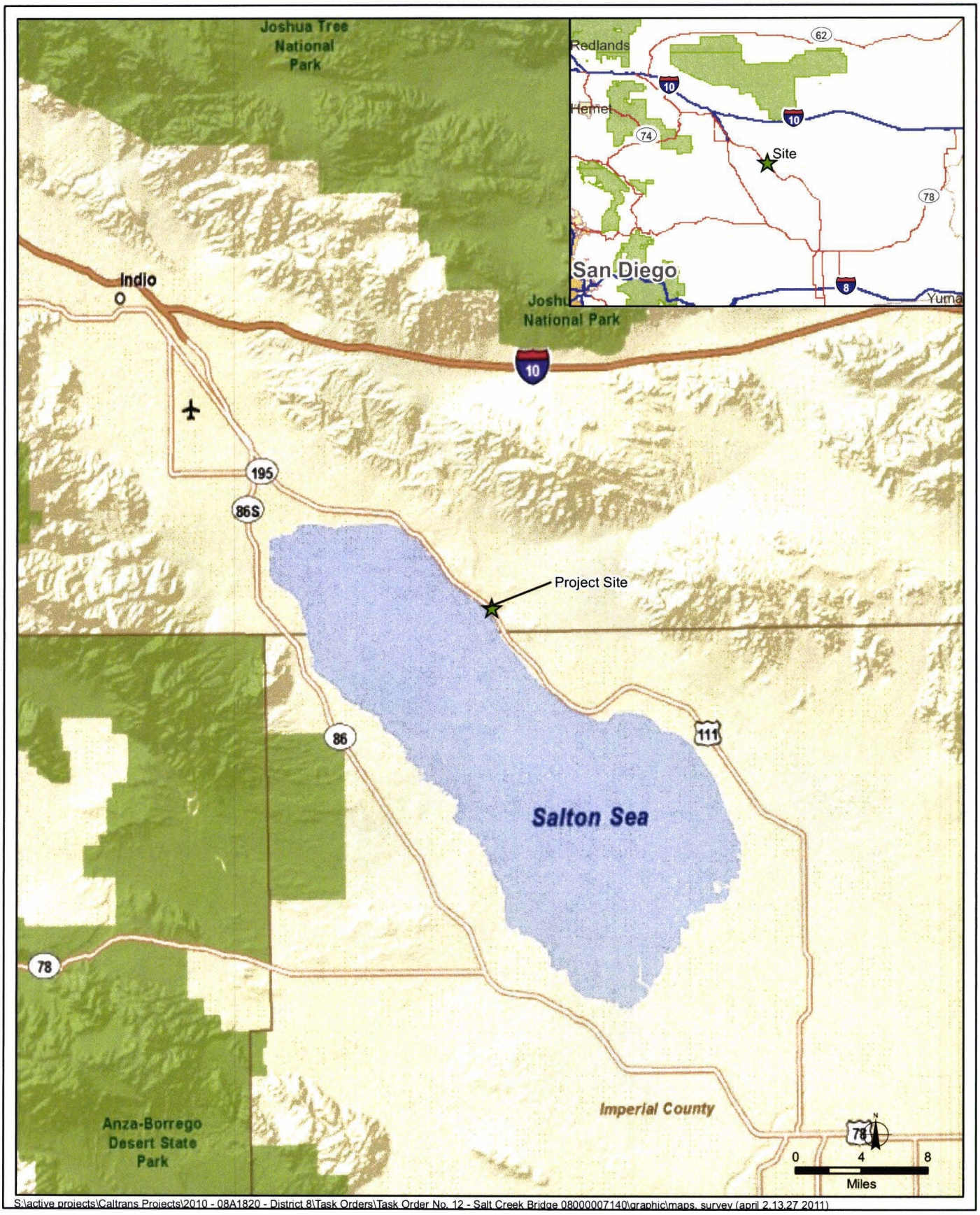

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Regional Location
Salt Creek Bridge

FIGURE
1

Caltrans
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Rail Survey
Salt Creek Bridge

FIGURE
2

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APPENDIX A

BIRD LIST

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July 2011

APPENDIX A

These birds were detected in the project vicinity during the focused surveys for California Black Rail and Yuma Clapper Rail, and the habitat assessment for sensitive riparian birds. The list includes species on the shore of the Salton Sea, and birds flying over the project area.

BIRDS

Anatidae	**Waterfowl**
Melanitta fusca	White-winged Scoter
Odontophoridae	**New World Quails**
Callipepla gambelii	Gambel's Quail
Podicipedidae	**Grebes**
Podiceps nigricollis	Eared Grebe
Aechmophorus occidentalis	Western Grebe
Pelecanidae	**Pelicans**
Pelecanus erythrorhynchos	American White Pelican
Phalacrocoracidae	**Cormorants**
Phalacrocorax auritus	Double-crested Cormorant
Ardeidae	**Heron, Bitterns, and Allies**
Ardea herodias	Great Blue Heron
Egretta thula	Snowy Egret
Butorides virescens	Green Heron
Charadriidae	**Plovers and Lapwings**
Charadrius vociferus	Killdeer
Recurvirostridae	**Stilts and Avocets**
Himantopus mexicanus	Black-necked Stilt
Laridae	**Gulls, Terns, and Skimmers**
Larus californicus	California Gull
Hydroprogne caspia	Caspian Tern
Columbidae	**Pigeons, Doves**
Zenaida macroura	Mourning Dove
Zenaida	*asiatica* White-winged Dove
Apodidae	**Swifts**
Aeronautes saxatalis	White-throated Swift

Tyrannidae	**Tyrant Flycatchers**
Contopus sordidulus	Western Wood-Pewee
Empidonax sp.	"Western" Flycatcher
Empidonax traillii	Willow Flycatcher
Tyrannus verticalis	Western Kingbird
Sayornis nigricans	Black Phoebe
Sayornis saya	Say's Phoebe
Laniidae	**Shrikes**
Lanius ludovicianus	Loggerhead Shrike
Vireonidae	**Vireos**
Vireo gilvus	Warbling Vireo
Hirundinidae	**Swallows**
Stelgidopteryx serripennis	Northern Rough-winged Swallow
Petrochelidon pyrrhonota	Cliff Swallow
Hirundo rustica	Barn Swallow
Remizidae	**Penduline Tits and Bushtits**
Auriparus flaviceps	Verdin
Troglodytidae	**Wrens**
Thryomanes bewickii	Bewick's Wren
Sylviidae	**Old World Warblers and Gnatcatchers**
Polioptila melanura	Black-tailed Gnatcatcher
Turdidae	**Thrushes**
Catharus ustulatus	Swainson's Thrush
Sturnidae	**Starlings**
**Sturnus vulgaris*	European Starling
Parulidae	**Wood-Warblers**
Oreothlypis celata	Orange-crowned Warbler
Wilsonia pusilla	Wilson's Warbler
Dendroica petechia	Yellow Warbler
Oporornis tolmiei	MacGillivray's Warbler
Geothlypis trichas	Common Yellowthroat
Emberizidae	**Emberizids**
Melozone aberti	Abert's Towhee

Cardinalidae	**Cardinals and Allies**
Piranga ludoviciana	Western Tanager
Pheucticus melanocephalus	Black-headed Grosbeak
Icteridae	**Blackbirds**
Agelaius phoeniceus	Red-winged Blackbird
Euphagus cyanocephalus	Brewer's Blackbird
Quiscalus mexicanus	Great-tailed Grackle
Molothrus ater	Brown-headed Cowbird
Icterus cucullatus	Hooded Oriole
Icterus bullockii	Bullock's Oriole
Fringillidae	**Finches, Allies**
Carpodacus mexicanus	House Finch

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APPENDIX B

PHOTOGRAPHIC EXHIBITS

Caltrans
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Reconstruct Salt Creek Bridge
AMEC Project No. 1055402012
July 2011

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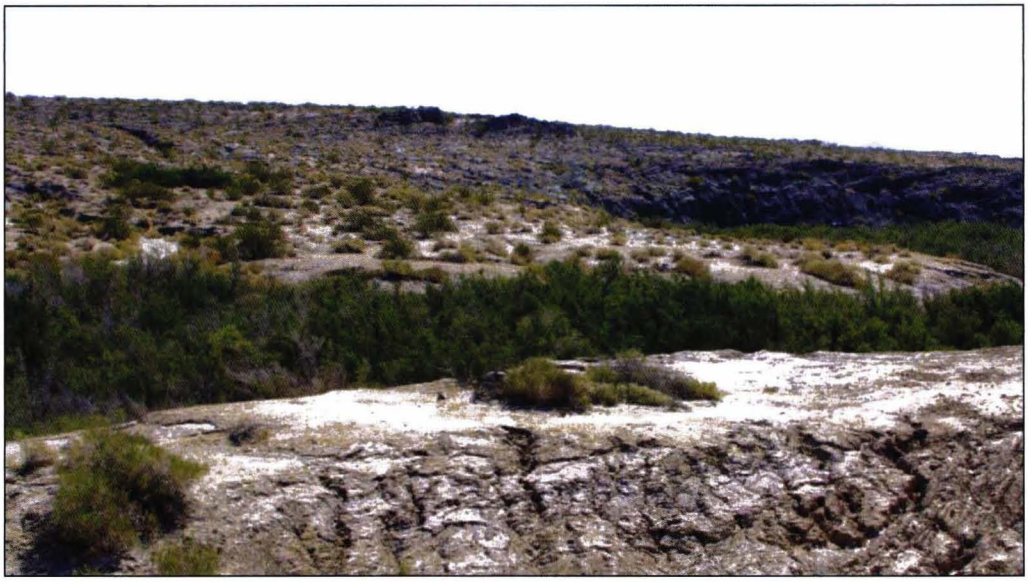
FOCUSED SURVEYS FOR CALIFORNIA BLACK RAIL ANDYUMA CLAPPER RAIL
CALTRANS AGREEMENT NO. 8A1820 TASK ORDER NO. 12
RECONSTRUCT SALT CREEK BRIDGE
APPENDIX B
PHOTOGRAPHIC LOG



Photograph No. 1

Tamarisk thicket under Salt Creek Bridge.



Photograph No. 2

Tamarisk along Salt Creek upstream from bridges.

AMEC Job No. 1055402012	Prepared By: Chet McGaugh	amec

FOCUSED SURVEYS FOR CALIFORNIA BLACK RAIL ANDYUMA CLAPPER RAIL
CALTRANS AGREEMENT NO. 8A1820 TASK ORDER NO. 12
RECONSTRUCT SALT CREEK BRIDGE
APPENDIX B
PHOTOGRAPHIC LOG



Photograph No. 3

Stream bed, left of sand, downstream from Salt Creek Bridge (Salton Sea in distance).



Photograph No. 4

Marsh (Common Reed) between Salt Creek Bridge and Southern Pacific RR bridge.

AMEC Job No. **1055402012**	**Prepared By:** **Chet McGaugh**	amec

**CERTIFICATION STATEMENT FOR THE
UNITED STATES FISH AND WILDLIFE SERVICE**

Ms. Love, per your request, this certification is to be attached to the following report referenced in your email of 23 May 2014: 2011 report, Reconstruct Salt Creek Bridge, Yuma clapper rail surveys.

I certify that the information in the survey report and attached exhibits fully and accurately represents my work.

Signed: John F. Green

Date: 23 May 2014

Signed:

Date: 23 May 2014

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County Riverside
Year 2011
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Srv. Rpt.
D.B. DL 4/28/12
GIS 3-4-13
L+R
File

27 July 2011
AMEC Project No. 8151001100

Ms. Erin McCarthy
Recovery Permit Coordinator
United States Fish and Wildlife Service
Ecological Services, Carlsbad Field Office
6010 Hidden Valley Road, Suite 101
Carlsbad, CA 92011

Re: Results of Protocol Surveys for Yuma Clapper Rail and California Black Rail at the Dos Palmas Core Marsh, Riverside County, California, 2011.

Dear Ms. McCarthy:

This letter report presents the results of focused surveys for the Yuma Clapper Rail (*Rallus longirostris yumanensis*), and California Black Rail (*Laterallus jamaicensis coturniculus*), at the Dos Palmas Core Marsh in Riverside County, California (Figure 1). The Yuma Clapper Rail is listed as an endangered species by the United States Fish and Wildlife Service (USFWS), and as a threatened species by the California Department of Fish and Game (CDFG). The California Black Rail is listed as a threatened species by CDFG.

These surveys were carried out as part of the Monitoring Plan for the Dos Palmas area as contracted by the San Diego County Water Authority (SDCWA) as part if its mitigation commitment for the Coachella Canal Lining Project (CCLP). Surveys for the Yuma Clapper Rail and California Black Rail were conducted following protocol developed in the Monitoring Plan (AMEC, 2009a) which was approved by the USFWS as part of the review team for the biological monitoring project conducted for the San Diego County Water Authority. (Carol Roberts pers. com.). The surveys were conducted under the authority of USFWS section 10(a) permits held by AMEC Environmental & Infrastructure, Inc.(AMEC) biologists John Green (TE054011-2), Stephen Myers (TE804203-8), and Chet McGaugh (TE836517-5).

1.0 INTRODUCTION

The Yuma Clapper Rail occurs along the lower Colorado River in freshwater marsh dominated by cattails (*Typha* sp.), bulrush (*Scirpus* sp.), and common reed (*Phragmites australis*), from Needles, California, south to the Colorado River delta (Tomlinson and Todd 1973). Additional populations occur at the south end of the Salton Sea, and along the Salt and Gila Rivers (Eddleman 1989), and is known to occur at Dos Palmas (AMEC 2008). Yuma Clapper Rails forage primarily on crustaceans and minnows during the breeding season, and rely more on a diet of seeds and vegetation in the winter. Populations of Yuma Clapper Rails have undergone decline in the United States due to their limited distribution, and destruction and degradation of freshwater marsh habitat.

AMEC Earth & Environmental, Inc.
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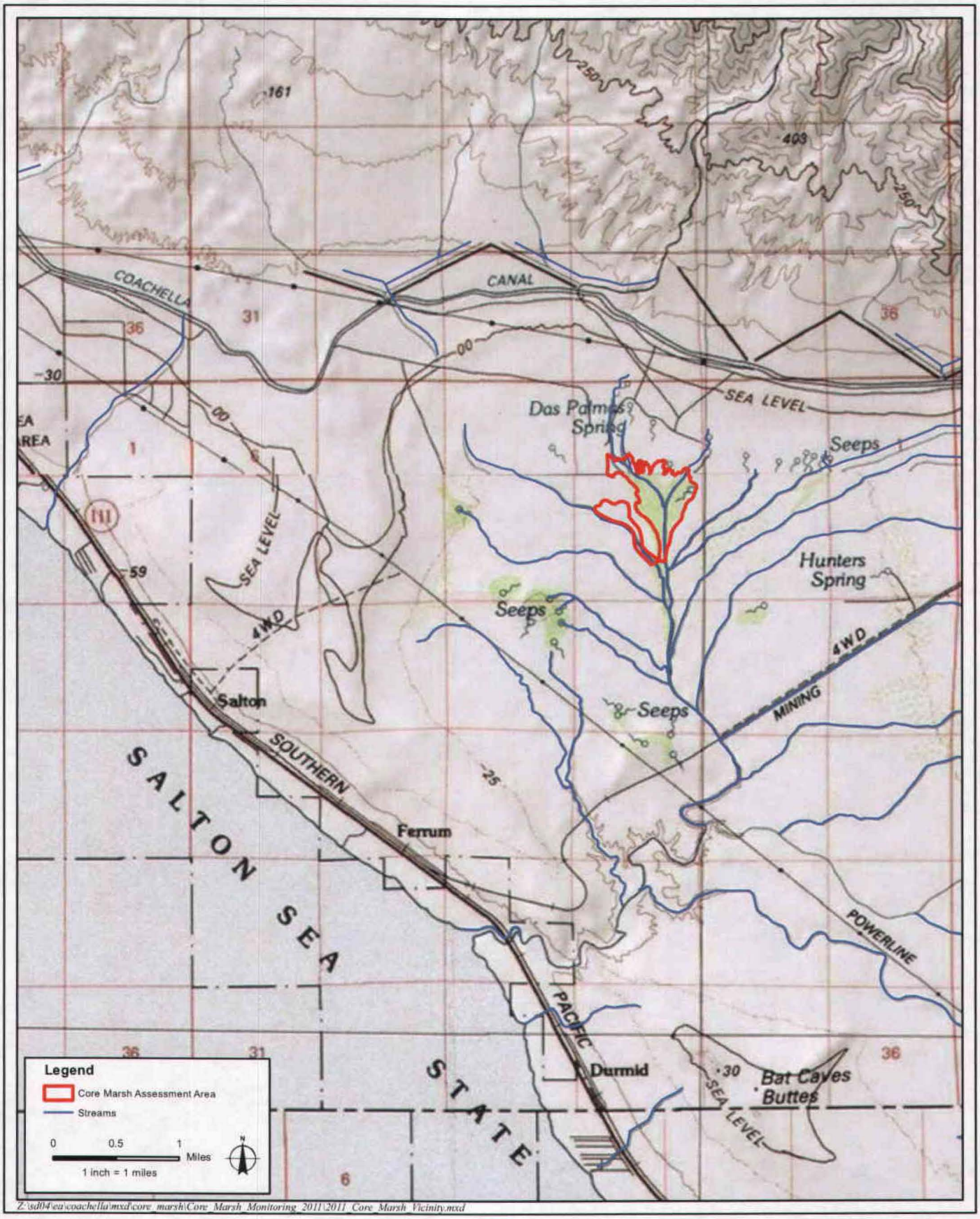

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2011 Rail Survey Vicinity Map
Dos Palmas Core Marsh Monitoring
Coachella Canal Lining Project

FIGURE
1

The California Black Rail is a small, sparrow-sized secretive rail, blackish above with white speckling, a chestnut nape, grayish-black underparts, narrow white barring on the flanks, and a short black bill. The California Black Rail occurs in the lower Colorado River area from the Imperial Dam, south to the Mexican border, with smaller, isolated populations scattered from Marin and San Luis Obispo counties in coastal California, southward to San Diego County, northwestern Baja California, and the lower Imperial Valley (Eddleman *et al* 1994, Small 1994), and in the foothills of the Sierra Nevada (Richmond et al. 2010; Aigner et al. 1995). The species is known to occur at Dos Palmas (AMEC 2008). California Black Rails tend to favor mixed pickleweed (*Salicornia* sp.), cordgrass (*Spartina foliosa*), and bulrush marshes in coastal habitats; and bulrush, common reed, and cattail freshwater marshes in inland areas (Small 1994, Conway and Sulzman 2007, Del Pizzo, pers. comm.). California Black Rails typically forage on aquatic and terrestrial invertebrates and seeds. Like the Yuma Clapper Rail, the California Black Rail has undergone decline due to habitat degradation and destruction.

2.0 PROJECT LOCATION

The Dos Palmas Core Marsh is located within the Dos Palma Area of Critical Environmental concern (ACEC) to the east of Highway 111 near the north end of the Salton Sea (Figure 1). It is known to be habitat for the Yuma Clapper Rail and California Black Rail, as surveys for these species were conducted in 2006, 2007, and 2009 (AMEC 2010). This survey was conducted at essentially the same sampling stations that were used in the previous studies, although three additional stations were added in the west arm of Salt Creek, as this area had been converted from salt cedar habitat to marsh habitat during the past two years.

3.0 PROJECT SITE DESCRIPTION

The Dos Palmas Core Marsh is located in the Dos Palmas ACEC. It is a marsh of approximately 150 acres. Vegetation includes emergent bulrush, cattails, and common reed (*Phragmites australis*) which are present in varying densities throughout the marsh. In addition, there are stands of salt cedar or tamarisk (*Tamarix* sp.) and saltgrass (*Distichlis spicata*) along the margins of the marsh. Upland vegetation adjacent to the marsh is characterized by tamarisk, arrowweed (*Pluchea sericea*), and quailbush (*Atriplex lentiformis*), with an occasional honey mesquite (*Prosopis glandulosa*), and patches of saltgrass (*Distichlis spicata*) and salt crusts. The topography of the entire area is relatively flat; with water flowing through the marsh from seeps and springs to the north, and concentrating into Salt Creek at the outflow of the marsh to the south. The elevation of the survey area ranges from approximately -120 feet (- 36 meters) to -134 feet (-41 meters) below Mean Sea Level.

4.0 METHODS

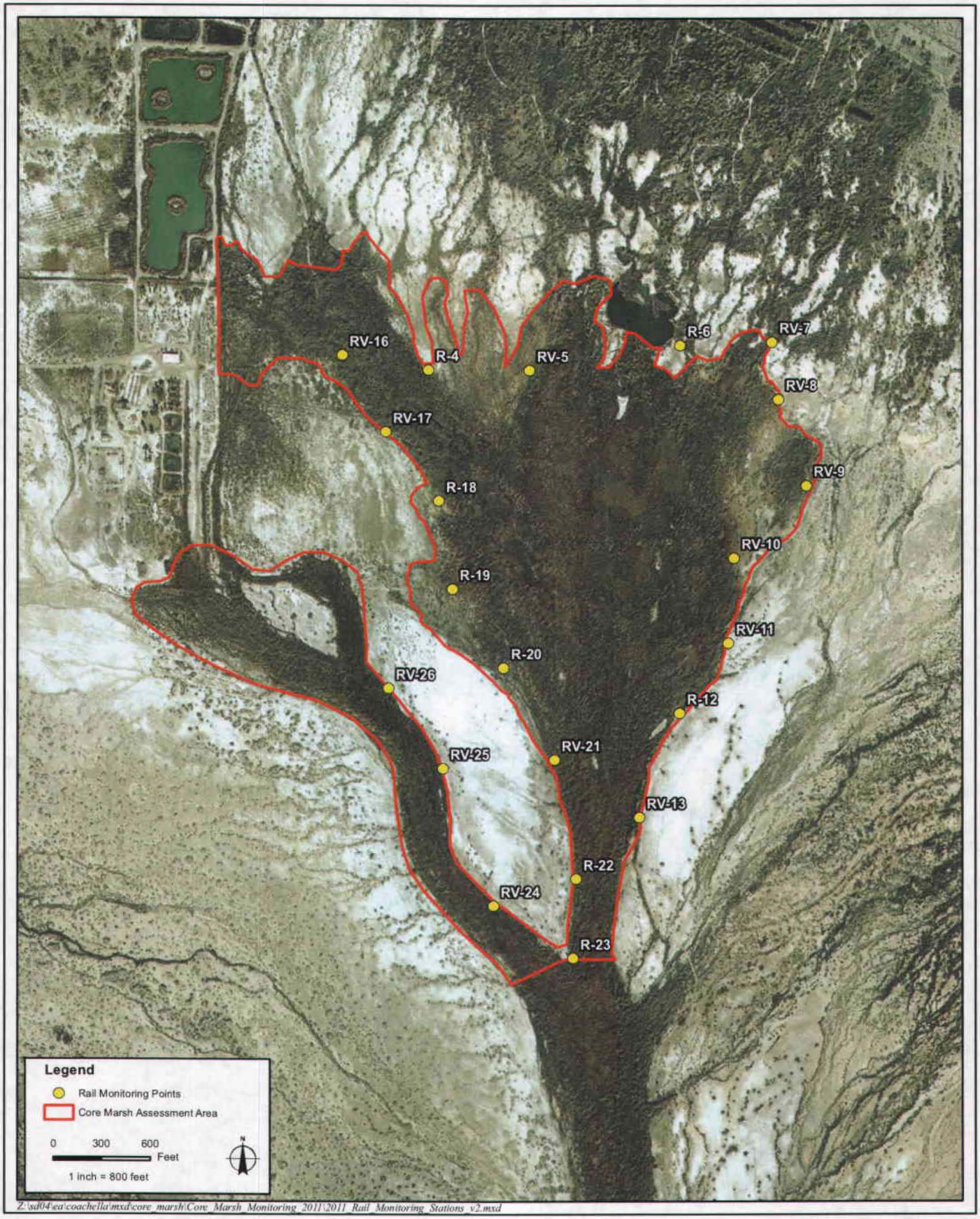
Three focused surveys for the Yuma Clapper Rail and California Black Rail were conducted according to the protocol detailed in the Monitoring Plan developed for the SDCWA (AMEC, 2009), which was approved by the USFWS as part of the review team. (Carol Roberts pers. com.). Protocols follow guidance in Conway (2008). Dusk surveys were conducted on March 28, 2011, initiating at 1530 and continuing until 1800. Dawn surveys for the two species were conducted on April 25 and May 23, 2011. The dawn surveys were initiated roughly 30 minutes prior to sunrise, at approximately 0530, and continued until no later than 0930. Weather conditions and other details of the surveys are presented in Table 1.

The surveys were conducted by three surveyors working simultaneously. A total of 21 survey stations were used, which are approximately 490 - 650 feet (150-200 meters) apart along the north, west, and east margins of the marsh , as well as along the west arm of Salt Creek (Figure 2). All surveyors followed an identical protocol. Surveys were conducted for California Black Rail first. Passive listening was conducted for two minutes initially, followed by 30 seconds of broadcast "grr" calls and 30 seconds of silence, then an additional 30 seconds of "grr" and 30 seconds of silence. Then 30 seconds of "kik-kic-kerr" call was broadcast, followed by 30 seconds of silence, and an additional 30 seconds of "kik-kic-kerr" call followed by 30 seconds of silence. The survey for Yuma Clapper Rail followed this sequence. Two minutes of passive listening was followed by 1 one-minute call broadcast, one minute of silence, another minute of broadcast, and five minutes of silence. Weather conditions during the three surveys are summarized in Table 1.

Table 1. Environmental conditions during three Yuma Clapper Rail and California Black Rail surveys of the Core Marsh of the Dos Palmas ACEC in Riverside County, California, 2009.

Survey #	Date	Surveyor*	Time	Weather Conditions (OC = overcast)
1	03/28/11	SM, JG, CM	1540-1805	78-86F, wind 1-3 mph, 10% high clouds
2	04/25/11	SM, JG, CM	0642-0934	56-78F, wind 0-7 mph, 0% OC
3	05/23/11	SM, JG, CM	0545-0831	60-75F, wind 0 mph, 0 % OC

* JG-John Green; SM – Steve Myers; CM-Chet McGaugh



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2011 Rail Survey Stations
Dos Palmas Core Marsh Monitoring
Coachella Canal Lining Project

FIGURE
2

5.0 RESULTS

Only Yuma Clapper Rails (a total of 14 detections) were detected in the Core Marsh during these surveys. The survey results are shown in Table 2.

Table 2. Rail Census Data in the Dos Palmas Core Marsh in 2011.

Location	28-Mar-11		25-Apr-11		23-May-11	
	YCR[4]	CBR[5]	YCR	CBR	YCR	CBR
4						
5	1					
6						
7	1				1	
8						
9						
10						
11						
12						
13						
16			1			
17						
18					1	
19			1		1	
20			2		1	
21						
22						
23						
24						
25			2			
26			1		1	
TOTAL	**2**	**0**	**7**	**0**	**5**	**0**

6.0 DISCUSSION

Rail surveys were conducted in the past in the Core Marsh in 2006, 2007, and 2009. Table 3 below summarizes these results, and indicates the survey stations where the rails were detected. The location of the survey stations has remained essentially the same for all years, including 2009.

Table 3. Rail Census Data in the Dos Palmas Core Marsh in 2006, 2007, and 2009.

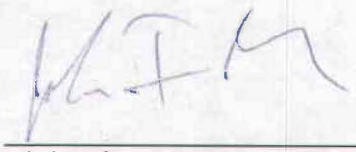
Station	YCR 2006	YCR 2007	YCR 2009		CBR 2006	CBR 2007	CBR 2009
1	---	A, M	---		---	---	---
2	---	A, M	---		---	---	---
3	---	M	M		---	---	---
4	---	M	A,M		---	---	---
5	---	A, M	---		---	A	---
6	A	---	---		---	---	---
7	A	---	M		---	---	---
8	A	---	M		---	---	---
9	---	A, M	M		---	---	---
10	A	A	---		---	---	---
11	J	M	Ma, A		---	---	Ma
12	---	---	---		---	---	---
13	A	---	---		---	---	---
14	---	A	---		---	---	---
15	---	A, M	---		---	---	---
16	---	---	Ma		---	---	---
17	M	---	Ma		---	---	---
18	---	---	---		---	---	---
19	M	M	---		---	---	---
20	---	---	---		---	---	---
21	---	A	---		---	---	---
TOTAL	8	17	12		0	1	1

A = April; M = May; Ma = March

It can be seen that there were fewer Yuma Clapper Rails detected in 2011 than in 2007, although more than in 2006 or 2009. California Black Rails were absent during the 2011 surveys, but have been reported anecdotally from pond areas to the northwest of the core marsh. Fewer sampling stations detected rails of either species in 2011 than in 2007, and the distribution of the species of rails has changed somewhat. During 2011, the best rail habitat appears to be associated with stations 7, 19, 20, and 26. Figure 2 shows these stations to be in the north and east portions of the marsh, as well as in the relatively new habitat of the west arm. In 2009, it was the subjective impression of the surveyors, three of whom had been involved in the 2006 and 2007 surveys, that the marsh edge was drier in these areas than it had been in previous years, although water was returning to the west portions of the marsh. During 2011, these areas were still recorded as dry, and the distance from the survey station to what the surveyors judged to be suitable rail habitat was up to 40 m away. In the west arm area, however, the survey stations were at the very edge of the marsh habitat.

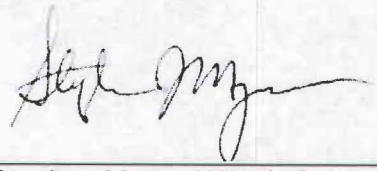
7.0 CERTIFICATION

We certify that the information in this survey report and attached exhibits fully and accurately represent our work.



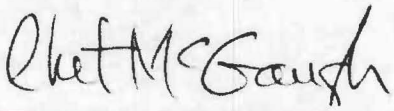
John Green, Wildlife Biologist
TE054011-2

27 July 2011
Date



Stephen Myers, Wildlife Biologist
TE804203-8

27 July 2011
Date



Chester McGaugh, Wildlife Biologist
TE836517-5

27 July 2011
Date

Ms. Erin McCarthy
Yuma Clapper Rail and California Black Rail Surveys
Dos Palmas Core Marsh
Riverside County, California
AMEC Project No. 8151001100.0003
27 July 2011

If you have any questions or concerns regarding this survey report, please contact John Green at 951-369-8060 or by email john.green@amec.com.

Respectfully submitted,

AMEC Earth & Environmental, Inc.

John Green
Wildlife Biologist

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Record Id 12322
County San Bernardino
Year 2012
YCR (+)
Spp CBR (-)
Srv. Rpt.
D.B. DLC 1/30/13
GIS RN 6-14-13
Ltr
File

Konecny Biological Services
Biological Consulting, Research, Conservation

July 22, 2012
12-04-A

Environmental Services Business Group
2485 Natomas Park Drive, Suite 600
Sacramento, CA 95833

Attn: Ms. Marjorie A. Eisert

Re: Results of a Focused Survey for the Yuma Clapper Rail and California Black Rail at the Pacific Gas and Electric Topock Compressor Station Site (PGE-1925), City of Needles, County of San Bernardino, California, 2012.

Dear Ms. Eisert:

This letter report presents the results of focused surveys for the Yuma clapper rail (*Rallus longirostris yumanensis*), and California black rail (*Laterallus jamaicensis coturniculus*), at Pacific Gas and Electric's (PGE) Topock Compressor Station Site, City of Needles, San Bernardino County, California. The Yuma clapper rail is listed as an endangered species by the United States Fish and Wildlife Service (USFWS), and as a threatened species by the California Department of Fish and Game (CDFG). The California black rail is listed as a threatened species by CDFG.

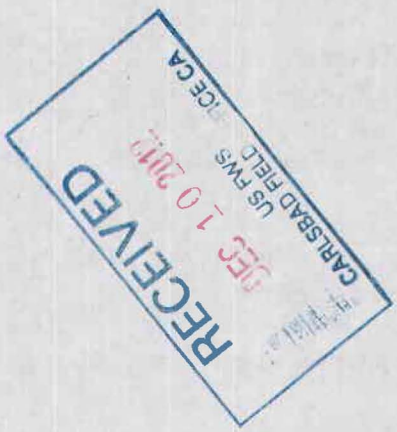
Surveys for the Yuma clapper rail and California black rail were conducted following protocol established by Conway (2008), with a modification suggested by the Clapper Rail Study Team (CRST 2009) for projects that directly impact potential clapper rail habitat. The surveys were conducted by wildlife biologist John Konecny. PGE biologist Melanie day assisted on two surveys. This activity is authorized by USFWS section 10(a) permit number TE837308-5, and a CDFG Memorandum of Understanding.

INTRODUCTION

The Yuma clapper rail is a slender, tawny-breasted bird with grayish edges on brown centered back feathers, olive wing coverts, vertical white bars on the flanks, a white stripe over the eye, and a partially orange bill. The Yuma clapper rail occurs along the lower Colorado River in freshwater marsh dominated by cattails (*Typha* sp.), bulrush (*Scirpus* sp.), and common reed (*Phragmites australis*), from Needles, California, south to the Colorado River delta (Tomlinson and Todd 1973). Additional populations occur at the south end of the Salton Sea, and the Salt and Gila Rivers (Eddleman 1989). Yuma clapper rails forage primarily on crustaceans and minnows during the breeding season, and rely more on a diet of seeds and vegetation in the winter. Recent claims of migratory movement along the lower Colorado River could not be confirmed by radiotelemetry studies (Eddleman 1989, Conway 1990). Populations of Yuma clapper rails have undergone decline in the United States due to their limited distribution, and destruction and degradation of freshwater marsh habitat.

The California black rail is a small, sparrow-sized secretive rail, blackish above with white speckling, has a chestnut nape, grayish-black underparts, narrow white barring on the flanks, and a short black bill. The California black rail occurs in the lower Colorado River area from the Imperial Dam, south to the Mexican border, with smaller, isolated populations scattered from

1501 east Grand Avenue, # 2403, Escondido, California, 92027
Tel: (760) 489-5276 E-mail: jkonecny@cox.net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CARLSBAD FIELD
CA

Marin and San Luis Obispo Counties in coastal California, southward to San Diego County, northwestern Baja California, and the lower Imperial Valley (Eddleman *et al* 1994, Small 1994). California black rails tend to favor mixed pickleweed (*Salicornia* sp.), cordgrass (*Spartina foliosa*), and bulrush marshes in coastal habitats; and bulrush and cattail freshwater marshes in inland areas (Small 1994). Black rails typically forage on aquatic and terrestrial invertebrates and seeds. Like the Yuma clapper rail, the California black rail has undergone decline due to habitat degradation and destruction. The population of California black rails along the Colorado River from Needles, California, to Yuma, Arizona, probably numbers between 75-100 individuals (Evens et al. 1991).

PROJECT LOCATION

The Pacific Gas and Electric Topock Compressor Station site is located immediately north and south of Interstate-40 on the California/Arizona border. The Interstate-40 Bridge crossing of the Colorado River is approximately 11-miles (18-kilometers) southeast of the town of Needles, California (Figure 1). The project site extends northward of Interstate-40 on the California side for approximately two-miles (three-kilometers) in Myoabi County Park; approximately three-tenths of a mile (one-half kilometer) southward on Pacific Gas and Electric property; and approximately four-tenths of a mile (six-tenths of a kilometer) eastward in Topock Marsh in Arizona. Specifically, the project area is located in Township 7 North, Range 24 East on the Needles, CA 7.5-minute quadrangle; and Township 15 North, Range 21 West on the Topock, AZ 7.5 minute quadrangle.

PROJECT SITE DESCRIPTION

The Colorado River in the vicinity of the Pacific Gas and Electric Topock Compressor Station site is wide and relatively slow moving. At times there is considerable recreational boat traffic in the area. Emergent bulrush, cattails, and common reed (*Phragmites australis*) are present in varying densities and patch size along both river banks in the project site area. Topock marsh in Arizona is a relatively undisturbed freshwater marsh located in a protected inlet of the river that transition northward as a lush bulrush and cattail marsh. Only a small boat dock is present in the southern area of the marsh.

Myoabi County Park is present on the north side of Interstate-40 on the California side of the river and includes cabins and a boat basin. A Pacific Gas and Electric facility is present south of the Interstate on the California side. A deeply incised drainage is present south of the access road to the plant and there is a large patch of common reed at its confluence with the river. A couple of small residences are located south of the Interstate on the Arizona side.

Upland vegetation in the area is characterized by tamarisk (*Tamarix* sp.), arrowweed (*Pluchea sericea*), and quailbush (*Atriplex lentiformis*), with an occasional honey mesquite (*Prosopis glandulosa*), and creosote bush (*Larrea tridentate*). The elevation of the Colorado River at the Topock Compressor Station site is approximately 456 feet (139 meters) above Mean Sea Level.

METHODS

Habitat Assessment

A habitat assessment of the Topock Compressor Station site was conducted on March 13, 2012. All areas within 300 feet (91 meters) of a potential action area were looked at by

Yuma clapper rail permitted biologist John Konecny and PGE biologist Melanie Day. All emergent shoreline vegetation was inspected from the water by boat and later ground truthed on foot from the shore. An aerial photograph (1 inch to 500 feet) and binoculars were used as an aid in determining vegetation location. Potential habitat was marked on the aerial photograph.

Focused Surveys

Six focused survey events for the Yuma clapper rail and California black rail were conducted at least one week apart between March 14th and May 19th, 2012 following the survey protocol of Conway 2008, with a modification suggested by the Clapper Rail Study Team (CRST 2009) for projects that directly impact potential clapper rail habitat. Eddlemann and Conway (1998) and Conway (2008 pers.comm.) suggest a 40% detection rate to clapper rail call prompting. Using a detection probability of 0.4 (undetection probability of 0.6), six survey events are required to achieve a value of P = 0.05, i.e. to say there is 95% confidence that clapper rails are not present in an area.

Each survey event had a dawn and dusk component. Dawn surveys were initiated approximately 30 minutes prior to sunrise, approximately 0500-0600, and continued until approximately 1000. Dusk surveys were initiated approximately two hours before sunset and continued until dark.

The surveys were conducted by stopping at twenty-three points that are at approximately 270 foot (120 meters) intervals along the Colorado River, Topock Marsh, and Myoabi County Park (Figure 2A-C) and listening for Yuma clapper rails and California black rails for five minutes. If rails were not detected, a digital vocalization (call prompt), consisting of 30 seconds of California black rail followed by 30 seconds of silence, 30 seconds of least bittern (*Ixobrychus exillis*) followed by 30 seconds of silence, 30 seconds of Virginia rail (*Rallus limicola*) followed by 30 seconds of silence, and 30 seconds of Yuma clapper rail followed by 30 seconds of silence was played with an iPod and amplified speakers. A response was listened for during a one minute period following the recorded vocalizations before proceeding to the next station.

Beginning with the third survey event on March 29th and 30th, three additional species; the pied-billed grebe (*Podilymbus podiceps*), common gallinule (*Gallinula galeata*), and American coot (*Fulica americana*) were added as target species at station three (USFWS Point 49; 34.714573, -114.486672) and seven (USFWS Point 50; 34.717854, -114.488407) at the request of the USFWS. Digital vocalizations of these three species were not played.

Weather conditions during the three surveys are summarized in Table 1. Copies of data sheets are included as Attachment 1.

Table 1. Environmental Conditions During Five Yuma Clapper Rail and California Black Rail Surveys at the Pacific Gas and Electric Topock Compressor Station Site (PGE-1925), City of Needles, County of San Bernardino, California, 2012.

Survey #	Date	Surveyor (Species) *	Time	Weather Conditions (OC = overcast)
1A	03/14/12	JK, MD (YCR, CBR)	1630-1925	75-72F, wind 1-5 mph, 0% OC
1B	03/15/12	JK, MD (YCR, CBR)	0619-0959	53-65F, wind 1-5 mph, 0% OC
2A	03/21/12	JK, (YCR, CBR)	1700-1905	83-72F, wind 3-5 mph, 0% OC
2B	03/22/12	JK (YCR, CBR)	0610-1030	54-71F, wind 3-5 mph, 0% OC
3A	03/29/12	JK, (YCR, CBR)	1625-1850	86-80 F, wind 3-10 mph, 20 % OC

3B	03/30/12	JK. (YCR, CBR)	0559-0930	61-73F, wind 4-7 mph, 10 % OC
4A	04/19/12	JK, (YCR, CBR)	0510-0836	69-77F, wind 1-5 mph, 10 % OC
4B	04/20/12	JK, (YCR, CBR)	1800-2120	94-87F, wind 5-10 mph, 10 % OC
5A	04/27/12	JK, (YCR, CBR)	0500-0816	66-78F, wind 6-15 mph, 10% OC
5B	04/28/12	JK, (YCR, CBR)	1750-2050	91-80F, wind 3-5 mph, 10% OC
6A	05/18/12	JK, (YCR, CBR)	0500-0815	80-89F, wind 7-15 mph, 10% OC
6B	05/19/12	JK, (YCR, CBR)	1810-2125	96-87F, wind 5-10 mph, 10% OC

* JK-John Konecny; MD-Melanie Day; YCR-Yuma clapper rail; CBR-California black rail

RESULTS

Habitat Assessment

Field reconnaissance of the site yielded 24 points of potential Yuma clapper rail or California black rail habitat in the project area. Calls prompt stations were established at twenty three of these points. There was no call prompt station established at point #19. This location was within 300 feet of a potential project action, but could only be reached by boat, so it is only referred to as a location, not by station number. This location was within audible distance of the call prompt from station #20. Seven points (six stations and one additional location (#19)) are located on the Arizona side of the river and 21 stations are located on the California side. The highest quality habitat, based on vegetation species composition, i.e. cattails and bulrush, and degree of being isolated from disturbance is in the Topock Marsh. The twenty-four locations are shown in Figures 2A-2C in Attachment 2.

Focused Surveys

One pair of Yuma clapper rails and two single advertising male Yuma clapper rails were detected during the 2012 survey (Figure 3). Each of these three locations was located in the Topock Marsh in Arizona. No Yuma clapper rails were detected on the California side of the Colorado River. The two single Yuma clapper rails were detected during all six survey events. The Yuma clapper rail pair was detected on five of the six survey events. The Yuma clapper rail pair that was detected at location #19 and station 20 is likely the same pair. No California black rails were detected anywhere in the project area.

American coots were detected visually at both station #3 and station #7 for the USFWS survey. A pied-billed grebe was detected auditorally at station #7. No common gallinules were detected.

DISCUSSION

No California black rails were detected in the survey area. California black rails are habitat specialists that require at least 1.25 acres (0.5 hectares) of emergent marsh and shallow water that is less than one and one-half inches (two centimeters) in depth (Conway and Sulzman 2007, Eddleman 1994). Given those habitat requirements, California black rail habitat is not present for the most part on the west side of the river. The Colorado River is known to fluctuate by up to four feet (meters) daily, due to release of water at the Davis Dam, 37 miles (54 kilometers) upstream. The upper areas of the protected Topock Marsh may offer some areas of breeding habitat for the California black rail. Small (1994) estimates that 75 to 100 individuals may be present on the lower Colorado River, with the majority being located around the Imperial Dam and farther south.

No Yuma clapper rails were detected on the California side of the Colorado River. This is likely due to the high daily fluctuation of water level of the river and disturbance from boat traffic. Very few crushed crayfish (*Procambarus clarkii*) carapaces or other invertebrates that are preferred food items of the Yuma clapper rail were found in these areas. The upper reach (northwest most) area of Myoabi County Park appears to be suitable habitat, with fewer disturbances then the boat basin proper. This area may serve as breeding habitat in optimal years of reproduction and may represent an expansion of the local breeding area in those years.

The area of highest habitat quality identified is the Topock Marsh area and was consequently found to be occupied by Yuma clapper rails, with the two single advertising males located in the periphery of the marsh and the pair embedded deeper in the marsh.

CERTIFICATION

I certify that the information in this survey report and attached exhibits fully and accurately represent my work. The results of focused surveys for listed species are typically considered valid for one year by the USFWS and CDFG. If you have any questions or require additional information, please contact me at (760) 489-5276, the letterhead address, or jkonecny@cox.net.

Sincerely,

John K. Konecny
Wildlife Biologist
TE837308-5

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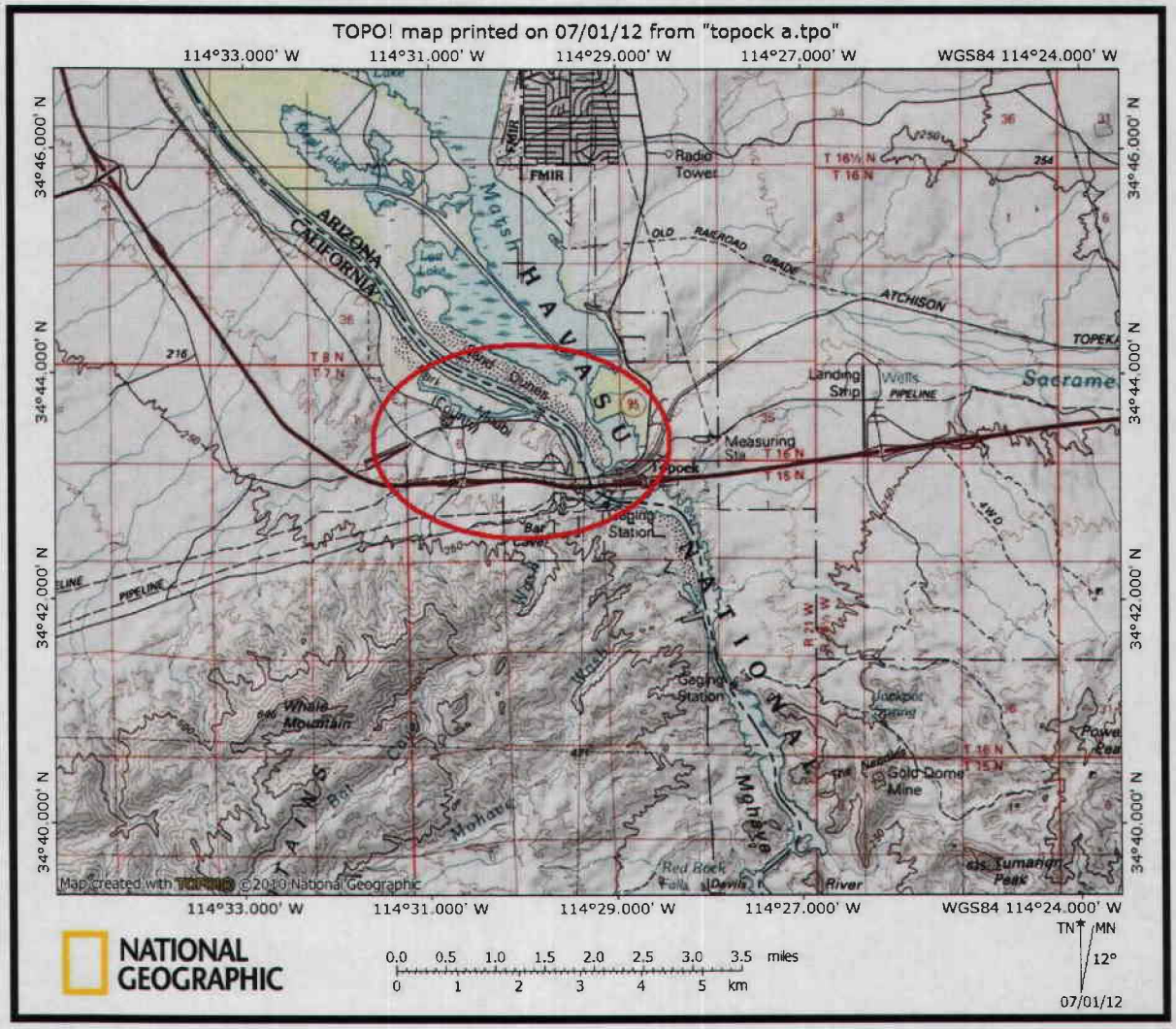


Figure 1. **Location of a Focused Survey (within red oval) for the Yuma Clapper Rail and California Black Rail at the Pacific Gas and Electric Topock Compressor Station Site (PGE-1925), City of Needles, County of San Bernardino, California, 2012.**

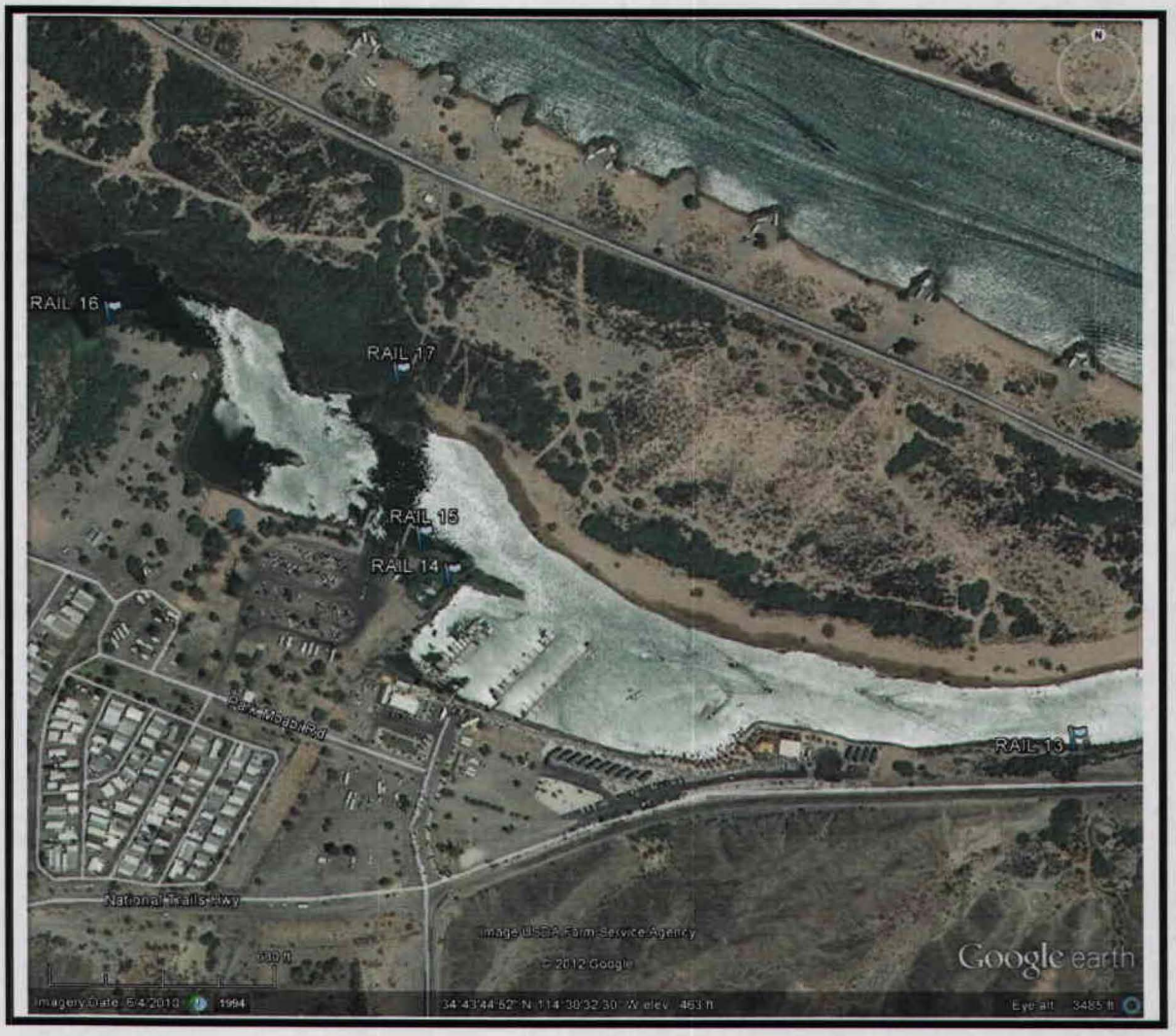


Figure 2A. **Location of North Survey Locations for the Focused Survey for the Yuma Clapper Rail and California Black Rail at the Pacific Gas and Electric Topock Compressor Station Site (PGE-1925), City of Needles, County of San Bernardino, California, 2012.**



Figure 2B. **Location of Central Survey Locations for the Focused Survey for the Yuma Clapper Rail and California Black Rail at the Pacific Gas and Electric Topock Compressor Station Site (PGE-1925), City of Needles, County of San Bernardino, California, 2012.**



Figure 2C. **Location of South Survey Locations for the Focused Survey for the Yuma Clapper Rail and California Black Rail at the Pacific Gas and Electric Topock Compressor Station Site (PGE-1925), City of Needles, County of San Bernardino, California, 2012.**



Figure 3. **Location of the Three Yuma Clapper Rail Territories Detected (South Topock Marsh Area) During the Focused Survey for the Yuma Clapper Rail and California Black Rail at the Pacific Gas and Electric Topock Compressor Station Site (PGE-1925), City of Needles, County of San Bernardino, California, 2012. (yellow "K" represents kekking male, yellow "P" represents duetting pair).**

National Marsh Bird Monitoring Program Survey Data Sheet

Pg 1 of 1

Date 14 March 2012; 15 March

Name of marsh or route : Topock Compressor Station

Observer(s) *(list all)**: John Konecny / Melanie Day

Survey replicate # : 1 of 6

	(14th) Before	After	15th Before	After
Temperature *(°F)*:	75	72	53	65
Wind speed *(mph)*:	1-5	3-5	1-3	3-5
Cloud cover *(%)*:	Ø	30	Ø	Ø
Precipitation *(see below)*:	Ø	Ø	Ø	Ø

**list all observers in order of their contribution to the data collected*

put an "S" in the appropriate column if the bird was seen, a "1" if the bird was heard, and "1S" if both heard and seen

Station#	Start Time (military)	Background noise	Species	Responded During: Before	Pass 0-1	Pass 1-2	Pass 2-3	Pass 3-4	Pass 4-5	BLRA 5-6	LEBI 6-7	VIRA 7-8	CLRA 8-9	After	Call Type(s)	Direction	Distance (meters)	Detected at a Previous Point	Comments
1	1621	2	Ø													○			
2	1656	2	Ø													○			
3	1710	1	Ø													○			
4	1721	1	Ø													○			
5	1733	1	Ø													○			
6	1745	2	Ø													○			
7	1800	2	Ø													○			
8	1819	1	Ø													○			
9	1846	1	Ø													○			
10	1901	1	Ø													○			
11	1914	1	Ø													○			
																○			
3/15/12																○			
13	0619	Ø	Ø													○			
12	0635	Ø	Ø													○			
14	0712	Ø	Ø													○			
15	0657	Ø	Ø													○			
16	0726	Ø	Ø													○			
17	0751	Ø	Ø													○			
18	0818	Ø	Ø													○			
* 19	0830	Ø	Ø													○			
20	0844	Ø	Ø													○			
21	0900	1	CLRA	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	1	Kek	Ⓝ	30	No	
22	0914	1	CLRA	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	1	1	Kek	Ⓝ	30	Yes	heard concurrent w/21
23	0928	3	Ø													○			
24	0949	2	Ø													○			

Call Types: BLRA: *kicky-doo, grr, churt* CLRA: *cltr, kburr, kek, khurrah* LEBI: *coo, kak, ert* VIRA: *grunt, ticket, kicker*

If the call type is not one of the above listed types, describe the call in the comments column

Precipitation: light rain, rain, heavy rain, light snow, snow, heavy snow, fog, none

Background noise: 0 *no noise* 1 *faint noise* 2 *moderate noise (probably can't hear some birds beyond 100m)*
3 *loud noise (probably can't hear some birds beyond 50m)* 4 *intense noise (probably can't hear some birds beyond 25m)*

* No point taken, but distance covered from Station 20

National Marsh Bird Monitoring Program Survey Data Sheet

Pg 1 of 1

Date 21 March 2012; 22 March
Name of marsh or route : Topock Compressor Station
Observer(s) *(list all)**: John Konecny / Melanie Day
Survey replicate # : 2 of 6

	(21st) Before	After	(22nd) Before	After
Temperature *(°F)*:	83	72	54	71
Wind speed *(mph)*:	3-5	3-5	3-5	3-5
Cloud cover *(%)*:	5	10	Ø	Ø
Precipitation *(see below)*:	Ø	Ø	Ø	Ø

**list all observers in order of their contribution to the data collected*
put an "S" in the appropriate column if the bird was seen, a "1" if the bird was heard, and "1S" if both heard and seen

Station#	Start Time (military)	Background noise	Species	Responded During: Before	Pass 0-1	Pass 1-2	Pass 2-3	Pass 3-4	Pass 4-5	BLRA 5-6	LEBI 6-7	VIRA 7-8	CLRA 8-9	After	Call Type(s)	Direction	Distance (meters)	Detected at a Previous Point	Comments
24	1702	1	Ø													○			
23	1715	1	Ø													○			
22	1730	1	CLRA	1	1	1	1	1	1	1	1	1	1	1	KeK	(N)	30	No	
21	1743	1	CLRA	Ø	Ø	1	1	1	1	1	1	1	Ø	Ø	KeK	(W)	10	Yes	
20	1754	1	CLRA	Ø	1	1	1	Ø	Ø	1	1	Ø	1	Ø	KeK	(W)	60	Yes	same as 21
* 19	1804	1	CLRA	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	CLR	(N)	90	Yes	taken from 20
18	1824	Ø	VIRA	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	1	1	KKR	(N)	25	No	
17	1838	Ø	Ø													○			
16	1852	Ø	Ø													○			
																○			
3/22																○			
15	0610	Ø	Ø													○			
14	0623	Ø	Ø													○			
13	0653	Ø	Ø													○			
12	0706	Ø	Ø													○			
11	0730	Ø	Ø													○			
10	0740	Ø	Ø													○			
9	0758	Ø	Ø													○			
8	0821	Ø	Ø													○			
7	0844	Ø	Ø													○			
6	0854	Ø	Ø													○			
5	0912	Ø	Ø													○			
4	0923	Ø	Ø													○			
3	0954	Ø	Ø													○			
2	1008	Ø	Ø													○			
1	1050	Ø	Ø													○			

Call Types: BLRA: *kicky-doo, grr, churt* CLRA: *cltr, kburr, kek, khurrah* LEBI: *coo, kak, ert* VIRA: *grunt, ticket, kicker*
If the call type is not one of the above listed types, describe the call in the comments column
Precipitation: light rain, rain, heavy rain, light snow, snow, heavy snow, fog, none
Background noise: 0 *no noise* 1 *faint noise* 2 *moderate noise (probably can't hear some birds beyond 100m)*
3 *loud noise (probably can't hear some birds beyond 50m)* 4 *intense noise (probably can't hear some birds beyond 25m)*

* taken from Station 20

NATIONAL MARSH BIRD SURVEY DATA SHEET PG 1 of 1

Date: 29 March 2012 ; 30 March
Name of marsh or route: Topock Compressor Station
Observer(s) (list all)*: John Koneen
Survey replicate #: 3 of 6

	Before	After
Temperature:	56	80
Wind Speed (mph):	3-5	7-10
Weather**:	2	2

*list all observers in order of their contributions to the data collected
**Weather conditions: 0 calm and clear 1 partly cloudy 2 cloudy 3 light rain 4 rain 5 sleet 6 snow
***put an "S" in the appropriate column if the bird was seen, a "1" if the bird was heard, and "1S" if both heard and seen
~Background noise: 0 no noise 1 calls can't be heard over 200m 2 call can't be heard over 100m

	Before 30th	After
	61	73
	4-7	4-7
	1	1

	Station#	Start Time (hh:mm)	Background~	Individual (ex: A,B,C)	Species	Responded During***: Pass 0-1	Pass 1-2	Pass 2-3	Pass 3-4	Pass 4-5	BLRA 5-6	LEBI 6-7	VIRA 7-8	CLRA 8-9	Call Type(s)	Distance (m)	AMCO (Y/N)	Repeat(Y/N)
	24	1625	1	Ø	Ø													
	23	1627	1	Ø	Ø													
	22	1652	1	A	CLRA	Ø	Ø	1	Ø	1	1	Ø	Ø	1	Kek	20	N	N
	21	1715	1	A	CLRA	Ø	Ø	Ø	1	1	1	1	1	1	Kek	20	N	N
	20	1726	1	Ø	Ø													
*	19	1736	1	A	CLRA	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	Clr	80	N	N
	18	1756	Ø	Ø	Ø													
	17	1810	Ø	Ø	Ø													
	16	1824	Ø	Ø	Ø													
	15	1829	Ø	Ø	Ø													
	3/30																	
	14	0554	Ø	Ø	Ø													
	13	0620	Ø	Ø	Ø													
	12	0634	Ø	Ø	Ø													
	11	0658	Ø	Ø	Ø													
	10	0710	Ø	Ø	Ø													
	9	0728	Ø	Ø	Ø													
	8	0751	Ø	Ø	Ø													
AMCO	7	0912	Ø	A	PBGR	1	Ø	Ø	Ø	1	1	Ø	Ø	1	Kow-Kow-Kowp	40	N	N
	6	0827	Ø	Ø	Ø													
	5	0840	Ø	Ø	Ø													
	4	0900	Ø	Ø	Ø													
AMCO	3	0921	Ø	Ø	Ø													
	2	0925	Ø	Ø	Ø													
	1	0947	Ø	Ø	Ø													

* Location 19 taken from Station 20

NATIONAL MARSH BIRD SURVEY DATA SHEET PG __ of __

Date: 19 April 2012; 20 April
Name of marsh or route: Topock Compressor Station
Observer(s) (list all)*: John Koneczny
Survey replicate #: 4 of 6

	Before (1944)	After
Temperature:	69	77
Wind Speed (mph):	1-3	3-5
Weather**:	1	1

Before (2045)	After
94	87
5-7	7-10
1	1

*list all observers in order of their contributions to the data collected

**Weather conditions: 0 calm and clear 1 partly cloudy 2 cloudy 3 light rain 4 rain 5 sleet 6 snow

***put an "S" in the appropriate column if the bird was seen, a "1" if the bird was heard, and "1S" if both heard and seen

~Background noise: 0 no noise 1 calls can't be heard over 200m 2 call can't be heard over 100m

Station#	Start Time (hh:mm)	Background~	Individual (ex: A,B,C)	Species	Responded During***: Pass 0-1	Pass 1-2	Pass 2-3	Pass 3-4	Pass 4-5	BLRA 5-6	LEBI 6-7	VIRA 7-8	CLRA 8-9	Call Type(s)	Distance (m)	AMCO (Y/N)	Repeat(Y/N)
1	0510	2	Ø	Ø													
2	0526	2	Ø	Ø													
AMCO 3	0550	1	Ø	Ø													
4	0602	1	Ø	Ø													
5	0614	1	Ø	Ø													
6	0626	2	Ø	Ø													
AMCO 7	0641	2	Ø	Ø													
8	0710	2	Ø	Ø													
9	0728	1	Ø	Ø													
10	0747	1	Ø	Ø													
11	0756	1	Ø	Ø													
12	0810	Ø	Ø	Ø													
13	0826	Ø	Ø	Ø													
4/20/12																	
14	1800	Ø	Ø	Ø													
15	1817	Ø	Ø	Ø													
16	1847	Ø	Ø	Ø													
17	1913	Ø	Ø	Ø													
18	1939	Ø	Ø	Ø													
* 19	1951	Ø	Ø	Ø													
20	2002	Ø	A	CLRA	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	Clk	60	N	N
21	2018	1	A	CLRA	1	1	Ø	Ø	1	1	Ø	Ø	1	Kek	20	N	N
22	2032	1	A	CLRA	1	1	1	1	Ø	Ø	Ø	Ø	1	Kek	20	N	N
23	2056	1	Ø	Ø													
24	2102	1	Ø	Ø													

* No call prompt at 19, taken from #20

NATIONAL MARSH BIRD SURVEY DATA SHEET PG 1 of 1

Date: 28 April 2012; 29 April
Name of marsh or route: Topah Compressor Site
Observer(s) (list all)*: John Konecny
Survey replicate #: 5 of 6

	Before (28th)	After
Temperature:	66	78
Wind Speed (mph):	6-8	10-15
Weather**:	1	1

Before (29th)	After
91	80
3-5	3-5
1	1

*list all observers in order of their contributions to the data collected
**Weather conditions: 0 calm and clear 1 partly cloudy 2 cloudy 3 light rain 4 rain 5 sleet 6 snow
***put an "S" in the appropriate column if the bird was seen, a "1" if the bird was heard, and "15" if both heard and seen
~Background noise: 0 no noise 1 calls can't be heard over 200m 2 call can't be heard over 100m

Station#	Start Time (hh:mm)	Background~	Individual (ex: A,B,C)	Species	Responded During***: Pass 0-1	Pass 1-2	Pass 2-3	Pass 3-4	Pass 4-5	BLRA 5-6	LEBI 6-7	VIRA 7-8	CLRA 8-9	Call Type(s)	Distance (m)	AMCO (Y/N)	Repeat(Y/N)
1	0500	1	Ø	Ø													
2	0523	1	Ø	Ø													
3	0537	1	Ø	Ø													
4	0549	1	Ø	Ø													
5	0602	1	Ø	Ø													
6	0615	1	Ø	Ø													
7	0630	1	A	PRGR	Ø	1	Ø	Ø	Ø	1	Ø	Ø	Ø	KOW-KOWP	50	N	N
8	0647	1	Ø	Ø													
9	0709	1	Ø	Ø													
10	0719	1	Ø	Ø													
11	0732	1	Ø	Ø													
12	0746	Ø	Ø	Ø													
13	0802	Ø	Ø	Ø													
14	0816	Ø	Ø	Ø													
4/29/12																	
15	1750	Ø	Ø	Ø													
16	1818	Ø	Ø	Ø													
17	1843	Ø	Ø	Ø													
18	1910	Ø	A	VIRA										KHR	40	N	N
* 19	1926	Ø	Ø	Ø													
20	1936	Ø	Ø	Ø													
21	1952	1	A	CLRA	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	1	KeK	35	N	N
22	2006	1	A	CLRA	Ø	Ø	Ø	Ø	1	1	Ø	1	1	KeK	20	N	N
23	2020	1	Ø	Ø													
24	2040	1	Ø	Ø													

* No call prompt at # 19, done from # 20

NATIONAL MARSH BIRD SURVEY DATA SHEET PG __ of __

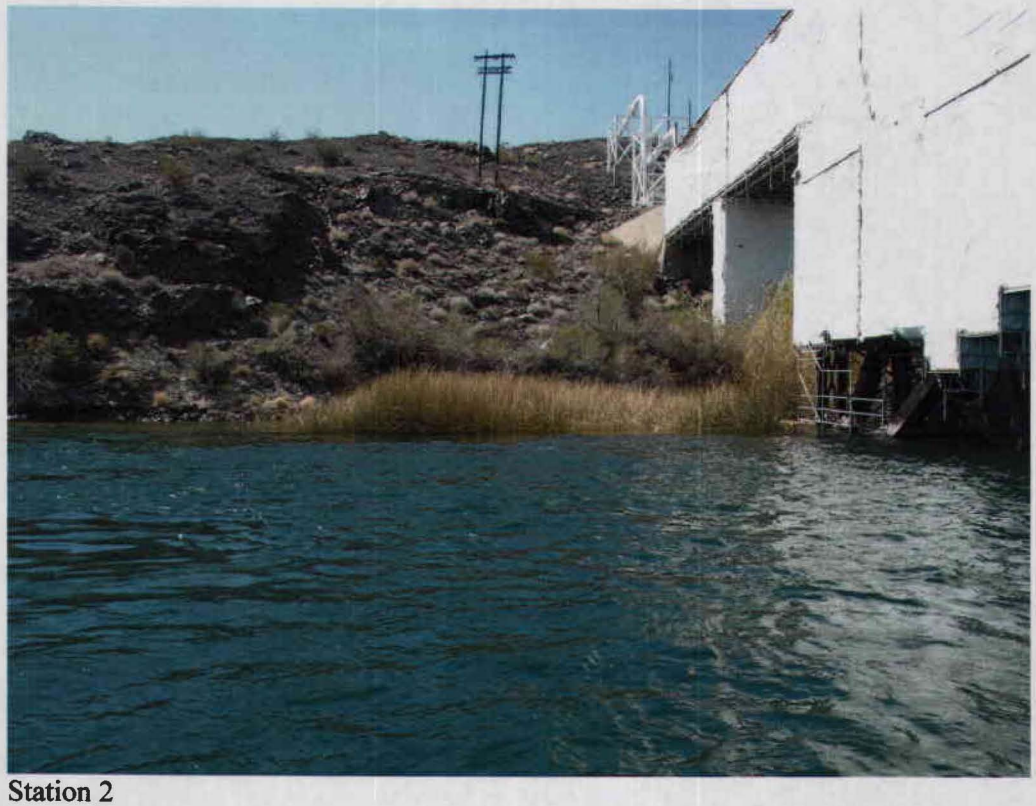
Date: 18 May 2012; 19 May
Name of marsh or route: Topock Compressor Station
Observer(s) (list all)*: John Keneny
Survey replicate #: 6 of

	Before (8th)	After
Temperature:	80	84
Wind Speed (mph):	7-10	10-15
Weather**:	1	1
	Before (19th)	After:
	96	87
	7-10	5-7
	1	1

*list all observers in order of their contributions to the data collected
**Weather conditions: 0 calm and clear 1 partly cloudy 2 cloudy 3 light rain 4 rain 5 sleet 6 snow
***put an "S" in the appropriate column if the bird was seen, a "1" if the bird was heard, and "1S" if both heard and seen
~Background noise: 0 no noise 1 calls can't be heard over 200m 2 call can't be heard over 100m

Station#	Start Time (hh:mm)	Background~	Individual (ex: A,B,C)	Species	Responded During***: Pass 0-1	Pass 1-2	Pass 2-3	Pass 3-4	Pass 4-5	BLRA 5-6	LEBI 6-7	VIRA 7-8	CLRA 8-9	Call Type(s)	Distance (m)	AMCO (Y/N)	Repeat(Y/N)
24	0500	1	Ø	Ø													
23	0513	1	Ø	Ø													
22	0529	1	A	CLRA	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	1	KeH	40	N	N
21	0543	1	A	CLRA	Ø	Ø	Ø	Ø	Ø	1	Ø	1	1	KeH	25	N	N
20	0556	1	Ø	Ø													
* 19	0607	1	A	CLRA	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	CHr	60	N	V
18	0627	Ø	Ø	Ø													
17	0641	Ø	Ø	Ø													
16	0655	Ø	Ø	Ø													
15	0710	Ø	Ø	Ø													
14	0734	Ø	Ø	Ø													
13	0805	Ø	Ø	Ø													
5/19																	
12	1810	Ø	Ø	Ø													
11	1824	Ø	Ø	Ø													
10	1846	Ø	Ø	Ø													
9	1858	Ø	Ø	Ø													
8	1940	Ø	Ø	Ø													
(AMCO) 7	1940	Ø	Ø	Ø													
6	1958	Ø	Ø	Ø													
5	2010	Ø	Ø	Ø													
4	2030	Ø	Ø	Ø													
(AMCO) 3	2049	Ø	Ø	Ø													
2	2107	Ø	Ø	Ø													
1	2115	Ø	Ø	Ø													

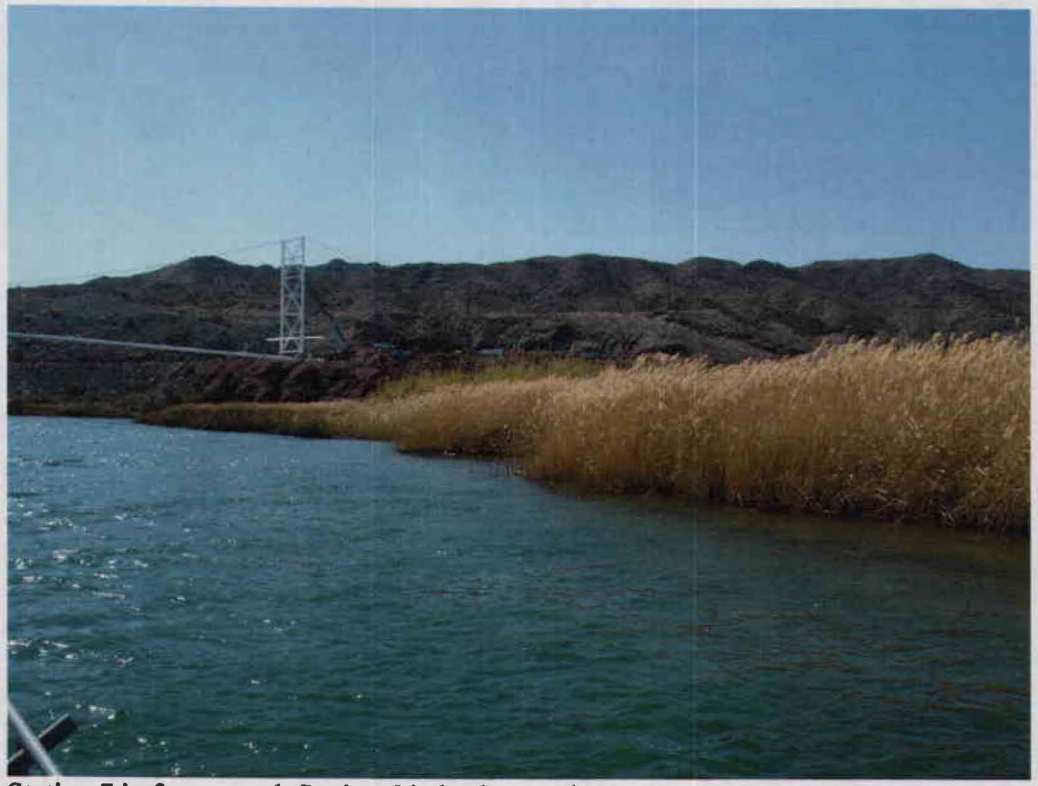
* 19 not call prompted from station, taken from #20



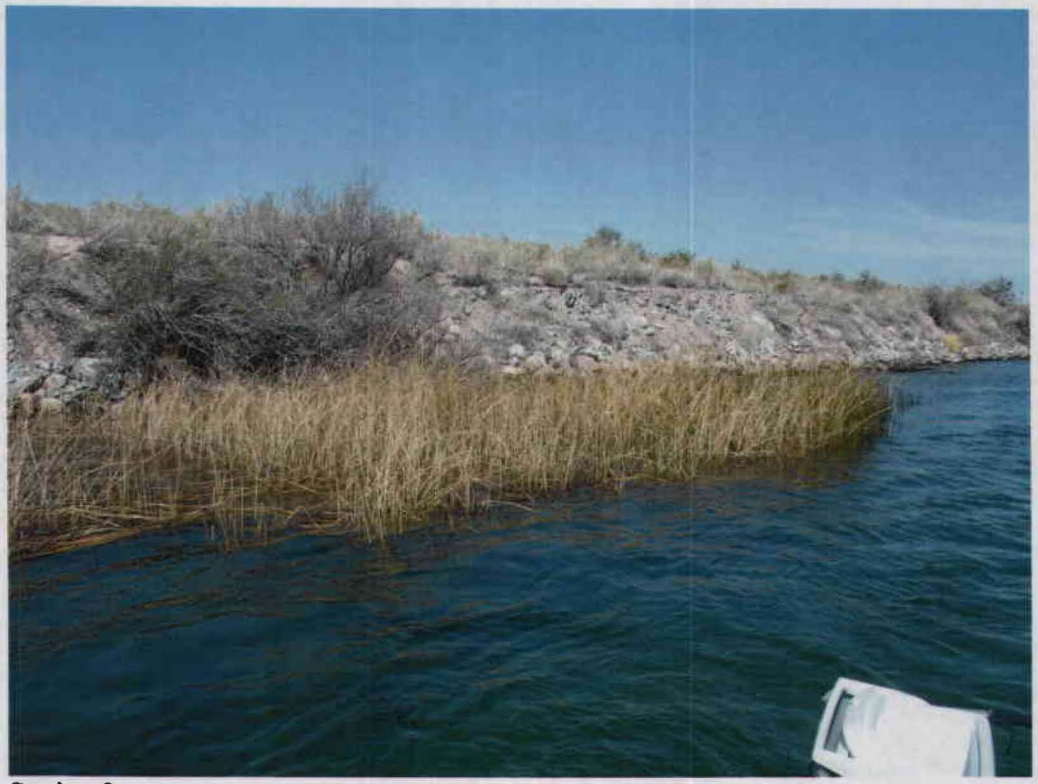
Station 2



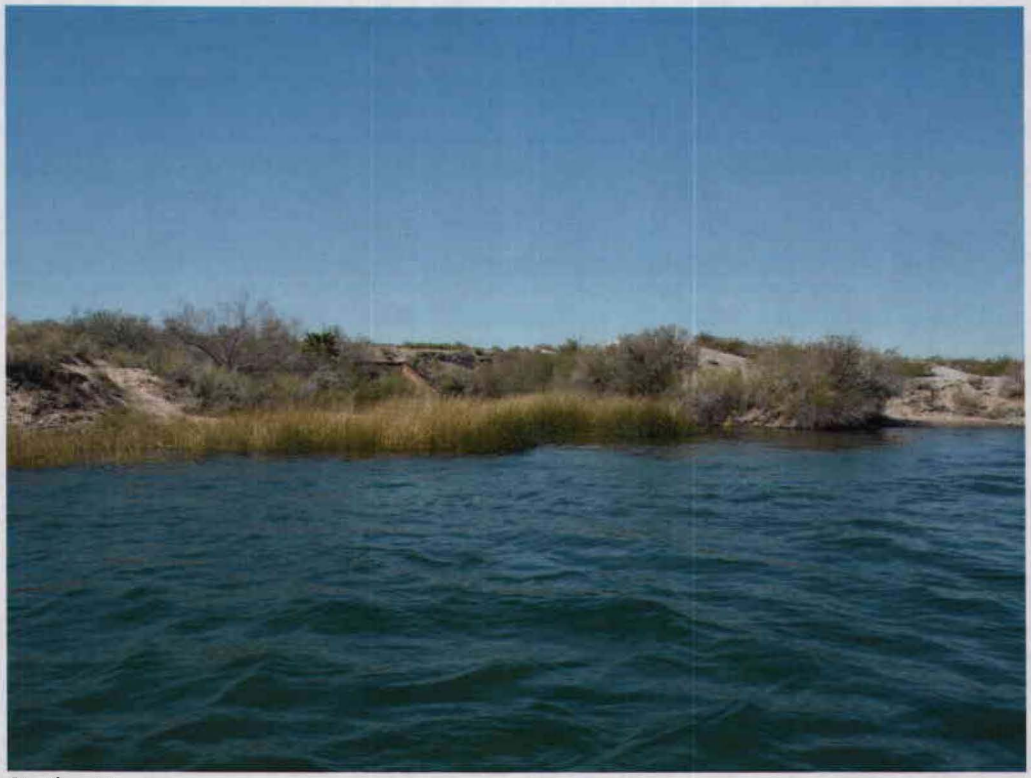
Station 4 in foreground, Station 3 in background.



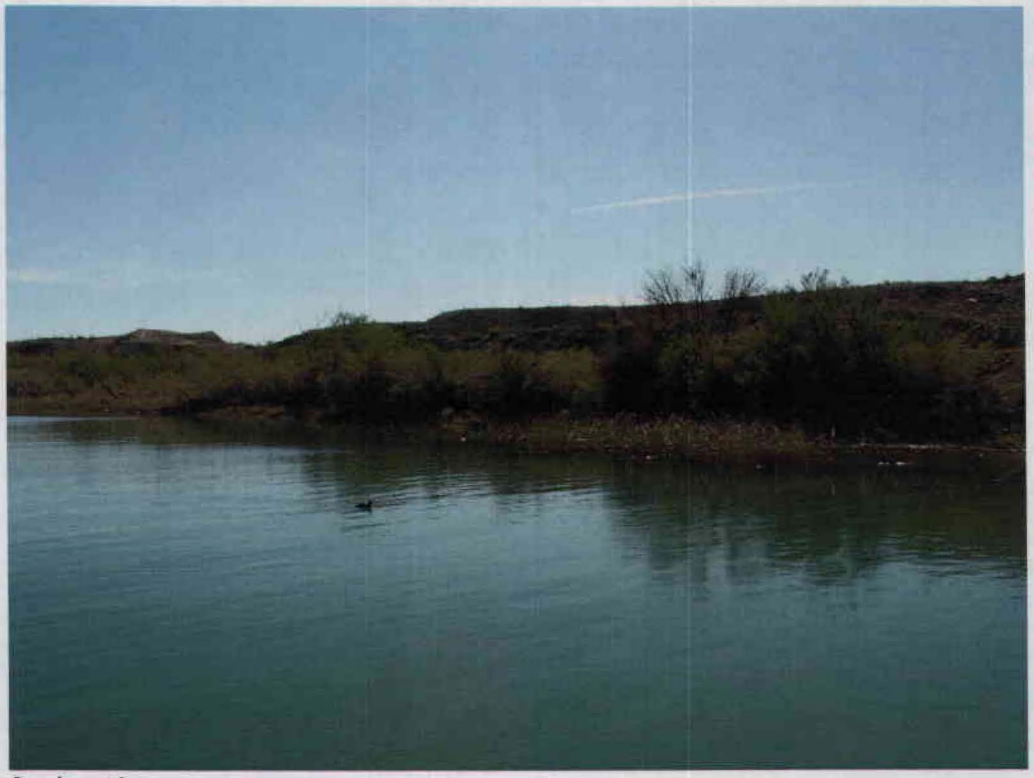
Station 7 in foreground, Station 6 in background.



Station 8.



Station11.



Station 12



Station 13.



Station 14.



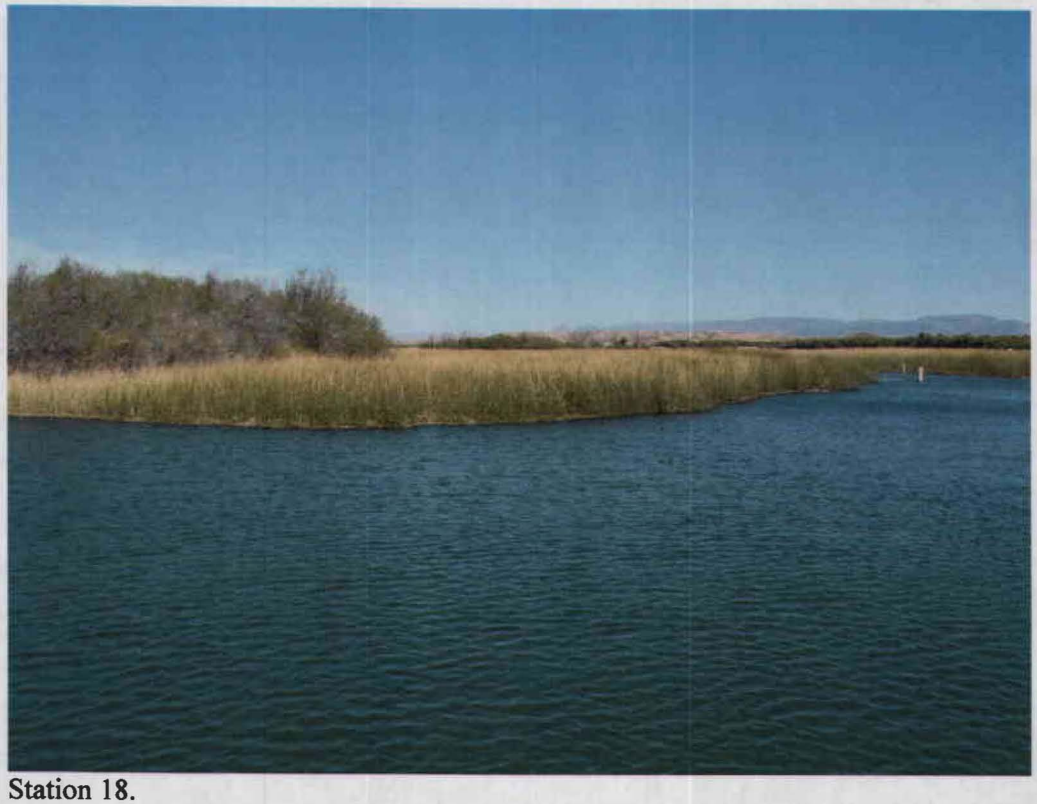
Station 15.



Station 16.



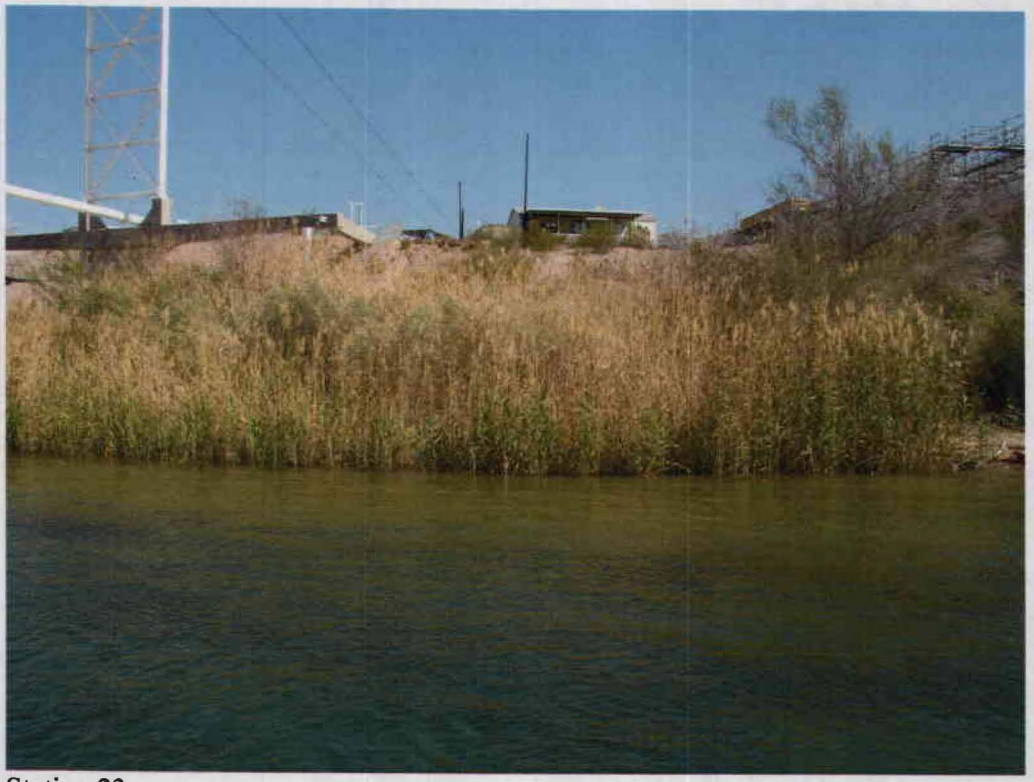
Station 17.



Station 18.



Station 19, with Station 20 in right background.



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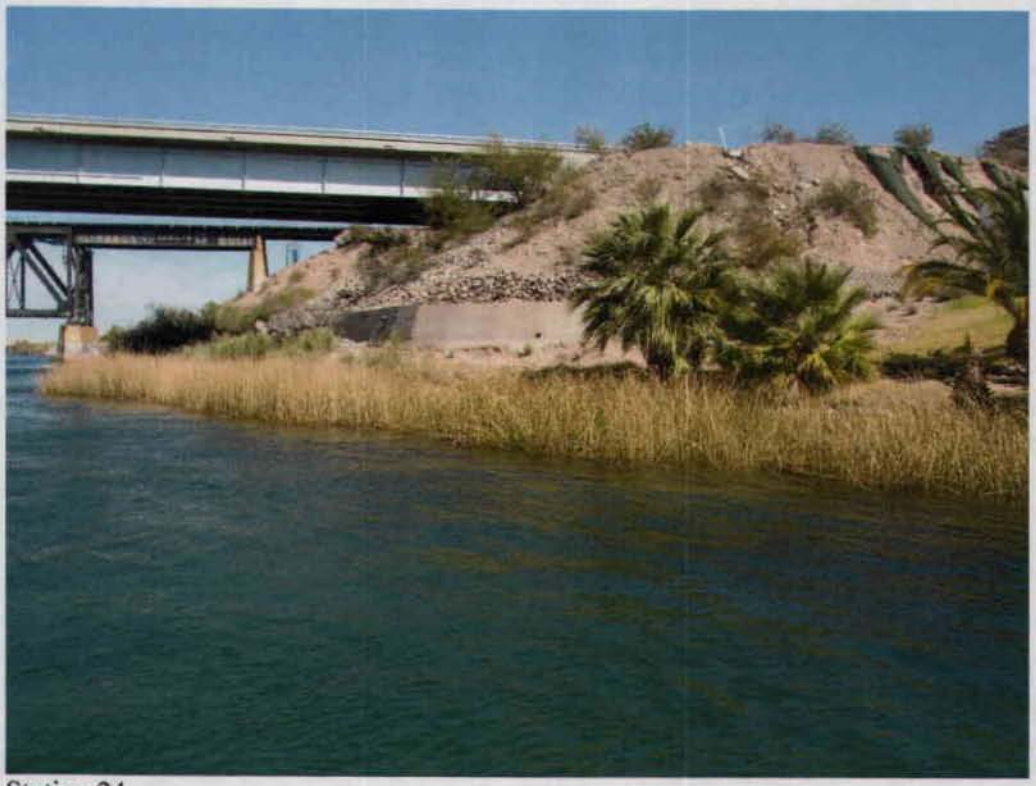

Station 24.

Record Id 12435
County Riverside
Year 2013
Spp YCR (+)
Srv. Rpt.
D.B. DW 6/27/13
GIS RN 7-24-13
R
File

17 June 2013
AMEC Project No. 8151001100

Ms. Susie Tharratt
Recovery Permit Coordinator
Fish and Wildlife Biologist
2177 Salk Avenue, Suite 250
Carlsbad, CA 92008

Re: Results of Protocol Surveys for Yuma Clapper Rail and California Black Rail at the Dos Palmas Core Marsh, Riverside County, California, 2013

Dear Ms. Tharratt:

This letter report presents the results of focused surveys for the Yuma Clapper Rail (*Rallus longirostris yumanensis*), and California Black Rail (*Laterallus jamaicensis coturniculus*), at the Dos Palmas Core Marsh area in Riverside County, California (Figure 1). The Yuma Clapper Rail is listed as an endangered species by the United States Fish and Wildlife Service (USFWS), and as a threatened species by the California Department of Fish and Game (CDFG). The California Black Rail is listed as a threatened species by CDFG.

These surveys were carried out as part of the Monitoring Plan for the Dos Palmas area as contracted by the San Diego County Water Authority (SDCWA) as part of its mitigation commitment for the Coachella Canal Lining Project (CCLP). Surveys for the Yuma Clapper Rail and California Black Rail were conducted following protocol developed in the Monitoring Plan (AMEC, 2009a) which was approved by the USFWS as part of the review team for the biological monitoring project conducted for the San Diego County Water Authority. (Carol Roberts pers. com.). The surveys were conducted under the authority of USFWS section 10(a) permits held by AMEC Environmental & Infrastructure, Inc. (AMEC) biologists John Green (TE054011-2) and Stephen Myers (TE804203-8).

1.0 INTRODUCTION

The Yuma Clapper Rail occurs along the lower Colorado River in freshwater marsh dominated by cattails (*Typha* sp.), bulrush (*Schoenoplectus* sp.), and common reed (*Phragmites australis*), from Needles, California, south to the Colorado River delta (Tomlinson and Todd 1973). Additional populations occur at the south end of the Salton Sea, and along the Salt and Gila Rivers (Eddleman 1989), and is known to occur at Dos Palmas (AMEC 2008). Yuma Clapper Rails forage primarily on crustaceans and minnows during the breeding season, and rely more on a diet of seeds and vegetation in the winter. Populations of Yuma Clapper Rails have undergone decline in the United States due to their limited distribution, and destruction and degradation of freshwater marsh habitat.

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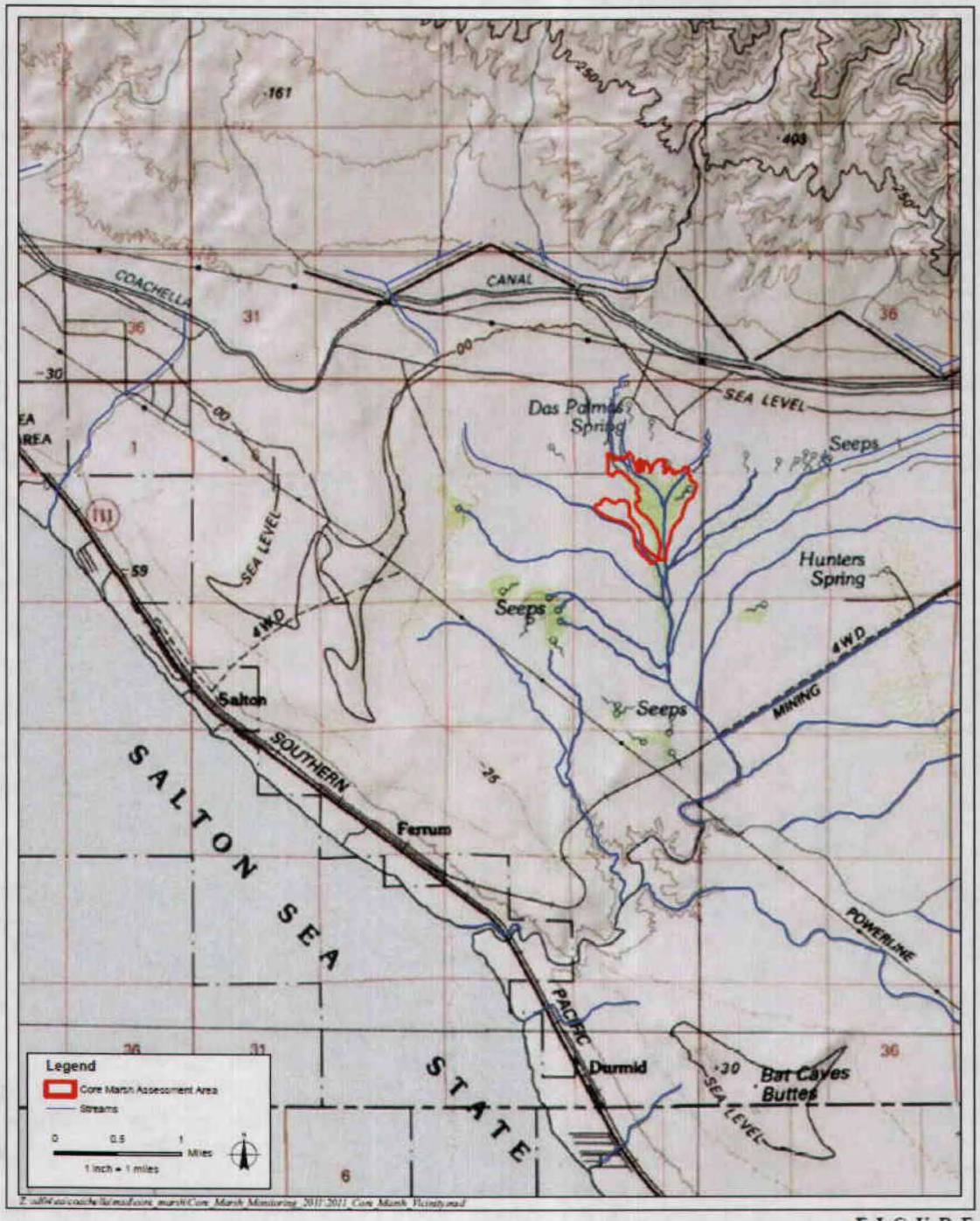
Ms. Susie Tharratt
Yuma Clapper Rail and California Black Rail Protocol Surveys
Dos Palmas Core Marsh
Riverside County, California
AMEC Job No. 8151001100.0003
17 June 2013

Figure 1. Location of Dos Palmas Core Marsh in Riverside County, CA.



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2011 Rail Survey Vicinity Map
Dos Palmas Core Marsh Monitoring
Coachella Canal Lining Project

FIGURE
1

The California Black Rail is a small, sparrow-sized secretive rail, blackish above with white speckling, a chestnut nape, grayish-black underparts, narrow white barring on the flanks, and a short black bill. The California Black Rail occurs in the lower Colorado River area from the Imperial Dam, south to the Mexican border, with smaller, isolated populations scattered from Marin and San Luis Obispo counties in coastal California, southward to San Diego County, northwestern Baja California, and the lower Imperial Valley (Eddleman *et al* 1994, Small 1994), and in the foothills of the Sierra Nevada (Richmond et al. 2010; Aigner et al. 1995). The species is known to occur at Dos Palmas (AMEC 2008). California Black Rails tend to favor mixed pickleweed (*Salicornia* sp.), cordgrass (*Spartina foliosa*), and bulrush marshes in coastal habitats; and bulrush, common reed, and cattail freshwater marshes in inland areas (Small 1994, Conway and Sulzman 2007, Del Pizzo, pers. comm.). California Black Rails typically forage on aquatic and terrestrial invertebrates and seeds. Like the Yuma Clapper Rail, the California Black Rail has undergone decline due to habitat degradation and destruction.

2.0 PROJECT LOCATION

The Dos Palmas Core Marsh is located within the Dos Palma Area of Critical Environmental concern (ACEC) to the east of Highway 111 near the north end of the Salton Sea (Figure 1). It is known to be habitat for the Yuma Clapper Rail and California Black Rail, as surveys for these species were conducted in 2006, 2007, 2009, and 2011 (AMEC 2012). This survey was conducted at essentially the same sampling stations that were used in the previous studies, although three additional stations (stations 27, 28, and 29) were added in the 17-acre Created Marsh, as this area has now developed into marsh habitat potentially suited to these two rail species during the past two years.

3.0 PROJECT SITE DESCRIPTION

The Dos Palmas Core Marsh is located in the Dos Palmas ACEC. It is a marsh of approximately 150 acres. The Created Marsh is adjacent to the northwest edge of the Core Marsh. Vegetation in the Core Marsh includes emergent bulrush, cattails, and common reed (*Phragmites australis*) which are present in varying densities throughout the marsh. In addition, there are stands of salt cedar or tamarisk (*Tamarix* sp.) and saltgrass (*Distichlis spicata*) along the margins of the marsh. Upland vegetation adjacent to the marsh is characterized by tamarisk, arrowweed (*Pluchea sericea*), and quailbush (*Atriplex lentiformis*), with an occasional honey mesquite (*Prosopis glandulosa*), and patches of saltgrass (*Distichlis spicata*) and salt crusts. The topography of the entire area is relatively flat; with water flowing through the marsh from seeps and springs to the north, and concentrating into Salt Creek at the outflow of the marsh to the south. Vegetation in the Created Marsh is principally cattail, bulrush, saltgrass, and Cooper's rush (*Juncus cooperi*), with arrowweed and mesquite on the adjacent berms. The elevation of the survey area ranges from approximately -105 feet (- 32 meters) to -134 feet (-41 meters) below Mean Sea Level.

4.0 METHODS

Three focused surveys for the Yuma Clapper Rail and California Black Rail were conducted according to the protocol detailed in the Monitoring Plan developed for the SDCWA (AMEC, 2009), which was approved by the USFWS as part of the review team. (Carol Roberts pers. com.). Protocols follow guidance in Conway (2008). Dusk surveys were conducted on March 21 and 28, 2013, initiating at 1500 and continuing until 1919 on March 28. Dawn surveys for the two species were conducted on April 23 and 25, and May 21 and 23, 2013. The dawn surveys were initiated roughly 30 minutes prior to sunrise, at approximately 0600, and continued until no later than 0934. Weather conditions and other details of the surveys are presented in Table 1.

The surveys were conducted by two surveyors working simultaneously (a single surveyor worked the second day of each monthly survey). A total of 24 survey stations were used, which are approximately 490 - 650 feet (150-200 meters) apart along the north, west, and east margins of the marsh, along the west arm of Salt Creek, and in the Created Marsh (Figure 2). All surveyors followed an identical protocol. Surveys were conducted for California Black Rail first. Passive listening was conducted for two minutes initially, followed by 30 seconds of broadcast "grr" calls and 30 seconds of silence, then an additional 30 seconds of "grr" and 30 seconds of silence. Then 30 seconds of "kik-kic-kerr" call was broadcast, followed by 30 seconds of silence, and an additional 30 seconds of "kik-kic-kerr" call followed by 30 seconds of silence. The survey for Yuma Clapper Rail used a similar sequence. Two minutes of passive listening was followed by 1 one-minute call broadcast, one minute of silence, another minute of broadcast, and five minutes of silence. Weather conditions during the three surveys are summarized in Table 1.

Table 1.
Environmental conditions during three Yuma Clapper Rail and California Black Rail surveys of the Core Marsh of the Dos Palmas ACEC in Riverside County, California, 2013.

Survey #	Date	Surveyor*	Time	Weather Conditions (OC = overcast)
1	03/21 and 28/13	SM, JG	1540-1805	82-90° F, wind 5-7 mph, partly cloudy
2	04/23 and 25/13	SM, JG	0642-0934	57-81° F, wind 0-3 mph, few clouds
3	05/21 and 23/13	SM, JG	0545-0831	57-80° F, wind 0-3 mph, 0 % OC

* JG-John Green; SM – Steve Myers

Ms. Susie Tharratt
Yuma Clapper Rail and California Black Rail Protocol Surveys
Dos Palmas Core Marsh
Riverside County, California
AMEC Job No. 8151001100.0003
17 June 2013

Figure 2. Location of the survey stations in the Dos Palmas Core Marsh.



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2013 Rail Survey Locations
Dos Palmas Area of Critical Environmental Concern
Coachella Canal Lining Project

FIGURE
2

RESULTS

Both Yuma Clapper Rails (a total of 27 detections) and California Black Rail (one detection) were found in the Core and Created Marsh during these surveys. The survey results are shown in Table 2.

Table 2.
Rail Census Data in the Dos Palmas Core Marsh in 2013.

Location	21-28 Mar-11		23-25 Apr-11		21-23 May-11	
	YCR	CBR	YCR	CBR	YCR	CBR
4	2				2	
5	1				1	
6	2				1	
7						
8			1			
9	1					
10					2	
11	1				1	
12			1			
13						
16	1					
17	1		1	1		
18	1				1	
19						
20	1		1			
21			1			
22						
23			1			
24						
25						
26						
27	1		1			
28	1				1	
29	1					
TOTAL	**14**	**0**	**7**	**1**	**9**	**0**
Location	21-28 Mar-11		23-25 Apr-11		21-23 May-11	

Ms. Susie Tharratt
Yuma Clapper Rail and California Black Rail Protocol Surveys
Dos Palmas Core Marsh
Riverside County, California
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5.0 DISCUSSION

Rail surveys were conducted in the past in the Core Marsh in 2006, 2007, 2009, and 2011. Table 3 below summarizes these results, and indicates the survey stations where the rails were detected. The location of the survey stations has remained essentially the same for all years, with some points added in 2011 and 2013. Created marsh points were surveyed only in 2013.

Table 3.
Rail Census Data Dos Palmas Core Marsh in 2006, 2007, 2009, and 2011.

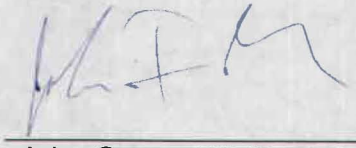
Station	YCR 2006	YCR 2007	YCR 2009	YCR 2011		CBR 2006	CBR 2007	CBR 2009	CBR 2011
1	---	A, M	---	---		---	---	---	---
2	---	A, M	---	---		---	---	---	---
3	---	M	M	---		---	---	---	---
4	---	M	A,M	---		---	---	---	---
5	---	A, M	---	Ma		---	A	---	---
6	A	---	---	---		---	---	---	---
7	A	---	M	Ma, M		---	---	---	---
8	A	---	M	---		---	---	---	---
9	---	A, M	M	---		---	---	---	---
10	A	A	---	---		---	---	---	---
11	J	M	Ma, A	---		---	---	Ma	---
12	---	---	---	---		---	---	---	---
13	A	---	---	---		---	---	---	---
14	---	A	---	---		---	---	---	---
15	---	A, M	---	---		---	---	---	---
16	---	---	Ma	A		---	---	---	---
17	M	---	Ma	---		---	---	---	---
18	---	---	---	M		---	---	---	---
19	M	M	---	A, M		---	---	---	---
20	---	---	---	A, M		---	---	---	---
21	---	A	---	---		---	---	---	---
25	---	---	---	A		---	---	---	---
26	---	---	---	A, M		---	---	---	---
TOTAL	8	17	12	14		0	1	1	0

Notes:
Ma = March; A = April; M = May

It can be seen that there were more Yuma Clapper Rail detections in 2013 than in any year of previous surveys. California Black Rail was also detected once during the 2013 surveys. Seventeen sampling stations detected rails in 2013. During 2013, the best rail habitat (based on detections during more than one survey period) appears to be associated with stations 4-6, 11, 16-18, 20, and 27-28 (created marsh). Figure 2 shows these stations to be in the northern and western portions of the marsh (single exception of station 11, on the eastern margin), as well as in the new habitat of the created marsh. The west arm of Salt Creek (stations 24-26) had no rail detections this year.

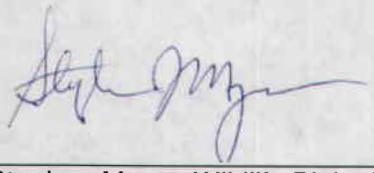
6.0 CERTIFICATION

We certify that the information in this survey report and attached exhibits fully and accurately represent our work.



John Green, Wildlife Biologist
TE054011-2

17 June 2013
Date



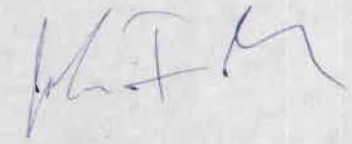
Stephen Myers, Wildlife Biologist
TE804203-8

17 June 2013
Date

If you have any questions or concerns regarding this survey report, please contact John Green at 951-369-8060 or by email john.green@amec.com.

Respectfully submitted,

AMEC Environment & Infrastructure, Inc.



John Green
Wildlife Biologist

W:\2013\Projects\8-151-001100 SDCWA\L0613-029\L0613-029 Final 2013 Rail Surveys.doc

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Record Id 12417
County Riverside
Year 2013
Spp YCR (+)
Srv. Rpt. OK
D.D. 8/1/13
GIS
L-R

17 June 2013
AMEC Project No. 8151001100

Ms. Susie Tharratt
Recovery Permit Coordinator
Fish and Wildlife Biologist
2177 Salk Avenue, Suite 250
Carlsbad, CA 92008

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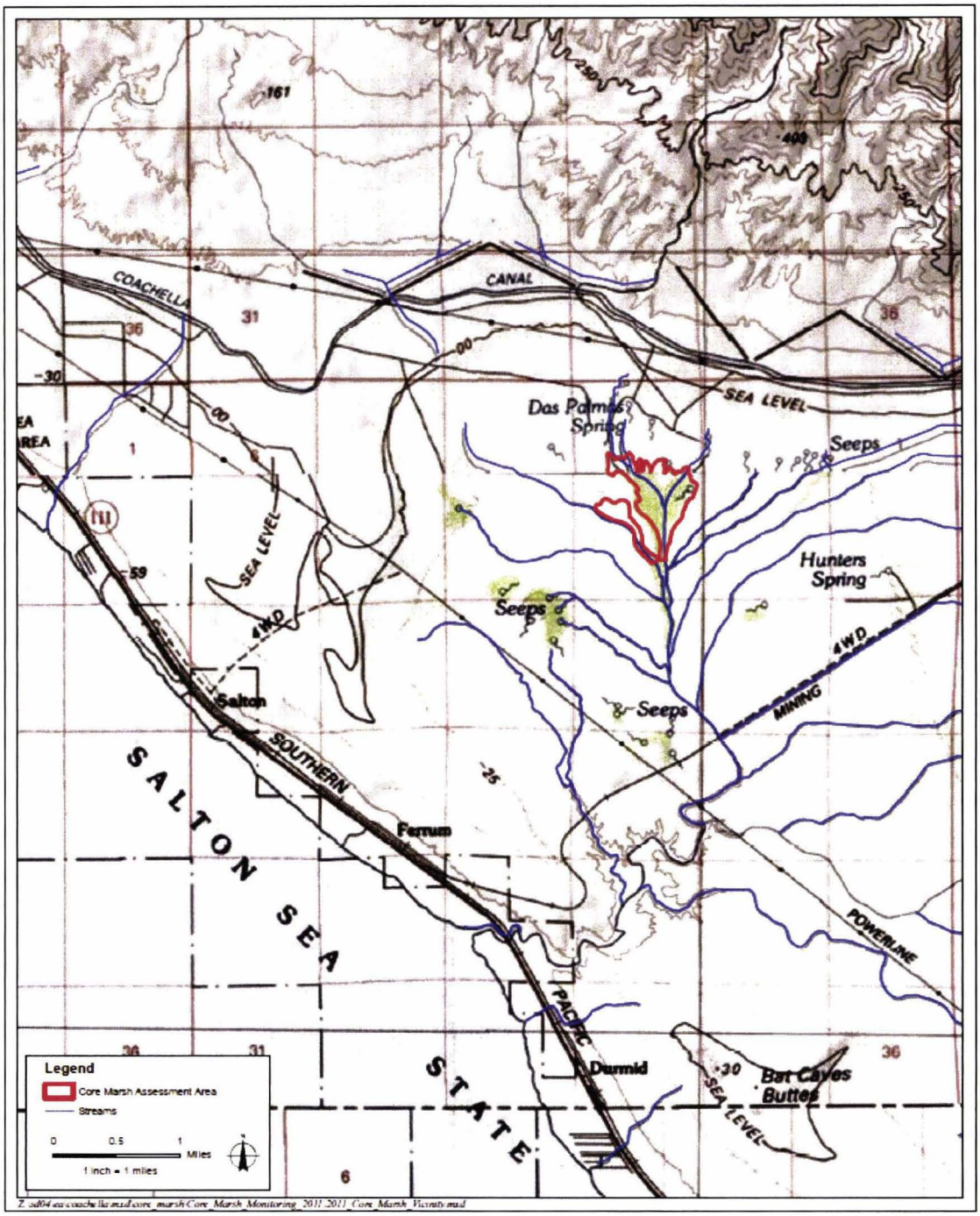
2013 JUL -8 AM 11: 48

Ms. Susie Tharratt
Yuma Clapper Rail and California Black Rail Protocol Surveys
Dos Palmas Core Marsh
Riverside County, California
AMEC Job No. 8151001100.0003
17 June 2013

Figure 1. Location of Dos Palmas Core Marsh in Riverside County, CA.



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2011 Rail Survey Vicinity Map
Dos Palmas Core Marsh Monitoring
Coachella Canal Lining Project

FIGURE 1

The California Black Rail is a small, sparrow-sized secretive rail, blackish above with white speckling, a chestnut nape, grayish-black underparts, narrow white barring on the flanks, and a short black bill. The California Black Rail occurs in the lower Colorado River area from the Imperial Dam, south to the Mexican border, with smaller, isolated populations scattered from Marin and San Luis Obispo counties in coastal California, southward to San Diego County, northwestern Baja California, and the lower Imperial Valley (Eddleman *et al* 1994, Small 1994), and in the foothills of the Sierra Nevada (Richmond et al. 2010; Aigner et al. 1995). The species is known to occur at Dos Palmas (AMEC 2008). California Black Rails tend to favor mixed pickleweed (*Salicornia* sp.), cordgrass (*Spartina foliosa*), and bulrush marshes in coastal habitats; and bulrush, common reed, and cattail freshwater marshes in inland areas (Small 1994, Conway and Sulzman 2007, Del Pizzo, pers. comm.). California Black Rails typically forage on aquatic and terrestrial invertebrates and seeds. Like the Yuma Clapper Rail, the California Black Rail has undergone decline due to habitat degradation and destruction.

2.0 PROJECT LOCATION

The Dos Palmas Core Marsh is located within the Dos Palma Area of Critical Environmental concern (ACEC) to the east of Highway 111 near the north end of the Salton Sea (Figure 1). It is known to be habitat for the Yuma Clapper Rail and California Black Rail, as surveys for these species were conducted in 2006, 2007, 2009, and 2011 (AMEC 2012). This survey was conducted at essentially the same sampling stations that were used in the previous studies, although three additional stations (stations 27, 28, and 29) were added in the 17-acre Created Marsh, as this area has now developed into marsh habitat potentially suited to these two rail species during the past two years.

3.0 PROJECT SITE DESCRIPTION

The Dos Palmas Core Marsh is located in the Dos Palmas ACEC. It is a marsh of approximately 150 acres. The Created Marsh is adjacent to the northwest edge of the Core Marsh. Vegetation in the Core Marsh includes emergent bulrush, cattails, and common reed (*Phragmites australis*) which are present in varying densities throughout the marsh. In addition, there are stands of salt cedar or tamarisk (*Tamarix* sp.) and saltgrass (*Distichlis spicata*) along the margins of the marsh. Upland vegetation adjacent to the marsh is characterized by tamarisk, arrowweed (*Pluchea sericea*), and quailbush (*Atriplex lentiformis*), with an occasional honey mesquite (*Prosopis glandulosa*), and patches of saltgrass (*Distichlis spicata*) and salt crusts. The topography of the entire area is relatively flat; with water flowing through the marsh from seeps and springs to the north, and concentrating into Salt Creek at the outflow of the marsh to the south. Vegetation in the Created Marsh is principally cattail, bulrush, saltgrass, and Cooper's rush (*Juncus cooperi*), with arrowweed and mesquite on the adjacent berms. The elevation of the survey area ranges from approximately -105 feet (- 32 meters) to -134 feet (-41 meters) below Mean Sea Level.

4.0 METHODS

Three focused surveys for the Yuma Clapper Rail and California Black Rail were conducted according to the protocol detailed in the Monitoring Plan developed for the SDCWA (AMEC, 2009), which was approved by the USFWS as part of the review team. (Carol Roberts pers. com.). Protocols follow guidance in Conway (2008). Dusk surveys were conducted on March 21 and 28, 2013, initiating at 1500 and continuing until 1919 on March 28. Dawn surveys for the two species were conducted on April 23 and 25, and May 21 and 23, 2013. The dawn surveys were initiated roughly 30 minutes prior to sunrise, at approximately 0600, and continued until no later than 0934. Weather conditions and other details of the surveys are presented in Table 1.

The surveys were conducted by two surveyors working simultaneously (a single surveyor worked the second day of each monthly survey). A total of 24 survey stations were used, which are approximately 490 - 650 feet (150-200 meters) apart along the north, west, and east margins of the marsh, along the west arm of Salt Creek, and in the Created Marsh (Figure 2). All surveyors followed an identical protocol. Surveys were conducted for California Black Rail first. Passive listening was conducted for two minutes initially, followed by 30 seconds of broadcast "grr" calls and 30 seconds of silence, then an additional 30 seconds of "grr" and 30 seconds of silence. Then 30 seconds of "kik-kic-kerr" call was broadcast, followed by 30 seconds of silence, and an additional 30 seconds of "kik-kic-kerr" call followed by 30 seconds of silence. The survey for Yuma Clapper Rail used a similar sequence. Two minutes of passive listening was followed by 1 one-minute call broadcast, one minute of silence, another minute of broadcast, and five minutes of silence. Weather conditions during the three surveys are summarized in Table 1.

Table 1.
Environmental conditions during three Yuma Clapper Rail and California Black Rail surveys of the Core Marsh of the Dos Palmas ACEC in Riverside County, California, 2013.

Survey #	Date	Surveyor*	Time	Weather Conditions (OC = overcast)
1	03/21 and 28/13	SM, JG	1540-1805	82-90° F, wind 5-7 mph, partly cloudy
2	04/23 and 25/13	SM, JG	0642-0934	57-81° F, wind 0-3 mph, few clouds
3	05/21 and 23/13	SM, JG	0545-0831	57-80° F, wind 0-3 mph, 0 % OC

* JG-John Green; SM – Steve Myers

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Yuma Clapper Rail and California Black Rail Protocol Surveys
Dos Palmas Core Marsh
Riverside County, California
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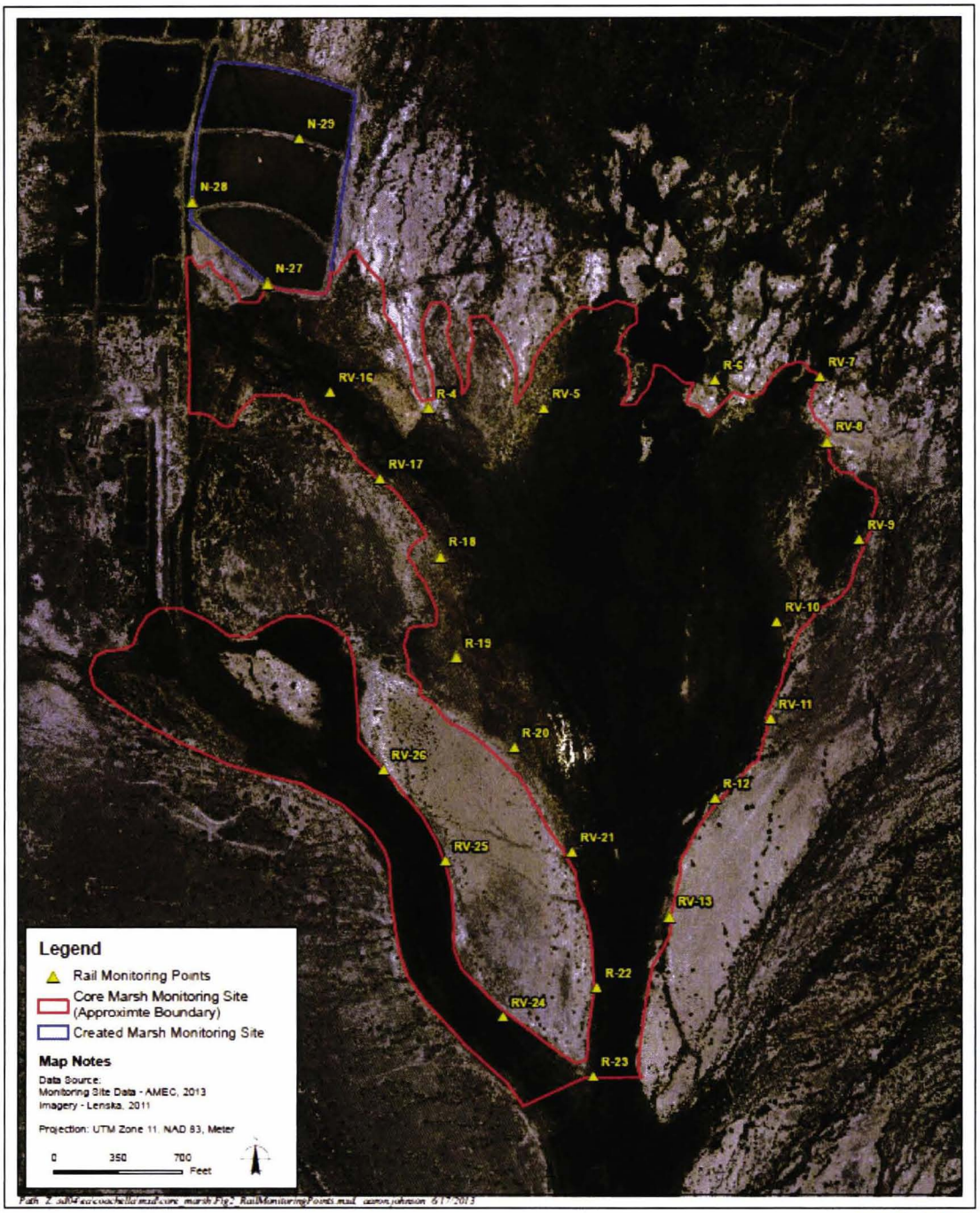
Figure 2. Location of the survey stations in the Dos Palmas Core Marsh.



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2013 Rail Survey Locations
Dos Palmas Area of Critical Environmental Concern
Coachella Canal Lining Project

FIGURE
2

RESULTS

Both Yuma Clapper Rails (a total of 27 detections) and California Black Rail (one detection) were found in the Core and Created Marsh during these surveys. The survey results are shown in Table 2.

Table 2.
Rail Census Data in the Dos Palmas Core Marsh in 2013.

Location	21-28 Mar-13		23-25 Apr-13		21-23 May-13	
	YCR	CBR	YCR	CBR	YCR	CBR
4	2				2	
5	1				1	
6	2				1	
7						
8			1			
9	1					
10					2	
11	1				1	
12			1			
13						
16	1					
17	1		1	1		
18	1				1	
19						
20	1		1			
21			1			
22						
23			1			
24						
25						
26						
27	1		1			
28	1				1	
29	1					
TOTAL	**14**	**0**	**7**	**1**	**9**	**0**

5.0 DISCUSSION

Rail surveys were conducted in the past in the Core Marsh in 2006, 2007, 2009, and 2011. Table 3 below summarizes these results, and indicates the survey stations where the rails were detected. The location of the survey stations has remained essentially the same for all years, with some points added in 2011 and 2013. Created marsh points were surveyed only in 2013.

Table 3.
Rail Census Data Dos Palmas Core Marsh in 2006, 2007, 2009, and 2011.

Station	YCR 2006	YCR 2007	YCR 2009	YCR 2011		CBR 2006	CBR 2007	CBR 2009	CBR 2011
1	---	A, M	---	---		---	---	---	---
2	---	A, M	---	---		---	---	---	---
3	---	M	M	---		---	---	---	---
4	---	M	A,M	---		---	---	---	---
5	---	A, M	---	Ma		---	A	---	---
6	A	---	---	---		---	---	---	---
7	A	---	M	Ma, M		---	---	---	---
8	A	---	M	---		---	---	---	---
9	---	A, M	M	---		---	---	---	---
10	A	A	---	---		---	---	---	---
11	J	M	Ma, A	---		---	---	Ma	---
12	---	---	---	---		---	---	---	---
13	A	---	---	---		---	---	---	---
14	---	A	---	---		---	---	---	---
15	---	A, M	---	---		---	---	---	---
16	---	---	Ma	A		---	---	---	---
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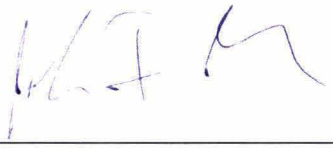
19	M	M	---	A, M		---	---	---	---
20	---	---	---	A, M		---	---	---	---
21	---	A	---	---		---	---	---	---
25	---	---	---	A		---	---	---	---
26	---	---	---	A, M		---	---	---	---
TOTAL	8	17	12	14		0	1	1	0

Notes:
Ma = March; A = April; M = May

It can be seen that there were more Yuma Clapper Rail detections in 2013 than in any year of previous surveys. California Black Rail was also detected once during the 2013 surveys. Seventeen sampling stations detected rails in 2013. During 2013, the best rail habitat (based on detections during more than one survey period) appears to be associated with stations 4-6, 11, 16-18, 20, and 27-28 (created marsh). Figure 2 shows these stations to be in the northern and western portions of the marsh (single exception of station 11, on the eastern margin), as well as in the new habitat of the created marsh. The west arm of Salt Creek (stations 24-26) had no rail detections this year.

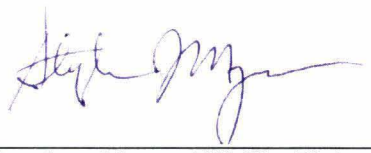
6.0 CERTIFICATION

We certify that the information in this survey report and attached exhibits fully and accurately represent our work.



John Green, Wildlife Biologist
TE054011-2

17 June 2013
Date



Stephen Myers, Wildlife Biologist
TE804203-8

17 June 2013
Date

If you have any questions or concerns regarding this survey report, please contact John Green at 951-369-8060 or by email john.green@amec.com.

Respectfully submitted,

AMEC Environment & Infrastructure, Inc.



John Green
Wildlife Biologist

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Record Id 12644
County Riverside
Year 2013
Spp YCR (+)
Srv. Rpt. 2/6/14
D.B. DV
GIS RN 2-21-14
L+R
File

17 June 2013
AMEC Project No. 8151001100

Ms. Erin McCarthy
Recovery Permit Coordinator
United States Fish and Wildlife Service
Ecological Services, Carlsbad Field Office
6010 Hidden Valley Road, Suite 101
Carlsbad, California 92011

Re: Results of Protocol Surveys for Yuma Clapper Rail and California Black Rail at the Dos Palmas Core Marsh, Riverside County, California, 2013.

Dear Ms. McCarthy:

This letter report presents the results of focused surveys for the Yuma Clapper Rail (*Rallus longirostris yumanensis*), and California Black Rail (*Laterallus jamaicensis coturniculus*), at the Dos Palmas Core Marsh area in Riverside County, California (Figure 1). The Yuma Clapper Rail is listed as an endangered species by the United States Fish and Wildlife Service (USFWS), and as a threatened species by the California Department of Fish and Game (CDFG). The California Black Rail is listed as a threatened species by CDFG.

These surveys were carried out as part of the Monitoring Plan for the Dos Palmas area as contracted by the San Diego County Water Authority (SDCWA) as part of its mitigation commitment for the Coachella Canal Lining Project (CCLP). Surveys for the Yuma Clapper Rail and California Black Rail were conducted following protocol developed in the Monitoring Plan (AMEC, 2009a) which was approved by the USFWS as part of the review team for the biological monitoring project conducted for the San Diego County Water Authority. (Carol Roberts pers. com.). The surveys were conducted under the authority of USFWS section 10(a) permits held by AMEC Environmental & Infrastructure, Inc. (AMEC) biologists John Green (TE054011-2) and Stephen Myers (TE804203-8).

1.0 INTRODUCTION

The Yuma Clapper Rail occurs along the lower Colorado River in freshwater marsh dominated by cattails (*Typha* sp.), bulrush (*Schoenoplectus* sp.), and common reed (*Phragmites australis*), from Needles, California, south to the Colorado River delta (Tomlinson and Todd 1973). Additional populations occur at the south end of the Salton Sea, and along the Salt and Gila Rivers (Eddleman 1989), and is known to occur at Dos Palmas (AMEC 2008). Yuma Clapper Rails forage primarily on crustaceans and minnows during the breeding season, and rely more on a diet of seeds and vegetation in the winter. Populations of Yuma Clapper Rails have undergone decline in the United States due to their limited distribution, and destruction and degradation of freshwater marsh habitat.

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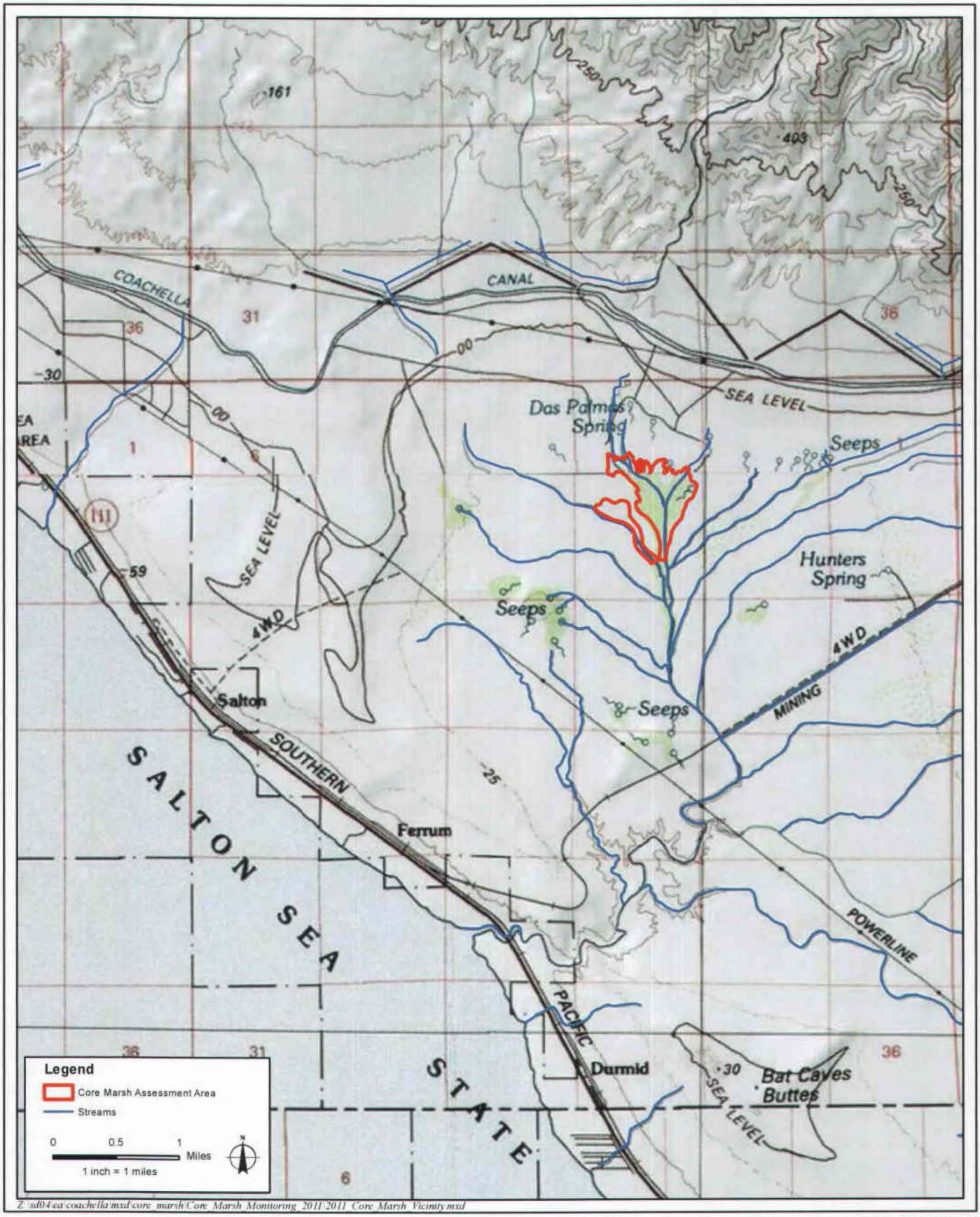

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2011 Rail Survey Vicinity Map
Dos Palmas Core Marsh Monitoring
Coachella Canal Lining Project

FIGURE
1

AR074344

The California Black Rail is a small, sparrow-sized secretive rail, blackish above with white speckling, a chestnut nape, grayish-black underparts, narrow white barring on the flanks, and a short black bill. The California Black Rail occurs in the lower Colorado River area from the Imperial Dam, south to the Mexican border, with smaller, isolated populations scattered from Marin and San Luis Obispo counties in coastal California, southward to San Diego County, northwestern Baja California, and the lower Imperial Valley (Eddleman *et al* 1994, Small 1994), and in the foothills of the Sierra Nevada (Richmond et al. 2010; Aigner et al. 1995). The species is known to occur at Dos Palmas (AMEC 2008). California Black Rails tend to favor mixed pickleweed (*Salicornia* sp.), cordgrass (*Spartina foliosa*), and bulrush marshes in coastal habitats; and bulrush, common reed, and cattail freshwater marshes in inland areas (Small 1994, Conway and Sulzman 2007, Del Pizzo, pers. comm.). California Black Rails typically forage on aquatic and terrestrial invertebrates and seeds. Like the Yuma Clapper Rail, the California Black Rail has undergone decline due to habitat degradation and destruction.

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3.0 PROJECT SITE DESCRIPTION

The Dos Palmas Core Marsh is located in the Dos Palmas ACEC. It is a marsh of approximately 150 acres. The Created Marsh is adjacent to the northwest edge of the Core Marsh. Vegetation in the Core Marsh includes emergent bulrush, cattails, and common reed (*Phragmites australis*) which are present in varying densities throughout the marsh. In addition, there are stands of salt cedar or tamarisk (*Tamarix* sp.) and saltgrass (*Distichlis spicata*) along the margins of the marsh. Upland vegetation adjacent to the marsh is characterized by tamarisk, arrowweed (*Pluchea sericea*), and quailbush (*Atriplex lentiformis*), with an occasional honey mesquite (*Prosopis glandulosa*), and patches of saltgrass (*Distichlis spicata*) and salt crusts. The topography of the entire area is relatively flat; with water flowing through the marsh from seeps and springs to the north, and concentrating into Salt Creek at the outflow of the marsh to the south. Vegetation in the Created Marsh is principally cattail, bulrush, saltgrass, and Cooper's rush (*Juncus cooperi*), with arrowweed and mesquite on the adjacent berms. The elevation of the survey area ranges from approximately -105 feet (- 32 meters) to -134 feet (-41 meters) below Mean Sea Level.

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Survey #	Date	Surveyor*	Time	Weather Conditions (OC = overcast)
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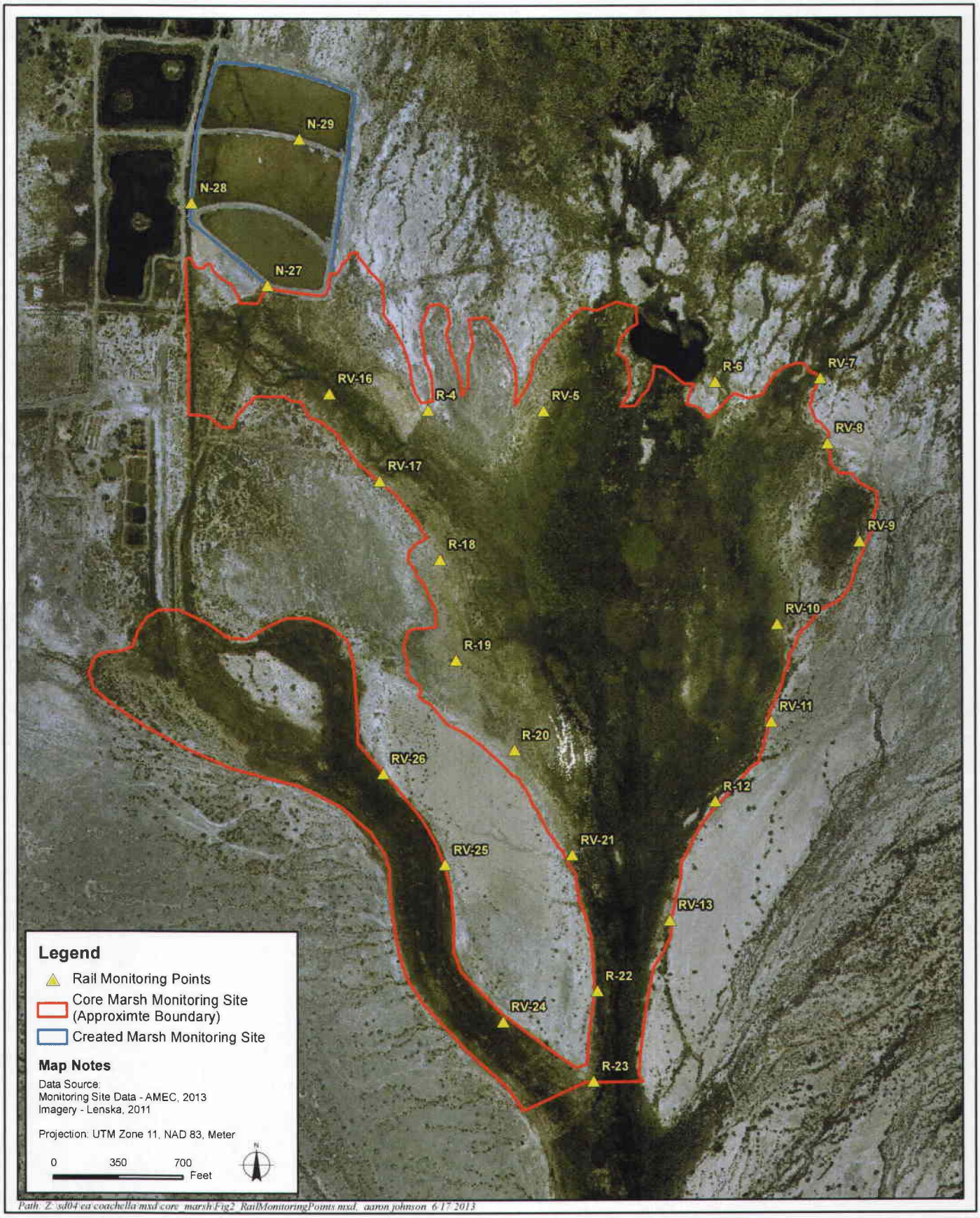
* JG-John Green; SM – Steve Myers



2013 Rail Survey Locations
Dos Palmas Area of Critical Environmental Concern
Coachella Canal Lining Project

FIGURE
2

AR074347

5.0 RESULTS

Both Yuma Clapper Rails (a total of 27 detections) and California Black Rail (one detection) were found in the Core and Created Marsh during these surveys. The survey results are shown in Table 2.

Table 2.
Rail Census Data in the Dos Palmas Core Marsh in 2013.

Location	21-28 Mar-11		23-25 Apr-11		21-23 May-11	
	YCR	CBR	YCR	CBR	YCR	CBR
4	2				2	
5	1				1	
6	2				1	
7						
8			1			
9	1					
10					2	
11	1				1	
12			1			
13						
16	1					
17	1		1	1		
18	1				1	
19						
20	1		1			
21			1			
22						
23			1			
24						
25						
26						
27	1		1			
28	1				1	
29	1					
TOTAL	**14**	**0**	**7**	**1**	**9**	**0**
Location	21-28 Mar-11		23-25 Apr-11		21-23 May-11	

6.0 DISCUSSION

Rail surveys were conducted in the past in the Core Marsh in 2006, 2007, 2009, and 2011. Table 3 below summarizes these results, and indicates the survey stations where the rails were detected. The location of the survey stations has remained essentially the same for all years, with some points added in 2011 and 2013. Created marsh points were surveyed only in 2013.

Table 3.
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2	---	A, M	---	---		---	---	---	---
3	---	M	M	---		---	---	---	---
4	---	M	A,M	---		---	---	---	---
5	---	A, M	---	Ma		---	A	---	---
6	A	---	---	---		---	---	---	---
7	A	---	M	Ma, M		---	---	---	---
8	A	---	M	---		---	---	---	---
9	---	A, M	M	---		---	---	---	---
10	A	A	---	---		---	---	---	---
11	J	M	Ma, A	---		---	---	Ma	---
12	---	---	---	---		---	---	---	---
13	A	---	---	---		---	---	---	---
14	---	A	---	---		---	---	---	---
15	---	A, M	---	---		---	---	---	---
16	---	---	Ma	A		---	---	---	---
17	M	---	Ma	---		---	---	---	---
18	---	---	---	M		---	---	---	---
19	M	M	---	A, M		---	---	---	---
20	---	---	---	A, M		---	---	---	---
21	---	A	---	---		---	---	---	---
25	---	---	---	A		---	---	---	---
26	---	---	---	A, M		---	---	---	---
TOTAL	8	17	12	14		0	1	1	0

Notes:
Ma = March; A = April; M = May

It can be seen that there were more Yuma Clapper Rail detections in 2013 than in any year of previous surveys. California Black Rail was also detected once during the 2013 surveys. Seventeen sampling stations detected rails in 2013. During 2013, the best rail habitat (based on detections during more than one survey period) appears to be associated with stations 4-6, 11, 16-18, 20, and 27-28 (created marsh). Figure 2 shows these stations to be in the northern and western portions of the marsh (single exception of station 11, on the eastern margin), as well as in the new habitat of the created marsh. The west arm of Salt Creek (stations 24-26) had no rail detections this year.

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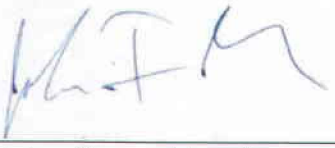
We certify that the information in this survey report and attached exhibits fully and accurately represent our work.



John Green, Wildlife Biologist
TE054011-2

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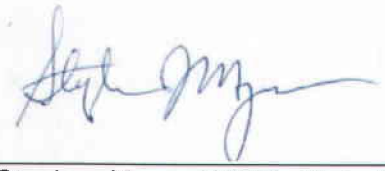

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AMEC Environment & Infrastructure, Inc.



John Green
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THE STATUS OF YUMA CLAPPER RAIL AND YELLOW-BILLED CUCKOO ALONG PORTIONS OF THE VIRGIN RIVER AND MUDDY RIVER IN SOUTHERN NEVADA: 2005 FINAL

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October 2006

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INTRODUCTION

The Clapper Rail (*Rallus longirostris*) is a marsh obligate species whose range includes saltwater marshland from New England south to Texas along the Atlantic coast and from San Francisco south to Baja California along the Pacific coast (Bent 1926). The Yuma Clapper Rail (*Rallus longirostris yumanensis*) subspecies is found in freshwater habitats along the Colorado River and its associated drainages, and in isolated regions of the Salton Sea, California (Philips, et al. 1964, Alcorn 1988, Eddleman 1989). In addition, Yuma Clapper Rail are currently known to occupy areas along the Muddy River and the Virgin River in southern Nevada (McKernan and Braden 1999, 2001a, 2001b, McKernan and Carter 2002, Rathbun and Braden 2003, Braden and Miller 2004).

The breeding season for Clapper Rail extends from mid-March through August. Nests are placed on elevated ground within the marsh and are constructed of plant stems and grasses. The nests are concealed with live vegetation pulled over the nest to form a canopy. A clutch of 8 to 11 eggs is laid in the nest, but may occasionally be as few as 4 or as many as 14 eggs. Both male and female Clapper Rail incubate the eggs for 20 to 24 days. Both parents attend to the nestlings. Nestlings can swim within a day after hatching, are independent of parents in 35 to 42 days, and can fly by 63 to 70 days after hatching (Baicich and Harrison 1997).

Yellow-billed Cuckoo (*Coccyzus americanus*) are found in stream-side willow and alder groves, open woodlands, parkland, gardens and orchards from British Columbia east to Newfoundland and south into South America (Alcorn 1988, Baicich and Harrison 1997). The breeding range of the Yellow-billed Cuckoo in the United States includes isolated areas of Idaho, Utah, California, Arizona, southern Nevada, and throughout most of the continent east of the Rocky Mountains to the Atlantic coast (Mulroy 2002). The distribution of the western race of the Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*) has contracted in recent years. The Yellow-billed Cuckoo has been considered a rare and transient summer resident in Nevada where the breeding populations in the western and southern portion of the state are considered to be nearly extinct (Alcorn 1988).

The breeding season for the Yellow-billed Cuckoo extends from late May through early August. Nests are concealed in a bush or tree from 2 to 20 feet above the ground and are constructed of a variety of plant materials. A clutch of 3 to 4 eggs are laid in the nest, but may be as few as 1 or as many as 5 eggs. The female incubates the eggs for 9 to 11 days, with occasional help from the male. The nestlings are tended by both parents and can fly about 21 days after hatching (Baicich and Harrison 1997).

The Muddy River and Virgin River in southern Nevada both contain extensive areas of suitable breeding habitat for the Yuma Clapper Rail and the Yellow-billed Cuckoo. This report details the continuation of the focused Clapper Rail and Yellow-billed Cuckoo surveys that have been conducted along the Virgin River and Muddy River in southern Nevada since 1999.

METHODS

Survey Methodology:

Yuma Clapper Rail - Field surveys were conducted from May to June 2005 to determine the presence of Yuma Clapper Rail. The surveys were conducted between 5:00 AM and 12:00 PM and consisted of walks through and around suitable habitat. Surveyors stopped every 20 to 40 meters to play a continuous loop tape with recordings of Yuma Clapper Rail vocalizations including "keks", "clatters", and agitated "kek'ing". The tape was played for up to 2 minutes, with a pause of up to three minutes after each broadcast to listen for a response. In addition, surveyors walked through the habitat observing and listening for birds, without the use of tapes, for unspecified periods of time.

Yellow-billed Cuckoo - Field surveys were conducted from June through late July/early August 2005 to determine the presence of Yellow-billed Cuckoo. The surveys were conducted between 5:15 AM and 12:15 PM and consisted of walks through suitable habitat. Surveyors stopped at regular intervals and played a continuous loop tape with recordings of Yellow-billed Cuckoo vocalizations, primarily the " ka ka ka ka kow kow kowlp kowlp" call, which was played for 30 to 45 seconds with a 2 minute pause after each play to listen for a response.

The Warm Springs site was surveyed only in conjunction with an associate of the landowner and therefore limited in number. The surveys were performed in the same way each time along a route established by Nevada Department of Wildlife biologists.

Survey Site Descriptions:

An overview of site locations can be found in Figure 1. Geographic coordinates for the survey sites are listed in Table 1. Specific site descriptions are as follows:

Virgin River Sites

The Virgin River flows south from Utah and terminates at Lake Mead. The perennial river flow is largely unaltered with the exception of a few erosion control structures in the town of Mesquite. Consequently, the river is susceptible to flooding, usually during warm winter storms or heavy spring run-off. The marsh vegetation along the river, when present, is dominated by cattail (*Typha* spp.) and bulrush (*Scirpus* spp.), with intermixed components of Goodding black willow (*Salix gooddingii*), sandbar willow (*S. exigua*) and tamarisk (*Tamarix* spp.). Wooded areas are present in conjunction with most of the sites surveyed and are comprised of willow, tamarisk, Fremont cottonwood (*Populus fremontii*), and honey mesquite (*Prosopis glandulosa*). The survey sites along the Virgin River are in the vicinity of Littlefield, Mesquite, Mormon Mesa, and the Virgin River Delta in southern Nevada (Table 1).

Early in 2005, rains filled the river to near capacity, resulting in extensive scouring of the riparian areas. Most affected were habitats for Yuma Clapper Rail from Littlefield and Beaver Dam Wash downstream to Lake Mead. Habitats in the town of Mesquite were further compromised by attempts to control the flood event. After the flooding subsided, there were varying degrees of openness and substantive changes to the vegetative structure along the Virgin River with fewer areas of assessable suitable breeding habitat for Yuma Clapper Rail and to a lesser degree Yellow-billed Cuckoo, than in years past. Survey sites were reconnoitered in late

winter and spring of 2005, and again in early 2006. Reconnaissance results, surveys, and current habitat suitability for Yuma Clapper Rail and Yellow-billed Cuckoo are reported under the survey site headings that follow.

Littlefield, AZ

Flood damage to habitat at the Littlefield North and South survey sites (Figure 2) was substantial. Yuma Clapper Rail and Yellow-billed Cuckoo habitat in Beaver Dam Wash (Littlefield North) were reduced to a clean gravel channel that was down-cut by 1 meter in some areas. Remaining canopy heights along the stream margins were 1 to 2 meters but there was little vegetation remaining. Canopy heights in the cottonwood grove northwest of Beaver Dam Wash were over 25 meters and unaffected by the flooding, but the under-story was scoured to bare earth. Great swaths of the adjacent golf course were also torn away. The habitat in the wash, on the golf course, and the cottonwood grove had not changed substantially as of early 2006. In its present condition the habitat at Littlefield North is suitable for Yellow-billed Cuckoo, but not suitable for Yuma Clapper Rail. For the 2005 season, Littlefield North was surveyed for Yellow-billed Cuckoo, but not for Yuma Clapper Rail due to lack of suitable habitat.

At Littlefield South (Figure 2) the flood of 2005 scoured the habitat, removed the beaver dam(s) that retained water in the marsh, flattened the Yuma Clapper Rail habitat, and scoured the Virgin River channel leaving the marsh dry and unsuitable for Yuma Clapper Rail in 2005. By early 2006, surface water had re-appeared in the marsh, beaver activity was apparent at the old dam site, and the marsh vegetation had begun to recover. However, there were still substantial amounts of open water and the pre-flood Yuma Clapper Rail habitat had been reduced by approximately half.

Littlefield South was not surveyed in 2005 for Yuma Clapper Rail or Yellow-billed Cuckoo due to the lack of suitable habitats. Suitable habitat for Yuma Clapper Rail might be present by the 2006 season.

Mesquite

Vegetation in the river channel at the historic Mesquite Bridge survey sites was eliminated by the flood of 2005 and by improvised flood control structures designed to confine flood flows to the center one-quarter of the channel. Stands of tamarisk along the edge of the river channel persist upstream and downstream of the bridge on the southeast bank but the main channel was clear of all vegetation for 1,500 meters in either direction. Yuma Clapper Rail and Yellow-billed Cuckoo surveys were not performed at the historic Mesquite Bridge survey sites (Table 4) in 2005 due to lack of suitable habitats.

By early 2006 marsh vegetation (cattails and sedges) were emerging at restricted locations of substantive size above and to a limited extent below the Mesquite Bridge in back waters created by the improvised flood control structures. Emergent habitats below the bridge will not likely persist as they appear to be within an urban development expansion area. Emergent habitats above the bridge were approaching 0.5 meter in height by early 2006 and, if undisturbed, might potentially be suitable for Yuma Clapper Rail by the 2006 survey season.

Mormon Mesa

Big Marsh is located along the northwest bank of the Virgin River near Mormon Mesa (Figure 3). Springs as well as inflow from the Virgin River feed the marsh, the later depending on the alignment of the active portion of the river channel. The active portion of the Virgin River channel is variable among years. Prior to 2001, the active channel partially fed into the marsh. From spring 2001 to 2004, the active channel had shifted to approximately 0.5 kilometers from the marsh, no longer feeding the marsh. After the flood of 2005 the active portion of the channel had shifted back to its pre 2001 position, but had also done significant damage to the Big Marsh habitat.

The 2005 flood filled the entire width of the Virgin River channel, including Big Marsh, and scoured and flattened the cattail habitat in the marsh. By the 2005 survey season, habitat in the marsh consisted of a ring of sparse but suitable monotypic stands of cattail up to 1 meter tall encompassing a large area of open water in the center. The marsh still covered approximately 10 hectares and was still bordered by creosote scrub desert to the northwest. Dense stands of black willow, sandbar willow, and tamarisk up to 8 meters tall still border the marsh to the east. To the southeast the marsh begins to merge with the Virgin River active flow channel, and eventually discharges into the river channel at the south end of the marsh. Yuma Clapper Rail surveys covering the remaining post-flood habitats were performed in 2005.

Visits to Big Marsh in early 2006 found no significant hydrologic changes, but did find substantial growth and rebound of the cattail habitats encompassing the marsh. Big Marsh should be surveyed in 2006 for Yuma Clapper Rail. The dense stands of black willow, sandbar willow, and tamarisk up to 8 meters tall bordering Big Marsh to the east should be surveyed for Yellow-billed Cuckoo.

Long Marsh is a long (1.5 kilometer) linear stretch of marsh habitat that runs parallel to, and down the center of, the Virgin River channel (Figure 3). Outside of large flood events, the active portion of the Virgin River flows on either the northwest or the southeast side of Long Marsh, but not both. The habitat in the marsh is complex. Patchy stands of low profile (< 2 meters) cattail and tamarisk predominate on the southeast side of the marsh, but become dense thickets of cattail, black willow, sandbar willow, and tamarisk on the northwest side of the marsh where vegetation heights average 7 meters or more. Prior to 2001, river flows on the northwest side would percolate into the dense perennial trees of the marsh. From spring 2001 until 2004, river flows on the southeast side of the marsh would percolate into the lower profile cattail. During the flooding of 2005 the active channel of the Virgin River changed course again back to the historic channel on the northwest side of Long Marsh. Strong flows in the Virgin River throughout the Yuma Clapper Rail survey season prevented surveyors from crossing into Long Marsh. When access was possible in June of 2005, the marsh was dry and actively foraged by range cattle. Follow up visits in early 2006 found that the center portion of Long Marsh was wet again with surface water running downstream, despite the entrenchment of the active portion of the channel. Cattail clumps up to 2 meters were alive and thriving, but were patchily distributed. Range cattle were also present. The 2006 observations suggest that springs and/or complex subsurface channel flows are sustaining Long Marsh, at least to a limited degree, but the fragile habitat is still degraded and threatened by range cattle. The existing habitats in Long Marsh, after floods, drying, and cattle are still suitable for Yuma Clapper Rail and Yellow-billed Cuckoo, though more so for the later.

Yellow-billed Cuckoo surveys were performed at Long Marsh during the 2005 survey season. Both Yellow-billed Cuckoo and Yuma Clapper Rail surveys should be done in the 2006 season.

East Marsh is a small (ca. 4 ha) circular piece of marsh habitat on the east side of the Virgin River northeast of Long Marsh (Figure 3). When surveyors were able to reach East Marsh late in the 2005 season it was found to be dry with very little live vegetation present. A subsequent visit in early 2006 reestablished that the marsh was still dry, devoid of any live vegetation, and cutoff from any channel flow. Habitat at East Marsh is no longer suitable for Yuma Clapper Rail. There is little indication the situation will improve over the next year or possibly beyond.

Virgin Delta

Virgin River Landing and Fisherman's Cove were new sites for 2003 (Figure 4). In prior years both sites were inundated by Lake Mead. Reduced lake levels exposed these sites in 2002, which quickly became populated with emergent vegetation. The floods of 2005 down-cut into the habitat at the Virgin River Landing site to 5 meters in some places. No surface water was present in the habitat around the entrenched river channel. Stands of dying cattail up to 2 meters high and incredibly thick tamarisk up to 3 meters tall dominate the area. Absent any influence from Lake Mead, the area is largely dependent on flows from the Virgin River though springs are present in some areas. Yuma Clapper Rail surveys were performed at Virgin River Landing in 2005, though the habitat was marginal at best due to lack of extensive water. The habitat in 2005 at the Virgin River Landing was not suitable for Yellow-billed Cuckoo, being patchy and low in profile.

Reconnaissance of the Virgin River Landing site in early 2006 found previously surveyed habitats remained high, dry, and likely to remain so for the foreseeable future. Any remaining habitat from the 2005 season was desiccated and dead. However, there were sparse emergent cattail and sedges in the new incised channel some distance from the end of the access road and west of the old site. Range cattle had significantly degraded most though not all the recovering vegetation in the channel. The habitat is not likely to be suitable for Yuma Clapper Rail or Yellow-billed Cuckoo in the near future, but should be monitored for recovery in 2006.

The 2005 floods completely scoured Fisherman's Cove of vegetation as strong flows passed through the "Narrows" (Figure 4) before dumping into Lake Mead. The river channel was down-cut to 6 meters in some places. No surveys were done in the 2005 season due to lack of suitable habitat for either Yuma Clapper Rail or Yellow-billed Cuckoo.

Reconnaissance of Fisherman's Cove in early 2006 showed some promise for Yuma Clapper Rail habitat recovery. Emergent vegetation of cattail and sedges were developing in the new channel. The channel had broadened considerably, with Virgin River flows meandering across the low gradient sandy base. There was little sign of cattle or cattle damage to the young habitat. The habitat will likely be suitable for Yuma Clapper Rail, but not Yellow-billed Cuckoo, by the 2006 survey season.

Muddy River Sites

The surveyed areas of the Muddy River begin in the Moapa Valley west of Glendale and terminate near Lake Mead. The channel and perennial river flows in the channel have been heavily modified and re-directed east of Glendale by a complex series of flood control structures, agricultural channels, agricultural drains, and canals. Since the flooding of 2005, the habitat along and in the Muddy River varies greatly in the degree of openness and vegetative structure but has several areas of habitat still suitable for Yuma Clapper Rail and Yellow-billed Cuckoo. The marsh vegetation is dominated by cattail, bulrush, and common reed (*Phragmites australis*) with intermixed components of willow and tamarisk. Wooded areas are present in conjunction with most of the sites surveyed and are comprised of willow, tamarisk, Fremont cottonwood, and honey mesquite. With the exception of Honeybee Pond and Warm Springs Ranch, most habitats occur as small patches (ca. 0.5 to 5 ha.) or short (100 to 800 m) linear lengths. The survey sites along the Muddy River are in the vicinity of Overton and Logandale, Nevada (Table 1).

Warm Springs Ranch

The Warm Springs Ranch site is located in the Moapa Valley at the Warm Springs Ranch, approximately nine miles west of Glendale and one mile south of Highway 168 (Figure 5). The site is not on the Muddy River. Surface flows on the site come from Warm Springs, located immediately south. Water from the springs flow through the area, emptying into the Muddy River to the north. The habitat at the site is composed of cottonwood, black willow, tamarisk, and non-native fan palms. The canopy height is variable, but generally 5 to 15+ meters. The canopy is not continuous. Perennials are patchy with intervening pastures and ruderal fields. Cottonwoods are mostly arrayed in a linear fashion along pasture borders, though cottonwood, willow, and tamarisk patches are scattered throughout the site near water sources and in moist areas. The habitat was robust and quite suitable for Yellow-billed Cuckoos that are reported to have bred there in large numbers (ca. 7-14 pairs). This was one of the only sites that was not affected by the flooding in 2005. The Warm Springs Ranch site was surveyed for Yellow-billed Cuckoo in 2005.

Logandale

Bowman Canal is an overflow and runoff catchment for Bowman Reservoir and the surrounding farmland (Figure 6). The canal is 4 meters wide and approximately 180 meters long with three small ponds at the juncture with the reservoir's head gate. The canal was filled with long thick patches of cattail that opened up at several stretches. The cattail were flattened for most of the season by the 2005 floods, but started to bounce back at the end of the survey period. The vegetation around two of the ponds consisted of mesquite, creosote and small clumps of cattail. Bowman Canal was surveyed for Yuma Clapper Rail in 2005. The habitat was unsuitable for Yellow-billed Cuckoo. Reconnaissance in early 2006 found the Bowman Canal had been cleared sometime after the 2005 surveys. Cattail habitat was already recovering and will likely be suitable for Yuma Clapper Rail by the 2006 season.

The Grant Bowler Park site is located in Grant Bowler Park in the town of Logandale (Figure 7). The surveyed area consisted of a 30 meter wide and 150 meter long stretch of the Muddy River bordering the park with the highway bridge as the northern boundary. Habitat in

the surveyed area was composed of thin monotypic cattail approximately 2 to 3 meters tall adjacent to the river channel and bordered by patches of tamarisk and willow on the upper banks. The habitat was burned at the end of the survey period in 2003, after which it was marginal at best but recovering. The Grant Bowler Park site was surveyed for Yuma Clapper Rail in 2005. The habitat was not suitable for Yellow-billed Cuckoo.

Overton

Maverick Ditch site is located in the town of Overton near the intersection of Cooper and Jones Street (Figure 8). The site was named after the Maverick convenience store immediately adjacent to the site. The channel appears to function for irrigation, high water overflow, and possibly suburban storm water run-off. The surveyed area is approximately 400 meters long and 30 meters across at its widest point. A majority of the site burned in early 2004 but recovered very quickly. The tamarisk on the edges of the site were unaffected by the fire. The site was dominated by small cattail, bulrush, tamarisk and yerba mansa averaging one meter. Mature tamarisk up to 4 meters is prevalent along the edges of the surveyed area and a mature monotypic cattail patch of up to 3 meters persists at the southeastern end of the site. The surveyed area is bordered by homes and businesses. The effects of the 2005 floods were relatively minor, even though there were extensive flood flows through the site. The Maverick Ditch site was surveyed for Yuma Clapper Rail in 2005. The habitat was not suitable for Yellow-billed Cuckoo. Reconnaissance in early 2006 found the habitat still suitable for Yuma Clapper Rail.

Overton Wildlife Management Area

Honeybee Pond is located on the Nevada Division of Wildlife Refuge (NDOW) Overton Wildlife Management Area (OWMA) near Overton, Nevada (Figure 9). In past years the site had been subdivided into Eastern and Western sites. In 2004 and 2005, the sites were combined and surveyed as one site. The habitat in the area is composed of cattail and reeds in Honeybee Pond and surrounding water impoundments. Black willows and mature tamarisk thickets line the channels that connect adjacent ponds and are periodically flooded. Water for Honeybee Pond and the associated impoundments is diverted from the Muddy River channel which lies immediately to the north. Honeybee Pond, in conjunction with nearby ponds, provides shallow open water habitats and are largely managed for waterfowl and wading birds. In 2005, the shallow ponds north of Honeybee Pond were left dry and were filled with young tamarisk up to 2 meters tall. During the survey period no water was added to Honeybee Pond and it slowly dried up. Thick areas of cattail emerged but, at the end of the survey period, the soil continued to dry and crack. Suitable habitats in Honeybee Pond were surveyed for Yuma Clapper Rail. The surrounding habitat was surveyed for Yellow-billed Cuckoo.

Several smaller areas (0.5 ha or less) were also surveyed for Yellow-billed Cuckoo within the OWMA (Figure 9). The mature cottonwood and locust habitat south of the main OWMA building was surveyed for cuckoo during the 2005 breeding season (Figure 9). Linear strips of mature black willow were surveyed along the roads around Pintail Pond. In addition, patches of black willow and tamarisk east-northeast of Pintail Pond were also surveyed for Yellow-billed Cuckoo. Pintail Pond and adjacent ponds looked promising for Yuma Clapper Rail at the end of the 2005 survey season.

RESULTS

Yuma Clapper Rail

Yuma Clapper Rail survey dates, durations, and results are tabulated in Table 2. No Yuma Clapper Rails were detected in 2005 at any sites. Virginia Rails were detected at many sites and Sora at Honeybee Pond. Cumulative survey results for Yuma Clapper Rail from 2000 through 2005 are summarized in Table 4. Overall, Yuma Clapper Rail detections have been declining since the high in 2000.

Yellow-billed Cuckoo

Yellow-billed Cuckoo survey dates, durations, and results are tabulated in Table 3. Yellow-billed Cuckoo detections continued to be low as only two birds were detected. A single bird was heard in the small habitat patch south of the OWMA main building on June 30th. One individual was seen and heard at Warm Springs Ranch on July 1st.

Cumulative survey results for Yellow-billed Cuckoo from 2000 through 2005 are summarized in Table 4. Overall, Yellow-billed Cuckoo detections have been declining since the high in 2001.

Other Species' Detections

Four Southwestern Willow Flycatchers were detected on 13 June on the Nevada Department of Wildlife's Overton Wildlife Management Area while conducting Yellow-billed Cuckoo surveys. The birds were found in a small (0.5 acre) dense sandbar and black willow riparian habitat along the Muddy River. A banded male (gold service band on the left leg) and two female birds were observed in one territory. Two nests, one active and one abandoned, were also found. Another singing bird was heard 50 meters downstream. Both nests were built in young tamarisk trees. Nest coordinates were 11 732092E 4043995 N for the active nest and 11 732101 E 4043950 N for the abandoned nest. Both coordinates are use NAD27 map datum.

Additional incidental bird species detected at each survey site during the 2005 surveys are tabulated in Table 5. 117 species of birds were detected during the 2005 survey season, down from 139 in 2004. Detections of Least Bittern continued at Honeybee Pond and may be of particular interest. The occurrences of other species of interest at the survey sites are listed in Table 5. Species detections were incidental and do not indicate absence of any particular species from a survey site.

DISCUSSION

Yuma Clapper Rail

Surveys conducted by museum researchers have documented multiple occurrences of Yuma Clapper Rail along the Virgin and Muddy Rivers since surveys began several years ago, but detection rates have fallen since 2000 to zero detections in 2005 (Table 4). The Virgin River Mormon Mesa sites have had the highest number of rail detections and the biggest declines over

the years. The reasons for the trends are not currently understood but several factors may be contributing to the decline.

Coincident with the decrease in detections have been natural realignments of the water flow in the Virgin River channel. Prior to the spring of 2001, the Virgin River active channel flow was immediately adjacent to Big Marsh and flowed through the entire length of Long Marsh. After 2001, the river channel realigned to approximately 0.5 kilometers southeast of its previous location, leaving the hydrology in Big Marsh more, perhaps entirely, dependant on subterranean springs. Following the 2005 flood, the active channel had returned to its pre 2001 location. The dynamic surface hydrology over the years likely affects the quality habitats if not the extent of the Yuma Clapper Rail habitat, which could cause populations to fluctuate in size and location.

Another possibility is drought. Coincident with the period of study, the southwestern United States has received less than average precipitation for the last ten years that may have adversely affected habitat suitability at the Mormon Mesa sites. There is insufficient information at this time to confirm or dismiss low rainfall, channel realignment, or both acting in concert as causative agents in the decline of Yuma Clapper Rail at the Mormon Mesa sites over the years.

Aside from the Mormon Mesa sites, Yuma Clapper Rail patterns of site occupancy appear to be low and intermittent over the years. It is important to remember that determining rail occupancy relies greatly on vocalized responses to taped vocalizations. Responses of telemetered rails to tape playback was found to be only 42% and greatly influenced by the nest cycle (Eddleman 1989). Thus, sites where few rails are known to be present that have intermittent rail detections across the years may or may not be occupied in years when no rails were detected. The Littlefield sites, prior to 2005, are a good example of this. Two rails were detected at each of these sites in 2000 but there were no rail detections until 2004 when one rail was found at each site (Table 4). The confidence level of negative survey results has not been established for the Yuma Clapper Rail survey protocol; therefore negative results should be cautiously interpreted.

Issues of detection aside, it is also worth noting that southern Nevada is at the upper northern limit of the Yuma Clapper Rail distribution. Species' distributional limits are indicators that one or more environmental features are becoming limiting factors to the suitability of the areas for the species. These environmental features are likely to vary among years, allowing small expansions and contractions of a species' distribution. A reasonable argument can be made that apparent decline in Yuma Clapper Rail are a result of cyclic annual variations in features of the habitat associated with the northern limits of the species' distribution.

One additional consideration is that local populations of Yuma Clapper Rail may have occupied suitable habitat not included in the annual surveys. This possibility is difficult to evaluate. Yuma Clapper Rail on the lower Colorado River are resident year round but also engage in substantial post breeding dispersal, up to 5 kilometers (Eddleman 1989). Assuming Yuma Clapper Rail in southern Nevada have similar life-history traits as those on the lower Colorado River, it is reasonable to expect rails to change locations in their annual searches for habitat, food, and mates. Nevertheless, absent expanded surveys, it is not possible to accurately determine if decreases in the rail population at the Mormon Mesa sites are accompanied by increases in other unsurveyed rail habitats on the Virgin and Muddy Rivers.

Whatever the ultimate factor(s) affecting Yuma Clapper Rail occupation on the Virgin and Muddy Rivers, one obvious and important proximate factor is the loss and/or degradation of habitat during the 2005 floods. The Beaver Wash portion of Littlefield North has been prone to

flooding and scouring over the years. However, prior to the 2005 flood, rail habitat was quick to recover from flood events. As of early 2006, the rail habitat in Beaver Wash showed no sign of recovering from the 2005 flood. Other areas of rail habitat at Littlefield North (under the cottonwood grove) had not been scoured in flood events prior to 2005, but were scoured clean of all under story vegetation in 2005. As of early 2006, this area of Littlefield North was still without substantive under story vegetation recovery.

Yuma Clapper Rail habitats at the Virgin River Mesquite sites were the most affected by the 2005 flood and potentially by attempts to control the flooding. All vegetation at all the Mesquite sites (Table 4) was gone by early 2005, and the Virgin River channel had been significantly modified. Modifications consisted of earthen berms erected by heavy machinery to confine the channel to approximately one quarter its former width in the center of the channel. Earthen berms extended both up and downstream for some distance. By early 2006 marsh vegetation was emerging both above and below, but outside the berms. The most promising habitat recovery was occurring above the Mesquite Bridge, where the earthen berms were less continuous and backwaters had formed outside the berms either by contact with the river, subsurface flow through the porous sand substrate, or urban runoff. These areas above the bridge were of sufficient size and had sufficient emergent marsh vegetation to potentially be suitable for Yuma Clapper Rail by the 2006 season. Whether these areas were created accidentally or by design remains unclear, thus there permanency is uncertain.

At the Virgin River Mormon Mesa sites the flooding of 2005 shifted the active river channel back to its former location on the northwest side of the valley, scoured the cattail habitat in Big Marsh, and entrenched the river below the habitat in Long Marsh. Since the 2005 surveys, the channel entrenchment has lessened due to sediment transport, now being less than a meter from inundating the marsh. Nevertheless, as of early 2006 there was little river flow into Long Marsh, though there was surface flow in Long Marsh from an unknown source. Big Marsh, East Marsh, and Long Marsh have experienced some drying over the years, coincident with the shifts in the river channel, but all three marshes maintained at least 80% of their original Yuma Clapper Rail habitat as of 2004. After the flooding of 2005, East Marsh had dried up entirely and Big and Long Marsh retained about 40% of their original Yuma Clapper Rail habitat. In short, Yuma Clapper Rail habitat at the Mormon Mesa sites were significantly reduced in 2005 by flood waters that did not recede until the middle of June, a plausible explanation for the lack of Yuma Clapper Rail detections at these sites during the 2005 survey season.

The Virgin River Delta sites had great potential in 2003 but channelization of the river, floods, and cattle grazing have substantively reduced the potential. Nevertheless, based on 2006 reconnaissance Fisherman's Cove will likely fill in with cattail and again provide suitable Yuma Clapper Rail habitat. The old survey site at Virgin River Landing is a wasteland of dry, dead cattail and thick, overgrown tamarisk. On a more optimistic note, there is emergent marsh vegetation near the Virgin River Landing in the new channel to the northwest of the old survey site. The most immediate threat to this new incipient Yuma Clapper Rail habitat is the presence of range cattle that forage on the emergent marsh vegetation. The site will likely not recover until cattle are removed or excluded from the area. Continued surveys at Fisherman's Cove and habitat monitoring at the Virgin River Landing are necessary to determine the long-term significance of the emergent Virgin River Delta sites as suitable habitat for Yuma Clapper Rail and other marsh dependent species.

The Muddy River Yuma Clapper Rail sites suffered less flood damage than the Virgin River sites. Habitat disturbances at the Muddy River sites are more anthropogenic in origin, being related to fire (Grant Bowler Park, Maverick Ditch), clearing (Bowman Canal), and conflicting management goals (Honeybee Pond). Despite these disturbances Yuma Clapper Rail habitats at the Muddy River sites have been surprisingly resilient. How these types of disturbances affect short term and long-term occupation of the sites by Yuma Clapper Rail is not well known.

Yellow-billed Cuckoo

Similar to Yuma Clapper Rail, Yellow-billed Cuckoo detections have likewise declined over the past five seasons at the survey sites associated with the Virgin and Muddy Rivers (Table 4). The most noticeable declines again having occurred on the Virgin River at the Mormon Mesa sites. Also noteworthy are apparent declines at the Warm Springs site, which was previously monitored by others and reported to have a large (ca. 7-14 pair) breeding population. Though Yellow-billed Cuckoo have been detected at Warm Springs Ranch from 2003 through 2005, evidence of nesting has yet to be observed. Although factors such as below average rainfall, river re-alignment (for some sites), distributional limits, annual variability in habitat suitability, and detection cannot be eliminated as potential reasons influencing the perceived decline, the most parsimonious explanation has to do with Yellow-billed Cuckoo life-history.

The Yellow-billed Cuckoo is a neotropical migrant exhibiting irruptive breeding patterns. Irruptive breeding means that breeding populations show up in sporadic and inconsistent locations among years. Why irruptive breeders vary in population size and breeding locations from year to year is not known. Proximal causes proposed to explain the irruptive breeding pattern for Yellow-billed Cuckoo have included natural variability in food resources, nesting substrates, habitat loss, habitat conversion, habitat quality, cattle grazing, population declines, search for breeding opportunities, and variable migration routes. All proposed explanations likely have some merit but none have been rigorously tested. This lack of scientific information on the proximal and ultimate causes of Yellow-billed Cuckoo breeding distributional patterns makes it particularly difficult to interpret perceived decreases in cuckoo populations associated with the Virgin and Muddy Rivers. As with Yuma Clapper Rail, there are areas of suitable habitat on the Virgin and Muddy Rivers that are outside of the survey areas. Without an expanded effort, it is not possible to know if declines in Yellow-billed Cuckoo detections at the survey sites, including Warm Springs, are accompanied by increases in other un-surveyed cuckoo habitats associated with the Virgin and Muddy Rivers. Unlike Yuma Clapper Rail, the distance between breeding locations among years could possibly be tens or even hundreds of kilometers.

Unlike the Yuma Clapper Rail habitats, the 2005 flood for the most part less affected Yellow-billed Cuckoo survey site habitats. The most significant damage to Yellow-billed Cuckoo habitats occurred in Beaver Wash at Littlefield North and at the Mesquite Bridge sites. The Yellow-billed Cuckoo habitat in Beaver Wash no longer exists and recovery has been poor. While the under story of the cottonwood grove at Littlefield North was washed away, the grove itself is intact and still suitable for Yellow-billed Cuckoo. Similar to Beaver Wash, the Yellow-billed Cuckoo habitat at the Mesquite Bridge sites no longer exists. Suitable Yellow-billed

Cuckoo habitat still exists below the bridge on the southeast bank of the river, but the overall quality of the habitat in and around the Mesquite Bridge sites is greatly diminished by the loss of habitat in the channel. Yellow-billed Cuckoo habitat at the Mormon Mesa sites still remains and may possibly be enhanced by the realignment of the active river channel following the flood. Habitat at the Warm Springs Ranch site was virtually unaffected as was the habitat at Honey Bee Pond.

SUMMARY

There were no detections of Yuma Clapper Rail during the 2005 surveys. Yuma Clapper Rail habitats at most surveyed sites were damaged or degraded, and some were destroyed by severe flooding and flood control prior to the 2005 breeding season. Habitat recovery is proceeding at some, but not all affected survey sites. Habitat loss and damage from flood and flood control was the most proximate cause for the decline in Yuma Clapper Rail detections in 2005, though other ultimate factors likely play an undefined role. In the case of Honeybee Pond, conflicting water management objectives created poor wetland habitat possibly affecting rail presence.

Yellow-billed Cuckoo were detected within suitable habitat associated with the Muddy River, but not the Virgin River survey sites in 2005. Yellow-billed Cuckoo habitats suffered less damage and degradation than Yuma Clapper Rail habitats from flood and flood control with the exception of the Mesquite Bridge and Beaver Wash. Reduced detections of Yellow-billed Cuckoo within surveyed suitable habitat suggest a decline of Yellow-billed Cuckoo in southern Nevada, but not a specific cause.

Overall, a regional decline of Yuma Clapper Rail and Yellow-billed Cuckoo in southern Nevada is possible but un-surveyed habitats, undefined confidence levels in survey methodologies, poor Yuma Clapper Rail tape response patterns, and an insufficient number of annual surveys confound confirmation. Continued monitoring of survey areas is warranted to produce additional information with regard to the distribution, habitat use, and breeding status of Yuma Clapper Rail and Yellow-billed Cuckoo on the Virgin Muddy River complex in southern Nevada.

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Table 1. Locations, site names, and geographic coordinates for Yuma Clapper Rail and Yellow-billed Cuckoo survey sites on and along the Virgin and Muddy Rivers in southern Nevada for the 2005 breeding season.

LOCATION	SITE NAME	UTM (NAD27)
Yuma Clapper Rail		
Virgin River near Mormon Mesa	Big Marsh	11 739380E, 4057804N
Virgin River Delta	Virgin River Landing	11 739481E, 4042710N
Muddy River near Overton, Nevada	Honeybee Pond	11 731358E, 4045626N 11 730630E, 4045513N
Muddy River in Overton, Nevada	Maverick Ditch	11 728854E, 4047398N
Muddy River in Logandale, Nevada	Grant Bowler Park	11 725288E, 4053282N
Drainage Canal from Bowman Reservoir Overton, Nevada	Bowman Canal	11 724706E, 4056527N
Yellow-billed Cuckoo		
Virgin River in Littlefield, Arizona	Littlefield North	12 239591E, 4087141N
Virgin River near Mormon Mesa	Center Marsh to Big Marsh	11 739897E, 4057210N to 11 739380E, 4057804N
Muddy River near Overton, Nevada	Honeybee Pond and areas inside Overton Wildlife Management Area	11 731358E, 4045626N 11 730630E, 4045513N

Table 1 continued. Locations, site names, and geographic coordinates for Yuma Clapper Rail and Yellow-billed Cuckoo survey sites on and along the Virgin and Muddy Rivers in southern Nevada for the 2005 breeding season.

LOCATION	SITE NAME	UTM (NAD27)
Muddy River near Glendale, Nevada	Warm Springs Ranch	11 707135E, 4064603N

Table 2. Location, date, time, and results of San Bernardino County Museum Yuma Clapper Rail Surveys in 2005 for sites in and along the Virgin and Muddy Rivers in southern Nevada.

SITE	DATE	TIME	# YCRA DETECTED	OTHER RAILS
Virgin River Sites				
Big Marsh	5 May	6:50 - 12:00	0	
	Total hours:	**5.2**		
Virgin River Landing	4 May	6:30 - 9:30	0	VIRA
	5 June	6:30 - 8:30	0	
	Total hours:	**5.0**		
Muddy River Sites				
Grant Bowler Park	3 May	10:40 - 11:10	0	
	16 May	5:00 - 5:30	0	
	6 June	9:15 - 10:00	0	
	Total hours:	**1.75**		
Maverick Ditch	3 May	8:25 - 9:25	0	VIRA
	16 May	5:45 - 6:50	0	VIRA
	6 June	5:15 - 6:40	0	VIRA
	Total hours:	**2.5**		
Honeybee Pond	3 May	6:00 - 8:00	0	VIRA
(East and West)	17 May	5:30 - 8:30	0	VIRA
	6 June	6:50 - 8:50	0	VIRA
	Total hours:	**7.0**		
Bowman Canal	3 May	10:00 - 10:25	0	
	16 May	7:40 - 8:40	0	
	6 June	9:15 - 10:00	0	
	Total hours:	**2.2**		
Total Survey Hours:		**23.65**		

Table 3. Location, date, time, and results of San Bernardino County Museum Yellow-billed Cuckoo Surveys in 2005 for sites in and along the Virgin and Muddy Rivers in southern Nevada.

SITE	DATE	TIME	# YBCU DETECTED
Virgin River Sites			
Littlefield North	13 June	8:00 - 9:00	0
	2 July	12:30 - 1:30	0
	17 July	11:30 - 12:15	0
	Total hours:	**2.75**	
Long Marsh to Big Marsh	14 June	6:30 - 12:15	0
	2 July	5:30 - 10:30	0
	17 July	5:45 - 9:45	0
	30 July	6:30 - 10:30	0
	Total hours:	**18.75**	
Muddy River Sites			
Warm Springs Ranch	1 July	5:40 - 10:15	1
	15 July	5:40 - 10:20	0
	8 August	5:45 - 9:00	0
	Total hours:	**12.6**	
Honeybee Ponds	13 June	5:15 - 11:30	0
	30 June	5:15 - 11:00	1
	18 July	5:45 - 10:45	0
	31 July	6:00 - 11:15	0
	Total hours:	**21.25**	0
Total Survey Hours:		**55.35**	

Table 4. Summary of San Bernardino County Museum Yuma Clapper Rail and Yellow-billed Cuckoo surveys along the Virgin and Muddy Rivers in Southern Nevada from 2000 through 2005. Numbers are number of individuals detected. -ns- = not surveyed.

	2000	2001	2002	2003	2004	2005
Yuma Clapper Rail						
Virgin River Sites						
Littlefield North [a]	2	0	0	0	1	-ns- [h]
Littlefield Bridge	0	0	0	0	-ns- [b]	-ns- [h]
Littlefield South	2	0	0	0	1	-ns- [h]
Mesquite Upstream	0	0	0	1	-ns- [c]	-ns- [h]
Mesquite Bridge	2	0	2	1	1	-ns- [h]
Mesquite Downstream	0	0	0	0	-ns- [c]	-ns- [h]
Mormon Mesa: Big Marsh [d]	7 [e]	8-12	3	0	1	0
Mormon Mesa: Long Marsh	6	1	0	0	0	0
Mormon Mesa: East Marsh	5	2	-ns-	-ns-	0	-ns- [h]
Fisherman's Cove	-ns-	-ns-	-ns-	0	0	-ns- [h]
Virgin River Landing	-ns-	-ns-	-ns-	0	2	0
Muddy River Sites						
Glendale	-ns-	-ns-	0	0	-ns-	-ns-
Honeybee Pond	1	0	0	2	0	0
Maverick Ditch	1	0	4	1	0	0
Grant Bowler Park	-ns-	-ns-	-ns-	0	0	0
Bowman Canal	-ns-	-ns-	-ns-	-ns-	0	0

Table 4 continued. Summary of San Bernardino County Museum Yuma Clapper Rail and Yellow-billed Cuckoo surveys along the Virgin and Muddy Rivers in Southern Nevada from 2000 through 2005. Numbers are number of individuals detected. -ns- = not surveyed.

	2000	2001	2002	2003	2004	2005
Yellow-billed Cuckoo						
Virgin River Sites						
Littlefield North	2	0	0	0	0	0
Mesquite Bridge	1	0	0	1	0	-ns- [h]
Mormon Mesa	3-4	6-10	0	0	0	0
Virgin Delta West	-ns-	2 [f]	0	-ns-	-ns-	-ns-
Muddy River Sites						
Warm Springs Ranch [g]	-ns-	-ns-	-ns-	1	1	1
Honeybee Pond	-ns-	-ns-	-ns-	0	0	1

a - Also known as Beaver Dam Wash.
b - Site was split in half and surveyed in 2004 as additions to Little Field North and South.
c - Suitable habitat at Mesquite Upstream and Downstream sites has been decreased over the years, so both sites combined with Mesquite Bridge site and surveyed with same for 2004.
d - Mormon Mesa sites have been referenced as “Overton” sites in past reports.
e - Includes observations of two fledglings.
f - Nest, two eggs, and fledglings.
g - Warm Springs Ranch and adjacent areas have been previously survey by individuals not associated with SBCM.
h- Habitat disturbed by floods or bulldozers during winter 2005 flood events. YCRA habitat likely to recover by 2006.

Table 5. Incidental bird species detected during San Bernardino County Museum 2005 Yuma Clapper Rail and Yellow-billed Cuckoo surveys in and near the Virgin and Muddy Rivers in southern Nevada. Detections are incidental and indicate presence only. Absence should not be inferred. See text and Table 1 for site locations.

Species	Littlefield North	Big Marsh	Long Marsh	Virgin River Landing	Warm Springs	Overton NWR	Maverick Ditch	Grant Bowler Park	Bowman Canal
Pied-billed Grebe						X			
Clark's Grebe						X			
American White Pelican				X		X			
Least Bittern						X			
Black-crowned Night-Heron						X			
Green Heron		X			X	X			X
Snowy Egret		X				X	X		
Great Egret						X			
Great Blue Heron		X		X		X	X		
White-faced Ibis						X			X
Canada Goose						X	X		
Mallard				X		X	X		X
Gadwall				X		X			X
Green-winged Teal						X			
American Widgeon						X			

Table 5 continued. Incidental bird species detected during San Bernardino County Museum 2005 Yuma Clapper Rail and Yellow-billed Cuckoo surveys in and near the Virgin and Muddy Rivers in southern Nevada. Detections are incidental and indicate presence only. Absence should not be inferred. See text and Table 1 for site locations.

Species	Littlefield North	Big Marsh	Long Marsh	Virgin River Landing	Warm Springs	Overton NWR	Maverick Ditch	Grant Bowler Park	Bowman Canal
Northern Pintail						X			
Northern Shoveler						X			
Blue-winged Teal						X			
Cinnamon Teal						X			
Redhead						X			
Ruddy Duck						X			X
Turkey Vulture					X	X	X		
Osprey									X
Northern Harrier						X			
Cooper's Hawk	X					X			
Common Black-Hawk	X								
Red-tailed Hawk					X				
American Kestrel					X	X			
Ring-necked Pheasant					X		X		
Wild Turkey						X			
Gambel's Quail					X	X	X	X	X

Table 5 continued. Incidental bird species detected during San Bernardino County Museum 2005 Yuma Clapper Rail and Yellow-billed Cuckoo surveys in and near the Virgin and Muddy Rivers in southern Nevada. Detections are incidental and indicate presence only. Absence should not be inferred. See text and Table 1 for site locations.

Species	Littlefield North	Big Marsh	Long Marsh	Virgin River Landing	Warm Springs	Overton NWR	Maverick Ditch	Grant Bowler Park	Bowman Canal
Clapper Rail									
Virginia Rail		X	X	X		X	X		
Sora						X			
American Coot						X	X		X
Killdeer		X			X	X			X
American Avocet						X			
Black-necked Stilt						X			
Greater Yellowlegs						X			
Spotted Sandpiper						X			X
Marbled Godwit						X			
Long-billed Dowitcher						X			
Wilson's Phalarope						X			
Franklin's Gull						X			X
Rock Dove					X		X		
Mourning Dove	X	X	X	X	X	X	X	X	
White-winged Dove	X				X	X			

Table 5 continued. Incidental bird species detected during San Bernardino County Museum 2005 Yuma Clapper Rail and Yellow-billed Cuckoo surveys in and near the Virgin and Muddy Rivers in southern Nevada. Detections are incidental and indicate presence only. Absence should not be inferred. See text and Table 1 for site locations.

Species	Littlefield North	Big Marsh	Long Marsh	Virgin River Landing	Warm Springs	Overton NWR	Maverick Ditch	Grant Bowler Park	Bowman Canal
Yellow-billed Cuckoo					X	X			
Greater Roadrunner		X			X	X	X		
Barn Owl					X	X			
Great Horned Owl					X				
Lesser Nighthawk	X	X							
White-throated Swift				X					
Black-chinned Hummingbird							X	X	
Ladder-backed Woodpecker		X			X	X			
Western Wood-Pewee									X
Willow Flycatcher		X			X	X			
Gray Flycatcher		X							
Black Phoebe	X		X		X	X	X		X
Say's Phoebe				X	X	X	X	X	
Vermillion Flycatcher					X	X			
Brown-crested Flycatcher	X	X			X				

Table 5 continued. Incidental bird species detected during San Bernardino County Museum 2005 Yuma Clapper Rail and Yellow-billed Cuckoo surveys in and near the Virgin and Muddy Rivers in southern Nevada. Detections are incidental and indicate presence only. Absence should not be inferred. See text and Table 1 for site locations.

Species	Littlefield North	Big Marsh	Long Marsh	Virgin River Landing	Warm Springs	Overton NWR	Maverick Ditch	Grant Bowler Park	Bowman Canal
Ash-throated Flycatcher		X	X	X	X				
Western Kingbird		X			X	X	X		
Loggerhead Shrike		X		X	X	X			
Bell's Vireo	X	X	X		X	X			
Plumbeous Vireo									X
Warbling Vireo				X					X
Common Raven			X		X	X	X		
Violet-green Swallow						X			
Cliff Swallow	X	X				X			
Northern Rough-winged Swallow		X		X	X	X	X		
Barn Swallow						X			
Verdin	X	X			X	X	X		X
Bewick's Wren	X	X	X		X	X			X
Cactus Wren					X				
Rock Wren				X					
Marsh Wren						X			X

Table 5 continued. Incidental bird species detected during San Bernardino County Museum 2005 Yuma Clapper Rail and Yellow-billed Cuckoo surveys in and near the Virgin and Muddy Rivers in southern Nevada. Detections are incidental and indicate presence only. Absence should not be inferred. See text and Table 1 for site locations.

Species	Littlefield North	Big Marsh	Long Marsh	Virgin River Landing	Warm Springs	Overton NWR	Maverick Ditch	Grant Bowler Park	Bowman Canal
Blue-gray Gnatcatcher		X	X		X	X			
Black-tailed Gnatcatcher		X			X	X	X		
American Robin					X				
Northern Mockingbird		X			X	X	X		
Crissal Thrasher		X			X	X	X		
European Starling						X			
American Pipit				X					
Phainopepla					X	X			
Orange-crowned Warbler		X				X			
Lucy's Warbler	X	X		X	X	X			X
Black-throated Gray Warbler		X							
Yellow Warbler	X	X	X	X	X	X	X	X	X
MacGillivray's Warbler				X		X			
Wilson's Warbler				X		X			X
Common Yellowthroat	X	X	X	X	X	X	X	X	X

Table 5 continued. Incidental bird species detected during San Bernardino County Museum 2005 Yuma Clapper Rail and Yellow-billed Cuckoo surveys in and near the Virgin and Muddy Rivers in southern Nevada. Detections are incidental and indicate presence only. Absence should not be inferred. See text and Table 1 for site locations.

Species	Littlefield North	Big Marsh	Long Marsh	Virgin River Landing	Warm Springs	Overton NWR	Maverick Ditch	Grant Bowler Park	Bowman Canal
Yellow-breasted Chat	X	X	X	X	X	X			X
Summer Tanager	X								
Western Tanager					X			X	
Green-tailed Towhee					X				
Abert's Towhee	X	X	X	X	X	X	X	X	X
Chipping Sparrow									X
Brewer's Sparrow		X							
Lincoln's Sparrow		X							
Song Sparrow	X	X	X	X	X	X	X	X	X
White-crowned Sparrow						X			
Black-headed Grosbeak		X							
Blue Grosbeak		X	X	X	X	X	X	X	X
Lazuli Bunting					X				
Western Meadowlark					X	X	X		
Yellow-headed Blackbird					X	X			
Red-winged Blackbird				X	X	X	X	X	X

Table 5 continued. Incidental bird species detected during San Bernardino County Museum 2005 Yuma Clapper Rail and Yellow-billed Cuckoo surveys in and near the Virgin and Muddy Rivers in southern Nevada. Detections are incidental and indicate presence only. Absence should not be inferred. See text and Table 1 for site locations.

Species	Littlefield North	Big Marsh	Long Marsh	Virgin River Landing	Warm Springs	Overton NWR	Maverick Ditch	Grant Bowler Park	Bowman Canal
Great-tailed Grackle		X			X	X	X	X	X
Brown-headed Cowbird		X	X	X	X	X	X	X	X
Hooded Oriole		X		X	X				
Bullock's Oriole		X			X	X	X		
House Finch		X		X	X	X	X		
Pine Siskin						X	X		
Lesser Goldfinch	X				X		X		X
House Sparrow					X	X	X		

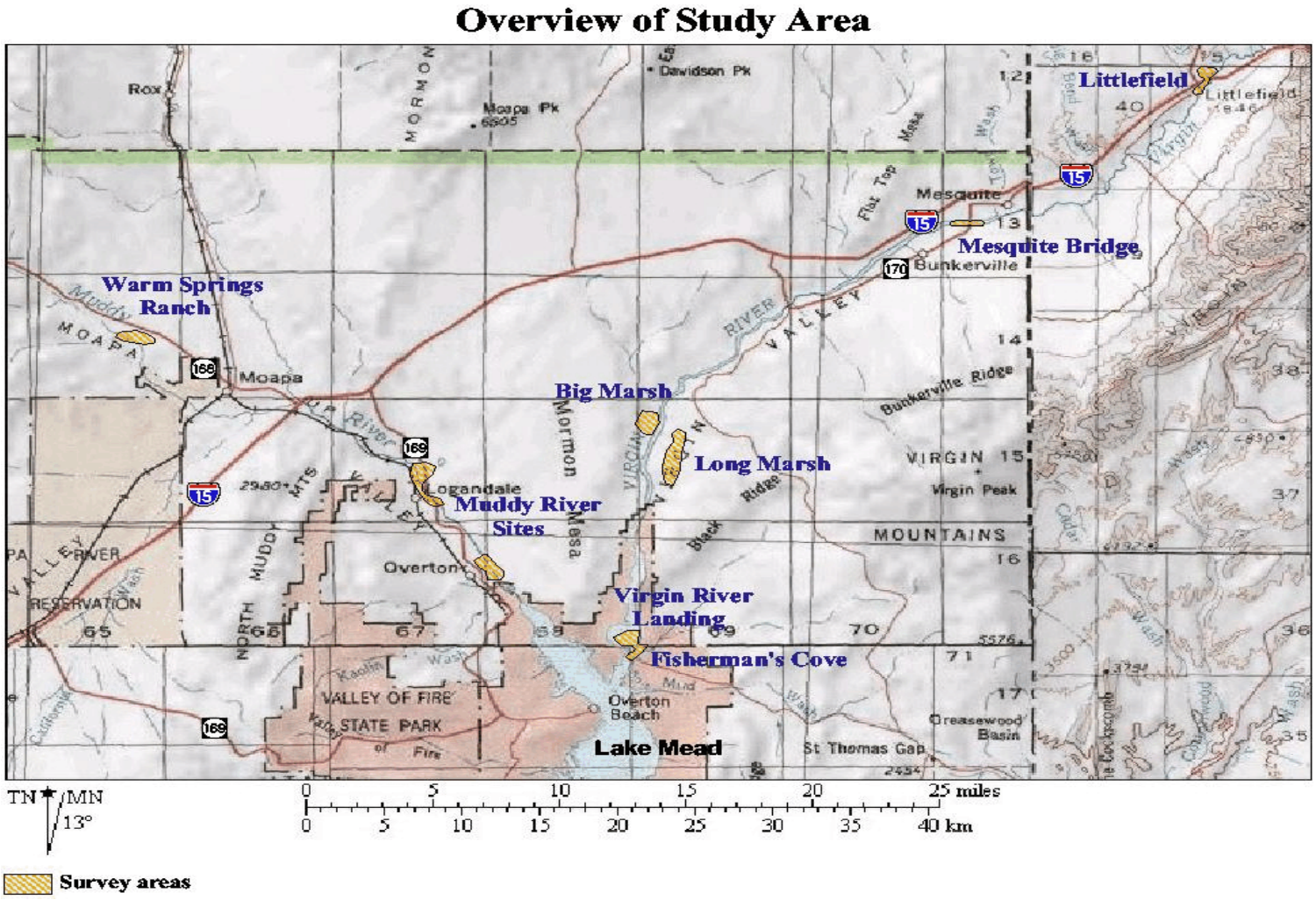

Figure 1: Survey locations for Yuma Clapper Rail and Yellow-billed Cuckoo along the Virgin and Muddy Rivers from 2000 through 2005. All sites not necessarily surveyed every year. See text and tables for details.

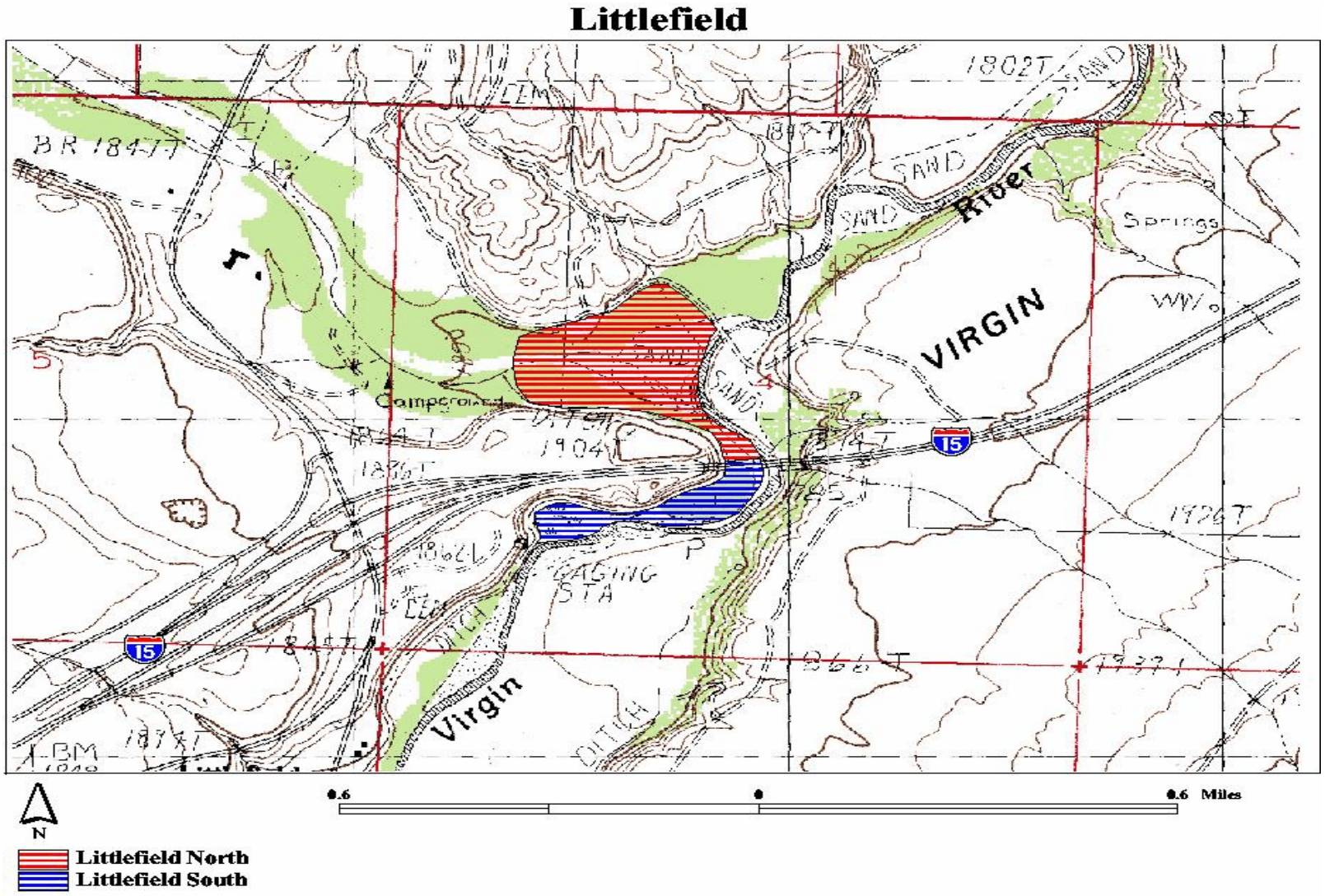

Figure 2: Littlefield, Arizona survey sites for Yellow-billed Cuckoo.

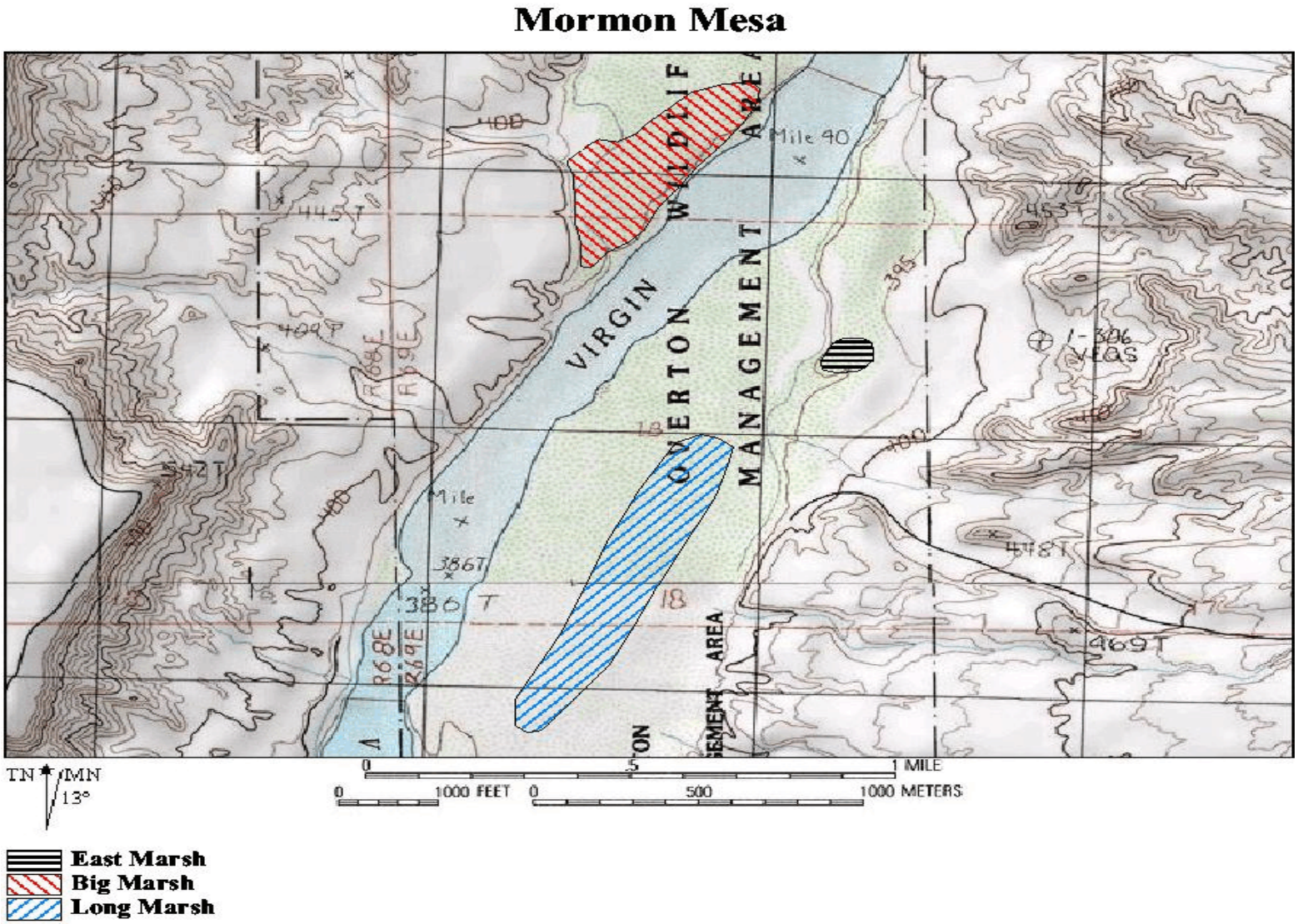

Figure 3: Mormon Mesa survey sites for Yuma Clapper Rail and Yellow-billed Cuckoo

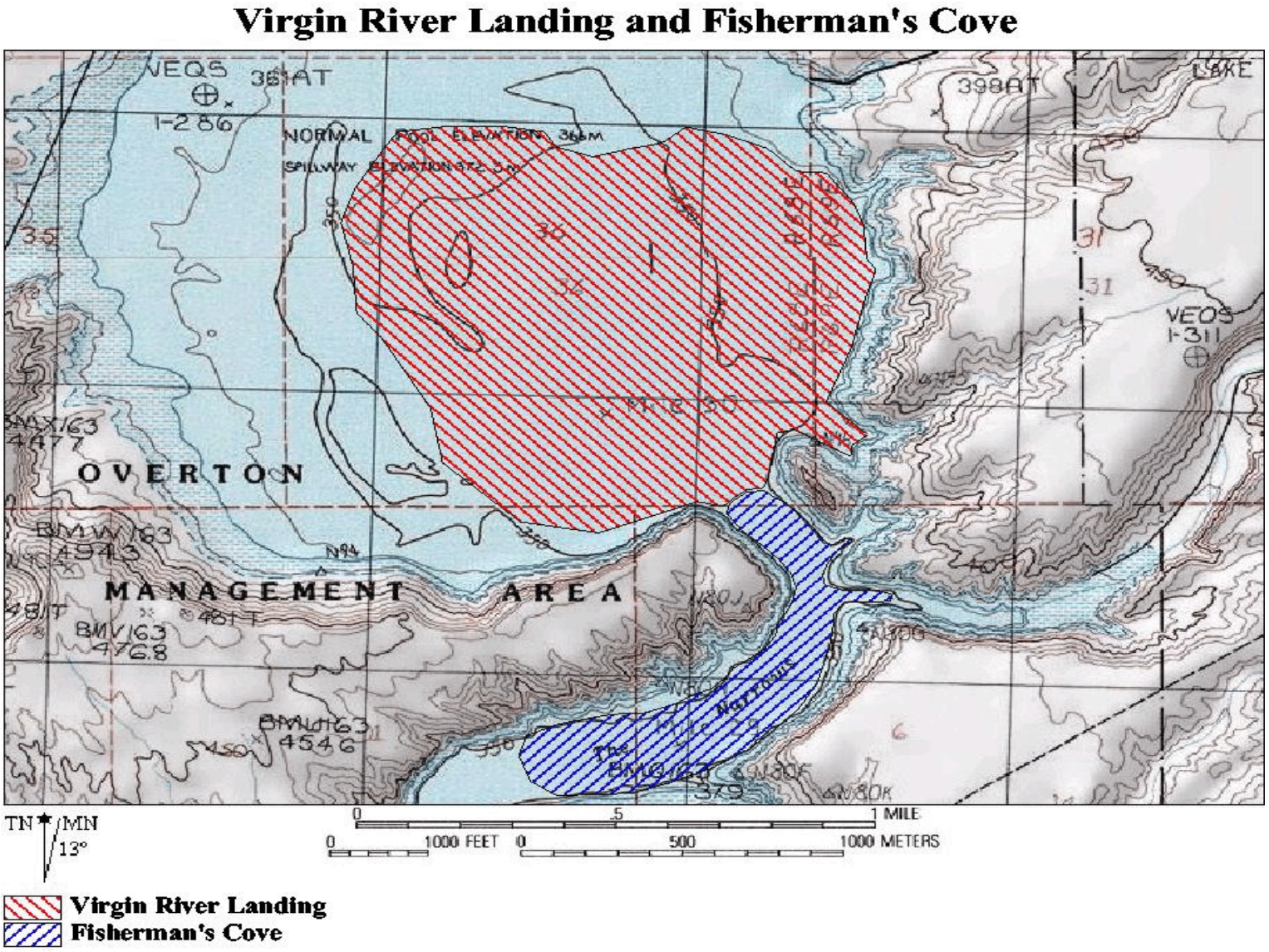

Figure 4: Virgin River delta sites for Yuma Clapper Rail and Yellow-billed Cuckoo.

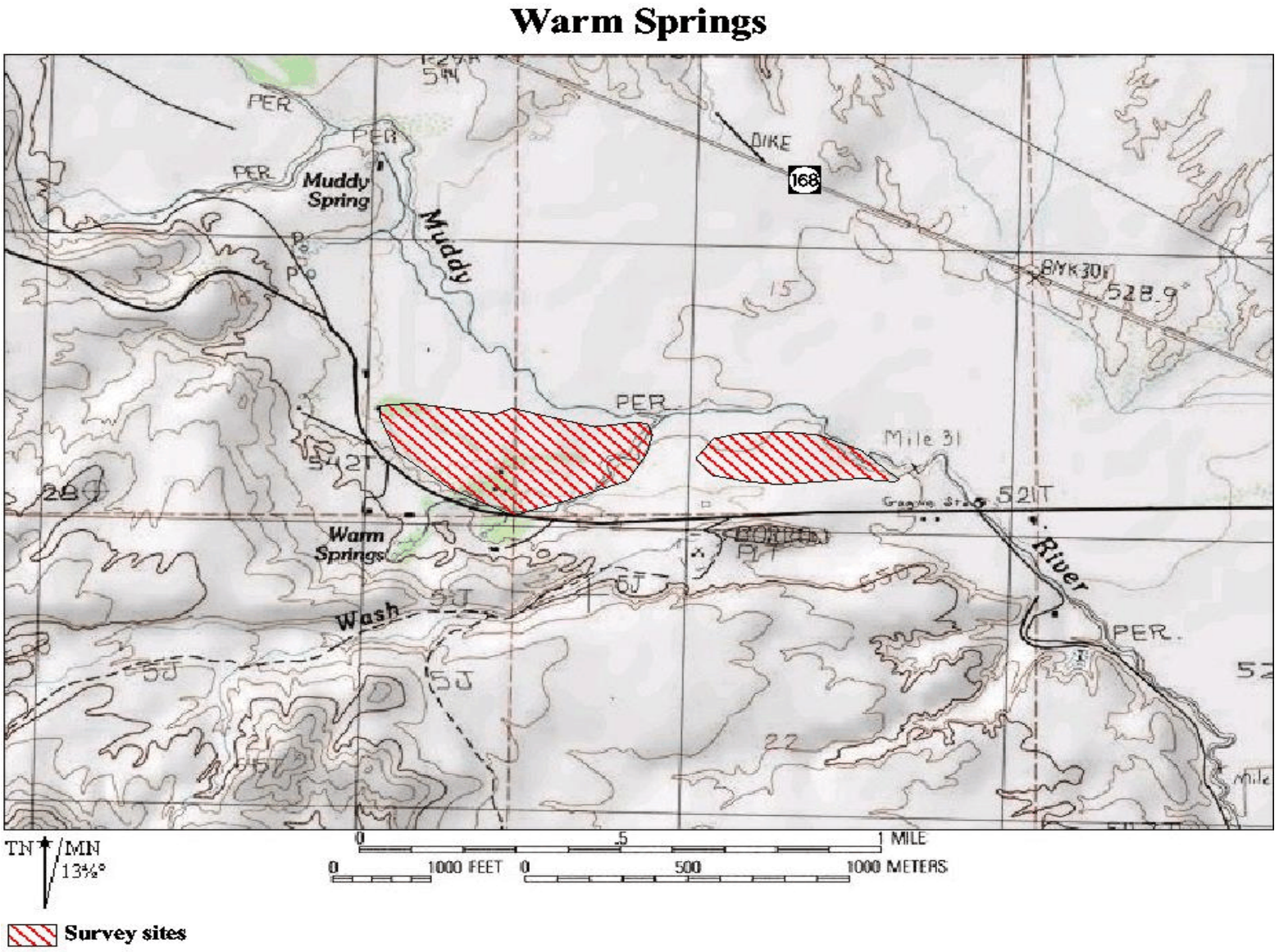

Figure 5: Warm Springs Ranch survey site for Yellow-billed Cuckoo.

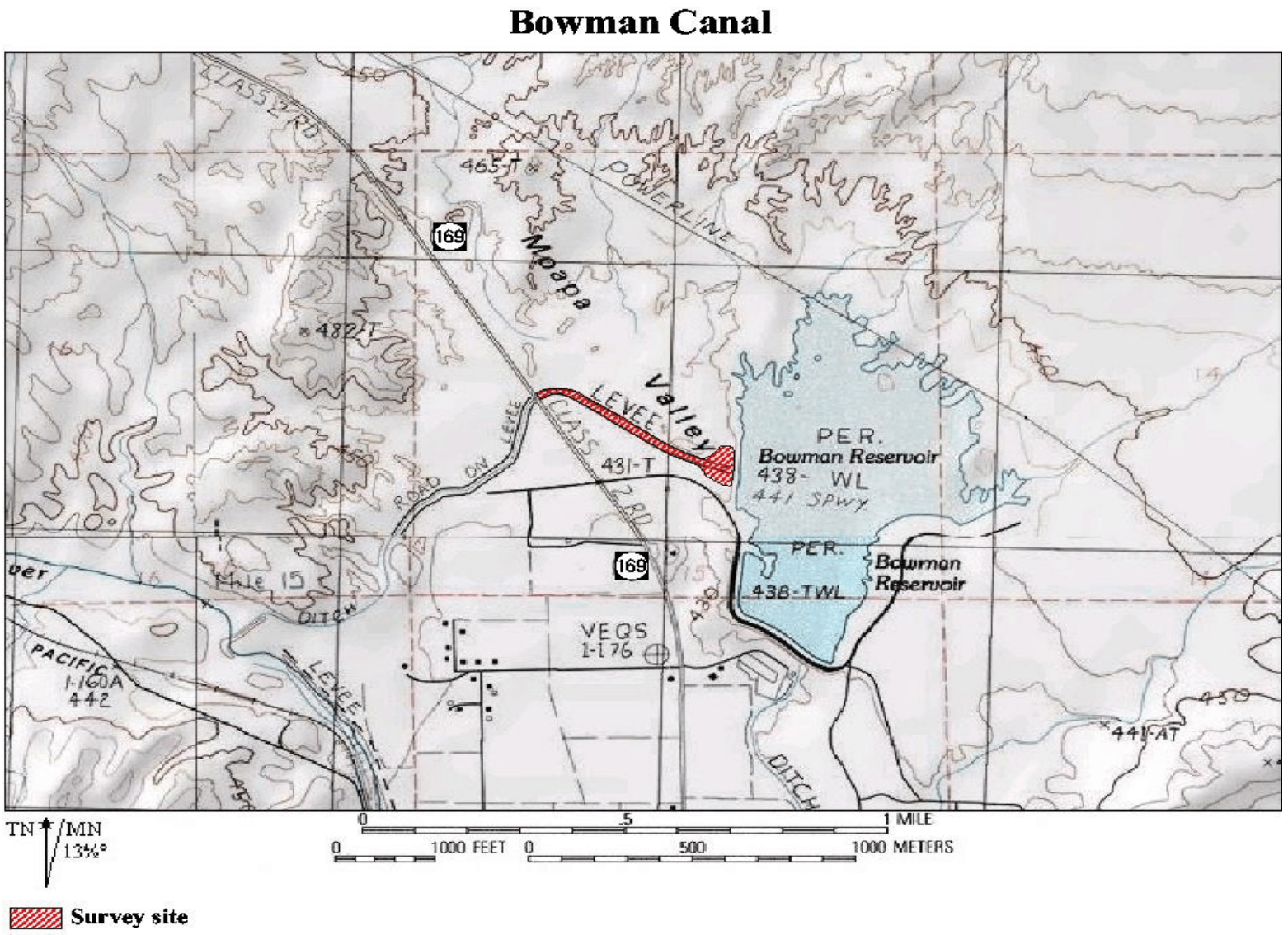

Figure 6: Bowman canal survey site for Yuma Clapper Rail.

Grant Bowler Park

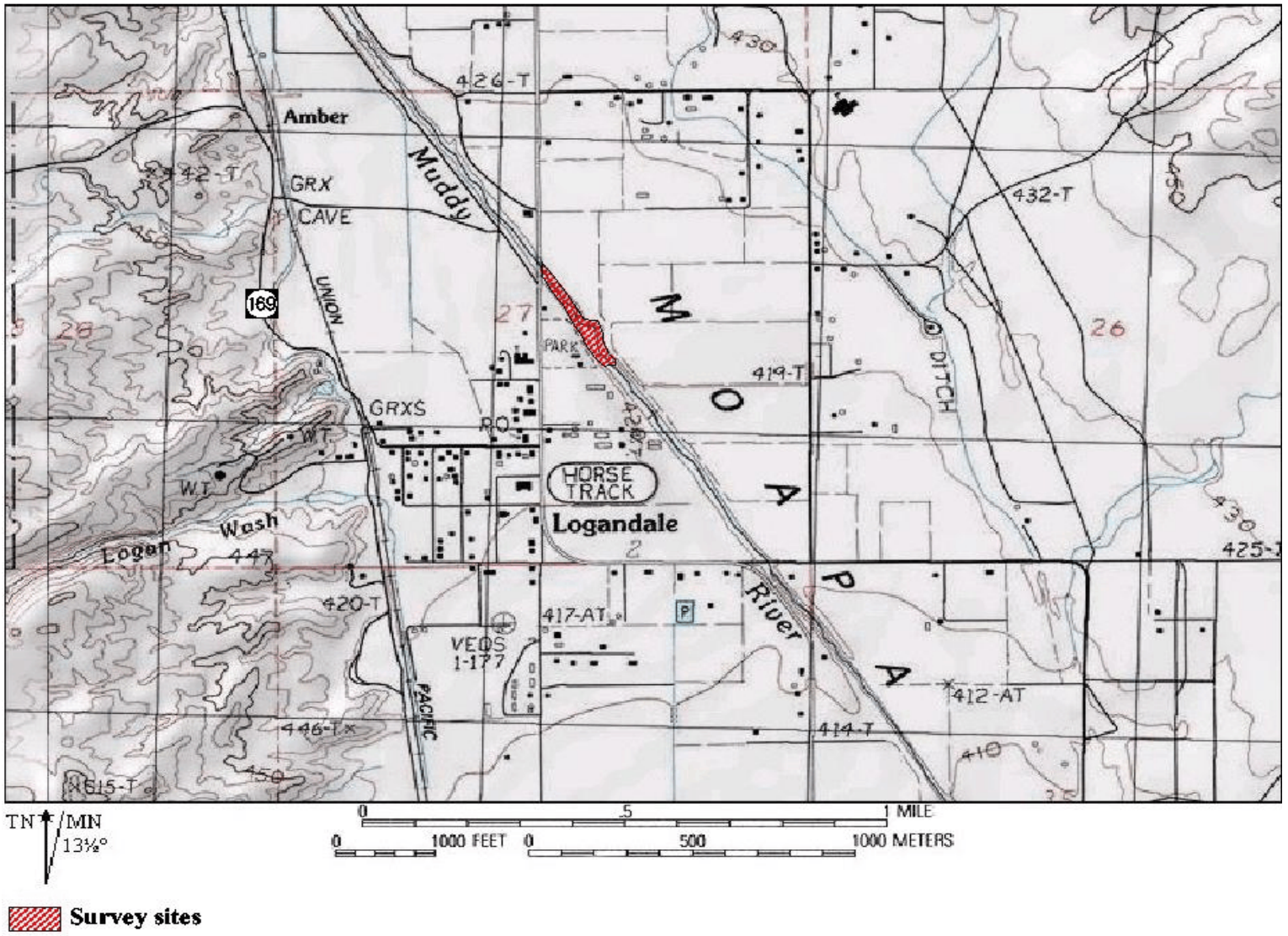

Figure 7: Grant Bowler Park survey site for Yuma Clapper Rail.

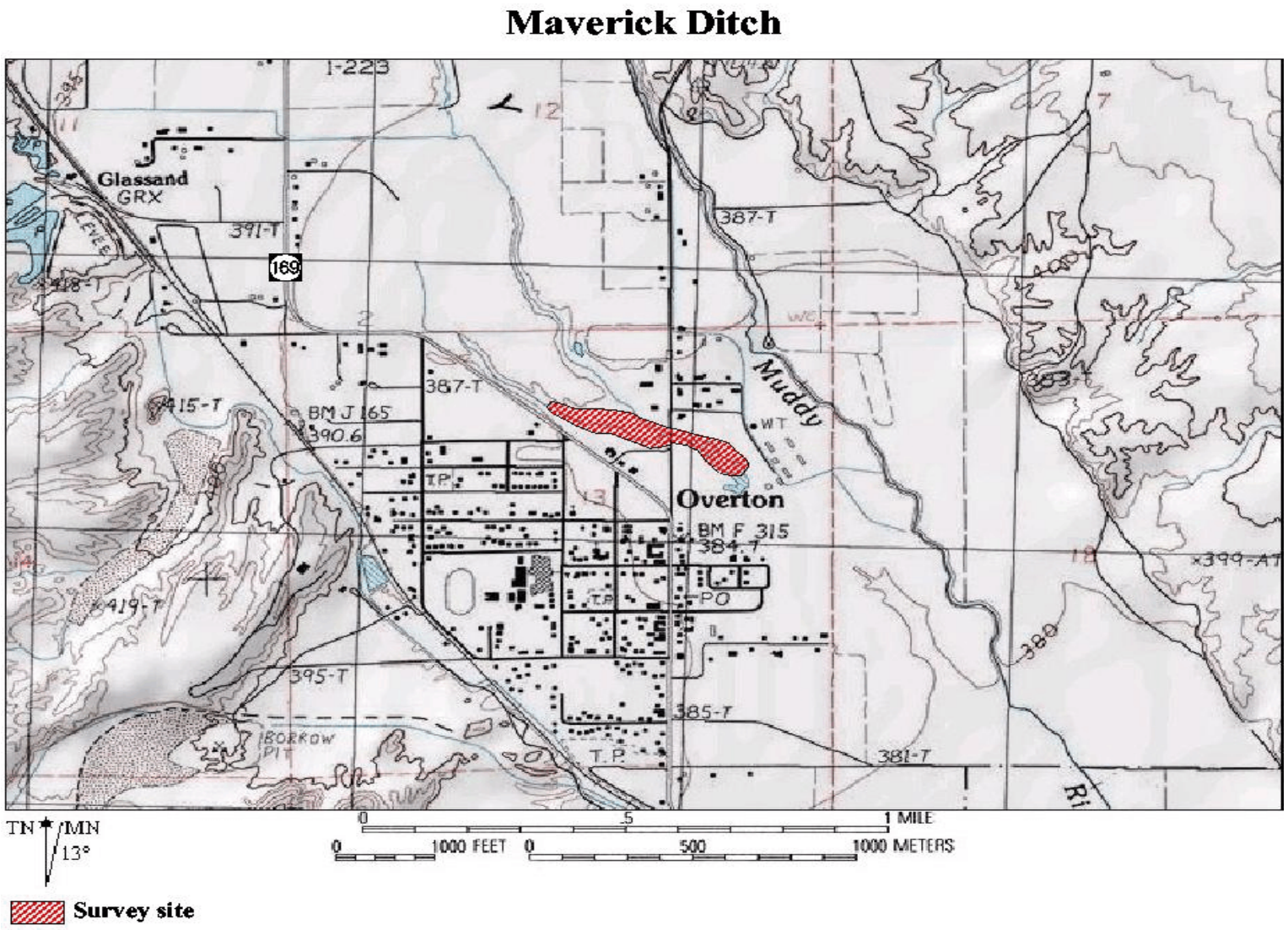

Figure 8: Maverick Ditch survey site for Yuma Clapper Rail.

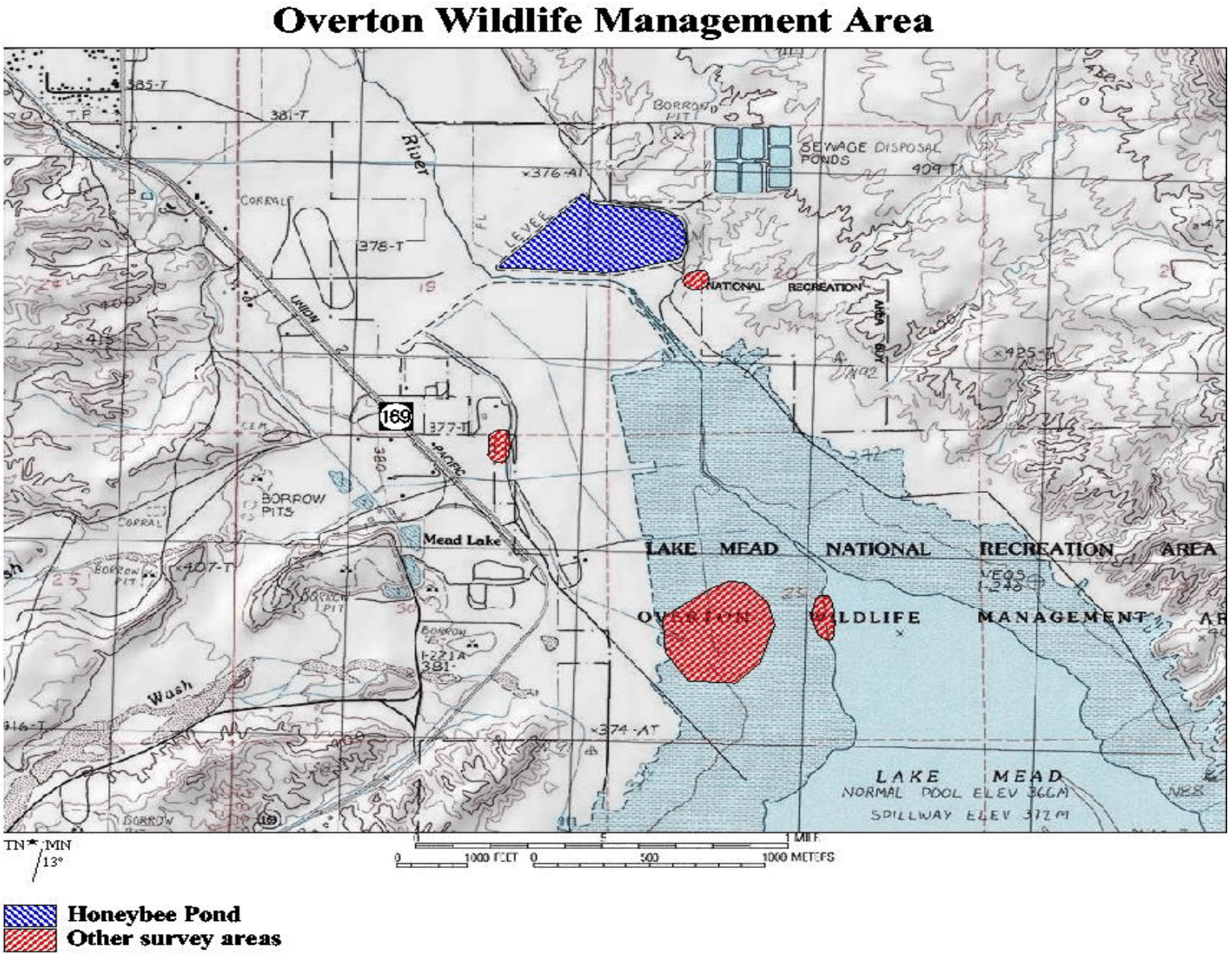

Figure 9: Overton Wildlife Management Area survey sites for Yuma Clapper Rail and Yellow-billed Cuckoo.

THE STATUS OF YUMA CLAPPER RAIL AND YELLOW-BILLED CUCKOO ALONG PORTIONS OF THE VIRGIN RIVER AND MUDDY RIVER IN SOUTHERN NEVADA: 2006 Final

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July 2007

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INTRODUCTION

The Clapper Rail (*Rallus longirostris*) is a marsh obligate species whose range includes saltwater marshland from New England south to Texas along the Atlantic coast and from San Francisco south to Baja California along the Pacific coast (Bent 1926). The Yuma Clapper Rail subspecies (*Rallus longirostris yumanensis*) is found in freshwater habitats along the Colorado River, associated drainages, and isolated regions of the Salton Sea, California (Philips, et al. 1964, Alcorn 1988, Eddleman 1989). In addition, Yuma Clapper Rail are currently known to occupy areas along the Muddy and Virgin Rivers in southern Nevada (McKernan and Braden 1999, 2001a, 2001b, McKernan and Carter 2002, Rathbun and Braden 2003, Braden, et al. 2005, Miller and Braden 2005).

The breeding season for Clapper Rail extends from mid-March through August. Nests are placed on elevated ground within the marsh and are constructed of plant stems and grasses. The nests are concealed with live vegetation pulled over the nest to form a canopy. A clutch of 8 to 11 eggs is laid in the nest, but may occasionally be as few as 4 or as many as 14 eggs. Both male and female Clapper Rail incubate the eggs for 20 to 24 days. Both parents attend to the nestlings. Nestlings can swim within a day after hatching, are independent of parents in 35 to 42 days, and can fly by 63 to 70 days after hatching (Baicich and Harrison 1997).

Yellow-billed Cuckoo (*Coccyzus americanus*) are found in stream-side willow and alder groves, open woodlands, parklands, gardens and orchards from British Columbia east to Newfoundland and south into South America (Alcorn 1988, Baicich and Harrison 1997). The breeding range of the Yellow-billed Cuckoo in the United States includes isolated areas of Idaho, Utah, California, Arizona, southern Nevada, and throughout most of the continent east of the Rocky Mountains to the Atlantic coast (Mulroy 2002). The distribution of the western race of the Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*) has contracted in recent years. The Yellow-billed Cuckoo has been considered a rare and transient summer resident in Nevada where the breeding populations in the western and southern portion of the state are considered to be nearly extinct (Alcorn 1988).

The breeding season for the Yellow-billed Cuckoo extends from late May through early August. Nests are concealed in a bush or tree from 2 to 20 feet above the ground and are constructed of a variety of plant materials. A clutch of 3 to 4 eggs are laid in the nest, but may be as few as 1 or as many as 5 eggs. The female incubates the eggs for 9 to 11 days, with occasional help from the male. The nestlings are tended by both parents and can fly about 21 days after hatching (Baicich and Harrison 1997).

The Muddy and Virgin Rivers in southern Nevada both contain multiple areas of suitable breeding habitat for the Yuma Clapper Rail and the Yellow-billed Cuckoo. This report details the continuation of the focused Clapper Rail and Yellow-billed Cuckoo surveys by San Bernardino County Museum Biologists that have been conducted along the Virgin and Muddy Rivers in southern Nevada since 1999.

METHODS

Survey Methodology:

Yuma Clapper Rail - Field surveys were conducted from April to June 2006, depending on the site, to determine the presence of Yuma Clapper Rail. The surveys were conducted between 5:00 AM and 12:00 PM and consisted of walks through and around suitable habitat. Surveyors stopped every 20 to 40 meters to play a continuous loop tape with recordings of Yuma Clapper Rail vocalizations including "keks", "clatters", and agitated "kek'ing". The tape was played for up to 2 minutes, with a pause of up to three minutes after each broadcast to listen for a response. In addition, surveyors walked through the habitat observing and listening for birds, without the use of tapes, for unspecified periods of time.

Yellow-billed Cuckoo - Field surveys were conducted from June through early August 2006 to determine the presence of Yellow-billed Cuckoo. The surveys were conducted between 5:15 AM and 12:15 PM and consisted of walks through suitable habitat. Surveyors stopped at regular intervals and played continuous recordings of Yellow-billed Cuckoo vocalizations, primarily the "ka ka ka ka kow kow kowlp kowlp" call, which was played for 30 to 45 seconds with a 2-minute pause after each play to listen for a response.

The Warm Springs site was surveyed only in conjunction with an associate of the landowner and therefore limited in number. The surveys were performed in the same way each time along a route established by Nevada Department of Wildlife biologists.

Survey Site Descriptions:

An overview of site locations can be found in Figure 1. Coordinates for the survey sites are listed in Table 1 using NAD 27 projection. Specific site descriptions follow:

Virgin River Sites

The Virgin River flows south from Utah and terminates at Lake Mead. The perennial river flow is largely unaltered with the exception of a few erosion control structures in the town of Mesquite and several minor irrigation diversions. Consequently, the river is susceptible to flooding, usually during warm winter storms or heavy spring run-off. The marsh vegetation along the river, when present, is dominated by cattail (*Typha* spp.) and bulrush (*Scirpus* spp.), with intermixed components of Goodding black willow (*Salix gooddingii*), sandbar willow (*S. exigua*) and tamarisk (*Tamarix* spp.). Wooded areas are present in conjunction with most of the sites surveyed and are comprised of willow, tamarisk, Fremont cottonwood (*Populus fremontii*), and honey mesquite (*Prosopis glandulosa*). The survey sites along the Virgin River (Figures 2, 4, 5, 8) are in the vicinity of Littlefield, Arizona and Mesquite, Mormon Mesa, and the Virgin River Delta in southern Nevada (Table 1).

Extensive flooding in 2005 and efforts to control the flooding, especially in the town of Mesquite, substantially diminished the available Yuma Clapper Rail and Yellow-billed Cuckoo habitats along the Virgin River (Miller et al 2006). By the 2006 survey season, Yuma Clapper Rail and to a lesser degree Yellow-billed Cuckoo habitats had recovered sufficiently to warrant surveys at most of the historic survey sites. For most survey sites and the Virgin River in general, suitable Yuma Clapper Rail and Yellow-billed Cuckoo habitats were either in the early stages of

growth and recovery or, recovery was being impeded by alterations in and around the Virgin River channel, the later being most evident in the town of Mesquite. Site-specific details are discussed below. In addition, due to the substantial changes in habitats following the 2005 floods, some additional survey locations for Yuma Clapper Rail and Yellow-billed Cuckoo were added for the 2006 surveys (this report). These new survey locations are also detailed below.

Desert Springs, Arizona

Desert Springs is a new site established in 2006 near Littlefield, AZ (Figure 2). The site consists of a 350 meter long and up to 80 meter wide strip of spring fed mature, native, riparian habitat on the Virgin River, across and upstream 850 meters from the historic Littlefield North survey site (Figure 2). The overstory is mature Fremont cottonwood. The understory consists of tamarisk and honey mesquite. Springs flow along the length of the strip feeding patches of yerba mansa (*Anemopsis californica*) and Arizona grape (*Vitis arizonica*). This site was surveyed for Yellow-billed Cuckoo in 2006. The habitat is not suitable for Yuma Clapper Rail.

Littlefield, Arizona

Littlefield North is slowly recovering from the flooding of 2005 but the changes to the vegetative structure and composition are still dramatic. The understory of the gallery Fremont cottonwood grove is still scoured out, along with the adjacent marshy area. The human habitations adjacent to the golf course and Beaver Dam Wash have not been replaced. Great swaths of the adjacent golf course are still torn up and the facility remains closed. Beaver Dam Wash flows through a clean gravel channel that is down-cut by 1.2 meters in some areas. Canopy heights, when present, in Beaver Dam Wash are 1 to 2 meters but in general there is little vegetation remaining. There has been no noticeable beaver activity at the site since 2005. There was little habitat to survey in 2006 at this site except for the gallery cottonwood grove and some remaining stands of tamarisk near the Virgin River. Yellow-billed Cuckoo surveys were performed at the gallery cottonwood grove. There were no Yuma Clapper Rail surveys due to the lack of suitable habitat. It is worth noting the nesting Common Black Hawks that have been back each year did return in 2006. This year they located their nest in a cottonwood near the golf course.

Flood damage to Yuma Clapper Rail habitat at Littlefield South (Figure 2) persists but is showing signs of recovery. The 2005 flood scoured out most of the vegetation around the historic marsh. The dense stand of tamarisk, willow and cottonwood on the south side of the site was completely washed away. The site has several clumps of live cattail near the river and many clumps of dead or dying cattail away from the river. Prior to 13 May 2006 there was no suitable Yuma Clapper Rail habitat at this site. By 13 May 2006 there was slow recolonization of the former marsh. Limited Yuma Clapper Rail surveys were performed at the Littlefield South site in 2006 coincident with the emergence of suitable habitat. The habitat was not suitable for Yellow-billed Cuckoo in 2006.

Mesquite

First disturbed by floods and improvised flood control structures in 2005, habitat recovery at the Mesquite Bridge Site (Figure 4) continues to be disrupted by in-channel activities both up and downstream of the Mesquite Bridge. Nevertheless, by the 2006 survey season, emergent rail habitats had become re-established both up and downstream of the bridge. Two recently created

backwater ponds occur just upstream and adjacent to the Mesquite Bridge. Both ponds receive excess runoff from an adjacent irrigation canal and from the Virgin River. The pond immediately upstream of the bridge is dominated by cattail and provides the best rail habitat. The pond farther upstream consists of open water with a shallow ring of cattail around its perimeter.

Downstream of the Mesquite Bridge rail habitat has also become re-established on the northwest side of the Virgin River channel, but outside of the improvised high water dikes created after the 2005 floods. Emergent rail habitat consists mostly of cattail with lesser amounts of sedges, emergent willow and tamarisk. The habitat appears to be watered by sub-surface flows, agricultural runoff and other unidentified sources originating in the town of Mesquite. There is no longer a clear surface flow connection to the Virgin River due to the improvised high water dike. All of the upstream and downstream emergent rail habitats in 2006 occurred within the perimeter of the historic Mesquite Bridge Site and all were surveyed for Yuma Clapper Rail in 2006.

The floods of 2005 eliminated the available Yellow-billed Cuckoo habitat at the historic Mesquite Bridge survey sites and the associated improvised flood control activities. Suitable Yellow-billed Cuckoo habitat has not recovered at the time of this report. A new Yellow-billed Cuckoo survey site, designated as Mesquite Bridge 2 (Figure 4), was established and surveyed for Yellow-billed Cuckoo in 2006. This new survey site is located 350 meters downstream of the Mesquite Bridge on the southeast side of the Virgin River channel. The habitat is composed of mature Fremont cottonwood and black willow. The site is immediately adjacent to the Virgin River and bordered on the southeast by an agricultural field.

Mormon Mesa

Big Marsh is located along the northwestern bank of the Virgin River near Mormon Mesa (Figure 5). The marsh is fed by a spring as well as inflow from the Virgin River, the later depending on the alignment of the river channel. The flow alignment in the Virgin River channel is variable among years and as a consequence the inflow to the marsh varies among years. Dense stands of Goodding black willow, sandbar willow, and tamarisk up to 8 meters tall still border the marsh to the northeast, east and southeast. At the extreme downstream edge, the marsh merges with the Virgin River active flow channel and eventually discharges into the river channel. The marsh habitat is recovering from the 2005 flood, though the extent of available marsh habitat remains substantially reduced from pre-flood conditions. Mature cattail covered the entire surface of Big Marsh in pre-flood conditions. Post flood, marsh vegetation was restricted to the perimeter of the marsh with the interior covered by a large expanse of open water. Nevertheless the progress in habitat recovery is encouraging as there was more and higher quality rail habitat in the 2006 survey season versus the 2005 season. Both Yuma Clapper Rail and Yellow-billed Cuckoo surveys were performed at Big Marsh in 2006.

Long Marsh is a long (1.5 kilometer) linear stretch of marsh habitat that runs parallel to and down the center of the Virgin River channel (Figure 5). Outside of large flood events, the active portion of the Virgin River flows on either the northwest or the southeast side of Long Marsh, but not both. After the flood of 2005 the Virgin River changed its course to the northwest side of the Virgin River channel (the northwest side of Long Marsh). Prior to the floods, the habitat in the marsh was complex. Patchy stands of low profile (< 2 meters) cattail and 3 to 5 meter tamarisk thickets predominated on the southeast side of the marsh, becoming dense

conglomerations of cattail, black willow, sandbar willow, and tamarisk with 100% cover on the northwest side of the marsh where vegetation heights averaged 7 meters or more. Since the 2005 flood, the habitat in Long Marsh remains complex but the suitable rail habitat has been substantially diminished. More specifically, the cattail stands have been reduced to low profile patches, the surface water flows have been much reduced, there has been an overall drying of the marsh vegetation, and rail habitat damaged by range cattle has increase significantly. In contrast, Yellow-billed Cuckoo habitat in Long Marsh was improved by the 2006 survey season. Realignment of the active river channel post-2005 appears to have revived black willow habitat, at least in the short term, which parallels the northwest margins of the marsh. Both Yuma Clapper Rail and Yellow-billed Cuckoo surveys were performed at Long Marsh in 2006.

East Marsh was a small (< 4 ha) circular piece of marsh habitat on the east side of the Virgin River northeast of Long Marsh (Figure 5). East Marsh has been dry and devoid of live vegetation since the 2005 survey season. Conditions were unchanged for the 2006 survey season therefore no surveys were performed in 2006.

Virgin Delta

Virgin River Landing and Fisherman's Cove were new sites in 2003 (Figure 8). In prior years both sites were inundated by Lake Mead. Reduced lake levels exposed these sites in 2002, which quickly became populated with emergent vegetation. In 2005, Fisherman's Cove was completely scoured of vegetation as strong flows passed through the "Narrows" before dumping into Lake Mead. The river channel was down-cut up to 6 meters in some places. In 2006, a majority of the new emergent cattail were eaten to the ground by cattle from Virgin Landing down to Lake Mead making it unsuitable for Yuma Clapper Rail, although two Virginia Rail were detected. One Yuma Clapper Rail survey was performed at this site in June of 2006. The habitat was not suitable for Yuma Clapper Rail prior to June of 2006. The habitat is not suitable for Yellow-billed Cuckoo.

The section of the river flowing through Virgin River Landing (Figure 8) down-cut into the habitat up to 5 meters in some places. No surface water was present in the habitat around the entrenched river channel. Stands of dying cattail up to 2 meters high and incredibly thick tamarisk up to 3 meters tall dominate the area. Absent any influence from Lake Mead, the area is largely dependent on flows from the Virgin River though springs are present in some areas. In short, there was little sign of rail habitat recovery at this site following the 2005 floods. The entrenchment of the river channel is a major concern as little if any water is available to create marshy conditions. Range cattle are likewise a major concern at this site. Grazing cattle eliminated emergent marsh habitat in the entrenched channel for most of the survey season. By 6 June sufficient rail habitat of very low quality had emerged to warrant a single Yuma Clapper Rail survey. The habitat was not suitable for Yellow-billed Cuckoo, being patchy and low in profile, and will likely continue to be so.

Muddy River Sites

The surveyed areas of the Muddy River begin in the Moapa Valley west of Glendale and terminate near Lake Mead (Figures 1, 3, 6, 7 and 9). The channel and perennial river flows in the channel have been heavily modified and re-directed east of Glendale by a complex series of flood control structures, agricultural channels, agricultural drains, canals, and waterfowl management

diversions. Since the flooding of 2005, the habitat along and in the Muddy River varies greatly in the degree of openness and vegetative structure but has several areas of habitat suitable for Yuma Clapper Rail and Yellow-billed Cuckoo. The marsh vegetation is dominated by cattail, bulrush, and common reed (*Phragmites australis*) with intermixed components of Goodding black willow, sandbar willow and tamarisk. Wooded areas are present in conjunction with most of the sites surveyed and are comprised of Goodding black willow, sandbar willow, tamarisk, Fremont cottonwood, and honey mesquite. With the exception of Honeybee Pond, South Marsh, and Warm Springs Ranch, most habitats occur as small patches (ca. 0.5 to 5 ha.) or short (100 to 800 m) linear lengths. The survey sites along the Muddy River are in the vicinity of Moapa, Overton, and Logandale (Table 1 and Figure 1). A larger scale map of survey sites associated with the Overton Wildlife Management Area (OWMA) southeast of Overton is provided in Figure 7.

Warm Springs Ranch

The Warm Springs Ranch site is located in the Moapa Valley at the Warm Springs Ranch, approximately nine miles west of Glendale and one mile south of Highway 168 (Figure 9). The site is adjacent to but not on the Muddy River. Surface flows on the site come from Warm Springs, located immediately south of the river. Water from the springs flow through the area, emptying into the Muddy River to the north. The habitat at the site is composed of cottonwood, black willow, velvet ash (*Fraxinus velutina*), tamarisk, and non-native fan palms (*Washingtonia filifera).* The canopy height is variable, but generally 5 to 15+ meters. The canopy is not continuous. Perennials are patchy with intervening pastures and ruderal fields. Cottonwoods are mostly arrayed in a linear fashion along pasture borders, though cottonwood, ash, willow, and tamarisk patches are scattered throughout the site near water sources and other moist areas. The habitat is robust and quite suitable for Yellow-billed Cuckoo, which are reported to have bred there in large numbers (ca. 7-14 pairs) in previous years. This was one of the only sites not affected by the flooding in 2005.

Logandale

The Grant Bowler Park site is located in Grant Bowler Park in the town of Logandale (Figure 1). The Grant Bowler Park site was not surveyed for Yuma Clapper Rail. The habitat is no longer suitable for Yuma Clapper Rail and Yellow-billed Cuckoo. Left undisturbed the habitat at this site has the potential to return to suitable Yuma Clapper Rail habitat.

Bowman Canal is an overflow and runoff catchment for Bowman Reservoir and the surrounding farmland (Figure 1). The canal is four meters wide and approximately 180 meters long with three small ponds at the juncture with the reservoir's head gate. The canal was cleared of vegetation between the 2005 and 2006 survey seasons. Clearing the Bowman canal appears to be an annual event. Left undisturbed the habitat at this site has the potential to return to suitable Yuma Clapper Rail habitat. The site was not surveyed for Yuma Clapper Rail in 2006.

Overton

The Maverick Ditch site is located in the town of Overton near the intersection of Cooper and Jones Street (Figure 3). The site was named after the Maverick convenience store immediately adjacent to the site. The channel appears to function for irrigation, high water overflow, and possibly suburban storm water run-off. The surveyed area is approximately 400

meters long and 50 meters across at its widest point. A majority of the site burned in early 2004 but recovered very quickly. The tamarisk on the edges of the site were unaffected by the fire. The site is dominated by small cattail, bulrush, tamarisk and yerba mansa averaging one meter tall. Common reed up to two meters tall is also present in abundance in some areas. Tamarisk up to 4 meters are common along the edges of the surveyed area and a mature monotypic cattail patch of up to 3 meters persists at the southeastern end of the site. The surveyed area is bordered by homes and businesses in a rural setting. This site has recovered completely from the 2005 floods. The Maverick Ditch site was surveyed for Yuma Clapper Rail in 2006. The habitat is not suitable for Yellow-billed Cuckoo.

Overton Wildlife Management Area (OWMA)

The Overton Wildlife Management area (OWMA), operated by the Nevada Division of Wildlife (NDOW), encompasses several survey areas for both Yuma Clapper Rail and Yellow-billed Cuckoo (Figures 1, 6, and 7). Suitable habitats at five of the survey sites are rather small, composed of 1.5 ha or less of habitat, depending on the survey area. Suitable habitats at two of the sites, Honeybee Pond (Figure 6) and South Marsh (Figure 7) are more substantial in regards to Yuma Clapper Rail.

Honeybee Pond is located on the OWMA near Overton and was subdivided during past surveys into Eastern and Western sites (Figure 6). In 2004 and 2005, the sites were combined and surveyed as one site. The habitat in the area is composed of cattail and reeds in both Honeybee Pond and the smaller surrounding water impoundments. A few Black willows and more extensive mature tamarisk thickets line the channels that connect adjacent ponds. The channels are periodically flooded. Water for Honeybee Pond and the associated impoundments is diverted from the Muddy River channel, which lies immediately to the north. Honeybee Pond, in conjunction with nearby ponds, provides shallow open water habitats that are largely managed for waterfowl. In 2006, the shallow ponds north of Honeybee pond were left dry and covered by young tamarisk up to 3 meters tall. Honeybee Pond itself was filled to capacity during the late spring/early summer and gradually receded but not as dramatically as in 2005 when the pond almost completely dried up. Suitable habitats in Honeybee Pond were surveyed for Yuma Clapper Rail in 2006. The surrounding habitat was also surveyed for Yellow-billed Cuckoo (Figure 6).

The Refuge Housing and Maintenance Shed site (Figure 7) is located, as the name suggests, adjacent and south of the OWMA housing area on Wildlife Road and 300 meters further south to the maintenance sheds. The habitat is park like, composed of mature cottonwood and locust trees embedded in open, grassy, park like areas. The habitats were surveyed for Yellow-billed Cuckoo. There is no suitable Yuma Clapper Rail habitat at these sites.

The Southwestern Willow Flycatcher site was new in 2005 (Figure 7). The habitat consists of a 150 meter strip of dense and mature Goodding black with a sandbar willow and tamarisk understory. The site borders the Muddy River. The site was named after the Southwestern Willow Flycatchers incidentally found at the site in 2005 and 2006 by SBCM biologists. The site was surveyed for Yellow-billed Cuckoo. There is no suitable Yuma Clapper Rail habitat at the site.

The Pintail Pond site (Figure 7) is a group of two interconnected ponds that are filled from the main irrigation ditch originating from the Muddy River. The site is bordered by cattail around the northern and eastern margins of the ponds. The centers of the ponds are usually open shallow water. The size and extent of Yuma Clapper Rail habitat at this site varies from year to year, depending on the waterfowl management prescriptions being applied by NDOW for that year. Habitat at Pintail Pond was surveyed for Clapper Rail. The habitat is not suitable for Yellow-billed Cuckoo.

The Willow Strip site (Figure 7) is located along the access road dikes around Pintail Pond. These access/dike roads are lined with linear strips of mature black willow from 3 to 5 meters tall. Coverages range from continuous to patchy. Habitats bordering the southern edge of the lower road are composed of dense tamarisk and mesquite up to 4 meters tall. These habitats were surveyed for Yellow-billed Cuckoo in 2006.

The South Marsh site (Figure 7) is located at the southernmost end of the OWMA. The site is composed of two large water impoundments bordered by access roads that circumnavigate the impoundments. The habitat is composed of cattail patches up to 250 meters wide and nearly 1 kilometer long interspersed with black willow, sandbar willow and tamarisk. The South Marsh site comprises the best and most extensive Yuma Clapper Rail habitat on the OWMA and was surveyed for the first time in 2006.

RESULTS

Yuma Clapper Rail

Yuma Clapper Rail survey dates, durations, and results are tabulated in Table 2. One Yuma Clapper Rail was detected on 3 May, two were detected on 31 May, and two were detected on 1 June. All detections occurred at South Marsh (Figure 7) and all occurred within the same cattail patch on the north side of the southernmost pond at the terminus of the OWMA road that leads south from the maintenance sheds.

Other Rail Detections

Detections of Sora, Virginia Rail, and Black Rail are tabulated in Table 2. Virginia Rail were detected at nearly every survey site and was the most abundant rail detected. Sora were detected in abundance at Honeybee Pond. A family group of Sora were also detected at the Maverick Ditch in early May. Black Rail were incidentally detected by sight and call at both the Big Marsh and the Mesquite Bridge sites.

Yellow-billed Cuckoo

Yellow-billed Cuckoo survey dates, durations, and results are tabulated in Table 3. Four Yellow-billed Cuckoos were observed in 2006, up from two in 2005. A single bird was heard giving the *kowlp* call while surveying Warm Springs Ranch on 24 June. Another individual was observed on 10 July at Long Marsh. It was preening for several minutes in a small black willow thicket. A pair of cuckoo were observed in the area around Big Marsh on 24 and 25 July. They

flew in aggressively to the taped playback and periodically gave a previously unknown, plaintive *ont - ont -ont* call reminiscent of the Family Trogonidae. Extensive nest searching yielded no results leaving breeding status probable but still speculative.

Other Species' Detections

Incidental bird species detected at each survey site during the 2006 surveys are tabulated in Table 5. 110 species of birds were detected during the 2006 survey season, down from 117 in 2005 and 139 in 2004. A casual Black-bellied Whistling Duck was observed landing and feeding in Big Marsh on 25 July. Detections of Least Bittern continued at Honeybee Pond and may be of particular interest. Eleven species of waterfowl and wading birds were noticeably absent from the 2006 species list coincident with the limited amount of pooled surface water at OWMA and continued channelization of the Virgin River at the Virgin River Delta. The occurrence of other species of interest at the survey sites can be determined by inspection of Table 5. Species detections were incidental and do not indicate absence of any particular species from a survey site.

The Southwestern Willow Flycatcher site on the OWMA discovered in 2005 continued to be active with several pairs in 2006. In addition, a pair of Southwestern Willow Flycatcher and their nest were discovered at the Mesquite Bridge 2 site while surveying for Yellow-billed Cuckoo on 8 July. The pair was protective of their nest, which contained one Brown-headed Cowbird egg and had one broken Brown-headed Cowbird egg under the nest. The UTM of the pair and nest is 11 758739E, 4075336N (NAD 27). The birds were not seen or heard after 8 July.

DISCUSSION

Yuma Clapper Rail

Rail habitats on the Virgin/Muddy river complex for the 2006 survey season showed improvement relative to the 2005 survey season when little to no habitat remained following the 2005 floods. Still, suitable rail habitats in 2006 remain, though somewhat reduced relative to previous years due to the 2005 floods, attempts to control them, and grazing by range cattle. Generally speaking, the quality, amount and distribution of rail habitat, though better than 2005, is low but recovering. In addition, rail habitat recovery and level of site suitability remain highly site dependent. Rail habitat at Littlefield North had not recovered by 2006. Rail habitat at Littlefield South warranted only two surveys late in the season due to insufficient habitat prior to 13 May. Virgin River Landing and Fisherman's Cove suffered similar fates, compounded by range cattle that grazed the emergent cattail to the ground leaving only small clumps in areas too muddy for the cattle to traverse. Rail habitats at the Mesquite Bridge sites are recovering, though continued channel modifications are impeding the recovery. The Mormon Mesa sites are likewise recovering, though the 2005 floods have reduced the available habitat to about 40% of their original Yuma Clapper Rail habitat, a result of scouring and lack of water. The most extensive and highest quality rail habitat in 2006 occurred on the OWMA, where a breeding pair was detected. Overall, rail habitat recovery was proceeding in 2006, albeit slowly and despite disruptions by cattle and continued channel modifications.

Yuma Clapper Rail detections have varied substantially over the years from a high of 26 individuals in 2000 to a low of zero detections in 2005 (Table 4). In 2006, there were five detections from a minimum of two individuals at a new, previously unsurveyed site on the OWMA. The reasons for variable rail detections and site occupancy across the last seven years remains unclear (Miller et al 2005), though fundamentally the reasons are habitat related. Possible factors that appear to be affecting the occurrence and distribution of rail habitat on the Virgin and Muddy River complex are both ultimate and proximal.

Ultimate factors are essentially natural and stochastic, consisting of droughts, floods, and associated river channel realignments (Miller et al 2005). For example, prior to the spring of 2001, the Virgin River flow was immediately adjacent to Big Marsh and flowed through the entire length of Long Marsh. After floods in early 2001, the river channel realigned to approximately 0.5 kilometers southeast of its previous location. The 2001 flooding event was not systemic, having had little affect on rail survey sites and habitats aside from Big and Long Marsh. In contrast, flooding events in 2005 were systemic and not only shifted the Virgin River active channel back to its former location (pre-2001 flood), but also affected rail habitat throughout the Virgin and Muddy River complex. The flood events clearly affect the distribution and abundance of rail habitat on the Virgin Muddy River complex (Miller et al 2005). Absent compounding disturbances from proximal factors (next paragraph) the rail habitat shows a strong propensity to recover from natural disturbances, often within a year.

Proximal factors that appear to affect rail habitat on the Virgin Muddy River complex through time are essentially anthropomorphic. Among these factors are range cattle, channel modifications, land use management practices, and variable water levels in Lake Mead. For example, range cattle have consistently degraded rail habitats on the Virgin River from Mormon Mesa downstream to the Virgin River Delta. Channel modifications to the Virgin River and other land use changes in the town of Mesquite commencing with the 2005 floods are retarding rail habitat recovery. Waterfowl management prescriptions, such as periodic wetland draining and cattail removal to benefit ducks, are affecting rail habitat persistence on the OWMA. Variations in surface elevations of Lake Mead greatly affect the extent, quality and persistence of rail habitats on the Virgin River delta and the downstream portions of the OWMA. Rail habitat persistence and quality has been most affected when ultimate and proximal factors coincide. For example, when floods are followed by cattle grazing or when post flood emergent habitats are disrupted by channel modifications.

Over the last seven years rail habitats on the Virgin/Muddy River complex have demonstrated a strong propensity to recover from flood events and even prolonged drought. Rail habitats on the Virgin and Muddy Rivers can best be enhanced at this point in time by eliminating or at least reducing factors that profoundly prolong recovery time, such as cattle grazing, channel modifications, and modifying rail habitat during the breeding season for the benefit of waterfowl.

Yellow-billed Cuckoo

Similar to Yuma Clapper Rail, Yellow-billed Cuckoo detections have likewise declined over the past five seasons at the survey sites associated with the Virgin and Muddy Rivers (Table 4). The most noticeable declines have again occurred on the Virgin River at the Mormon Mesa sites. Conversely, the only gains in site occupancy occurred at the Mormon Mesa sites with a probable pair located around Big Marsh in 2006. Also noteworthy are apparent declines at the Warm Springs site, which was previously monitored by others and reported to have a large (ca. 7-

14 pair) breeding population. While detection rates are low, Warm Springs has been the most consistent site for detecting cuckoos in the entire study area with one bird detected each year since 2003. Although factors such as below average rainfall, river re-alignment (for some sites), distributional limits, annual variability in habitat suitability, and detection cannot be eliminated as potential reasons influencing the perceived decline, the most parsimonious explanation has to do with Yellow-billed Cuckoo life-history.

The Yellow-billed Cuckoo is a Neotropical migrant exhibiting irruptive breeding patterns. Irruptive breeding means that breeding populations show up in sporadic and inconsistent locations among years. Why irruptive breeders vary in population size and breeding locations from year to year is not known. Proximal causes proposed to explain the irruptive breeding pattern for Yellow-billed Cuckoo have included natural variability in food resources, nesting substrates, habitat loss, habitat conversion, habitat quality, cattle grazing, population declines, search for breeding opportunities, and variable migration routes. All proposed explanations likely have some merit but none have been rigorously tested. This lack of scientific information on the proximal and ultimate causes of Yellow-billed Cuckoo breeding distributional patterns makes it particularly difficult to interpret perceived decreases in cuckoo populations associated with the Virgin and Muddy Rivers. As with Yuma Clapper Rail, there are areas of suitable habitat on the Virgin and Muddy Rivers that are outside of the survey areas. Without an expanded effort, it is not possible to know if declines in Yellow-billed Cuckoo detections at the survey sites, including Warm Springs, are accompanied by increases in other un-surveyed cuckoo habitats associated with the Virgin and Muddy Rivers. Unlike Yuma Clapper Rail, the distance between breeding locations among years could possibly be tens or even hundreds of kilometers.

SUMMARY

Detections of Yellow-billed Cuckoo within surveyed suitable habitat associated with the Virgin and Muddy Rivers remained for 2006. A presumed pair of Yuma Clapper Rail were located in a large pond on the southern end of the OWMA. An increased number of detections in 2006, while reduced from previous survey years, highlight the cyclical variability and sporadic nature of Yellow-billed Cuckoo within habitats in the region. This variability makes it difficult to predict whether Yellow-billed Cuckoo numbers are cycling back to an upward trend or merely experiencing an annual fluctuation. The specific cause of this cyclical variation is unclear but is likely a combination of factors previously discussed. Un-surveyed habitats, undefined confidence levels in survey methodologies, and in the case of Yuma Clapper Rail, poor tape response patterns, confound confirmation of an overall regional decline in southern Nevada for these two species. Continued monitoring of surveyed areas to include all suitable habitat within the jurisdiction of Southern Nevada Water Authority may produce additional information with regard to the habitat and breeding needs of Yuma Clapper Rail and Yellow-billed Cuckoo in southern Nevada and potentially lead to a more refined understanding of their natural history.

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Table 1. Locations, site names, and geographic coordinates for Yuma Clapper Rail and Yellow-billed Cuckoo survey sites on and along the Virgin and Muddy Rivers in southern Nevada for the 2006 breeding season.

SITE NAME	LOCATION	UTM (NAD27)
YUMA CLAPPER RAIL		
Big Marsh	Virgin River near Mormon Mesa	11 739380E, 4057804N
Long Marsh	Virgin River near Mormon Mesa	11 739897E, 4057210N
Fisherman's Cove	Virgin River Delta	11 739475E, 4041309N
Honeybee Pond	Muddy River near Overton, Nevada	11 731344E, 4045517N
Littlefield South	Virgin River in Littlefield, Arizona	12 239409E, 4086681N
Maverick Ditch	Muddy River in Overton, Nevada	11 728854E, 4047398N
Mesquite Bridge	Virgin River in Mesquite, Nevada	11 759409E, 4075400N
Pintail Pond	Overton Wildlife Management Area	11 731709 E, 4043602N to 11 731745 E, 4043607N
South Marsh	Overton Wildlife Management Area	11 732147E, 4042576N to 11 733094E, 4042621N
Virgin River Landing	Virgin River Delta	11 739481E, 4042710N
YELLOW-BILLED CUCKOO		
Desert Springs	Virgin River near Littlefield, Arizona	12 240130E, 4087670N to 12 240301E, 4087785N
Honeybee Pond	Muddy River near Overton, Nevada	11 731344E, 4045517N to 11 732108E, 4044076N

Table 1 continued. Locations, site names, and geographic coordinates for Yuma Clapper Rail and Yellow-billed Cuckoo survey sites on and along the Virgin and Muddy Rivers in southern Nevada for the 2006 breeding season.

SITE NAME	LOCATION	UTM (NAD27)
Littlefield North	Virgin River in Littlefield, Arizona	12 239591E, 4087141N
Long Marsh to Big Marsh	Virgin River near Mormon Mesa	11 739897E, 4057210N to 11 739380E, 4057804N
Mesquite Bridge 2	Virgin River in Mesquite, Nevada	11 758562E, 4075231N to 11 758755E, 4075336
Refuge Housing and Maintenance Sheds	Overton Wildlife Management Area	11 730668E, 4044449N to 11 731003E, 4044034N
Warm Springs Ranch	Muddy River near Glendale, Nevada	11 707135E, 4064603N
Willow Strip	Overton Wildlife Management Area	11 731747E, 4043607N to 11 731868E, 4043783N

Table 2. Location, date, time, and results of San Bernardino County Museum Yuma Clapper Rail Surveys in 2006 for sites in and along the Virgin and Muddy Rivers in southern Nevada.

SITE	DATE	TIME	# YCRA DETECTED	OTHER RAILS
VIRGIN RIVER SITES				
Big Marsh	18 April	7:30 - 9:30	0	
	2 May	6:30 - 9:30	0	BLRA
	14 May	5:45 - 7:45	0	VIRA
	3 June	5:15 - 6:05	0	
	8 June	6:40 - 10:00	0	
	Total hours:	**11.16**		
Long Marsh	18 April	7:30 - 10:00	0	
	2 May	6:30 - 10:30	0	VIRA
	14 May	8:00 - 11:00	0	
	3 June	6:45 - 9:00	0	
	8 June	10:00 - 12:00	0	
	Total hours:	**13.75**		
Fisherman's Cove	18 April [a]	--		
	6 June	5:15 - 7:30	0	VIRA
	Total hours:	**2.25**		
Littlefield South	18 April [a]	–		
	13 May	7:20 - 8:50	0	
	1 June	6:30 - 7:15	0	
	Total hours:	**2.25**		
Mesquite Bridge	19 April	6:30 - 7:30 (x2) [b]	0	BLRA, VIRA
	4 May	6:00 - 8:30 (x2) [b]	0	
	13 May	6:30 - 8:00 (x2) [b]	0	
	1 June	5:00 - 6:15	0	
	Total hours:	**11.25**		
Virgin River Landing	18 April [a]	--		
	6 June	7:30 - 11:00	0	
	Total hours:	**3.5**		

Table 2 continued. Location, date, time, and results of San Bernardino County Museum Yuma Clapper Rail Surveys in 2006 for sites in and along the Virgin and Muddy Rivers in southern Nevada.

SITE	DATE	TIME	# YCRA DETECTED	OTHER RAILS
MUDDY RIVER SITES				
Pintail Pond	3 May	8:10 - 8:40	0	VIRA
	14 May	9:30 - 10:00	0	
	31 May	9:10 - 9:40	0	
	1 June [a]	--	0	
	Total hours:	**1.5**		
South Marsh	3 May	8:40 - 9:40	1	VIRA
	14 May	10:30 - 11:30	0	
	31 May	10:00 - 11:00	2	
	1 June	8:30 - 12:00	2	
	Total hours:	**6.5**		
Honeybee Pond	3 May	9:45 - 11:00 (x2) [b]	0	VIRA, SORA
(East and West)	14 May	7:45 - 9:15 (x2) [b]	0	VIRA
	31 May	6:20 - 9:00	0	VIRA
	9 June	5:30 - 6:30	0	
	Total hours:	**9.17**		
Maverick Ditch	2 May	11:00 - 12:00	0	SORA
	3 May	6:30 - 8:00	0	VIRA, SORA
	14 May	6:30 - 7:30	0	VIRA
	31 May	4:45 - 6:00	0	
	Total hours:	**4.75**		
Total Survey Hours:		**66.08**		

a - No suitable habitat on that date.
b - Two observers, one upstream and one downstream

Table 3. Locations, dates, times, and results of San Bernardino County Museum Yellow-billed Cuckoo surveys in 2006 for sites in and along the Virgin and Muddy Rivers in southern Nevada.

SITE	DATE	TIME	# YBCU DETECTED
VIRGIN RIVER SITES			
Big Marsh area	8 June	6:40 - 10:00	0
	22 June	5:15 - 7:45	0
	10 July	5:30 - 7:15	0
	20 July	5:45 - 8:00	0
	24 July	5:45 - 11:45	2
	25 July	8:15 - 1:00	2
	Total hours:	**20.58**	
Long Marsh Area	8 June	10:00 - 12:00	0
	22 June	8 :00 - 11:00	0
	10 July	7:15 - 10:30	1
	20 July	8:10 - 11:00	0
	25 July	5:30 - 8:00	0
	Total hours:	**12.58**	
Desert Springs	7 June	11:00 - 12:00	0
	19 June	11:25 - 11:45	0
	9 July	10:30 - 11:30	0
	21 July	8:00 - 8:30	0
	Total hours:	**2.83**	
Littlefield North	7 June	9:30 - 10:45	0
	19 June	9:30 - 11:20	0
	9 July	8:20 - 10:20	0
	21 July	5:30 - 7:45	0
	Total hours:	**7.32**	
Mesquite Bridge Downstream	19 June	11:45 - 1:00	0
	9 July	5:15 - 7:45	0
	21 July	9:00 - 11:00	0
	Total hours:	**5.75**	

Table 3 continued. Locations, dates, times, and results of San Bernardino County Museum Yellow-billed Cuckoo Surveys in 2006 for sites in and along the Virgin and Muddy Rivers in southern Nevada.

SITE	DATE	TIME	# YBCU DETECTED
MUDDY RIVER SITES			
Refuge Housing and Maintenance Sheds	9 June	6:35 - 7:15	0
	23 June	7:15 - 8:40	0
	11 July	6:30 - 8:00	0
	23 July	6:30 - 8:10	0
	Total hours:	**5.25**	
Southwestern Willow Flycatcher Habitat	23 June	9:45 - 10:45	0
	11 July	8:45 - 10:30	0
	23 July	8:50 - 10:10	0
	Total hours:	**5.1**	
Willow Strip	9 June	8:20 - 8:45	0
	23 June	8:45 - 9:30	0
	11 July	8:00 - 8:45	0
	23 July	8:20 - 8:50	0
	Total hours:	**2.5**	
Honeybee Pond (East and West)	9 June	5:30 - 6:30	0
	23 June	5:00 -7:00	0
	11 July	5:30 - 6:20	0
	23 July	5:30 - 6:30	0
	Total hours:	**4.83**	
Warm Springs Ranch	24 June	5:30 - 10:30	1
	8 July	5:30 - 9:30	0
	22 July	5:30 - 9:15	0
	Total hours:	**12.75**	
Total Survey Hours:		**79.49**	

Table 4. Summary of San Bernardino County Museum Yuma Clapper Rail and Yellow-billed Cuckoo surveys along the Virgin and Muddy Rivers in Southern Nevada from 2000 through 2006. Numbers are number of individuals detected. (-ns- = not surveyed)

	2000	2001	2002	2003	2004	2005	2006
Yuma Clapper Rail							
Virgin River Sites							
Fisherman's Cove	-ns-	-ns-	-ns-	0	0	-ns- [h]	0
Littlefield North [a]	2	0	0	0	1	-ns- [h]	-ns- [h]
Littlefield Bridge	0	0	0	0	-ns- [b]		
Littlefield South	2	0	0	0	1	-ns- [h]	0
Mesquite Upstream	0	0	0	1	-ns- [c]		
Mesquite Bridge	2	0	2	1	1	-ns- [c, h]	0
Mesquite Downstream	0	0	0	0	-ns- [c]		
Mormon Mesa: Big Marsh [d]	7 [e]	8-12	3	0	1	0	0
Mormon Mesa: Long Marsh	6	1	0	0	0	0	0
Mormon Mesa: East Marsh	5	2	-ns-	-ns-	0	-ns- [h]	-ns- [i]
Virgin River Landing	-ns-	-ns-	-ns-	0	2	0	0
Muddy River Sites							
Bowman Canal	-ns-	-ns-	-ns-	-ns-	0	0	-ns- [i]
Glendale	-ns-	-ns-	0	0	-ns-	-ns-	-ns-
Grant Bowler Park	-ns-	-ns-	-ns-	0	0	0	-ns- [i]
Honeybee Pond	1	0	0	2	0	0	0
Maverick Ditch	1	0	4	1	0	0	0
Pintail Pond	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	0 [j]
South Marsh	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	2 [j]

Table 4 continued. Summary of San Bernardino County Museum Yuma Clapper Rail and Yellow-billed Cuckoo surveys along the Virgin and Muddy Rivers in Southern Nevada from 2000 through 2006. Numbers are number of individuals detected. (-ns- = not surveyed)

	2000	2001	2002	2003	2004	2005	2006
Yellow-billed Cuckoo							
Virgin River Sites							
Desert Springs	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	0 [j]
Littlefield North	2	0	0	0	0	0	0
Mesquite Bridge	1	0	0	1	0	-ns- [h]	-ns- [h, i]
Mesquite Bridge 2	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	0 [j]
Mormon Mesa [k]	3-4	6-10	0	0	0	0	3
Virgin Delta West	-ns-	2 [f]	0	-ns-	-ns-	-ns-	-ns-
Muddy River Sites							
Honeybee Pond	-ns-	-ns-	-ns-	0	0	1	0
Refuge Housing and Maintenance Sheds	-ns-	-ns-	-ns-	-ns-	-ns-	1	2
Southwestern Willow Flycatcher Habitat	-ns-	-ns-	-ns-	-ns-	-ns-	0	0
Warm Springs Ranch [g]	-ns-	-ns-	-ns-	1	1	1	1
Willow Strip	-ns-	-ns-	-ns-	-ns-	-ns-	0	0

a - Includes Beaver Dam Wash.
b - Site was split in half and surveyed since 2004 as additions to Little Field North and South.
c - Suitable habitat at Mesquite Upstream and Downstream sites has been decreased over the years, so both sites were combined with Mesquite Bridge site and surveyed with same since 2004.
d - Mormon Mesa sites have been referenced as “Overton” sites in past reports.
e - Includes observations of two fledglings.
f - Nest, two eggs and fledglings.
g - Warm Springs Ranch and adjacent areas have been previously survey by individuals not associated with SBCM.
h- Habitat disturbed by floods or bulldozers during winter 2005 flood events.
i - No suitable habitat
j - Survey site new in 2006.
k- Long Marsh, Big Marsh, and adjacent suitable habitats.

Table 5. Incidental bird species detected during San Bernardino County Museum Yuma Clapper Rail and Yellow-billed Cuckoo surveys in 2006 along the Virgin and Muddy Rivers in southern Nevada. Species are listed taxonomically according to the AOU. Detections are incidental and indicate presence only. Absence should not be inferred. See text and Table 1 for site locations.

Species	Big Marsh	Long Marsh	Desert Springs	Fisherman's Cove	Honeybee Pond	Little field North	Little field South	Maverick Ditch	Mesquite Bridge	Mesquite Bridge 2	OWMA	Virgin River Landing	Warm Springs
Black-bellied Whistling Duck	X												
Canada Goose					X		X				X		
Gadwall					X								
Mallard	X				X		X		X		X		
Cinnamon Teal					X						X		
Northern Shoveler					X								
Northern Pintail					X								
Green-winged Teal					X						X		
Redhead					X								
Ruddy Duck					X								
Ring-necked Pheasant	X	X											X
Wild Turkey											X		
Gambel's Quail	X	X	X		X	X		X			X		X
Pied-billed Grebe	X				X				X				
Eared Grebe					X								
Clark's Grebe											X		

Species	Big Marsh	Long Marsh	Desert Springs	Fisherman's Cove	Honeybee Pond	Little field North	Little field South	Maverick Ditch	Mesquite Bridge	Mesquite Bridge 2	OWMA	Virgin River Landing	Warm Springs
Least Bittern					X						X	X	
Great Blue Heron	X		X	X	X	X			X	X	X	X	
Great Egret					X				X				
Snowy Egret					X				X		X		
Green Heron					X				X	X			
Black-crowned Night-Heron	X			X						X		X	
White-faced Ibis					X						X		
Turkey Vulture													X
Osprey													X
Northern Harrier											X		
Cooper's Hawk						X				X			
Common Black-Hawk						X	X						
Red-tailed Hawk													X
American Kestrel						X					X		
Peregrine Falcon					X	X							
Clapper Rail											X		
Virginia Rail				X	X			X	X		X		X
Sora					X			X					
Black Rail	X								X				

Species	Big Marsh	Long Marsh	Desert Springs	Fisherman's Cove	Honeybee Pond	Little field North	Little field South	Maverick Ditch	Mesquite Bridge	Mesquite Bridge 2	OWMA	Virgin River Landing	Warm Springs
Killdeer	X				X			X	X				
Black-necked Stilt					X						X		
American Avocet					X								
Greater Yellowlegs											X		
Spotted Sandpiper	X									X			
Long-billed Dotwitcher											X		
Ring-billed Gull	X												
Rock Pigeon								X			X		
White-winged Dove											X		
Mourning Dove	X	X			X	X	X	X	X		X	X	X
Yellow-billed Cuckoo	X	X											X
Greater Roadrunner	X	X									X		X
Barn Owl					X					X	X		
Great Horned Owl											X		X

Species	Big Marsh	Long Marsh	Desert Springs	Fisherman's Cove	Honeybee Pond	Little field North	Little field South	Maverick Ditch	Mesquite Bridge	Mesquite Bridge 2	OWMA	Virgin River Landing	Warm Springs
Lesser Nighthawk		X											
White-throated Swift					X						X	X	X
Black-chinned Hummingbird			X			X	X	X		X	X		X
Anna's Hummingbird										X			
Ladder-backed Woodpecker		X	X			X				X	X		X
Western Wood-Pewee	X	X			X			X					X
Willow Flycatcher	X	X								X	X		
Dusky Flycatcher		X											
Black Phoebe			X		X	X			X		X		X
Say's Phoebe	X	X		X	X	X	X	X	X			X	X
Vermillion Flycatcher											X		X
Ash-throated Flycatcher	X	X				X					X		X
Brown-crested Flycatcher	X	X	X			X			X	X			X
Western Kingbird	X	X	X		X	X		X		X	X		X

Species	Big Marsh	Long Marsh	Desert Springs	Fisherman's Cove	Honeybee Pond	Little field North	Little field South	Maverick Ditch	Mesquite Bridge	Mesquite Bridge 2	OWMA	Virgin River Landing	Warm Springs
Loggerhead Shrike	X										X		X
Bell's Vireo	X	X	X		X	X	X		X		X		X
Solitary Vireo		X											
Hutton's Vireo					X								
Warbling Vireo		X				X							
Common Raven			X			X					X		
Violet-green Swallow	X	X			X						X		
Northern Rough-winged Swallow	X	X	X	X	X	X	X			X	X	X	X
Cliff Swallow	X	X	X		X	X	X		X	X		X	
Verdin		X	X		X	X		X			X		X
Rock Wren				X									
Canyon Wren			X									X	
Bewick's Wren	X	X	X		X	X				X		X	X
House Wren									X				
Marsh Wren				X	X		X		X		X	X	
Blue-gray Gnatcatcher	X	X				X							X
Black-tailed Gnatcatcher	X	X			X						X		X

Species	Big Marsh	Long Marsh	Desert Springs	Fisherman's Cove	Honeybee Pond	Little field North	Little field South	Maverick Ditch	Mesquite Bridge	Mesquite Bridge 2	OWMA	Virgin River Landing	Warm Springs
American Robin										X			X
Northern Mockingbird			X					X			X		X
Crissal Thrasher		X				X					X		X
Phainopepla			X		X						X		X
Lucy's Warbler	X	X	X	X	X	X	X	X		X	X		X
Yellow Warbler	X	X	X		X	X	X	X	X	X	X	X	X
Common Yellowthroat	X	X	X	X	X		X	X	X	X	X	X	X
Wilson's Warbler	X	X											
Yellow-breasted Chat	X	X	X		X	X		X	X	X	X		X
Summer Tanager		X				X	X						X
Western Tanager				X	X	X					X		X
Abert's Towhee	X	X	X		X	X		X		X	X		X
Brewer's Sparrow	X												
Black-throated Sparrow			X			X							
Song Sparrow	X	X	X	X	X	X	X	X	X	X	X	X	X
White-crowned Sparrow									X				

Species	Big Marsh	Long Marsh	Desert Springs	Fisherman's Cove	Honeybee Pond	Little field North	Little field South	Maverick Ditch	Mesquite Bridge	Mesquite Bridge 2	OWMA	Virgin River Landing	Warm Springs
Black-headed Grosbeak	X	X											
Blue Grosbeak	X	X	X	X	X	X		X	X	X	X	X	X
Lazuli Bunting						X	X			X			X
Red-winged Blackbird	X			X	X		X	X	X		X		X
Western Meadowlark					X			X			X		X
Yellow-headed Blackbird					X				X		X		
Great-tailed Grackle					X	X		X					X
Brown-headed Cowbird	X	X	X	X	X	X	X	X	X	X	X	X	X
Hooded Oriole			X			X							X
Bullock's Oriole		X	X		X	X				X	X		X
House Finch			X			X		X		X	X		X
Pine Siskin										X	X		
Lesser Goldfinch			X			X	X		X	X	X		X
House Sparrow			X			X					X		X

Overview of Study Area

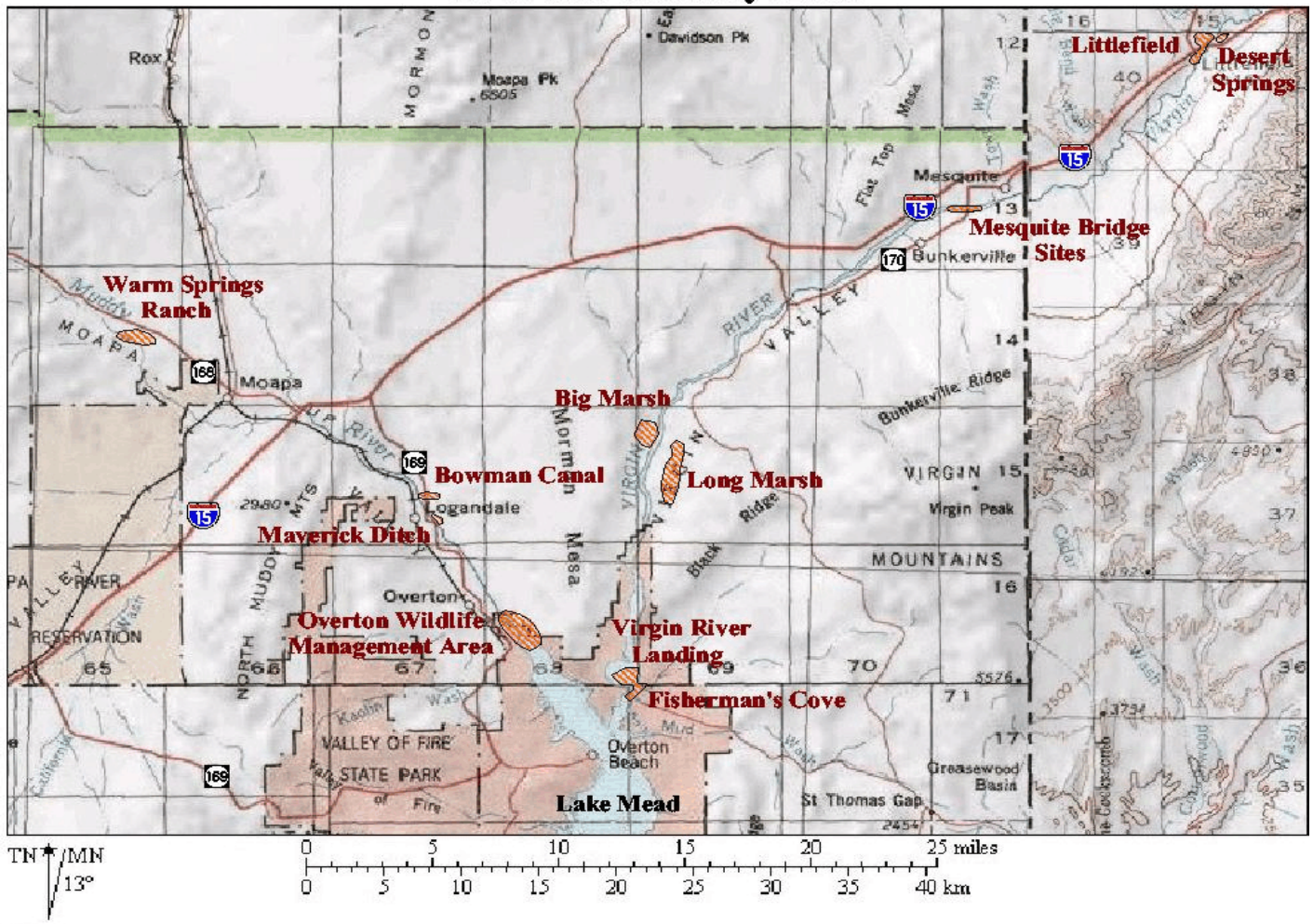

Figure 1: Survey locations for Yuma Clapper Rail and Yellow-billed Cuckoo along the Virgin and Muddy Rivers. All sites not necessarily surveyed every year. See text and tables for details.

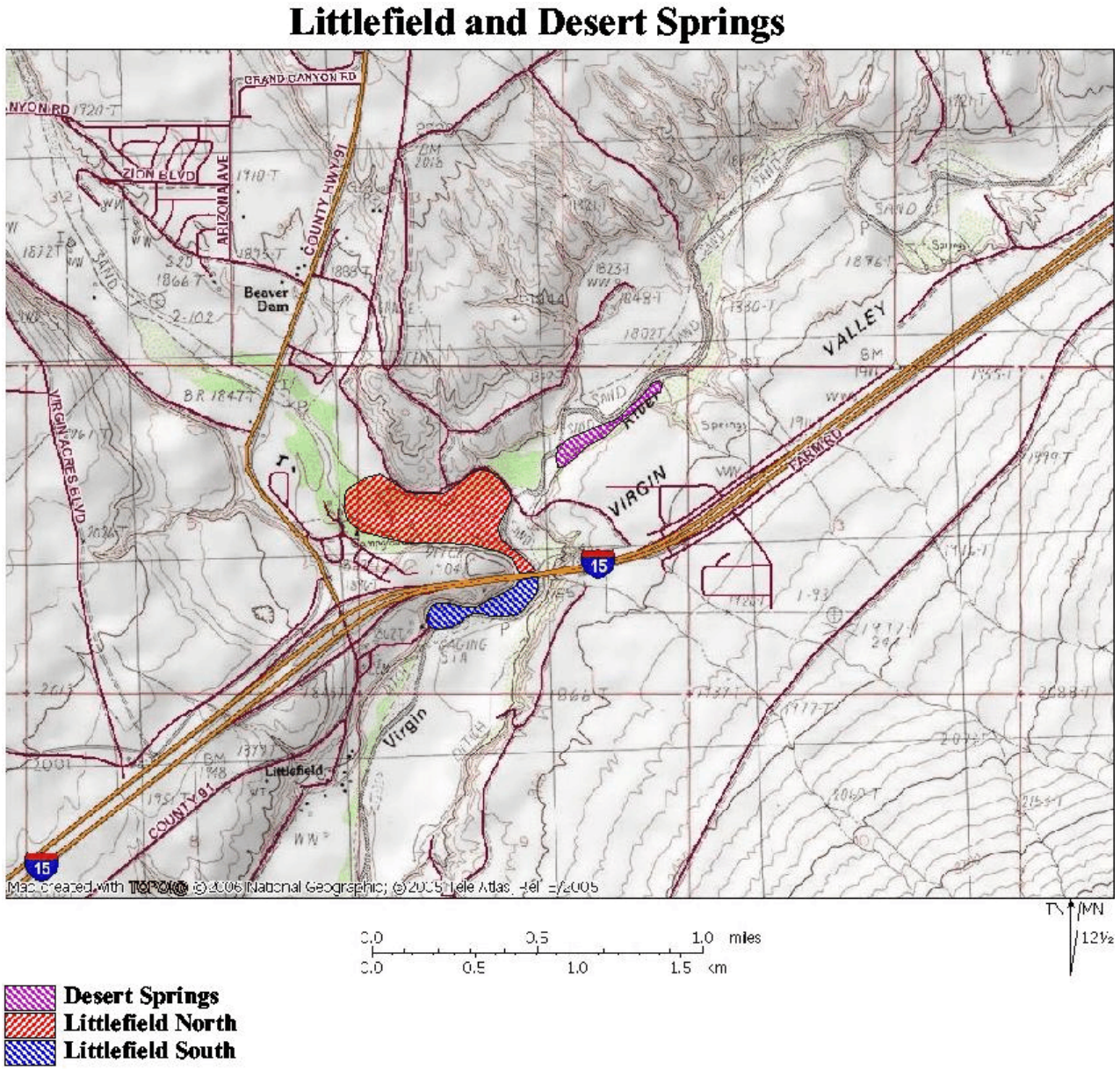

Figure 2: Littlefield, Arizona survey sites for Yuma Clapper Rail and Yellow-billed Cuckoo.

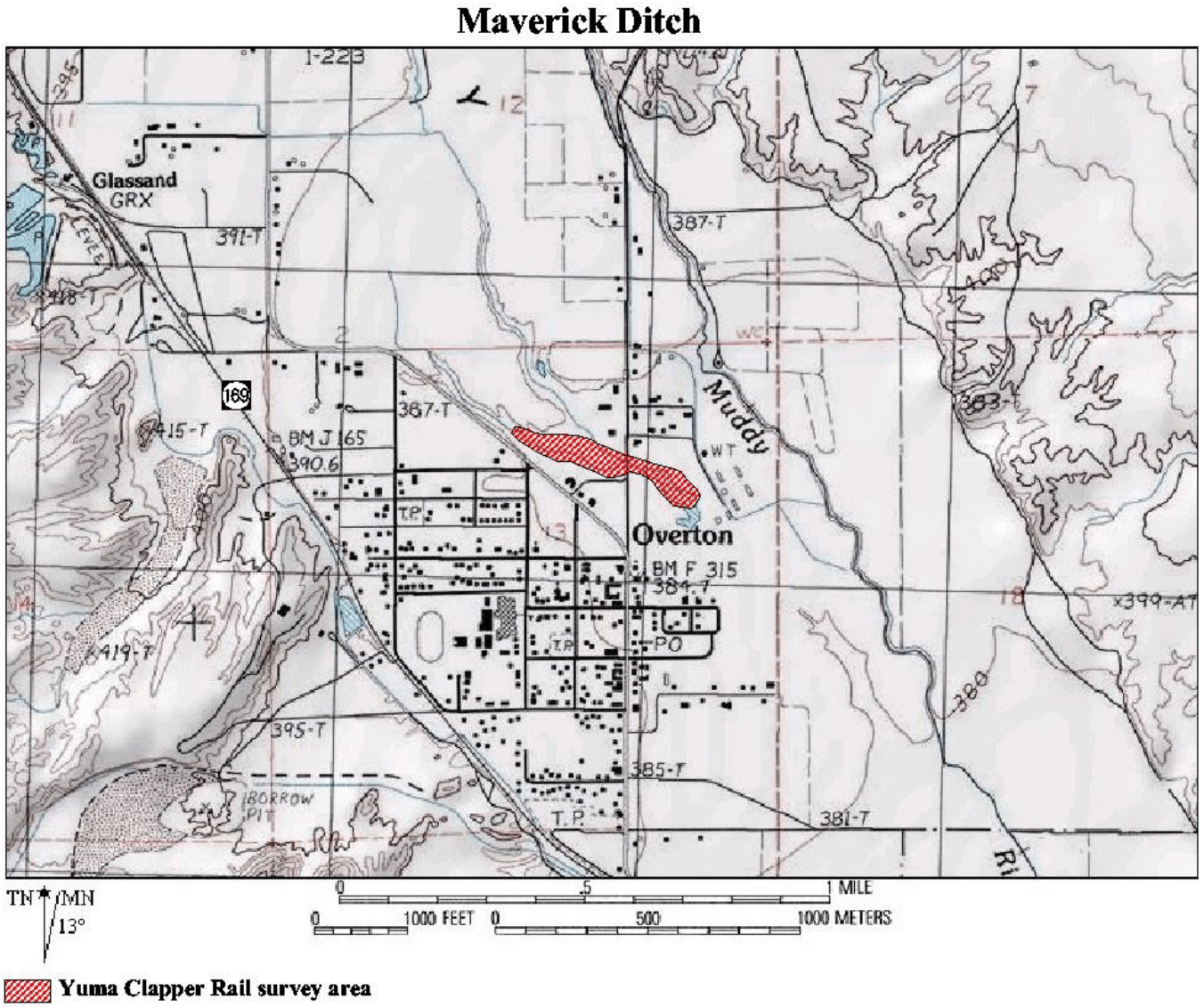

Figure 3: Maverick Ditch survey site for Yuma Clapper Rail.

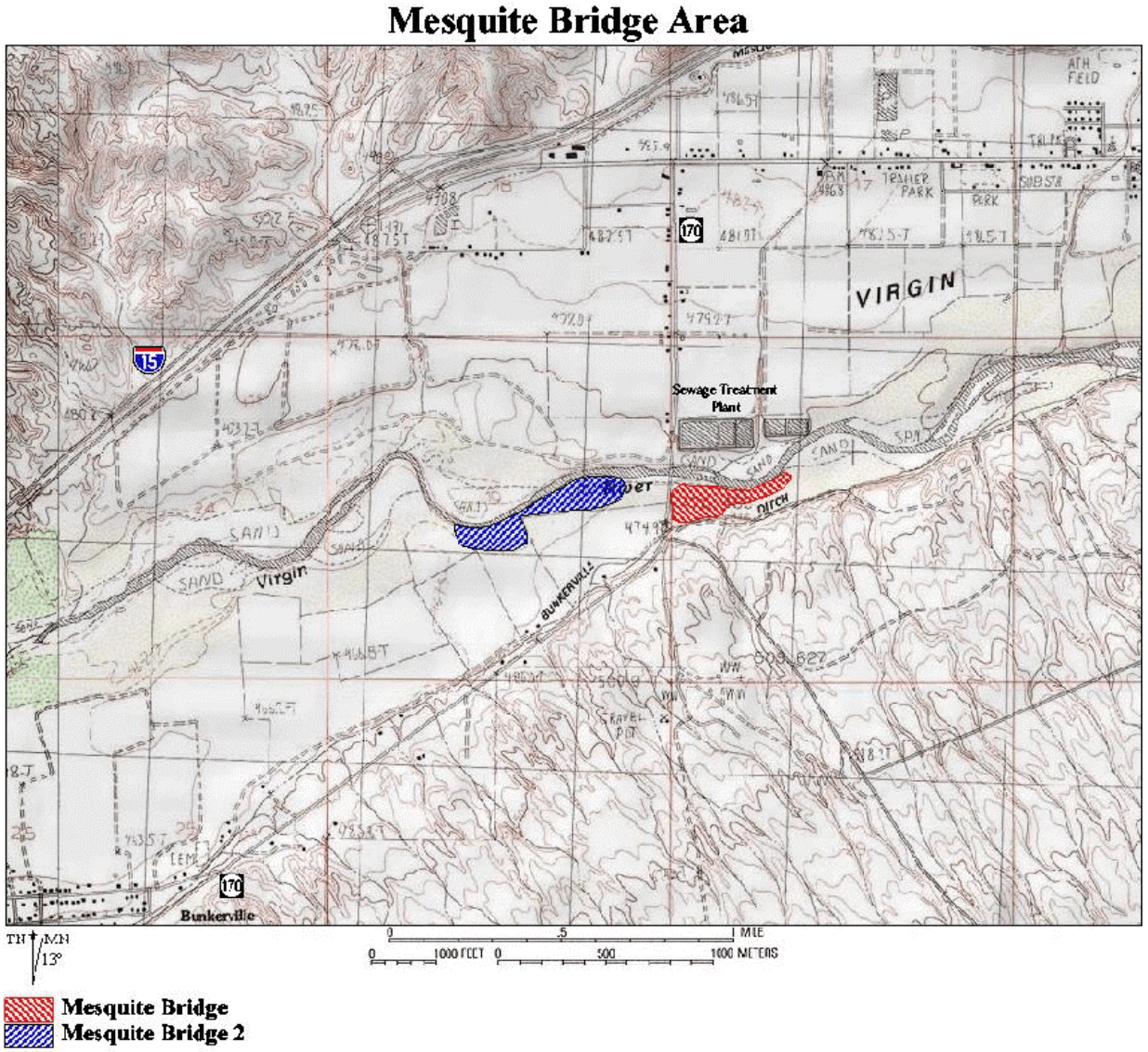

Figure 4: Mesquite Bridge survey sites for Yuma Clapper Rail and Yellow-billed Cuckoo

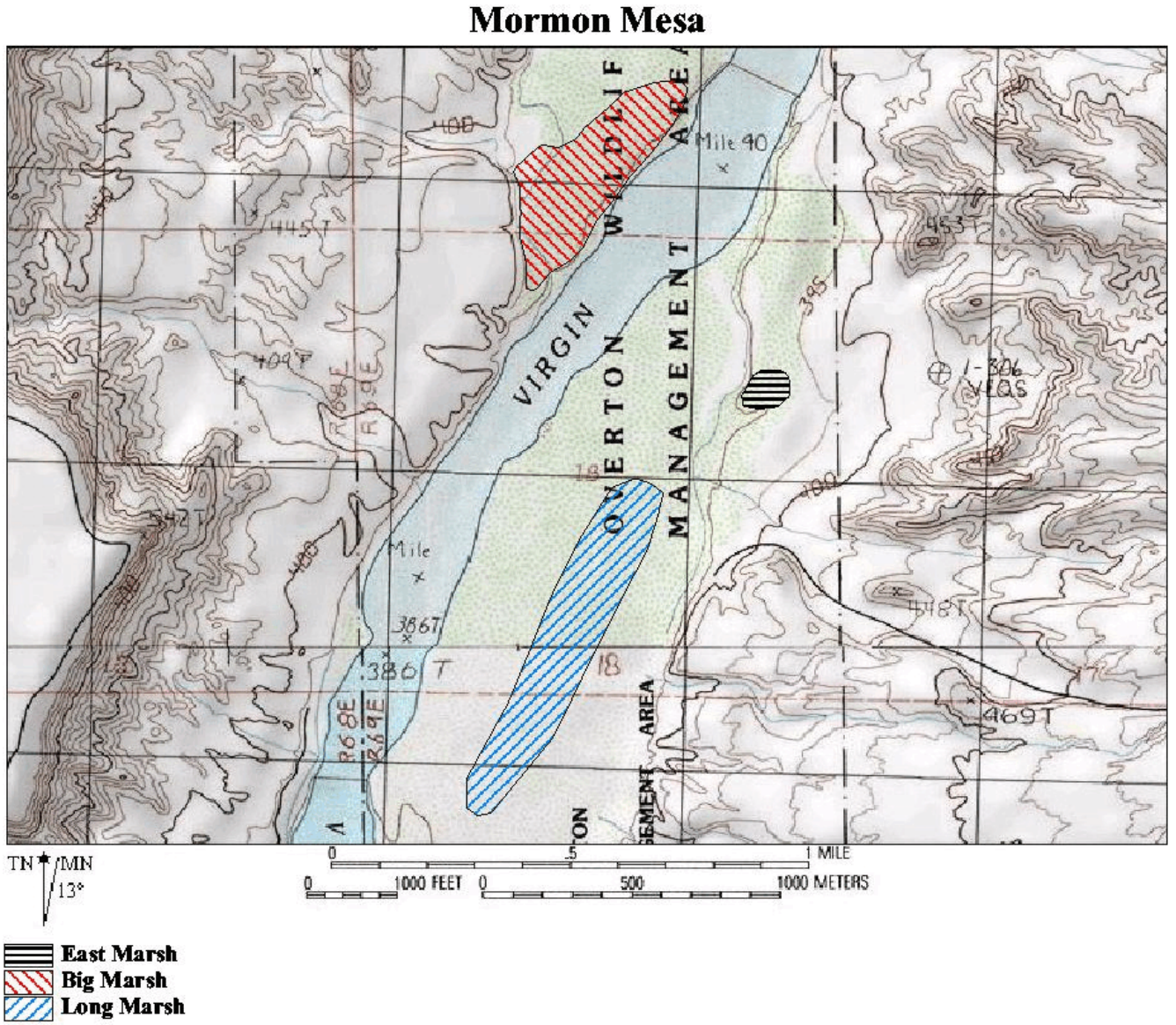

Figure 5: Mormon Mesa survey sites for Yuma Clapper Rail and Yellow-billed Cuckoo.

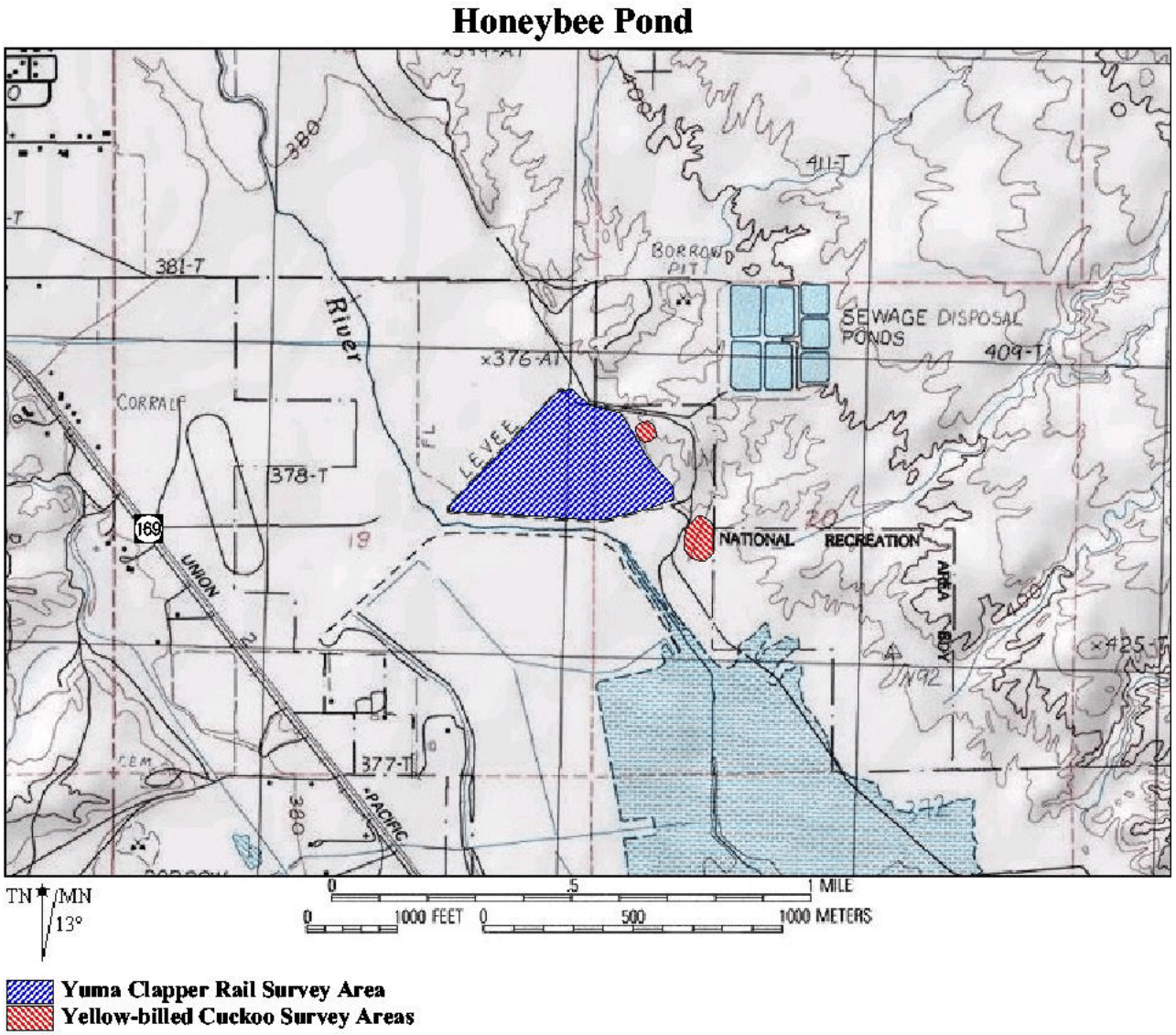

Figure 6: Honeybee Pond survey sites for Yuma Clapper Rail and Yellow-billed Cuckoo.

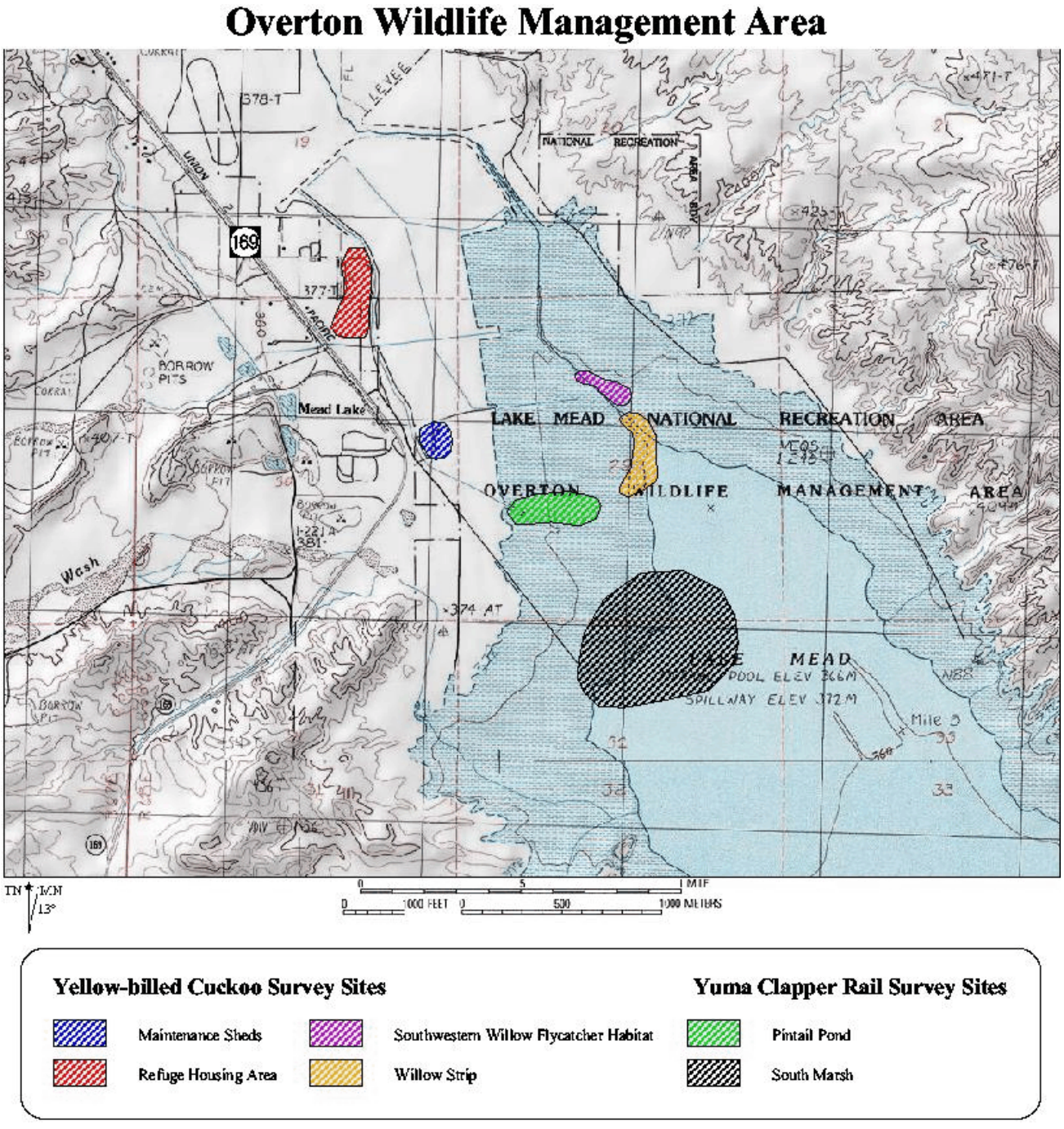

Figure 7: Overton Wildlife Management Area and survey sites for Yuma Clapper Rail and Yellow-billed Cuckoo.

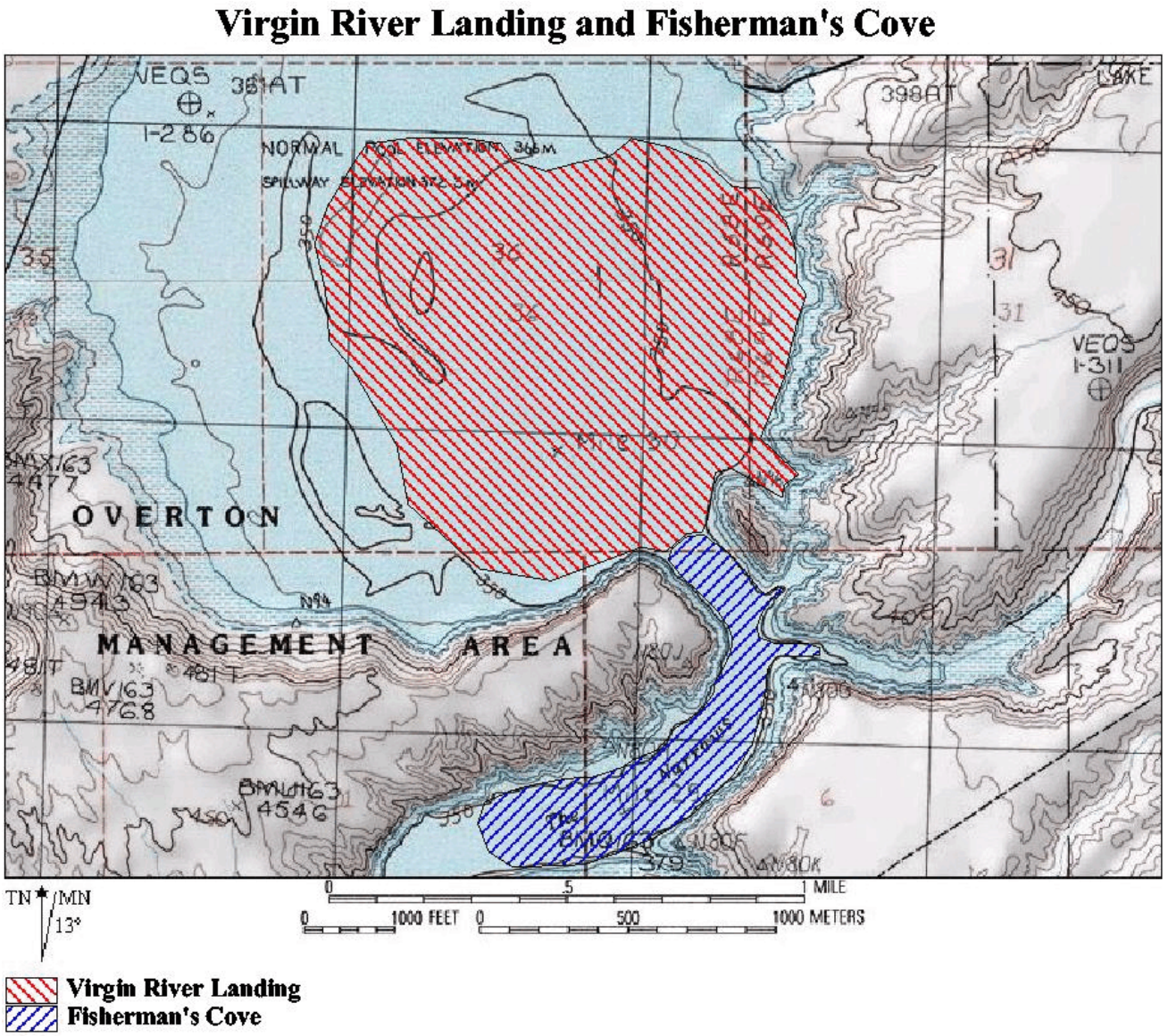

Figure 8: Virgin River delta sites for Yuma Clapper Rail and Yellow-billed Cuckoo.

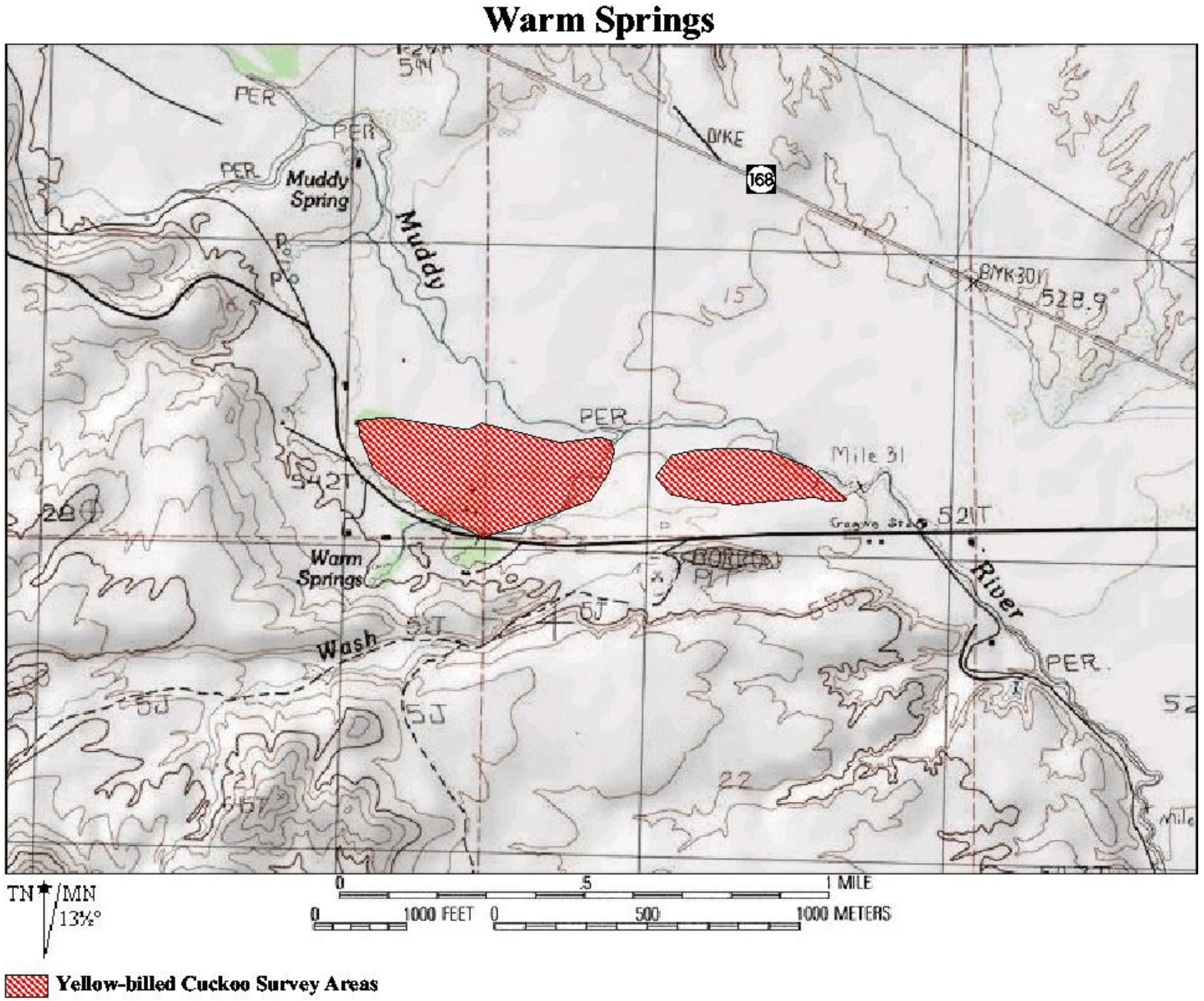

Figure 9: Warm Springs Ranch survey site for Yellow-billed Cuckoo.

THE STATUS OF YUMA CLAPPER RAIL AND YELLOW-BILLED CUCKOO ALONG PORTIONS OF THE VIRGIN RIVER AND MUDDY RIVER IN SOUTHERN NEVADA: 2007 Final

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October 2008

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INTRODUCTION

The Clapper Rail (*Rallus longirostris*) is a marsh obligate species whose range includes saltwater marshland from New England south to Texas along the Atlantic coast and from San Francisco south to Baja California along the Pacific coast (Bent 1926). The Yuma Clapper Rail subspecies (*Rallus longirostris yumanensis*) is found in freshwater habitats along the Colorado River, associated drainages, and isolated regions of the Salton Sea, California (Philips, et al. 1964, Alcorn 1988, Eddleman 1989). In addition, Yuma Clapper Rail are currently known to occupy areas along the Muddy and Virgin Rivers in southern Nevada (McKernan and Braden 1999, 2001a, 2001b, McKernan and Carter 2002, Rathbun and Braden 2003, Braden, et al. 2005, Miller et al. 2006, Braden et al. 2007).

The breeding season for Clapper Rail extends from mid-March through August. Nests are placed on elevated ground within the marsh and are constructed of plant stems and grasses. The nests are concealed with live vegetation pulled over the nest to form a canopy. A clutch of 8 to 11 eggs is laid in the nest, but may occasionally be as few as 4 or as many as 14 eggs. Both male and female Clapper Rail incubate the eggs for 20 to 24 days. Both parents attend to the nestlings. Nestlings can swim within a day after hatching, are independent of parents in 35 to 42 days, and can fly by 63 to 70 days after hatching (Baicich and Harrison 1997).

Yellow-billed Cuckoo (*Coccyzus americanus*) are found in stream-side willow and alder groves, open woodlands, parklands, gardens and orchards from British Columbia east to Newfoundland and south into South America (Alcorn 1988, Baicich and Harrison 1997). The breeding range of the Yellow-billed Cuckoo in the United States includes isolated areas of Idaho, Utah, California, Arizona, southern Nevada, and throughout most of the continent east of the Rocky Mountains to the Atlantic coast (Mulroy 2002). The distribution of the western race of the Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*) has contracted in recent years. The western race of Yellow-billed Cuckoo has been considered a rare and transient summer resident in Nevada where the breeding populations in the western and southern portion of the state are considered to be nearly extinct (Alcorn 1988).

The breeding season for the Yellow-billed Cuckoo extends from late May through early August. Nests are concealed in a bush or tree from 2 to 20 feet above the ground and are constructed of a variety of plant materials. A clutch of 3 to 4 eggs are laid in the nest, but may be as few as 1 or as many as 5 eggs. The female incubates the eggs for 9 to 11 days, with occasional help from the male. The nestlings are tended by both parents and can fly about 21 days after hatching (Baicich and Harrison 1997).

The Muddy and Virgin Rivers in southern Nevada both contain multiple and dynamic areas of suitable breeding habitat for both Yuma Clapper Rail and the Western Yellow-billed Cuckoo. This report details the continuation of focused Yuma Clapper Rail and Yellow-billed Cuckoo surveys by the San Bernardino County Museum conducted along the Virgin and Muddy Rivers in southern Nevada since 2000.

METHODS

Yuma Clapper Rail - Field surveys were conducted from March through June 2007 to determine

the presence of Yuma Clapper Rail. The surveys were conducted between 5:00 AM and 12:00 PM and consisted of walks through and around suitable habitat. Surveyors stopped every 20 to 40 meters to play digital (MP3) audio recordings of Yuma Clapper Rail vocalizations including "keks", "clatters", and agitated "kek'ing". The recording was played for up to 2 minutes, with a pause of up to three minutes after each broadcast to listen for a response. Surveys were conducted from March through June for seven to eight site visits, depending on site, and thus exceed the U.S. Fish and Wildlife protocol standards for this race.

Yellow-billed Cuckoo - Field surveys were conducted from June through August 2007 to determine the presence of Yellow-billed Cuckoo. The surveys were conducted between 5:15 AM and 12:00 PM and consisted of walks through suitable habitat. Surveyors stopped at regular and opportunistic intervals to play digital (MP3) recordings of Yellow-billed Cuckoo vocalizations, primarily the "ka ka ka ka kow kow kowlp kowlp" call, which was played for 30 to 45 seconds with a 2-minute pause after each play to listen for a response.

Other rails, bitterns and Moorhens - Surveys of other rails were conducted coincident with Yuma Clapper Rail surveys. Surveys consisted of broadcasting digital (MP3) audio recordings of Virginia Rail, Sora, Black Rail, Least Bittern and American Bittern coincident with but secondary to Yuma Clapper Rail broadcasts. The sequence of broadcasts were variable. Moorhen were surveyed based on observations alone.

Incidental observations - Species lists of incidental birds were constructed from visual and aural detections during a survey event. Incidental bird observations are not comprehensive and should be not be over interpreted. Incident bird species observations indicate presence only and should not be interpreted as absence of any one species.

Survey Site Descriptions:

An overview of survey sites for Yuma Clapper Rail and Yellow-billed Cuckoo are mapped in Figure 1. Coordinates for the survey sites are listed in Table 1. Specific site descriptions are as follows:

Virgin River Sites

The Virgin River flows south from Utah and terminates on the Overton arm of Lake Mead. The perennial river flow is largely unaltered with the exception of a few erosion control structures in the town of Mesquite and several minor irrigation diversions. Consequently, the river is susceptible to flooding during warm winter storms or heavy spring run-off. The marsh vegetation along the river, when present, is dominated by cattail (*Typha* spp.) and bullrush (*Scirpus* spp.), with intermixed components of Goodding black willow (*Salix gooddingii*), sandbar willow (*S. exigua*) and tamarisk (*Tamarix* spp.). Wooded areas are present in conjunction with most of the survey sites and are comprised of willow, tamarisk, Fremont cottonwood (*Populus fremontii*), and honey mesquite (*Prosopis glandulosa*).

The survey sites along the Virgin River (Figures 1 through 5) are in the vicinity of Littlefield, Arizona and Mesquite, Mormon Mesa, and the Virgin River Delta in southern Nevada. Survey site coordinates are listed in Table 1. Survey site descriptions, habitat suitability, and species surveys conducted in 2007 are as follows:

Desert Springs

The Desert Springs site was established in 2006 near Littlefield, Arizona (Figure 2) and surveyed again in 2007 for Yellow-billed Cuckoo. Habitat at this site is not suitable for Yuma Clapper Rail. The site consists of a 350 meter long and up to 80 meter wide strip of mature native riparian habitat on the Virgin River, across and 850 meters upstream from the historic Littlefield North survey site (Figure 2). The overstory is mature Fremont cottonwood. The understory consists of tamarisk and honey mesquite. Several springs along the length of the strip feed patches of yerba mansa (*Anemopsis californica*) and Arizona grape (*Vitis arizonica*).

Littlefield North and South

Yuma Clapper Rail habitats at the Littlefield North and Littlefield South sites (Figure 2) are still recovering from the floods of 2005. Suitable rail habitat in terms of vegetative structure and composition are still substandard in Beaver Dam Wash (Littlefield North) but showing improvement. Rail habitat on the adjacent private property in Beaver Dam Wash appeared to be fully recovered, but were not surveyed at the request of the landowner. At Littlefield South, the marsh showed signs of recovery, but never developed suitable rail habitat, having been de-watered early in the season. Suitable rail habitats at both the Littlefield North and South sites were assessed several times during the survey season, but no suitable Yuma Clapper Rail habitats emerged and no formal rail surveys were performed.

Yellow-billed Cuckoo habitat, consisting of gallery Fremont Cottonwood, persists at Littlefield North (Figure 2). The understory remains underdeveloped having been scoured during the 2005 floods and most recently degraded by range cattle in 2007. Regardless, the habitat is suitable for Yellow-billed Cuckoo and the site was surveyed in 2007.

Mesquite Bridge

Rail habitat at the Mesquite Bridge site (Figure 3) has become firmly re-established after the 2005 floods. On the upstream side of the bridge, habitat consists of dense cattail marshes averaging 3 meters tall. The ponds are approximately 10 hectares in size (combined) and are outside the main channel flow. These ponds were a result of dikes established after the 2005 floods for unknown reasons. Downstream habitats at the Mesquite Bridge site are composed predominately of cattail with lesser amounts of sedges and emergent perennials including tamarisk, black willow and cottonwood. As with the upstream ponds, the downstream habitat is separated from the main river channel by dikes constructed after the 2005 floods. The habitat is linear, interposed between the improvised dikes to the southeast and the golf course and associated housing construction to the northwest. The habitat appears to be watered by sub-surface flows, agricultural runoff and other unidentified drains originating in the town of Mesquite.

The Yuma Clapper Rail habitat at the Mesquite Bridge Site is excellent and surveys were conducted in 2007. The habitat at the Mesquite Bridge site has not been suitable for Yellow-billed Cuckoo since the 2005 floods and efforts to control the floods, thus no Yellow-billed Cuckoo surveys were conducted in 2007.

Mesquite Bridge 3

The Mesquite Bridge 3 site (Figure 3) was new for 2007. The floods of 2005 and improvised dikes resulted in extensive rail habitat by the 2007 survey season, necessitating the

establishment of the Mesquite Bridge 3 survey site. Habitats are generally linear, variable in height, occur both along the Virgin River main flow and outside of the improvised flood dikes, and include a large nonlinear water impoundment at the northwest upstream portion of the survey area. Habitats are dominated by cattail and sedges. Cattails range from 1 to 3 meters tall. Perennial habitats consist predominately of black willow with lesser amounts of cottonwood. Emergent perennial habitats occur along the length of the survey area and range from 1 to 3 meters tall. Excellent rail habitat, though somewhat patchy, occurs throughout the survey site. The site was surveyed for Yuma Clapper Rail in 2007. Habitats were not yet suitable for Yellow-billed Cuckoo.

Mesquite Bridge 2

Yellow-billed Cuckoo habitat at the Mesquite Bridge 2 site (Figure 3) is essentially unchanged from the previous year. The habitat consists of a long linear grove of mature black willow and cottonwood positioned between the southeast high water bank of the Virgin River and adjacent agricultural fields. There is no Yuma Clapper Rail habitat at thus site.

Big Marsh

Big Marsh is located along the northwestern side of the Virgin River near Mormon Mesa (Figure 4). The marsh is fed by a spring as well as inflow from the Virgin River, the later depending on the alignment of the river and time of year. The alignment of the Virgin River channel is variable. By June of 2007 there was no surface connection between the Virgin River channel and the marsh. Habitat along the western and southwestern margins of the site consist of sparse patches of cattail and sedges with more extensive areas of emergent perennials of varying composition. These habitats are all > 1 meter tall. Habitats on the northeast and eastern portions of the survey site consist of dense stands of Goodding black willow, sandbar willow, and tamarisk, making poor habitat for Yuma Clapper Rail but excellent habitat for Yellow-billed Cuckoo. Big Marsh was surveyed in 2007 for both Yuma Clapper Rail and Yellow-billed Cuckoo.

Long Marsh

Long Marsh is a long (1.5 kilometer) linear stretch of marsh habitat that runs parallel to, and down the center of, the Virgin River channel near Mormon Mesa (Figure 4). Aside from large flood events the active portion of the Virgin River channel occurs along the southeast side of Long Marsh since the 2005 floods. The habitat in Long Marsh is complex and suitable rail habitat has substantially diminished over the years. Cattail stands have been reduced to low profile patches, the surface water flows have been much reduced to nonexistent, there has been an overall drying of the marsh vegetation, and range cattle have decimated the rail habitat. By mid spring in 2007 the habitat was no longer suitable for Yuma Clapper Rail. In contrast, Yellow-billed Cuckoo habitat in Long Marsh remains excellent. Realignment of the active river channel post-2005 floods has revived the black willow habitat on the northwestern side of the marsh. Both Yuma Clapper Rail and Yellow-billed Cuckoo surveys were performed at Long Marsh in 2007.

East Marsh

East Marsh was a small (< 4 ha) circular piece of marsh habitat on the east side of the Virgin River northeast of Long Marsh (Figure 4). East Marsh has been dry and devoid of live vegetation since 2005. Conditions were unchanged for the 2007 survey season and no surveys were conducted at East Marsh in 2007.

Virgin River Landing and *Fisherman's Cove*

In previous years Virgin River Landing and Fisherman's Cove (Figure 5) were inundated by Lake Mead. Reduced lake levels exposed these sites in 2002, which quickly became populated with emergent vegetation. Floods in 2005 scoured both survey sites of vegetation and entrenched the Virgin River channel. The river channel remains entrenched at Virgin River Landing, up to 6 meters in some places, and range cattle continue to graze off any emergent vegetation. There were no suitable rail or cuckoo habitats at Virgin River Landing and Fisherman's Cove in 2007.

Muddy River Sites

The surveyed areas of the Muddy River begin upstream in the Moapa Valley west of Glendale and terminate near Lake Mead (Figures 1, 6, 7, 8, 9, 10 and 11). The channel and perennial river flows in the channel have been heavily modified and re-directed east of Glendale by a complex series of flood control structures, agricultural channels, agricultural drains, canals, and waterfowl management diversions. Habitats along and in the Muddy River channel vary greatly in the degree of openness, vegetation composition and vegetative structure. Thus, habitat conditions for Yuma Clapper Rail and Yellow-billed Cuckoo vary by site. In general, these habitats consist of cattail, bullrush, and common reed (*Phragmites australis*) with intermixed components of Goodding black willow, sandbar willow and tamarisk. Wooded areas are present in conjunction with most of the sites surveyed and are comprised of Goodding black willow, sandbar willow, tamarisk, Fremont cottonwood, and honey mesquite. Specific habitat composition by site are as follows:

Warm Springs Ranch

The Warm Springs Ranch site is located in the Moapa Valley at the Warm Springs Ranch, approximately nine miles west of Glendale and one mile south of Highway 168 (Figure 6). The site is adjacent to but not on the Muddy River. Surface flows on the site come from Warm Springs, located immediately south of the river. Water from the springs flow through the area, emptying into the Muddy River to the north. The habitat at the site is composed of cottonwood, black willow, velvet ash (*Fraxinus velutina*), tamarisk, and non-native fan palms (*Washingtonia filifera).* The canopy height is variable, but generally ranges from 5 to 15+ meters. The canopy is not continuous. Perennials are patchy within intervening pastures and ruderal fields. Cottonwoods are mostly arrayed in a linear fashion along pasture borders, though cottonwood, ash, willow, and tamarisk patches are scattered throughout the site near water sources and other moist areas. The habitat is robust and quite suitable for Yellow-billed Cuckoo. This site was minimally affected by flooding in 2005 and has remained essentially unchanged over the last decade. The Warm Springs site was surveyed for Yellow-billed Cuckoo in 2007 only in conjunction with the Nevada Division of Wildlife, by permission of the landowner, and

therefore limited in number. The surveys were performed along a route established by Nevada Division of Wildlife.

Bowman Canal

Bowman Canal is used to fill Bowman Reservoir and irrigate surrounding farmland located in the town of Logandale (Figure 7). The canal is approximately ten meters wide and 250 meters long with three small ponds at the juncture with the reservoir's head gate. In its undisturbed state the vegetation consists of dense cattail lined by willow and cottonwood groves. The canal was cleared of vegetation between the 2005 and 2006 survey seasons. Clearing the Bowman canal appears to be an annual event and there was no suitable rail or cuckoo habitat in 2007. Left undisturbed the habitat at this site has the potential to return to suitable Yuma Clapper Rail habitat. The site was not surveyed in 2007.

Grant Bowler Park

The Grant Bowler Park site is located in Grant Bowler Park in the town of Logandale (Figures 8). Habitats at this site are composed of cattail, sedges, tamarisk, willow and cottonwood. The site is entrenched with steep banks. The site has become more entrenched since the 2005 floods. The site is also subject to fire. Habitat at this site was not suitable for rail or cuckoo since 2006 and remained so in 2007. The site was assessed during the 2007 survey season but no surveys were performed. Left undisturbed and with modifications to the banks, the habitat at this site has the potential to return to suitable Yuma Clapper Rail habitat.

Maverick Ditch

The Maverick Ditch site is located in the town of Overton near the intersection of Cooper and Jones Street (Figure 9). The site was named after the Maverick convenience store immediately adjacent to the site. The channel appears to function for irrigation, high water overflow, and possibly suburban storm water run-off. The site is not on the active flow portion of the Muddy River. The surveyed area is approximately 400 meters long and 50 meters across at its widest point. A majority of the site appears to burn annually beginning in 2004 but habitat recovery is rapid. The site is dominated by cattail, bulrush, tamarisk and yerba mansa averaging one to two meters tall. Common reed up to two meters tall is also present in abundance in some areas. Tamarisk up to 4 meters are common along the edges. The surveyed area is bordered by homes and businesses in a rural setting. This site has recovered completely from the 2005 floods. The Maverick Ditch site was surveyed for Yuma Clapper Rail in 2007. The habitat is not suitable for Yellow-billed Cuckoo.

Overton Wildlife Management Area (OWMA)

The Overton Wildlife Management area (OWMA), operated by the Nevada Division of Wildlife (NDOW), encompasses multiple survey areas for Yuma Clapper Rail and Yellow-billed Cuckoo (Figures 10 and 11). Suitable habitats vary in size and quality, depending on the site. Site descriptions are as follows:

Honeybee Pond

Honeybee Pond is located on the OWMA near Overton and was subdivided during past surveys into Eastern and Western sites (Figure 10). Eastern and western sites were combined in

2004 when the western site was drained. Honeybee Pond is managed for waterfowl. Thus the habitat at the site is composed of large expanses of cattail and reeds interspersed with open water. The site is bordered on the south by the Muddy River, which is contained by dikes. Habitats along the Muddy River canal are predominately composed of tamarisk. The center flow of the canal is dredged irregularly among years. Rail habitat at Honeybee Pond is composed of dense monotypic patches of cattail varying in height from 3 to 4 meters tall. Proportions of vegetated versus open water habitat vary among years with the management prescription. In general, the habitat at Honeybee Pond is excellent for Yuma Clapper Rail and surveys were conducted in 2007.

Two patches of Yellow-billed Cuckoo habitats occur east and southeast of Honeybee Pond (Figure 10). Perennial habitat on the eastern patch is composed of palms, willows and cottonwoods, with large intervening areas of cattail and low profile tamarisk. Habitat to the southeast is composed of a dense, mature, linear and compact grove of tamarisk and black willow surrounded by cattail marshes and a complex series of dikes with black willow and tamarisk boarders. The extent of perennial habitat at both locations are confined to well defined patches with open and park like intervening areas of lower profile annual and perennial vegetation. Both patches were surveyed for Yellow-billed Cuckoo.

Refuge Housing Area

The Refuge Housing Area site (Figure 11) is located, as the name suggests, adjacent and south of the OWMA housing area on Wildlife Road. The habitat is park like, composed of mature cottonwood and locust trees up to 15 meters tall embedded in open, grassy, park like areas. Habitat at the site is excellent for Yellow-billed Cuckoo and was surveyed accordingly in 2007. There is not suitable Yuma Clapper Rail at this site.

Maintenance Shed

The Maintenance Shed site is located south of the OWMA housing area (Figure 11). The site was named for the maintenance sheds and "bone" yard used for service operations on the OWMA. Habitat at this site is classically park like. Access roads are lined by cottonwood groves. Intervening areas are composed of grass. A network of narrow canals move water to a series of ponds managed for waterfowl or upland game. The cuckoo habitat at the site is excellent and the site was surveyed accordingly in 2007. There was no Yuma Clapper Rail habitat at this site in 2007.

Southwestern Willow Flycatcher

The Southwestern Willow Flycatcher site was new in 2005 and surveyed since for Yellow-billed Cuckoo (Figure 11). The habitat consists of a 300 meter strip of dense, mature Goodding black willow with a sandbar willow and tamarisk understory. The site is on the Muddy River, which is confined by an artificial canal. The site was named after the Southwestern Willow Flycatchers incidentally found at the site in 2005 by SBCM biologists. The site was surveyed for Yellow-billed Cuckoo in 2007. There is no suitable Yuma Clapper Rail habitat at the site.

Pintail Pond

The Pintail Pond site (Figure 11) is a group of two interconnected ponds managed for

waterfowl. The ponds are filled intermittently depending on water supply from a network of canals and diversions originating on the Muddy River. Depending on the year, the site is bordered by cattail around the northern and eastern margins of the ponds. The centers of the ponds are open shallow water. The size and extent of rail habitat varies from year to year, depending on the waterfowl management prescriptions being applied. The prescription in 2007 left Pintail Pond dried and devoid of riparian habitat. No rail surveys were warranted in 2007 due to lack of habitat.

Willow Strip

The Willow Strip site (Figure 11) is located along the western access road dikes around Pintail Pond. The access dike road is lined with linear strips of mature black willow from 3 to 5 meters tall. Coverages range from continuous to patchy. Habitats bordering the western and southwestern edge of the access road, beyond the black willows, are composed of dense tamarisk and mesquite up to 4 meters tall. The habitat at the Willow Strip site is excellent for Yellow-billed Cuckoo and was surveyed accordingly in 2007. The habitat is not suitable for rails.

Blind 30

The Blind 30 site (Figure 11) was new in 2007. The site consists of a large, approximately 40 hectare, water impoundment managed for waterfowl. Black willow, sandbar willow, and tamarisk line the dikes that encompass the impoundment. Perennial heights range from 1 to 5 meters tall. Perennial distribution around the dikes is patchy, ranging from a few trees to 100 meter stretches of continuous perennial cover. There is no appreciable rail habitat at the site. The surrounding habitat is dominated by mature tamarisk. The Yellow-billed Cuckoo habitat is extensive. Blind 30 was surveyed for cuckoo, but not for rails in 2007.

Mike's Site

Mike's Site (Figure 11) was also new in 2007. The site is located along the access road leading to South Marsh (Figure 11). Habitat at the sites consists of a grove of cottonwood embedded in a vast expanse of tamarisk associated with the water impoundments. The cottonwoods are mature, up to 15 meters tall and patchy. The surrounding tamarisk are also mature, up to 7 meters tall, but continuous. Habitat at the site is suitable for Yellow-billed Cuckoo, but not for Yuma Clapper Rail. The site was surveyed accordingly in 2007.

South Marsh

The South Marsh site (Figure 11) is located at the southeastern border of the OWMA. The site is composed of two large water impoundments bordered by access roads that circumnavigate and bisect the impoundments. Collectively, these impoundments cover several hundred hectares. The habitat is composed of monotypic cattail patches up to 400 meters wide and nearly 1 kilometer long. The access roads on the dikes are irregularly and infrequently lined with black willow, sandbar willow and tamarisk. The South Marsh site comprises the best and most extensive Yuma Clapper Rail habitat on the OWMA. The site was surveyed for rails in 2007. No appreciable cuckoo habitat occurs at the site.

RESULTS

Yuma Clapper Rail

Yuma Clapper Rail survey results for 2007 are presented in Table 2. A total of nineteen Yuma Clapper Rail were detected. Yuma Clapper Rail were detected at the Mesquite Bridge (Figure 3), Honeybee Pond (Figure 10) and South Marsh (Figure 11) survey sites.

One pair of Yuma Clapper Rail were detected in the downstream portion of the Mesquite Bridge site on15 May. This site was surveyed eight times from 29 March through 21 June. Yuma Clapper Rail responses were elicited on one of the eight surveys.

Yuma Clapper Rail detections at Honeybee Pond occurred on 18 April, 16 May, 31 May, 11 June and 20 June. Rails were detected on five of eight surveys. Detections included pairs and single individuals. The maximum number of rails detected occurred on 11 June, consisting of a dueting pair and one unpaired detection for a total of three birds know to be present on that date.

Yuma Clapper Rail detections at South Marsh occurred from 18 April through 20 June. Rails were detected on six of seven surveys. The maximum number of rails detected occurred on 20 June, consisting of three dueting pairs and eight unpaired detections for a total of 14 birds known to be present. In addition, a Yuma Clapper Rail nest was found incidentally on 29 April (11 732819E, 4042281N, NAD27). The nest was constructed on a floating platform of rotten vegetation, shaded by a thin canopy of broken cattail stalks, covered by a large slanting clump of 3 m cattail, and measured 28cm x 32cm x 13cm deep. The nest was freshly constructed, no eggs were present and there was no apparent evidence of predation.

Yellow-billed Cuckoo

Yellow-billed Cuckoo survey results are presented in Table 3. There was a total of twelve Yellow-billed Cuckoo detections during the 2007 season. Yellow-billed Cuckoo were detected at six survey sites: Big Marsh (Figure 4), Long Marsh (Figure 4), Maintenance Sheds (Figure 11), Willow Strip (Figure 11), Blind 30 (Figure 11) and Mike's Site (Figure 11).

One Yellow-billed Cuckoo was detected at Big Marsh on 24 June. The bird was detected on the first of five surveys making a total of one cuckoo known to be present at Big Marsh in 2007.

At Long Marsh, Yellow-billed Cuckoo were detected during two of five surveys. A pair of Yellow-billed Cuckoo were detected on 10 July. A single bird was detected on 10 August. The behavior of the pair detected on 10 July suggested that a nest was present, but potential nest sites were abundant, visibility was severely limited, and nest searches yielded no results leaving breeding status probable but speculative.

A single Yellow-billed Cuckoo was observed at the Maintenance Sheds site (Figure 11) on two of five surveys. Single birds were detected on 4 July and 24 July. Absent unique markings or leg bands, it is unclear if these were the same birds. The cuckoo on 24 July was under observation for two hours. Visibility was good yet no nest or nesting or breeding behaviors were observed.

Three Yellow-billed Cuckoo were detected at the Willow Strip site on 11 July. Two of the birds were paired and exhibited both nesting and territorial behavior. Territorial behavior was observed between the pair and an adjacent third bird. No mate to the third bird was

observed, but its behavior suggested the bird was also paired. Lacking direct confirmation of a mate to this third bird, the paired status of the third bird remains likely but unconfirmed. Nest searches at the site were negative, but access at this site is confined to the dike road and extensive cuckoo habitat surrounds the site. The breeding status of these birds remains likely, but speculative.

Yellow-billed Cuckoo were observed at Blind 30 on one of five surveys. A pair of Yellow-billed Cuckoo was observed on 4 July. The pair was perched together in an isolated, 5 meter tall black willow and flew off together. Subsequent visits to the site were unsuccessful at locating either birds or nest(s).

A single Yellow-billed Cuckoo was observed at Mike's Site on 11 July. Subsequent visits to the site were unsuccessful at detecting the bird, thus the breeding status of this bird was undetermined.

Other Rails, Bitterns and Moorhens

Detections of other rails, bitterns and Common Moorhen are tabulated in Table 2. A minimum of 48 Virginia Rail were known to present in 2007. Virginia Rail were detected at every survey site and were the most abundant rail detected. Virginian Rail were most abundant at the Mesquite Bridge, Mesquite Bridge 3, Honeybee Pond and South Marsh sites. A minimum of 6 Sora were known to be present during the 2007 surveys. Sora were detected at the Maverick Ditch, Honeybee Pond and South Marsh sites. A minimum of 10 Least Bittern were known to be present during the 2007 surveys. Least Bittern were detected at the Mesquite Bridge, Mesquite Bridge 3, Honeybee Pond and South Marsh survey sites. Least Bittern were most abundant at the South Marsh survey site A single American Bittern was known to be present during the 2007 surveys. The single American Bittern was detected at the Honeybee Pond survey site. A total of 10 Common Moorhen were know to be present during the 2007 surveys. Common Moorhen were detected at the Mesquite Bridge, Honeybee Pond and South Marsh survey sites. Common Moorhen were most abundant at the South Marsh survey site. No Black Rail were detected during the 2007 survey season.

Incidental bird Species' Detections

Incidental bird species detected during the 2007 rail and cuckoo surveys are tabulated in Table 6. A total of 139 bird species were incidentally observed in 2007. The number is up from 110 birds species detected in 2006. Incidental bird species detections are incidental to rail and cuckoo surveys, and should not be over interpreted. Incidental bird species detections are not based on rigorous survey protocols. Incidental bird species observations indicate presence, but not absence of a bird species from a site.

DISCUSSION

Yuma Clapper Rail

Nineteen Yuma Clapper Rail were detected during the 2007 surveys. This was the second highest number of rail detections since SBCM surveys began in 2000, when 26 Yuma Clapper Rail were detected (Table 4). The preponderance of the increase in Yuma Clapper Rail

are likely due to increased rail habitat. The increase in rail habitat is most parsimoniously explained as a consequence of lower water elevations of Lake Mead. Fourteen of nineteen Yuma Clapper Rail known to be present during the 2007 surveys occurred on the OWMA South Marsh site (Figure 11). Suitable rail habitat at South Marsh has expanded exponentially over the years with the lowering of Lake Mead water elevations due to drought conditions in the Southwest. As a consequence, high quality rail habitat previously inundated by Lake Mead has been re-established at this site. As of 2007, the Yuma Clapper Rail populations on the OWMA are the largest and most viable known to exist in southern Nevada. Waterfowl management prescriptions likely contribute significantly to the quality and extent of Yuma Clapper Rail habitat on the OWMA Refuge. The integration of waterfowl prescriptions concordant with maintaining Yuma Clapper Rail habitats on the OWMA should be strongly supported and encouraged.

Yuma Clapper Rail habitat increases in 2007, outside of the OWMA, were extensive in the town of Mesquite where Yuma Clapper Rail habitat recovery after the 2005 floods has been phenomenal. Emergent rail habitats were firmly re-established and expanded both up and downstream of the bridge for the 2007 survey season. Downstream of the Mesquite Bridge rail habitat has re-established on the northwest side of the Virgin River channel, outside of the improvised high water dikes created after the 2005 floods, and adjacent to the golf course and housing construction. The longterm viability of this habitat is uncertain, but the quality in 2007 was excellent. It is important to note that rail habitats at the Mesquite survey sites are two years old, having been eliminated in 2005 by floods and attempts to control them. The pair of Yuma Clapper Rail detected at the Mesquite Bridge site, in the second breeding season following total habitat removal, suggest a great deal of resiliency in both Yuma Clapper Rail and rail habitat. Untoward disturbances, or disturbances of any nature, should be carefully considered to ensure that the re-establishment of Yuma Clapper Rail and rail habitat will persist through time at the Mesquite sites.

In contrast, Yuma Clapper Rail habitats at Mormon Mesa (Figure 4) downstream to the Virgin River Delta (Figure 5) have declined significantly from 2000 to the present . The habitat declines are most parsimoniously consequences of floods and range cattle, but causative factors vary by site.

At Big Marsh (Figure 4), Yuma Clapper Rail habitat has declined by at least 50% from previous years. Rail habitat at this site in previous years was characterized by high quality dense cattail habitat with little open water. By 2007, rail habitat consisted of short stature, sparse perennials edging large expanses of open water. These changes appear to be a direct consequence of hydrologic and topographic changes (channel elevations) associated with the 2005 floods.

Yuma Clapper Rail habitat at Long Marsh (Figure 4) in previous years consisted of a heterogenous and complex series of cattail patches interspersed among and underneath a willow and tamarisk overstory in a long linear marsh complex. Hydrologic changes associated with the 2005 floods have significantly impoverished the extent of wetlands in Long Marsh over the years. In addition, range cattle have denuded any remaining marsh habitats the extent that the habitat was no longer unsuitable for Yuma Clapper Rail by the end of the 2007 survey season. Recover of these marsh habitats is directly dependent on eliminating range cattle from the marsh.

Yuma Clapper Rail habitat at East Marsh (Figure 4) essentially disappeared after the 2005 floods. Hydrologic changes appear to be directly responsible for the event. Range cattle were present, but in this case, the desiccation of the habitat was more rapid than the ability of range cattle to otherwise degrade the habitat.

Yuma Clapper Rail habitat at Fisherman's Cove and Virgin River Landing (Figure 5) were promising following the lowered water elevations in Lake Mead, when extensive mud flats and potential rail habitats were exposed. However, the promising habitats were short lived, having been scoured by floods in 2005 and subsequent entrenchment of the Virgin River channel. All surviving rail habitats were quickly grazed off by range cattle. The potential for re-establishing rail habitat at these sites, even to a limited degree, is summarily precluded by range cattle grazing. There was no suitable Yuma Clapper Rail at these sites in 2007. Prospects for the establishment of rail habitats at these two sites is highly problematic.

Yellow-billed Cuckoo

There were twelve Yellow-billed Cuckoo detections during the 2007 surveys. This was the highest number of cuckoo detections since SBCM surveys began in 2000 (Table 5). Eight of the twelve detections occurred on the OWMA refuge (Figure 11). The four remaining detections occurred at the Mormon Mesa sites (Figure 4). Yellow-billed Cuckoo detections have increased dramatically from a low of zero in 2002, to three in 2005, to six in 2006, and now twelve in 2007 (Table 5). The center of Yellow-billed Cuckoo detections have also shifted from the Mormon Mesa sites where ten detected cuckoo were detected in 2001 versus four in 2007, to the OWMA where eight birds were detected in 2007 versus two in 2005 (Table 5). Reasons for the steady increase in Yellow-billed Cuckoo detections from 2002 to the present, or the spatial population shift from the Mormon Mesa sites in 2002 to the OWMA sites in 2007 are not readily apparent. Regardless, as of 2007, the Yellow-billed Cuckoo populations on the OWMA are the largest and most viable known to exist in southern Nevada. Maintaining Yellow-billed Cuckoo habitats on the OWMA refuge should be strongly supported and encouraged.

The spatial and temporal shifts of cuckoo detections since SBCM surveys began in 2000 are difficult to interpret. Part, but not all, of the changes are likely due to unequal survey efforts among the years. Not all sites were surveyed every year from 2000 through 2007 (Table 5). Yet, unequal effort among years cannot account for all the observed variation among the years. For example, the Mormon Mesa sites were consistently surveyed since 2000, yet cuckoo detections have declined from 2001 to 2005. The OWMA sites were not surveyed until 2005, yet cuckoo detections have increased from 2005 to 2007. The evidence suggests that survey effort alone cannot account for changes in Yellow-billed Cuckoo detections through time.

Confounding interpretation of Yellow-billed Cuckoo survey results, Yellow-billed Cuckoo habitats on the Virgin and Muddy Rivers, unlike Yuma Clapper Rail habitats, have remained relatively stable since 2000. The floods of 2005 resulted in little apparent long-term degradations to cuckoo habitats. Cuckoo habitats at the Mormon Mesa sites appear to have been rejuvenated by the 2005 floods. Cuckoo habitats at the OWMA appear to have been stable over the years, despite the 2005 floods and variable Lake Mead water elevations. And, the greatest flood related habitat degradations occurred in Mesquite and Littlefield areas, where habitat degradations appear to have been a consequence of anthropomorphic efforts to control the floods. Even more perplexing has been the Warm Springs Ranch site, where reports prior to 2000 suggested the presence of a sizeable Yellow-billed Cuckoo breeding population. SBCM

and NDOW surveys since 2000 have not found the cuckoo in sizeable numbers at the Warm Spring Ranch site, and yet no changes in cuckoo habitat have been apparent.

The current evidence suggests that available cuckoo habitat and survey effort are two of many variables affecting the detection and presence of Yellow-billed Cuckoo breeding populations in southern Nevada. The Yellow-billed Cuckoo is a neotropical migrant exhibiting irruptive breeding patterns. Irruptive breeding means that breeding populations show up in sporadic and inconsistent locations among years. Why irruptive breeders vary in population size and breeding locations from year to year is not known. Proximal factors proposed to explain the irruptive breeding pattern for Yellow-billed Cuckoo have included natural variability in food resources, nesting substrates, habitat loss, habitat conversion, habitat quality, cattle grazing, population declines, search for breeding opportunities, and variable migration routes. All proposed explanations likely have some merit but none have been rigorously tested. This lack of scientific information on factors affecting the distribution and occurrence of Yellow-billed Cuckoo breeding populations makes it particularly difficult to interpret the spatial and temporal changes of Yellow-billed Cuckoo breeding populations observed on the Virgin and Muddy Rivers since 2000, much less formulate credible management plans. In short, this species requires much more research before observational results can be effectively interpreted into a management context. Regardless, it is intuitively obvious that Yellow-billed Cuckoo habitats, to the extent that they can be defined, should be conserved to the maximum extent possible.

SUMMARY

Yuma Clapper Rail Detections

Nineteen Yuma Clapper Rail were detected during the 2007 surveys. This was the second highest number of detections since 2000. Seventeen of nineteen detections occurred on the OWMA, fourteen of the seventeen OWMA detections occurred at the South Marsh site, two occurred at the Honeybee Pond site. Outside of the OWMA, two Yuma Clapper Rail detections occurred at the Mesquite Bridge site. One Yuma Clapper Rail nest was found incidentally at the South Marsh site of the OWMA.

Yuma Clapper Rail Habitats

Yuma Clapper Rail habitats both expanded and contracted in 2007 depending on the site. Rail habitat expansions occurred at the Mesquite sites and the South Marsh site on the OWMA. Habitat gains were most significant at the Mesquite sites. Yuma Clapper Rail habitats either declined or were not present at all in the 2007 surveys at the Littlefield, Mormon Mesa, Virgin Delta, Bowman Canal and Grant Bowler Park sites. Habitat declines appeared to be a consequence of hydrologic changes, anthropomorphic changes, and range cattle. Range cattle were responsible for the greatest extent of habitat destruction or elimination in 2007.

Yellow-billed Cuckoo Detections

Twelve Yellow-billed Cuckoo were detected during the 2007 surveys. This was the highest number of detections since surveys began in 2000. Eight Yellow-billed Cuckoo were detected at the OWMA sites. Four Yellow-billed Cuckoo were detected at Mormon Mesa sites.

Behavioral evidence from birds at both sites strongly indicated breeding, though no nests were observed.

Yellow-billed Cuckoo Habitats

Yellow-billed habitats appeared to be stable. Degradations to the understory habitat were apparent at the Littlefield and Mormon Mesa sites. Habitat disturbances in 2007 were due to range cattle.

RECOMMENDATIONS

1) Continue Yuma Clapper Rail and Yellow-billed Cuckoo surveys. Surveys for both species have been conducted since 2000. These surveys are the most comprehensive and continuous surveys of Yuma Clapper Rail and Yellow-billed Cuckoo in southern Nevada. Data from these surveys provide fundamental, longterm, baseline information regarding the distribution and abundance of both species on the Virgin and Muddy River complex. This information is fundamental to constructive and effective integration of Yuma Clapper Rail and Yellow-billed Cuckoo conservation with water management policies.

2) Encourage and support OWMA management prescriptions that consider Yuma Clapper Rail, Yellow-billed Cuckoo, and their habitats on the OWMA. The center of both species' distributions are presently on the OWMA. Actions which encourage the persistence and management of these populations will benefit both species as well as provide endangered species compliance options in regards to water management of the Virgin and Muddy River complex.

3) Encourage and support all efforts to preserve Yuma Clapper Rail and Yellow-billed cuckoo habitats on the Virgin River in the town of Mesquite. Yuma Clapper Rail and Yellow-billed Cuckoo habitats in Mesquite were decimated in 2005. Yuma Clapper Rail habitat recovery has been phenomenal. As of 2007, Yuma Clapper Rail habitat in Mesquite is second only to the OWMA in extent and quality. Yellow-billed Cuckoo habitat recovery in the same area shows great promise.

4) Encourage and support all efforts to remove range cattle from the Virgin River. Range cattle have been and continue to be a significant contributor the degradation and elimination of Yuma Clapper habitats along the entire length of the Virgin River in southern Nevada. Habitat damage and elimination have been most severe at the Mormon Mesa and Virgin Delta sites.

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Table 1. Locations, site names, and geographic coordinates for Yuma Clapper Rail and Yellow-billed Cuckoo survey sites on and along the Virgin and Muddy Rivers in southern Nevada for the 2007 breeding season.

SITE NAME	LOCATION	UTM (NAD27)
Yuma Clapper Rail		
Big Marsh	Virgin River near Mormon Mesa	11 739380E, 4057804N
Long Marsh	Virgin River near Mormon Mesa	11 739897E, 4057210N
Fisherman's Cove	Virgin River Delta	11 739475E, 4041309N
Honeybee Pond	Overton Wildlife Management Area	11 731344E, 4045517N
Littlefield South	Virgin River in Littlefield, Arizona	12 239409E, 4086681N
Maverick Ditch	Muddy River in Overton, Nevada	11 728854E, 4047398N
Mesquite Bridge	Virgin River in Mesquite, Nevada	11 759409E, 4075400N
Mesquite Bridge 3	Virgin River in Mesquite, Nevada	11 761573E, 4076434N to 11 760521E, 4076082N
Pintail Pond	Overton Wildlife Management Area	11 731709 E, 4043602N to 11 731745 E, 4043607N
South Marsh	Overton Wildlife Management Area	11 732147E, 4042576N to 11 733094E, 4042621N
Virgin River Landing	Virgin River Delta	11 739481E, 4042710N
Yellow-billed Cuckoo		
Blind 30	Overton Wildlife Management Area	11 732014E, 4043439N

Table 1 continued. Locations, site names, and geographic coordinates for Yuma Clapper Rail and Yellow-billed Cuckoo survey sites on and along the Virgin and Muddy Rivers in southern Nevada for the 2007 breeding season.

SITE NAME	LOCATION	UTM (NAD27)
Desert Springs	Virgin River near Littlefield, Arizona	12 240130E, 4087670N to 12 240301E, 4087785N
Honeybee Pond	Overton Wildlife Management Area	11 731344E, 4045517N to 11 732108E, 4044076N
Littlefield North	Virgin River in Littlefield, Arizona	12 239591E, 4087141N
Long Marsh to Big Marsh	Virgin River near Mormon Mesa	11 739897E, 4057210N to 11 739380E, 4057804N
Mesquite Bridge 2	Virgin River in Mesquite, Nevada	11 758562E, 4075231N to 11 758755E, 4075336N
Mike's Site	Overton Wildlife Management Area	11 732508E, 4041889N
Refuge Housing and Maintenance Sheds	Overton Wildlife Management Area	11 730668E, 4044449N to 11 731003E, 4044034N
Southwestern Willow Flycatcher Habitat	Overton Wildlife Management Area	11 732108E, 4044076N to 11 731988E, 4044169N
Warm Springs Ranch	Muddy River near Glendale, Nevada	11 707135E, 4064603N
Willow Strip	Overton Wildlife Management Area	11 731747E, 4043607N to 11 731868E, 4043783N

Table 2. Results of Yuma Clapper Rail surveys by the San Bernardino County Museum in 2007 for sites in and along the Virgin and Muddy Rivers in southern Nevada in 2007. YCRA = Yuma Clapper Rail. VIRA = Virginia Rail. SORA = Sora, BLRA = Black Rail, LEBI = Least Bittern AMBI = American Bittern. COMO = Common Moorhen.

SITE	DATE	TIME	YCRA	VIRA	SORA	BLRA	LEBI	AMBI	COMO
Virgin River Sites									
Big Marsh	27 March	6:30 – 8:30	0	0	0	0	0	0	0
	17 April	6:15 – 8:00	0	1 [S]	0	0	0	0	0
	15 May	5:30 – 9:10	0	0	0	0	0	0	0
	2 June	5:25 – 6:25	0	0	0	0	0	0	0
	16 June	5:00 – 6:00	0	0	0	0	0	0	0
	19 June	6:00 – 7:30 [2]	0	0	0	0	0	0	0
	Total hours:	**10.9**							
Long Marsh	27 March	6:30 – 9:00	0	1 [S]	0	0	0	0	0
	17 April	6:00 – 9:30	0	2 [S]	0	0	0	0	0
	15 May	5:30 – 7:30	0	1 [S]	0	0	0	0	0
	2 June	6:45 – 9:15	0	0	0	0	0	0	0
	16 June	6:10 – 8:10	0	0	0	0	0	0	0
	19 June	6:00 – 7:30 [2]	0	0	0	0	0	0	0
	Total hours:	**14.0**							
Fisherman's Cove [a]	28 March	Assessment [1]							
Virgin River Landing [a]	28 March	Assessment [1]							
Littlefield South [a]	28 March	Assessment [1]							
	18 April	Reassessment [1]							
	15 May	Reassessment [1]							

Table 2 continued: Results of Yuma Clapper Rail surveys by the San Bernardino County Museum in 2007 for sites in and along the Virgin and Muddy Rivers in southern Nevada in 2007. YCRA = Yuma Clapper Rail. VIRA = Virginia Rail. SORA = Sora, BLRA = Black Rail, LEBI = Least Bittern AMBI = American Bittern. COMO = Common Moorhen.

SITE	DATE	TIME	YCRA	VIRA	SORA	BLRA	LEBI	AMBI	COMO
Littlefield North [a]	28 March	Assessment [1]							
	18 April	Reassessment [1]							
	15 May	Reassessment [1]							
Mesquite Bridge	29 March	4:45 – 5:30	0	2 [P]	0	0	0	0	0
	19 April	6:00 – 8:30	0	4 [S] + 3 [P]	0	0	0	0	0
	28 April	5:30 – 8:00	0	2 [S]	0	0	0	0	0
	15 May	5:30 – 7:30	1 [P]	10 [S]	0	0	0	0	0
	17 May	4:30 – 6:30	0	4 [S]	0	0	1 [S]	0	0
	1 June	5:25 – 7:00	0	0	0	0	0	0	2 [S]
	15 June	4:45 – 7:20	0	3 [S]	0	0	0	0	1 [S]
	21 June	5:30 – 8:00	0	8 [S]	0	0	0	0	0
	Total hours:	**16.4**							
Mesquite Bridge 3	29 March	5:00 – 7:30	0	4 [S]	0	0	0	0	0
	19 April	6:15 – 8:45	0	2 [S] + 4 [P]	0	0	0	0	0
	28 April	8:00 – 9:00	0	2 [S] + 2 [P]	0	0	0	0	0
	15 May	5:30 – 8:45	0	2 [S]	0	0	0	0	0
	17 May	4:30 – 6:30	0	5 [S]	0	0	1 [S]	0	0
	1 June	7:15 – 9:45	0	4 [F] + 1 [S]	0	0	0	0	0
	15 June	7:30 – 9:00	0	2 [S]	0	0	0	0	0
	21 June	5:40 – 8:15	0	4 [S]	0	0	0	0	0
	Total hours:	**17.8**							

Table 2 continued: Results of Yuma Clapper Rail surveys by the San Bernardino County Museum in 2007 for sites in and along the Virgin and Muddy Rivers in southern Nevada in 2007. YCRA = Yuma Clapper Rail. VIRA = Virginia Rail. SORA = Sora, BLRA = Black Rail, LEBI = Least Bittern AMBI = American Bittern. COMO = Common Moorhen.

SITE	DATE	TIME	YCRA	VIRA	SORA	BLRA	LEBI	AMBI	COMO
Muddy River Sites									
Bowman Canal [a]	27 March	Assessment [1]							
	17 April	Reassessment [1]							
Grant Bowler Park [a]	27 March	Assessment [1]							
	17 April	Reassessment [1]							
Maverick Ditch	27 March	9:30 – 10:15	0	2 S	0	0	0	0	0
	17 April	10:00 – 11:00	0	2 S	1 S	0	0	0	0
	29 April	5:30 – 6:15	0	2 S + 1 P	0	0	0	0	0
	16 May	6:45 – 7:45	0	7 F	0	0	0	0	0
	31 May	10:35 – 11:35	0	0	0	0	0	0	0
	11 June	5:20 – 6:20	0	0	0	0	0	0	0
	19 June	8:15 – 9:00	0	1 S	0	0	0	0	0
	Total hours:	**6.25**							
Honeybee Pond	28 March	6:00 – 7:45	0	3 S	0	0	0	0	0
	18 April	5:30 – 7:30	1 S	3 S + 2 P	2 S	0	0	0	0
	29 April	6:30 – 7:45	0	2 S	0	0	0	0	2 S
	15 May	8:30 – 9:30	0	2 P	0	0	0	1 S	0
	16 May	5:00 – 6:30	1 P	3 S + 2 P	0	0	1 S	0	0
	31 May	8:50 – 10:30	2 S	0	1 S	0	0	0	0
	11 June	6:30 – 9:00	1 P + 1 S	1 S	0	0	2 S	0	0
	20 June	9:10 – 10:10	1 S	2 S + 1 P	0	0	1 S	0	2 S
	Total hours:	**12.7**							

Table 2 continued: Results of Yuma Clapper Rail surveys by the San Bernardino County Museum in 2007 for sites in and along the Virgin and Muddy Rivers in southern Nevada in 2007. YCRA = Yuma Clapper Rail. VIRA = Virginia Rail. SORA = Sora, BLRA = Black Rail, LEBI = Least Bittern AMBI = American Bittern. COMO = Common Moorhen.

SITE	DATE	TIME	YCRA	VIRA	SORA	BLRA	LEBI	AMBI	COMO
Pintail Pond [a]	28 March	Assessment [1]							
	17 April	Reassessment [1]							
	16 May	Reassessment [1]							
South Marsh	28 March	8:00 – 10:00	0	6 S	0	0	0	0	0
	18 April	7:45 – 9:30	2 S + 3 P	3 S + 2 P	3 S	0	0	0	0
	29 April	8:00 – 1:00	2 S + 2 PN	2 S	2 S	0	0	0	0
	16 May	8:20 – 9:45	3 S + 4 P	3 S + 4 P	0	0	1 S	0	0
	31 May	6:00 – 8:00	5 S + 1 P	0	0	0	0	0	0
	12 June	5:30 – 8:15	2 S + 3 P	0	0	0	3 S	0	0
	20 June	5:30 – 9:00	8 S + 3 P	4 S + 2 P	0	0	6 S	0	6 S
	Total hours:	**17.6**							
	Total Detections		**19**	**48**	**6**	**0**	**10**	**1**	**10**

1 – No survey. No suitable habitat. Dates are field visits for habitat assessment/reassessments.
2 – Habitat suitability had degraded to the point of no longer suitable.
a – Habitat unsuitable for Yuma Clapper Rail. Not surveyed in 2007.
P - # of pairs detected, does not include # of single bird detections.
S - # of single birds detected. Does not include the # of pairs detected.
F - Family group.
N – Nest (fresh, no eggs).

Table 3. Results of Yellow-billed Cuckoo surveys by the San Bernardino County Museum in 2007 for sites in and along the Virgin and Muddy Rivers in southern Nevada in 2007.

SITE	DATE	TIME	# YBCU DETECTED
Virgin River Sites			
Big Marsh area	24 June	4:50 – 6:50	1
	3 July	6:00 – 7:30	0
	10 July	6:00 – 7:30	0
	24 July	9:45 – 11:00	0
	10 August	6:00 – 8:00	0
	Total hours:	**8.25**	
Long Marsh Area	24 June	7:00 – 9:00	0
	3 July	7:30 – 10:00	0
	10 July	6:00 – 7:30	2 (paired)
	24 July	7:15 – 9:20	0
	10 August	6:15 - 8:30	1
	Total hours:	**10.3**	
Desert Springs	17 June	7:00 – 7:30	0
	5 July	6:45 – 7:45	0
	12 July	6:45 – 7:30	0
	23 July	5:45 – 6:15	0
	12 August	7:15 – 8:30	0
	Total hours:	**4.0**	
Littlefield North	17 June	4:50 – 6:20	0
	5 July	5:30 – 6:30	0
	12 July	5:40 – 6:40	0
	23 July	7:05 – 8:25	0
	12 August	5:30 – 7:00	0
	Total hours:	**6.3**	
Mesquite Bridge 2	17 June	8:10 – 9:30	0
	5 July	8:45 – 10:00	0
	12 July	9:00 – 10:00	0
	23 July	9:40 – 10:40	0
	12 August	9:45 – 10:30	0
	Total hours:	**5.3**	

Table 3 continued: Results of Yellow-billed Cuckoo surveys by the San Bernardino County Museum in 2007 for sites in and along the Virgin and Muddy Rivers in southern Nevada in 2007.

SITE	DATE	TIME	# YBCU DETECTED
Muddy River Sites			
Refuge Housing	18 June	5:30 – 6:55	0
	4 July	5:30 – 5:50	0
	11 July	7:15 – 8:15	0
	24 July	9:05 – 10:05	0
	10 Aug	8:00 – 10:00	0
	Total hours:	**6.75**	
Maintenance Sheds	18 June	5:30 – 6:55	0
	4 July	5:30 – 5:50	1
	11 July	7:15 – 8:15	0
	24 July	9:05 – 10:05	1
	10 Aug	8:00 – 10:00	0
	Total hours:	**6.75**	
Southwestern Willow Flycatcher Habitat	18 June	9:10 – 9:45	0
	4 July	8:00 – 8:45	0
	11 July	6:00 – 7:00	0
	24 July	6:00 – 6:45	0
	10 Aug	8:30 – 9:30	0
	Total hours:	**4.1**	
Willow Strip	18 June	7:00 – 8:20	0
	4 July	7:00 – 8:00	0
	11 July	5:45 – 7:45	3 (1 pair +1 single)
	24 July	5:45 – 7:45	0
	10 Aug	7:30 – 9:00	0
	Total hours:	**7.8**	
Blind 30	18 June	8:20 – 9:00	0
	4 July	6:00 – 7:00	2 (1 pair)
	11 July	8:00 – 10:00	0
	24 July	5:45 – 6:45	0
	10 Aug	6:00 – 7:15	0
	Total hours:	**5.9**	

Table 3 continued: Results of Yellow-billed Cuckoo surveys by the San Bernardino County Museum in 2007 for sites in and along the Virgin and Muddy Rivers in southern Nevada in 2007.

SITE	DATE	TIME	# YBCU DETECTED
Mike's Site	11 July	10:00 – 10:45	1 (single)
	24 July	6:55 – 8:05	0
	10 Aug	5:30 – 6:30	0
	Total hours:	**2.9**	
Honeybee Pond	18 June	4:40- 5:30	0
	4 July	9:00 – 10:00	0
	11 July	10:00 – 11:45	0
	24 July	8:40 – 8:55	0
	10 Aug	8:30 – 9:00	0
	Total hours:	**4.3**	
Warm Springs Ranch	23 June	5:50 – 9:15	0
	6 July	5:30 – 11:30	0
	20 July	5:45 – 10:05	0
	Total hours:	**13.75**	
	Total Detections		**12**

Table 4. Summary of San Bernardino County Museum Yuma Clapper Rail surveys along the Virgin and Muddy Rivers in Southern Nevada from 2000 through 2007. Numbers are the maximum number of detections. (-ns- = not surveyed)

	2000	2001	2002	2003	2004	2005	2006	2007
Virgin River Sites								
Littlefield North [a]	2	0	0	0	1	ns- [h]	ns- [h]	-ns- [i]
Littlefield Bridge	0	0	0	0	-ns- [b]			
Littlefield South	2	0	0	0	1	-ns- [h]	0	-ns- [i]
Mesquite Upstream	0	0	0	1	-ns- [c]			
Mesquite Bridge	2	0	2	1	1	-ns- [c, h]	0	2
Mesquite Downstream	0	0	0	0	-ns- [c]			
Mesquite Bridge 3	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	0
Mormon Mesa: Big Marsh [d]	7 [e]	8-12	3	0	1	0	0	0
Mormon Mesa: Long Marsh	6	1	0	0	0	0	0	0
Mormon Mesa: East Marsh	5	2	-ns-	-ns-	0	-ns- [h]	-ns- [i]	-ns- [i]
Virgin River Landing	-ns-	-ns-	-ns-	0	2	0	0	-ns- [i]
Fisherman's Cove	-ns-	-ns-	-ns-	0	0	-ns- [h]	0	-ns- [i]
Muddy River Sites								
Glendale	-ns-	-ns-	0	0	-ns-	-ns-	-ns-	-ns-
Bowman Canal	-ns-	-ns-	-ns-	-ns-	0	0	-ns- [i]	-ns- [i]
Grant Bowler Park	-ns-	-ns-	-ns-	0	0	0	-ns- [i]	-ns- [i]
Maverick Ditch	1	0	4	1	0	0	0	0

Table 4 continued: Summary of San Bernardino County Museum Yuma Clapper Rail surveys along the Virgin and Muddy Rivers in Southern Nevada from 2000 through 2007. Numbers are the maximum number of detections. (-ns- = not surveyed)

	2000	2001	2002	2003	2004	2005	2006	2007
Honeybee Pond	1	0	0	2	0	0	0	3
Pintail Pond	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	0 [j]	-ns- [i]
South Marsh	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	2 [j]	14
Total Detections	**26**	**13**	**9**	**5**	**6**	**0**	**2**	**19**

a - Includes Beaver Dam Wash.
b - Site was split in half and surveyed since 2004 as additions to Little Field North and South.
c - Suitable habitat at Mesquite Upstream and Downstream sites has decreased through time. Sites were combined with Mesquite Bridge site and surveyed with same beginning in 2005.
d - Mormon Mesa sites have been referenced as "Overton" sites in past reports.
e - Includes observations of two fledglings.
f - Nest, two eggs and fledglings.
g - Warm Springs Ranch and adjacent areas have been previously surveyed by individuals not associated with SBCM.
h- Habitat disturbed by floods or bulldozers during winter 2005 flood events.
i - No suitable habitat
j - Survey site new in 2006.
k- Long Marsh, Big Marsh, and adjacent suitable habitats.

Table 5. Summary of San Bernardino County Museum Yellow-billed Cuckoo surveys along the Virgin and Muddy Rivers in southern Nevada from 2000 through 2007. Numbers are number of detections. (-ns- = not surveyed)

	2000	2001	2002	2003	2004	2005	2006	2007
Virgin River Sites								
Littlefield North	2	0	0	0	0	0	0	0
Mesquite Bridge	1	0	0	1	0	-ns- [h]	-ns- [h, i]	0
Mesquite Bridge 2	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	0 [j]	0
Mormon Mesa [k]	3-4	6-10	0	0	0	0	3	4
Virgin Delta West	-ns-	2 [f]	0	-ns-	-ns-	-ns-	-ns-	-ns-
Muddy River Sites								
Honeybee Pond	-ns-	-ns-	-ns-	0	0	1	0	0
Refuge Housing	-ns-	-ns-	-ns-	-ns-	-ns-	0	0	0
Maintenance Sheds	-ns-	-ns-	-ns-	-ns-	-ns-	1	2	2
Southwestern Willow Flycatcher Habitat	-ns-	-ns-	-ns-	-ns-	-ns-	0	0	0
Willow Strip	-ns-	-ns-	-ns-	-ns-	-ns-	0	0	3
Blind 30	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	2

Table 5 continued: Summary of San Bernardino County Museum Yellow-billed Cuckoo surveys along the Virgin and Muddy Rivers in southern Nevada from 2000 through 2007. Numbers are number of detections. (-ns- = not surveyed)

	2000	2001	2002	2003	2004	2005	2006	2007
Mike's Site	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	1
Warm Springs Ranch [g]	-ns-	-ns-	-ns-	1	1	1	1	0
Total Detections	**6**	**10**	**0**	**2**	**1**	**3**	**6**	**12**

a - Includes Beaver Dam Wash.
b - Site was split in half and surveyed since 2004 as additions to Little Field North and South.
c - Suitable habitat at Mesquite Upstream and Downstream sites has been decreased over the years, so both sites were combined with Mesquite Bridge site and surveyed with same since 2004.
d - Mormon Mesa sites have been referenced as "Overton" sites in past reports.
e - Includes observations of two fledglings.
f - Nest, two eggs and fledglings.
g - Warm Springs Ranch and adjacent areas have been previously surveyed by individuals not associated with SBCM.
h - Habitat disturbed by floods or bulldozers during winter 2005 flood events.
i - No suitable habitat
j - Survey site new in 2006.
k - Long Marsh, Big Marsh, and adjacent suitable habitats.

Table 6. Incidental bird species detected during San Bernardino County Museum Yuma Clapper Rail and Yellow-billed Cuckoo surveys in 2007 along the Virgin and Muddy Rivers in southern Nevada. Detections are incidental and indicate presence only. Absence should not be inferred. See text and Table 1 for site locations.

Species	Desert Springs	Littlefield North	Mesquite Bridge 3	Mesquite Bridge 2	Mesquite Bridge	Big Marsh	Long Marsh	Maverick Ditch	Honeybee Pond [1]	South Marsh [1]	OWMA [2]	Warm Springs
Canada Goose			X		X	X	X		X	X	X	
Gadwall			X						X	X	X	
Mallard			X		X	X	X		X	X	X	
Cinnamon Teal			X		X	X	X		X	X	X	
Northern Shoveler									X	X	X	
American Widgeon			X						X	X	X	
Northern Pintail									X	X	X	
Blue-winged Teal					X					X		
Green-winged Teal			X						X	X		
Redhead			X						X	X	X	
Greater Scaup										X		
Lesser Scaup									X	X	X	
Bufflehead									X	X		
Ruddy Duck			X						X	X	X	
Ring-necked Pheasant			X			X	X					X
Wild Turkey									X	X	X	

Table 6 continued: Incidental bird species detected during San Bernardino County Museum Yuma Clapper Rail and Yellow-billed Cuckoo surveys in 2007 along the Virgin and Muddy Rivers in southern Nevada. Detections are incidental and indicate presence only. Absence should not be inferred. See text and Table 1 for site locations.

Species	Desert Springs	Littlefield North	Mesquite Bridge 3	Mesquite Bridge 2	Mesquite Bridge	Big Marsh	Long Marsh	Maverick Ditch	Honeybee Pond [1]	South Marsh [1]	OWMA [2]	Warm Springs
Gambel's Quail	X	X	X		X	X	X	X	X	X	X	X
Pied-billed Grebe									X	X	X	
Horned Grebe									X	X	X	
Eared Grebe									X	X	X	
Clark's Grebe						X			X	X	X	
Western Grebe						X			X	X	X	
American White Pelican										X		
Double-crested Cormorant			X		X		X		X	X	X	
American Bittern									X			
Least Bittern					X	X			X	X		
Great Blue Heron		X	X		X	X			X	X	X	X
Great Egret			X		X	X			X	X	X	
Snowy Egret			X		X	X	X	X	X	X	X	
White-faced Ibis									X	X	X	
Green Heron				X		X			X	X	X	

Table 6 continued: Incidental bird species detected during San Bernardino County Museum Yuma Clapper Rail and Yellow-billed Cuckoo surveys in 2007 along the Virgin and Muddy Rivers in southern Nevada. Detections are incidental and indicate presence only. Absence should not be inferred. See text and Table 1 for site locations.

Species	Desert Springs	Littlefield North	Mesquite Bridge 3	Mesquite Bridge 2	Mesquite Bridge	Big Marsh	Long Marsh	Maverick Ditch	Honeybee Pond [1]	South Marsh [1]	OWMA [2]	Warm Springs
Black-crowned Night-Heron		X	X		X	X	X	X	X	X	X	
White-faced Ibis			X			X	X		X	X	X	
Turkey Vulture	X		X			X	X		X	X	X	X
Osprey			X			X				X	X	
Northern Harrier		X					X	X	X	X	X	
Sharp-shinned Hawk									X			
Cooper's Hawk				X			X				X	
Common Black-Hawk	X	X										
Red-tailed Hawk	X	X					X				X	X
American Kestrel			X		X	X		X	X	X	X	X
Prairie Falcon						X	X					
Peregrine Falcon							X					
Clapper Rail					X				X	X		
Virginia Rail			X		X		X	X	X	X	X	
Sora								X	X			
Common Moorhen					X				X	X	X	

Table 6 continued: Incidental bird species detected during San Bernardino County Museum Yuma Clapper Rail and Yellow-billed Cuckoo surveys in 2007 along the Virgin and Muddy Rivers in southern Nevada. Detections are incidental and indicate presence only. Absence should not be inferred. See text and Table 1 for site locations.

Species	Desert Springs	Littlefield North	Mesquite Bridge 3	Mesquite Bridge 2	Mesquite Bridge	Big Marsh	Long Marsh	Maverick Ditch	Honeybee Pond [1]	South Marsh [1]	OWMA [2]	Warm Springs
American Coot			X		X	X			X	X	X	
Killdeer	X	X	X	X	X	X	X	X	X	X	X	
Black-necked Stilt					X		X		X		X	
American Avocet							X		X	X	X	
Greater Yellowlegs			X							X	X	
Spotted Sandpiper	X			X	X		X		X		X	
Long-billed Curlew			X									
Long-billed Dowitcher							X		X	X	X	
Wilson's Phalarope			X									
Ring-billed Gull									X	X	X	
Forster's Tern			X							X		
White-winged Dove		X				X	X		X	X	X	X
Mourning Dove	X	X	X	X	X	X	X	X	X	X	X	X
Common Ground Dove											X	
Eurasian Collared Dove			X		X			X	X	X	X	
Yellow-billed Cuckoo						X	X			X	X	

Table 6 continued: Incidental bird species detected during San Bernardino County Museum Yuma Clapper Rail and Yellow-billed Cuckoo surveys in 2007 along the Virgin and Muddy Rivers in southern Nevada. Detections are incidental and indicate presence only. Absence should not be inferred. See text and Table 1 for site locations.

Species	Desert Springs	Littlefield North	Mesquite Bridge 3	Mesquite Bridge 2	Mesquite Bridge	Big Marsh	Long Marsh	Maverick Ditch	Honeybee Pond [1]	South Marsh [1]	OWMA [2]	Warm Springs
Greater Roadrunner	X	X			X	X	X				X	X
Barn Owl				X						X		
Great Horned Owl				X								X
Lesser Nighthawk	X	X	X		X	X	X		X	X	X	X
White-throated Swift						X			X	X	X	X
Black-chinned Hummingbird		X	X	X	X			X				X
Anna's Hummingbird		X					X				X	
Broad-tailed Hummingbird			X									
Belted Kingfisher					X	X						
Ladder-backed Woodpecker	X	X		X	X	X	X		X		X	X
Western Wood-Pewee							X	X			X	
Willow Flycatcher						X			X		X	X
Gray Flycatcher											X	
Cordilleran Flycatcher						X					X	
Black Phoebe	X	X	X	X			X	X	X	X	X	X

Table 6 continued: Incidental bird species detected during San Bernardino County Museum Yuma Clapper Rail and Yellow-billed Cuckoo surveys in 2007 along the Virgin and Muddy Rivers in southern Nevada. Detections are incidental and indicate presence only. Absence should not be inferred. See text and Table 1 for site locations.

Species	Desert Springs	Littlefield North	Mesquite Bridge 3	Mesquite Bridge 2	Mesquite Bridge	Big Marsh	Long Marsh	Maverick Ditch	Honeybee Pond [1]	South Marsh [1]	OWMA [2]	Warm Springs
Say's Phoebe	X			X		X	X	X		X	X	X
Vermillion Flycatcher											X	X
Ash-throated Flycatcher	X					X	X				X	X
Brown-crested Flycatcher		X	X	X		X	X				X	X
Cassin's Kingbird					X							
Western Kingbird		X	X	X	X	X	X	X	X	X	X	X
Loggerhead Shrike					X	X	X			X	X	
Arizona Bell's Vireo		X	X			X	X		X	X	X	X
Warbling Vireo				X			X				X	
Common Raven	X	X					X		X	X	X	
Tree Swallow						X	X		X	X		
Violet-green Swallow			X			X	X			X		X
Bank Swallow		X										
Cliff Swallow	X	X	X		X	X			X	X	X	X
Northern Rough-winged Swallow	X	X		X		X	X		X	X	X	X

Table 6 continued: Incidental bird species detected during San Bernardino County Museum Yuma Clapper Rail and Yellow-billed Cuckoo surveys in 2007 along the Virgin and Muddy Rivers in southern Nevada. Detections are incidental and indicate presence only. Absence should not be inferred. See text and Table 1 for site locations.

Species	Desert Springs	Littlefield North	Mesquite Bridge 3	Mesquite Bridge 2	Mesquite Bridge	Big Marsh	Long Marsh	Maverick Ditch	Honeybee Pond [1]	South Marsh [1]	OWMA [2]	Warm Springs
Barn Swallow		X			X	X			X	X		
Verdin	X	X	X		X	X	X	X	X		X	X
Bewick's Wren	X	X	X	X		X	X			X		X
House Wren		X					X					
Marsh Wren			X		X	X	X	X	X	X	X	
Ruby-crowned Kinglet					X			X				
Blue-gray Gnatcatcher		X	X				X					X
Black-tailed Gnatcatcher	X	X	X		X	X	X	X	X		X	
American Robin		X		X	X					X	X	
Northern Mockingbird		X				X	X	X	X	X	X	X
European Starling	X							X	X	X	X	
American Pipit			X						X		X	
Curve-billed Thrasher											X	
Crissal Thrasher		X				X	X		X			X
Phainopepla	X					X	X			X	X	X

Table 6 continued: Incidental bird species detected during San Bernardino County Museum Yuma Clapper Rail and Yellow-billed Cuckoo surveys in 2007 along the Virgin and Muddy Rivers in southern Nevada. Detections are incidental and indicate presence only. Absence should not be inferred. See text and Table 1 for site locations.

Species	Desert Springs	Littlefield North	Mesquite Bridge 3	Mesquite Bridge 2	Mesquite Bridge	Big Marsh	Long Marsh	Maverick Ditch	Honeybee Pond [1]	South Marsh [1]	OWMA [2]	Warm Springs
Orange-crowned Warbler		X	X		X		X			X	X	
Lucy's Warbler	X	X		X			X		X	X	X	X
Yellow-rumped Warbler	X	X				X	X			X		
Yellow Warbler	X	X	X	X	X	X [a]	X [a]		X	X [a]	X [a]	X
Common Yellowthroat		X	X	X	X	X	X	X	X	X	X	X
Wilson's Warbler			X				X		X		X	
Yellow-breasted Chat	X	X	X	X	X	X	X		X	X	X	X
Summer Tanager	X	X										X
Western Tanager	X	X		X			X			X	X	
Green-tailed Towhee										X		
Abert's Towhee		X	X		X	X	X	X	X	X	X	X
Chipping Sparrow						X	X	X				
Brewer's Sparrow			X		X				X			
Lark Sparrow					X	X	X	X			X	X
Song Sparrow		X	X	X	X	X	X	X	X	X	X	X
Lincoln's Sparrow			X									

Table 6 continued: Incidental bird species detected during San Bernardino County Museum Yuma Clapper Rail and Yellow-billed Cuckoo surveys in 2007 along the Virgin and Muddy Rivers in southern Nevada. Detections are incidental and indicate presence only. Absence should not be inferred. See text and Table 1 for site locations.

Species	Desert Springs	Littlefield North	Mesquite Bridge 3	Mesquite Bridge 2	Mesquite Bridge	Big Marsh	Long Marsh	Maverick Ditch	Honeybee Pond [1]	South Marsh [1]	OWMA [2]	Warm Springs
White-crowned Sparrow			X		X	X	X					
Black-headed Grosbeak	X	X					X				X	
Blue Grosbeak	X	X	X	X	X	X	X		X	X	X	X
Indigo Bunting									X			
Red-winged Blackbird	X	X	X	X	X	X	X	X	X	X	X	X
Western Meadowlark								X	X		X	X
Yellow-headed Blackbird		X	X		X				X	X	X	
Great-tailed Grackle	X	X	X		X	X	X	X	X	X	X	X
Brown-headed Cowbird	X	X	X		X	X	X	X	X	X	X	X
Hooded Oriole	X			X		X						X
Bullock's Oriole		X		X		X	X			X	X	X
House Finch	X	X	X	X	X		X	X	X	X	X	X
Pine Siskin							X					
Lesser Goldfinch		X	X	X			X	X			X	X

Table 6 continued: Incidental bird species detected during San Bernardino County Museum Yuma Clapper Rail and Yellow-billed Cuckoo surveys in 2007 along the Virgin and Muddy Rivers in southern Nevada. Detections are incidental and indicate presence only. Absence should not be inferred. See text and Table 1 for site locations.

Species	Desert Springs	Littlefield North	Mesquite Bridge 3	Mesquite Bridge 2	Mesquite Bridge	Big Marsh	Long Marsh	Maverick Ditch	Honeybee Pond [1]	South Marsh [1]	OWMA [2]	Warm Springs
House Sparrow	X			X	X			X			X	

a – Includes *marcomi and sonorana* races of the Yellow Warbler.
1 – Located on the OWMA.
2 – Includes Refuge Housing, SWWF Habitat, Willow Strip, Blind 30, and Mike's Site survey areas.

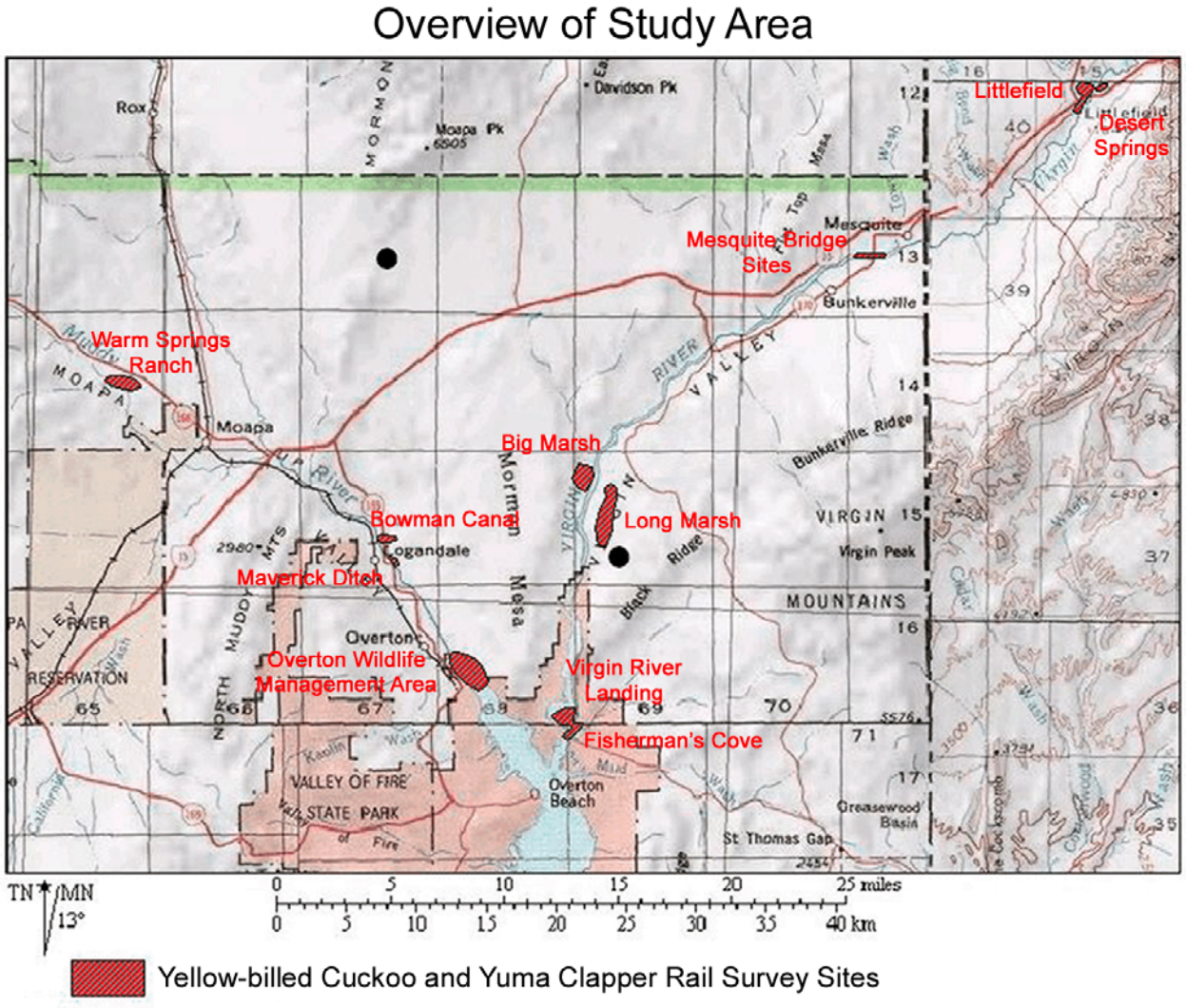

Figure 1: Overview of regional survey sites for Yuma Clapper Rail and Yellow-billed Cuckoo along the Virgin and Muddy Rivers. All sites not surveyed every year. See text and tables for details.

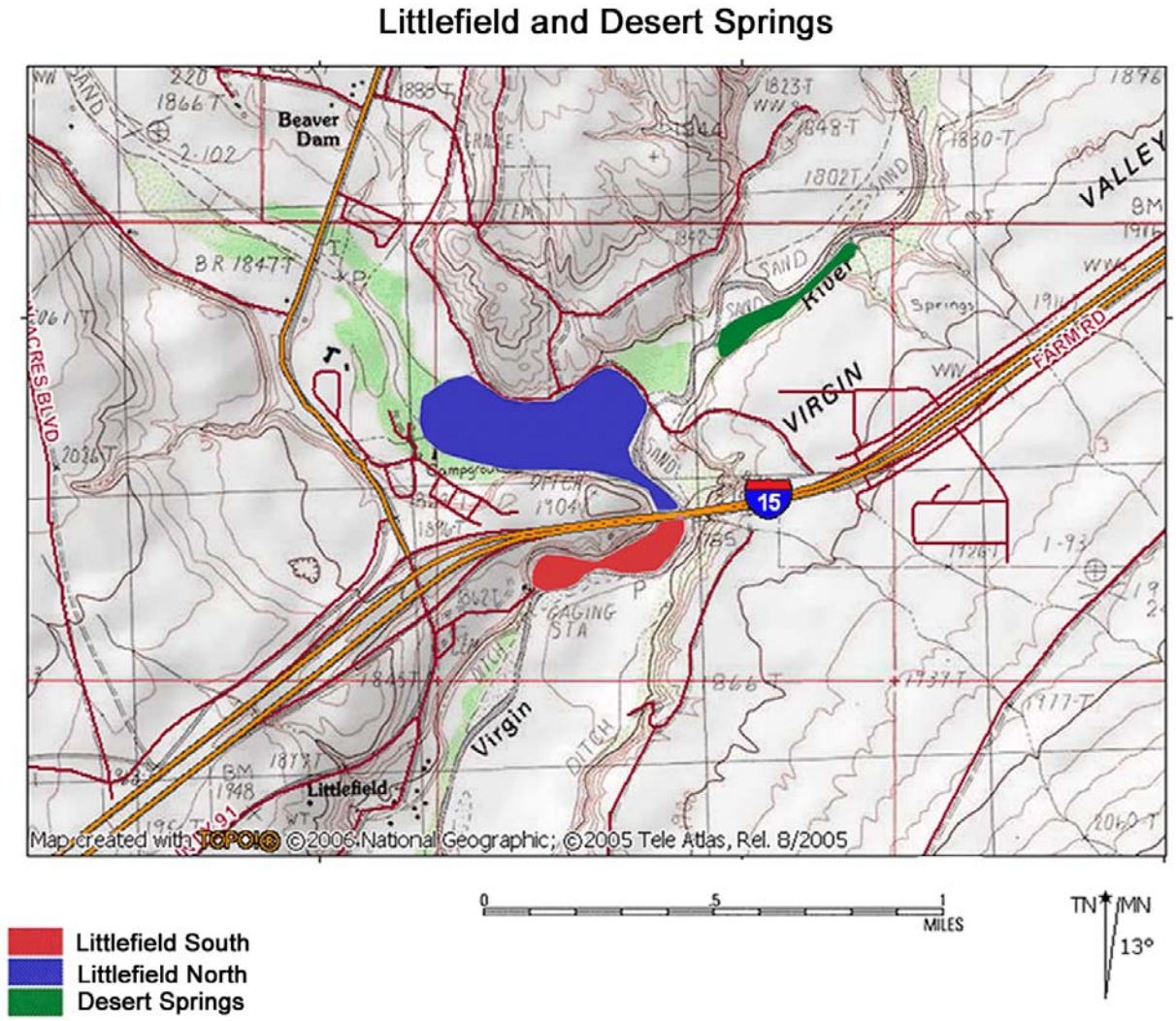

Figure 2: Littlefield, Arizona survey sites for Yuma Clapper Rail and Yellow-billed Cuckoo. See text and tables for survey years and results.

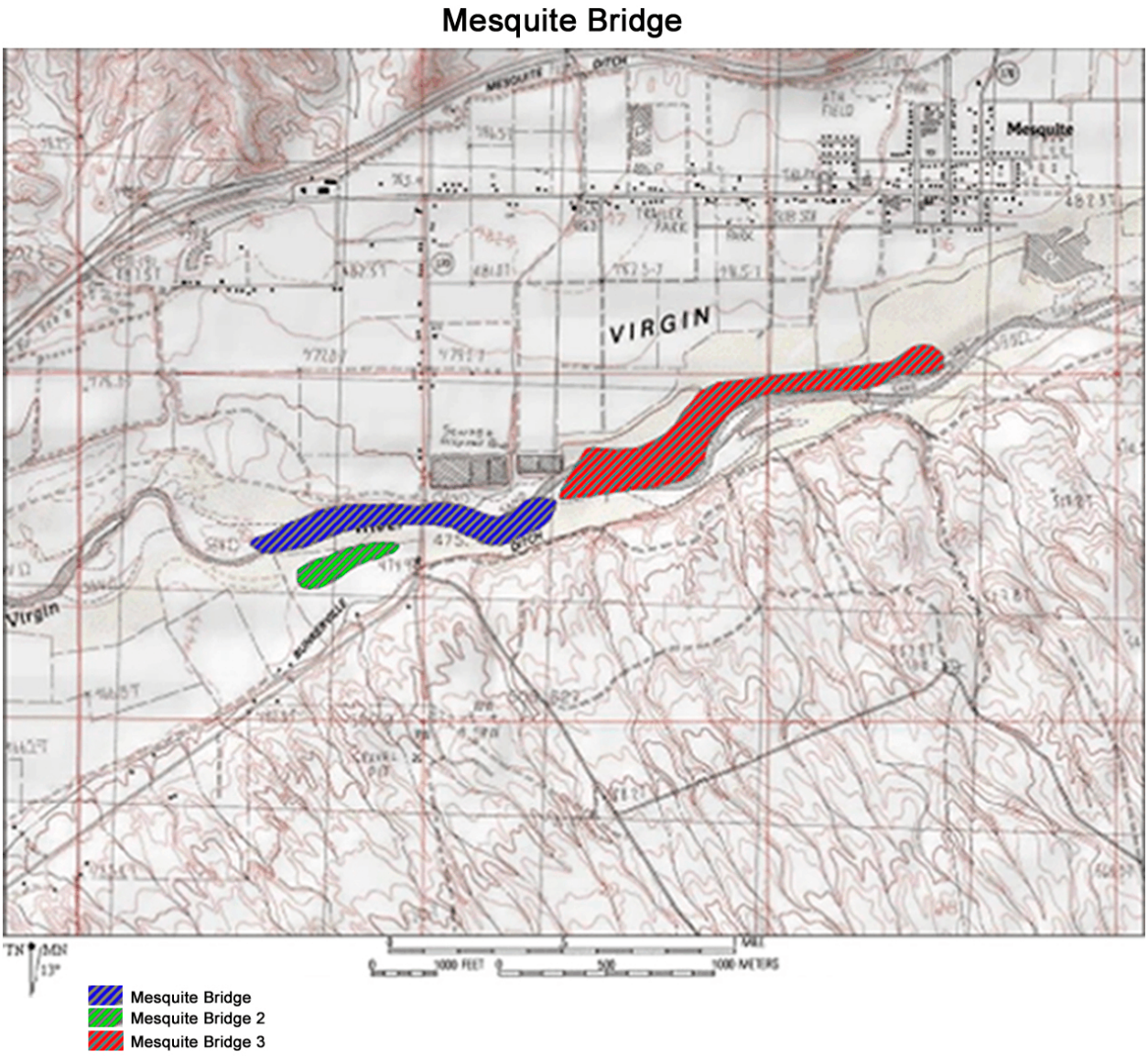

Figure 3: Mesquite, Nevada survey sites for Yuma Clapper Rail and Yellow-billed Cuckoo. See text and tables for details.

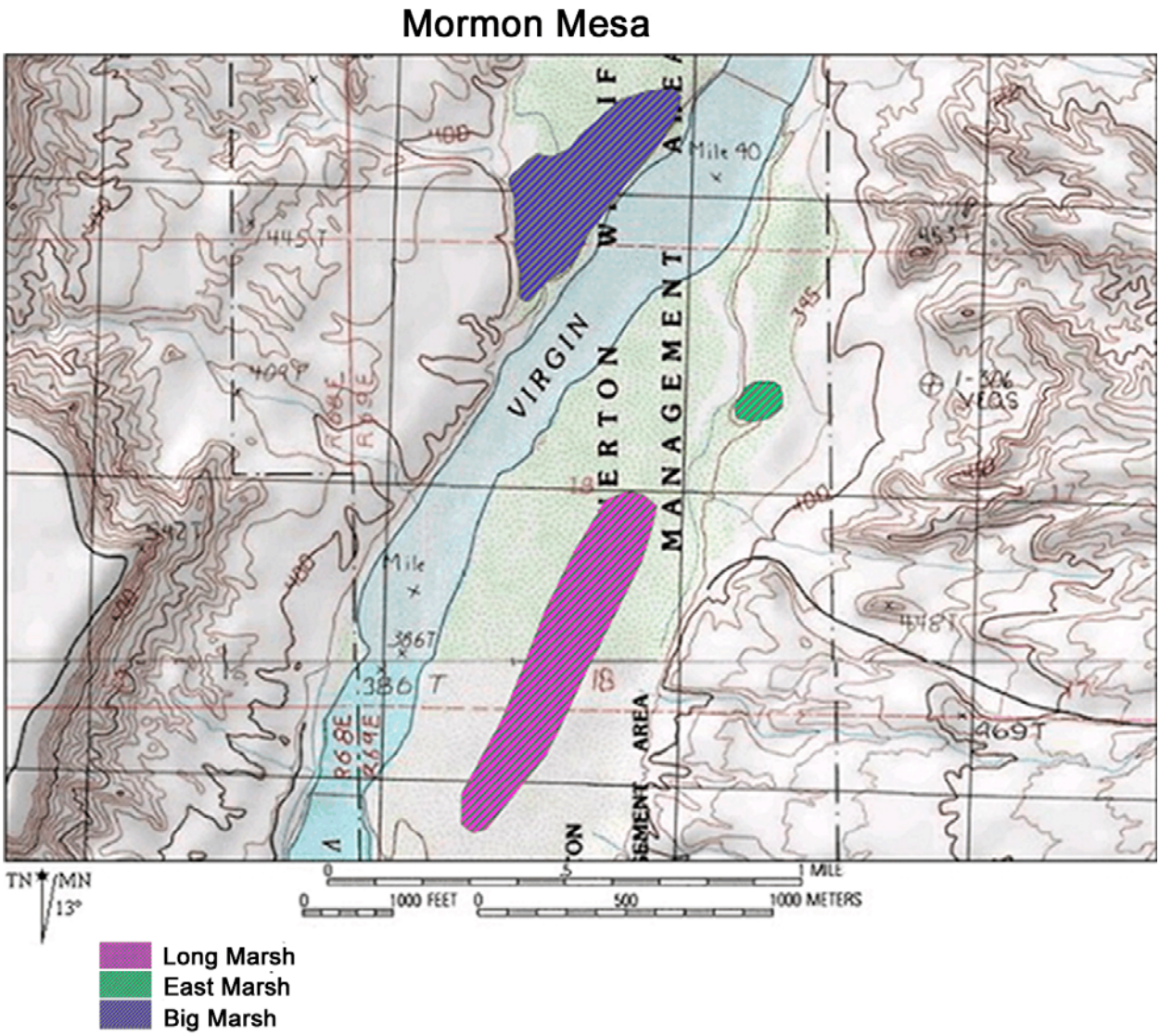

Figure 4: Mormon Mesa survey sites for Yuma Clapper Rail and Yellow-billed Cuckoo. See text and tables for survey results and habitat conditions.

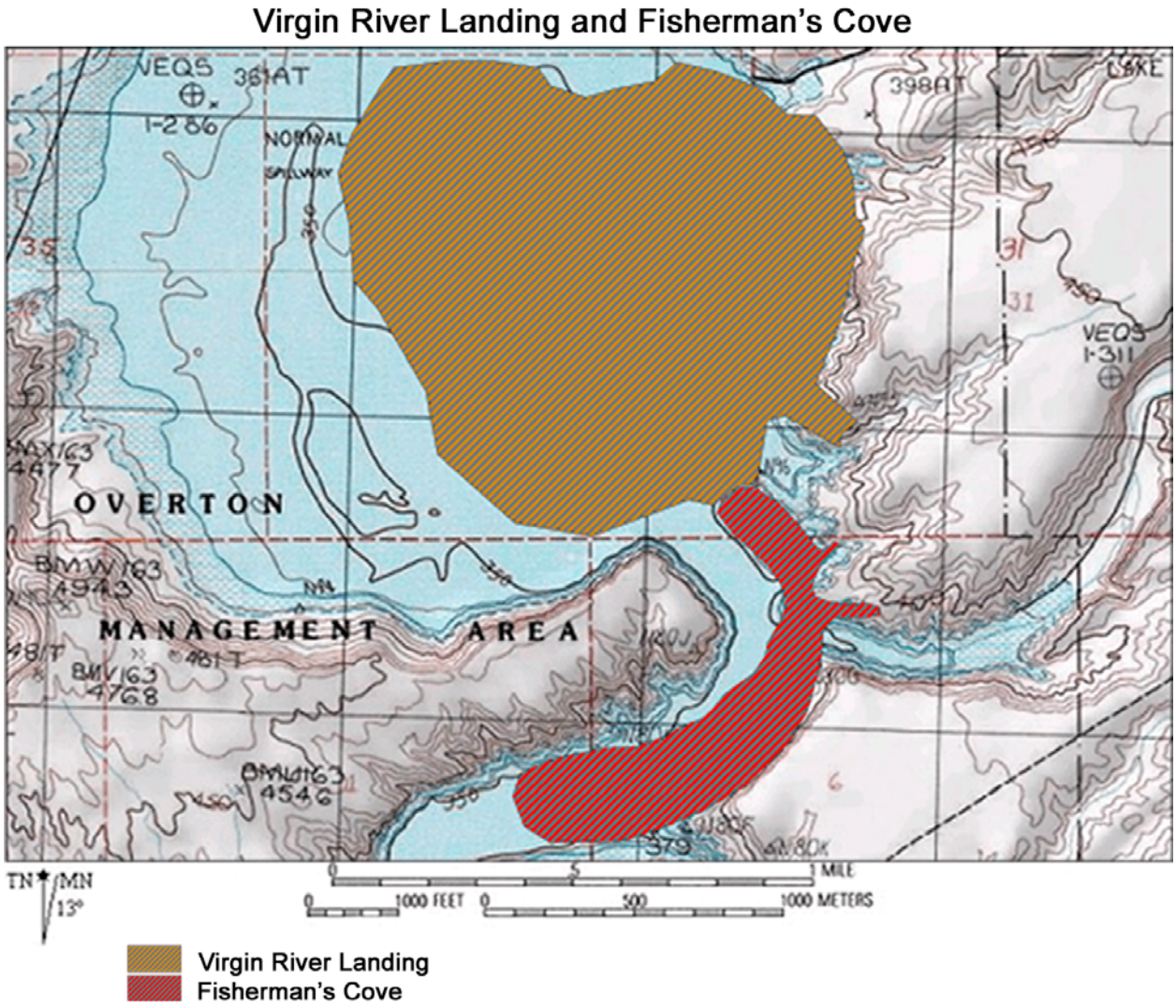

Figure 5: Virgin River Delta survey sites for Yuma Clapper Rail and Yellow-billed Cuckoo. Sites not surveyed every year. See text and tables for survey years, results, and habitat conditions.

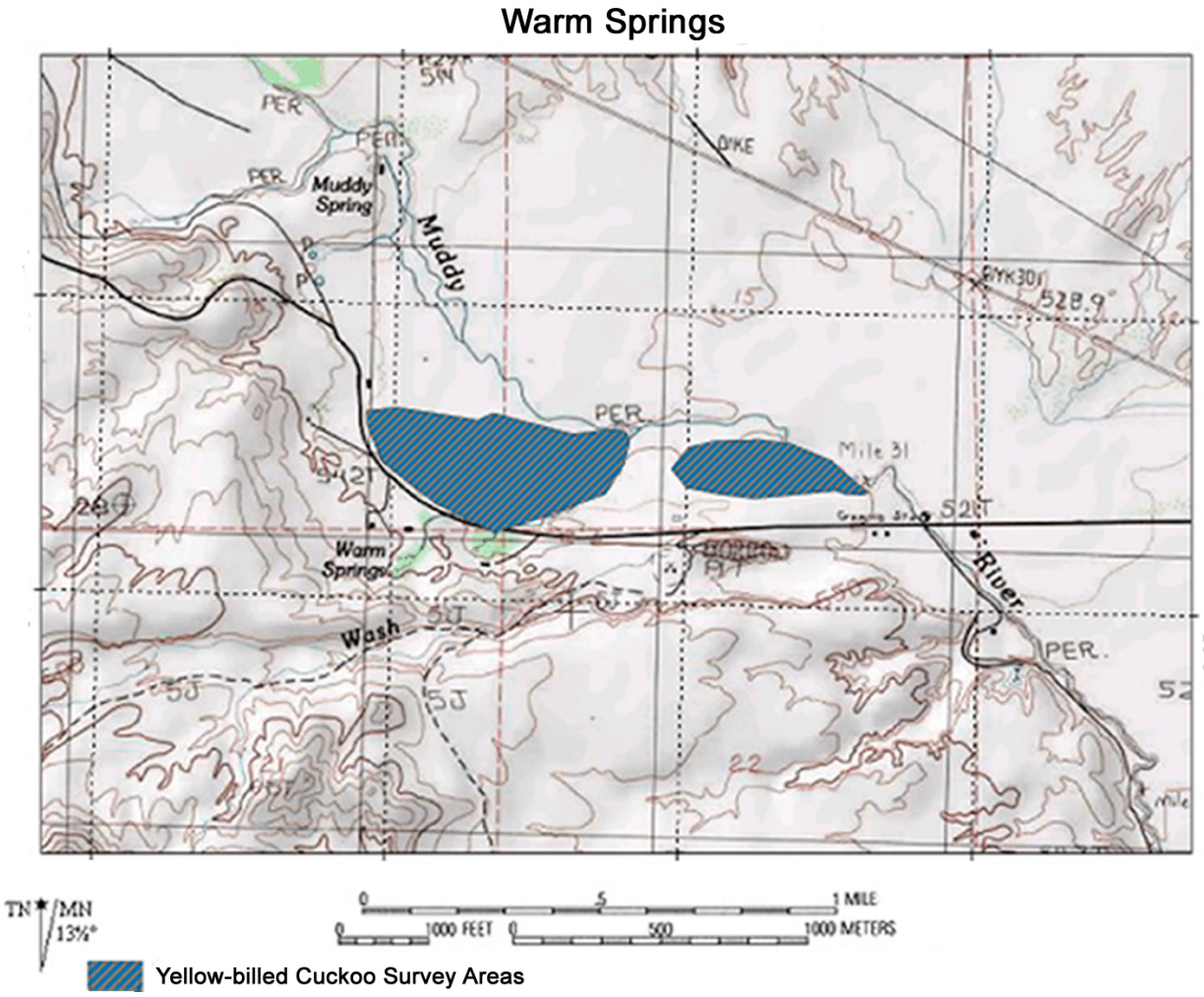

Figure 6: Warm Springs Ranch survey sites for Yellow-billed Cuckoo. Sites surveyed in conjunction with Nevada Division of Wildlife. See text and tables for details.

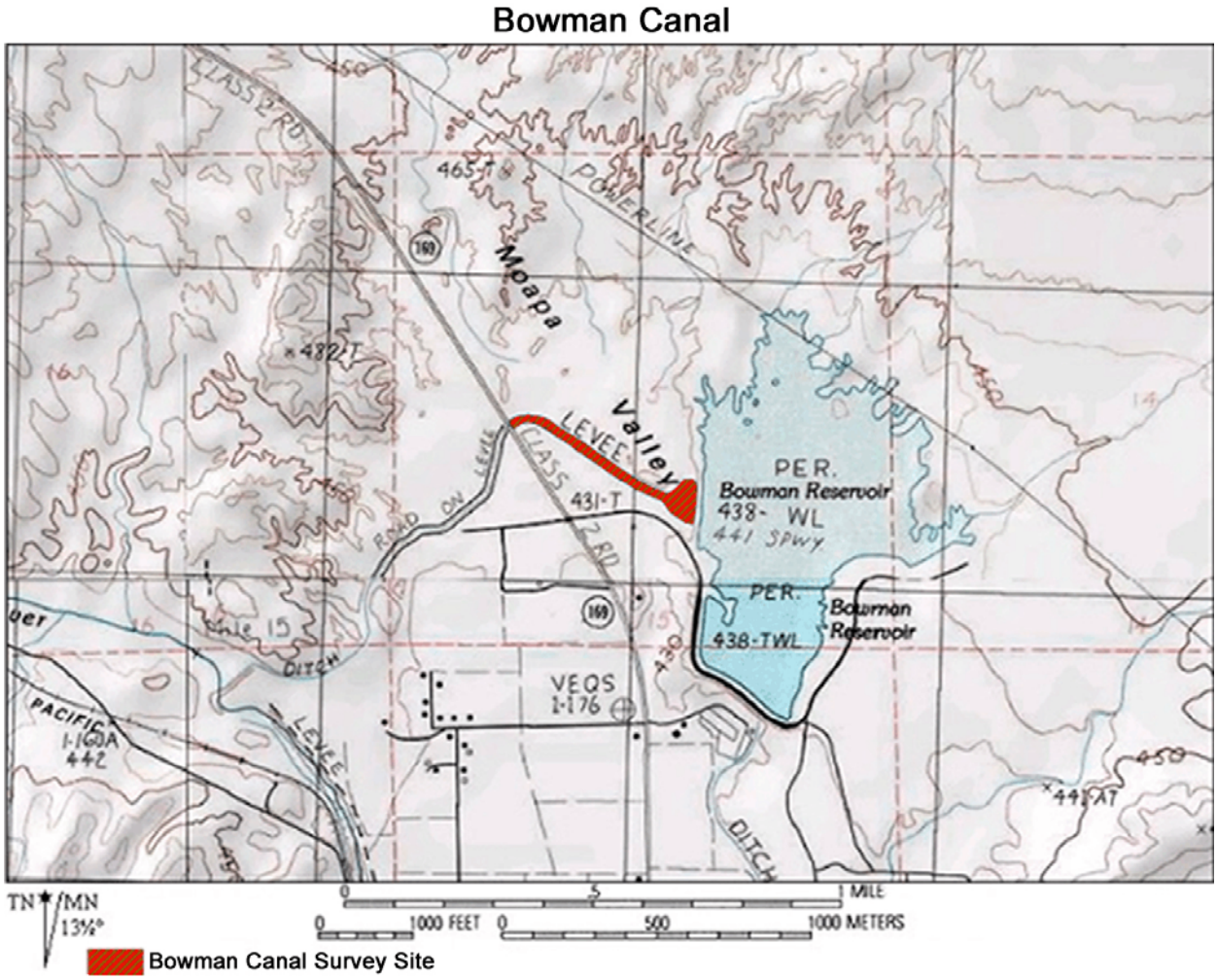

Figure 7: Bowman Canal survey site for Yuma Clapper Rail. See text and tables for survey years, results and habitat conditions.

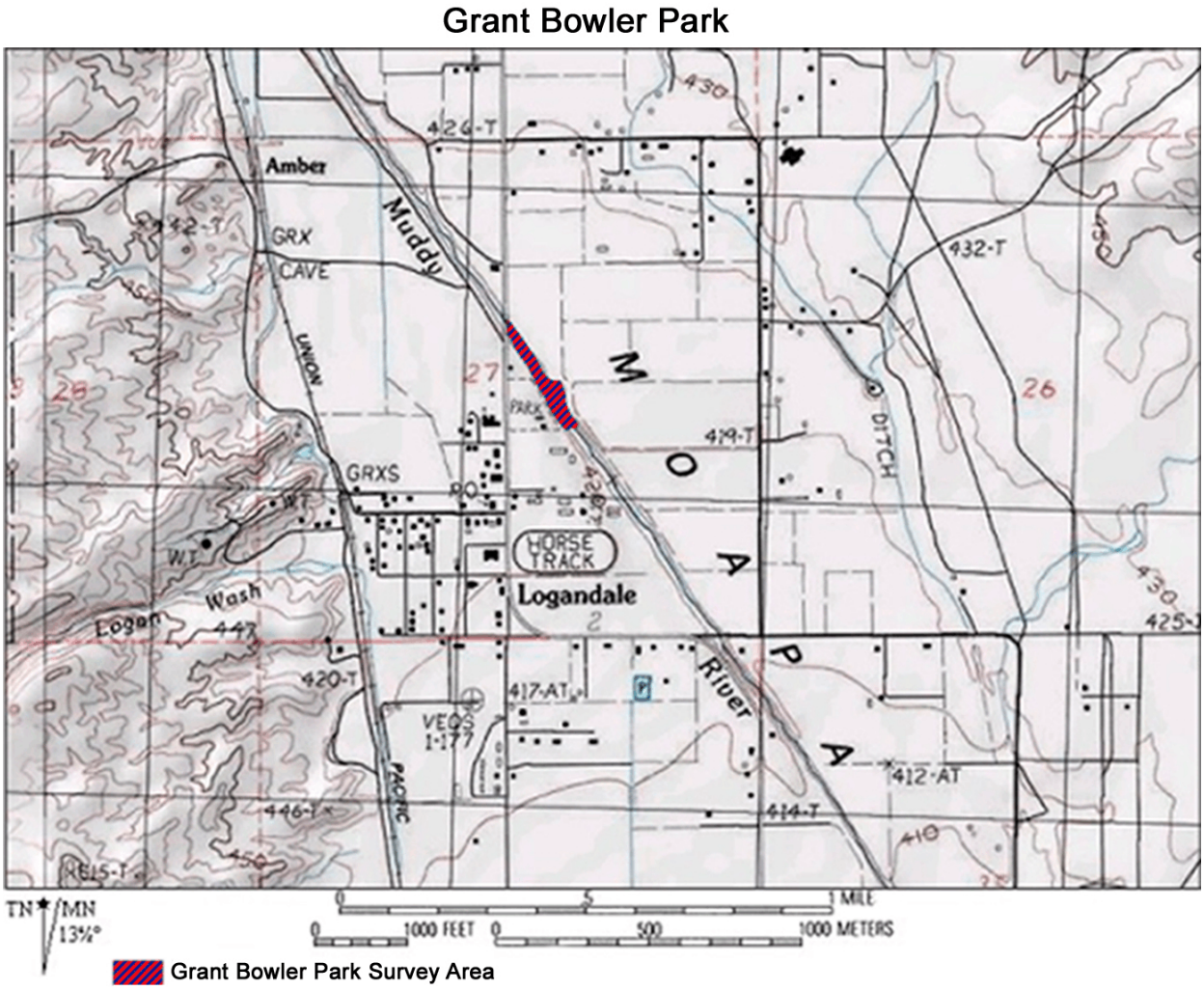

Figure 8: Grant Bowler Park survey site for Yuma Clapper Rail. See text and tables for survey years, results and habitat conditions.

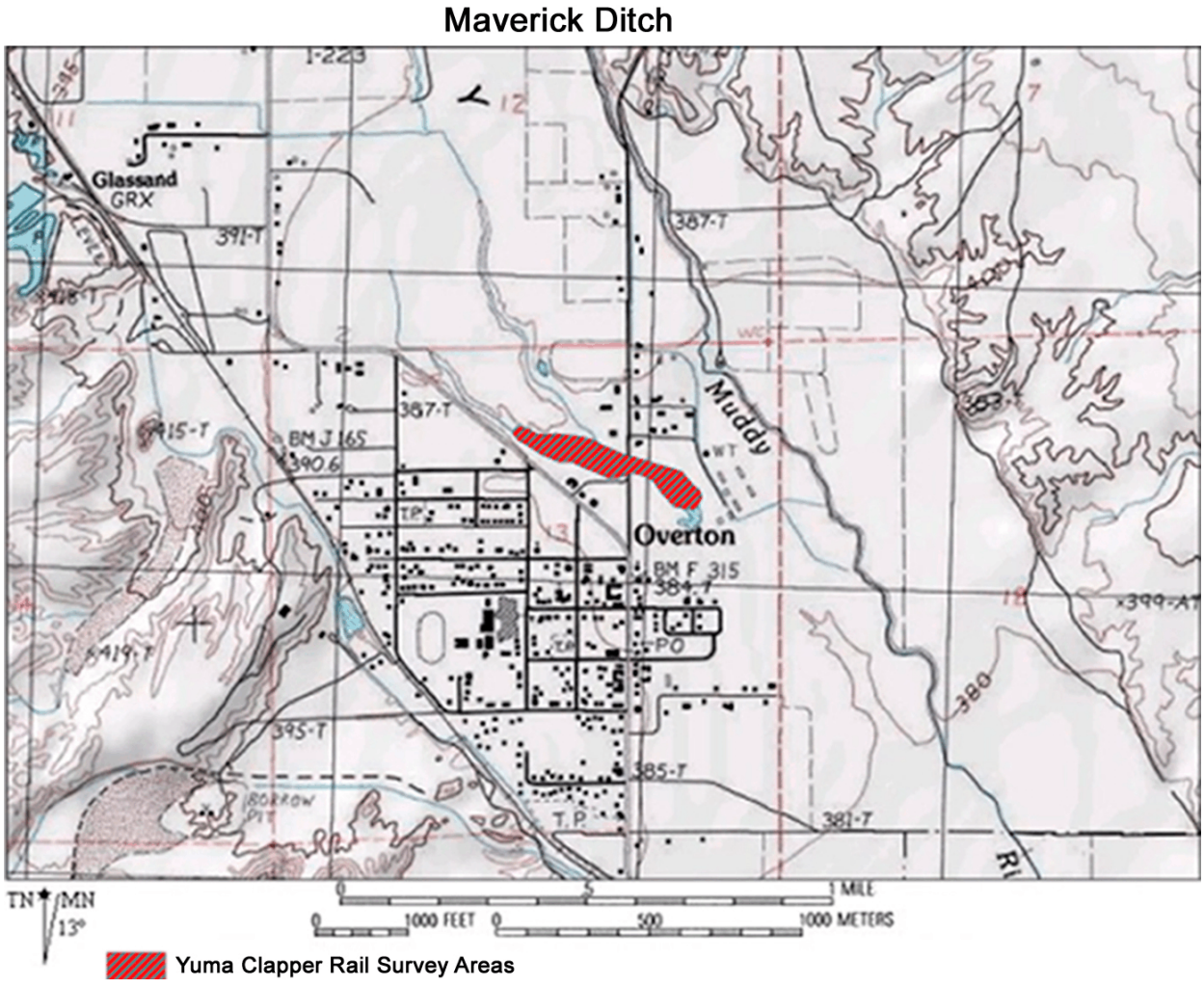

Figure 9: Maverick Ditch survey site for Yuma Clapper Rail. See text and tables for survey years, results and habitat conditions.

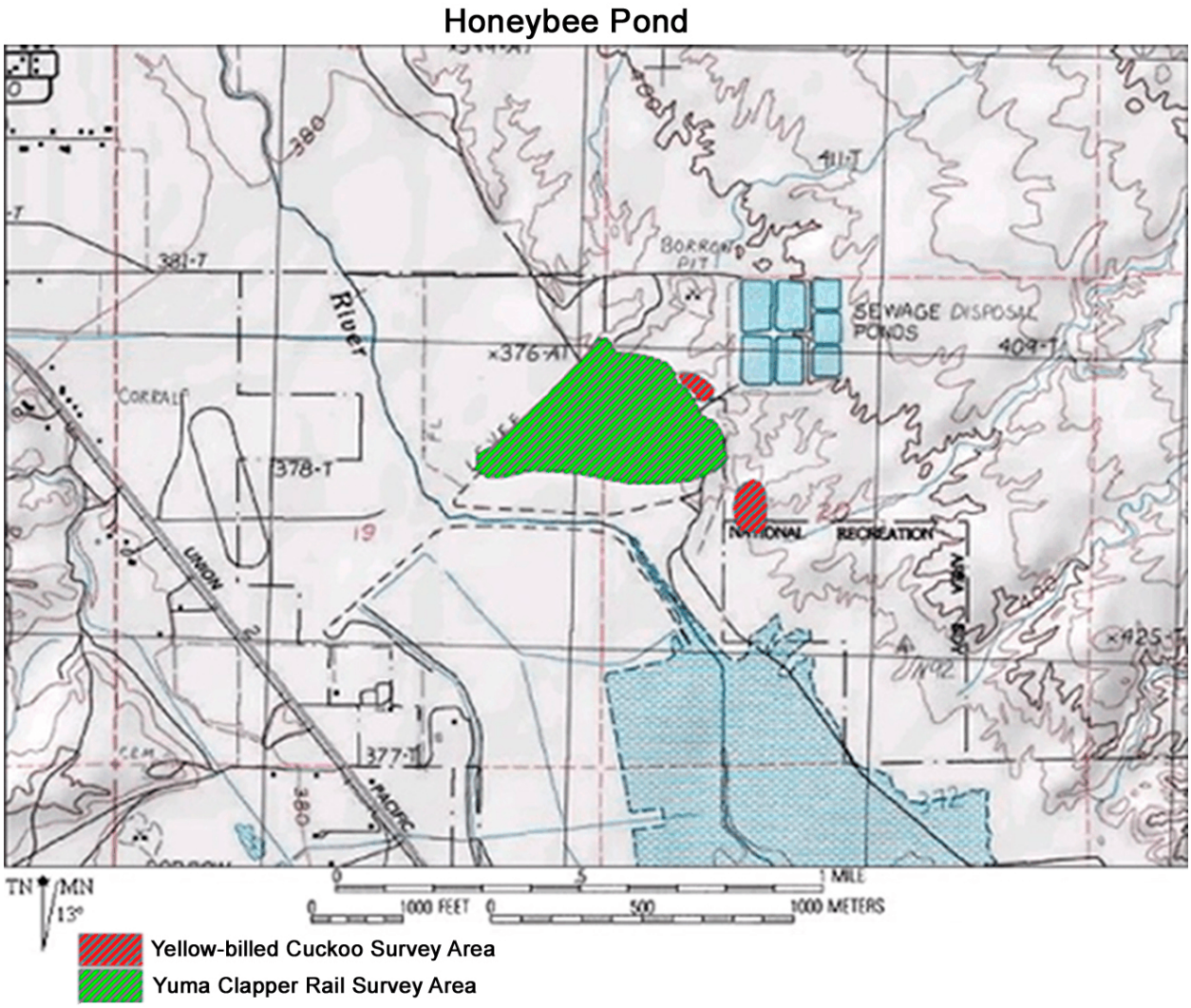

Figure 10: Honeybee Pond survey sites for Yuma Clapper Rail and Yellow-billed Cuckoo. See text and tables for survey years, results and habitat conditions.

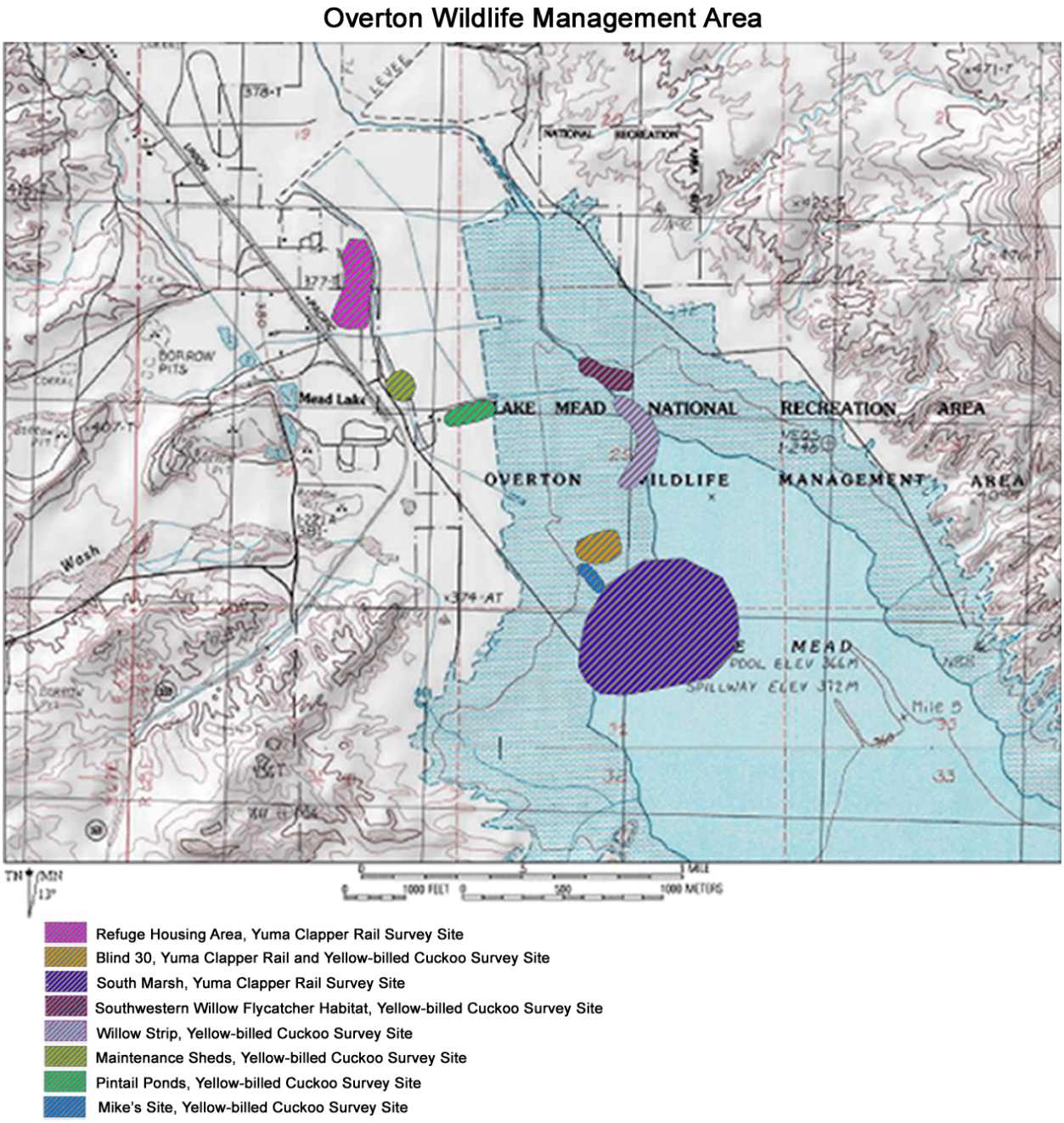

Figure 11: Overton Wildlife Management Area survey sites for Yuma Clapper Rail and Yellow-billed Cuckoo. See text and tables for survey years, results and habitat conditions.

THE STATUS OF YUMA CLAPPER RAIL AND YELLOW-BILLED CUCKOO ALONG PORTIONS OF THE VIRGIN RIVER AND MUDDY RIVER IN SOUTHERN NEVADA, WITH INCIDENTAL OBSERVATIONS OF THE SOUTHWESTERN WILLOW FLYCATCHER: 2008 FINAL

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February 2009

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INTRODUCTION

The Clapper Rail (*Rallus longirostris*) is a marsh obligate species whose range includes saltwater marshland from New England south to Texas along the Atlantic coast and from San Francisco south to Baja California along the Pacific coast (Bent 1926). The Yuma Clapper Rail subspecies (*Rallus longirostris yumanensis*) is found in freshwater habitats along the Colorado River, associated drainages, and isolated regions of the Salton Sea, California (Phillips, et al. 1964, Alcorn 1988, Eddleman 1989). In addition, Yuma Clapper Rail are currently known to occupy areas along the Muddy and Virgin Rivers in southern Nevada (McKernan and Braden 1999, 2001a, 2001b, McKernan and Carter 2002, Rathbun and Braden 2003, Braden et al. 2005, Miller et al. 2006, Braden et al. 2007, 2008).

The breeding season for Clapper Rail extends from mid-March through August. Nests are placed on elevated ground within the marsh and are constructed of plant stems and grasses. The nests are concealed with live vegetation pulled over the nest to form a canopy. A clutch of 8 to 11 eggs is laid in the nest, but may occasionally be as few as 4 or as many as 14 eggs. Both male and female Clapper Rail incubate the eggs for 20 to 24 days. Both parents attend to the nestlings. Nestlings can swim within a day after hatching, are independent of parents in 35 to 42 days, and can fly by 63 to 70 days after hatching (Baicich and Harrison 1997).

Yellow-billed Cuckoo (*Coccyzus americanus*) are found in stream-side willow and alder groves, open woodlands, parklands, gardens and orchards from British Columbia east to Newfoundland and south into South America (Alcorn 1988, Baicich and Harrison 1997). The breeding range of the Yellow-billed Cuckoo in the United States includes isolated areas of Idaho, Utah, California, Arizona, southern Nevada, and throughout most of the continent east of the Rocky Mountains to the Atlantic coast (Mulroy 2002). The distribution of the western race of the Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*) has contracted in recent years. The western race of Yellow-billed Cuckoo has been considered a rare and transient summer resident in Nevada where the breeding populations in the western and southern portion of the state are considered to be nearly extinct (Alcorn 1988).

The breeding season for the Yellow-billed Cuckoo extends from late May through early August. Nests are concealed in a bush or tree from 2 to 20 feet above the ground and are constructed of a variety of plant materials. A clutch of 3 to 4 eggs are laid in the nest, but may be as few as 1 or as many as 5 eggs. The female incubates the eggs for 9 to 11 days, with occasional help from the male. The nestlings are tended by both parents and can fly about 21 days after hatching (Baicich and Harrison 1997).

The Muddy and Virgin Rivers in southern Nevada both contain multiple and dynamic areas of suitable breeding habitat for both Yuma Clapper Rail and the Western Yellow-billed Cuckoo. This report details the continuation of focused Yuma Clapper Rail and Yellow-billed Cuckoo surveys by the San Bernardino County Museum conducted along the Virgin and Muddy Rivers in southern Nevada since 2000.

METHODS

Yuma Clapper Rail (YCRA) - Field surveys were conducted from March through June 2008 to determine the presence of YCRA. The surveys were conducted between 5:00 AM and 12:00 PM and consisted of walks through and around suitable habitat. Surveyors stopped every 20 to 40 meters to play digital (MP3) audio recordings of YCRA vocalizations including "keks", "clatters", and agitated "kek'ing". The recording was played for up to 2 minutes, with a pause of up to three minutes after each broadcast to listen for a response. Surveys were conducted from March through June and four to seven visits per site. The surveys exceed the U.S. Fish and Wildlife protocol standards for this race.

Yellow-billed Cuckoo (YBCU) - Field surveys were conducted from June through August 2008 to determine the presence of YBCU. The surveys were conducted between 5:15 AM and 12:00 PM and consisted of walks through suitable habitat. Surveyors stopped at regular and opportunistic intervals to play digital (MP3) recordings of YBCU vocalizations, primarily the "ka ka ka ka kow kow kowlp kowlp" call, which was played for 30 to 45 seconds with a 2-minute pause after each play to listen for a response. Surveys were conducted weekly, when possible, from late June to early August, resulting in four surveys at all but one site. A standard survey protocol has yet to be established for YBCU.

YCRA and YBCU longterm trends - YCRA and YBCU surveys began in 2000. YBCU and YCRA survey results are summarized for the Virgin/Muddy River complex.

Other rails, bitterns and Moorhens - Surveys of other rails were conducted coincident with Yuma Clapper Rail surveys. Surveys consisted of broadcasting digital (MP3) audio recordings of Virginia Rail, Sora, Black Rail, Least Bittern and American Bittern coincident with but secondary to Yuma Clapper Rail broadcasts. The sequence of broadcasts were variable. Common Moorhen were noted when observed.

Southwestern Willow Flycatcher - Southwestern Willow Flycatcher (WIFL) were noted when detected. Detections did not adhere to FWS protocol surveys nor were formal surveys conducted. Regardless, a significant number of WIFL were incidentally detected at the Warm Springs Natural Area. Incidental WIFL findings are summarized and discussed below.

Incidental observations - Species lists of incidental birds were constructed from visual and aural detections during survey events. Incidental bird observations are not comprehensive and should be not be over interpreted. Incident bird species observations indicate presence only and should not be interpreted as absence of any one species.

Survey Site Descriptions:

An overview of survey sites for YCRA and YBCU Cuckoo are mapped in Figure 1. Individual sites and surveyed polygons are delineated in figures specific to the survey site. Coordinates for the survey sites are listed in Table 1. Specific site descriptions are as follows:

Virgin River Sites

The Virgin River flows south from Utah and terminates on the Overton arm of Lake Mead. The perennial river flow is largely unaltered with the exception of a few erosion control structures in the town of Mesquite and several minor irrigation diversions. Consequently, the river is susceptible to flooding during warm winter storms or heavy spring runoff. The marsh vegetation along the river, when present, is dominated by cattail (*Typha* spp.) and bullrush (*Scirpus* spp.), with intermixed components of Goodding black willow (*Salix gooddingii*), sandbar willow (*S. exigua*) and tamarisk (*Tamarix* spp.). Wooded areas are present in conjunction with most of the survey sites and are comprised of willow, tamarisk, Fremont cottonwood (*Populus fremontii*), and honey mesquite (*Prosopis glandulosa*).

The survey sites along the Virgin River (Figures 1 through 5) are in the vicinity of Littlefield, Arizona and Mesquite, Mormon Mesa, and the Virgin River Delta in southern Nevada. Survey site coordinates are listed in Table 1. Survey site descriptions and habitat suitability for YCRA and YBCU in the 2008 survey season are reported below. YCRA and YBCU habitat suitability and site occupancy along the Virgin River can and does change dramatically over the years. Readers are strongly encouraged to consult previous reports for a comprehensive perspective of habitat dynamics and suitability for both species.

Desert Springs

The Desert Springs site was established in 2006. The site is located along the Virgin River mesa cut near Littlefield, Arizona approximately 850 meters upstream of the Littlefield North survey site (see below and Figure 2). Habitat at the site is not suitable for YCRA and only marginal for YBCU. Habitat consists of a 350 meter long and up to 80 meter wide isolated strip of mature cottonwoods along the southeastern margin of the Virgin River mesa cut. The overstory is mature Fremont cottonwood on a dry substrate, likely an historical remnant of the Virgin River. The understory consists of tamarisk and honey mesquite, with isolated small patches of yerba mansa (*Anemopsis californica*) and Arizona grape (*Vitis arizonica*). Subterranean springs are the likely water source that maintains the cottonwoods, since several such springs reach the surface downstream of the site near the Interstate 15 overpass.

Desert Springs was not surveyed for YBCU in 2008 due to poor habitat quality.

Littlefield North

Littlefield North is located northwest and adjacent to the Interstate 15 bridge (Figure 2). The site is probably best known for the pair of Common Black-Hawk which have nested there for at least the last ten years, and did so again in 2008. YCRA habitat at Littlefield North has never recovered from the floods of 2005. Suitable rail habitat remains substandard in Beaver Dam Wash and the Beaver Dam Wash/Virgin River confluence. Significantly better YCRA habitat occurs further upstream in Beaver Dam Wash on private property. Littlefield North was assessed for suitability in 2008 but not surveyed due to the lack of habitat. Suitable YCRA (and YBCU) habitat in the upstream areas of Beaver Dam Wash were not surveyed due to private property constraints.

In contrast to the YCRA habitat, YBCU habitat at Littlefield North is still quite suitable. The habitat consists of approximately 10 acres of gallery Fremont cottonwood with a sand bar willow and tamarisk understory. The understory is dry and damaged by range cattle. Additional

YBCU habitat (on private property) contagious with Littlefield North along Beaver Dam Wash and upstream of the site extends the suitable YBCU habitat by at least 40 acres. YBCU surveys were conducted in 2008, but were restricted to public access areas.

Littlefield South

Habitat at Littlefield South (Figure 2) has matured significantly since the 2007 surveys. The irrigation canal that arcs around the north and west perimeter of the site is active and beavers have once again constructed a dam on the site border with the Virgin River on the south. The hydrology at the site has been significantly improved by seepage from the now unlined canal and water retention behind the beaver dam. Consequently the YCRA habitat has re-established in the center of the site, albeit only a quarter (about 2 acres) of its size prior to the 2005 floods. The existing habitat is excellent. YCRA habitat consists of dense cattail and *Scirpus* surrounded by cottonwood, Goodding black willow and tamarisk, in that order. The site was surveyed for YCRA in 2008.

YBCU habitat has likewise established at the site. The habitat now is larger (about 5 acres) and more robust than its original state (before the 2005 floods). Fremont cottonwood now dominates the site, and reaches heights of 10+ meters. Significant amounts of Goodding's black willow and sandbar willow are also present, the former reaching heights of 7+ m. Tamarisk cover has been substantially reduced. The site was surveyed for YBCU in 2008. This was the first time habitat was suitable for YBCU at this site since surveys began in 2000.

Range cattle, no more than a dozen, were present in both YCRA and YBCU habitats at the start of the survey season (March) but were gone by mid-May. There had been little damage.

Mesquite Bridge

YCRA habitat at the Mesquite Bridge site (Figure 3) is excellent, but there have been significant encroachments on the habitat from golf courses and associated urban developments downstream of the bridge. High quality cattail and *Scirpus* habitats have been reduced by approximately 50% in the downstream area. The remaining habitat at the same downstream location remains separated from the main Virgin River channel by dikes constructed after the 2005 floods. Thus the remaining habitat is still largely linear, interposed between the improvised dike structure to the south and urban/golf course expansions to the north. The habitat still appears to be watered by subsurface flows, golf and agricultural runoff, and other unidentified drains originating in the town of Mesquite.

On the upstream side of the bridge, the YCRA habitat is intact, consisting of dense cattail marshes averaging 3 meters tall in ponds approximately 10 hectares in size (combined) outside of but adjacent to the main flow channel. Cottonwood and black willow are beginning to infiltrate areas immediately at and upstream of the bridge. The perennial structure, composition and hydrology of the habitat in this area of the site easily qualified as high quality WIFL habitat in 2008, and should be likewise for WIFL and YBCU in 2009.

The Mesquite site was surveyed for YCRA in 2008. The site was not surveyed for YBCU due to lack of habitat. There were no incidental WIFL detections at this site in 2008, though the habitat is excellent.

Mesquite Bridge 3

The Mesquite Bridge 3 site (Figure 3) was established for YCRA in 2007. Habitats are generally linear, variable in height, occur both along the main flow channel and outside of the improvised flood dikes, and include a large nonlinear water impoundment at the northwest upstream portion of the survey area. Habitats are dominated by cattail and sedges. Cattails range from 1 to 3 meters tall. Perennial habitats consist predominately of black willow with lesser amounts of cottonwood. Emergent perennial habitats occur along the length of the survey area and range from 2 to 4 meters tall. The best rail habitats are at the upstream portion of the site, just below and above a concrete control structure that bisects the Virgin River. Aside form normal habitat maturation, habitats at Mesquite Bridge 3 are essentially unchanged from 2007. Excellent rail habitat, though somewhat patchy, occurs throughout the survey site. The site was surveyed for Yuma Clapper Rail in 2008. Habitats were not yet suitable for Yellow-billed Cuckoo, but likely to become suitable by 2009.

Mesquite Bridge 2

YBCU habitat at the Mesquite Bridge 2 site (Figure 3) is essentially unchanged from the previous year. The downstream half of the site burned several years back, and the habitat is still in recovery stages. In general, the habitat consists of a long linear grove of mature black willow and cottonwood positioned between the southeast high waterline of the Virgin River and adjacent agricultural fields. Willows are upwards of 7 m, cottonwoods are up to 15 m. The understory is tamarisk and sandbar willow. WIFL were present and breeding at this site from 1997 through 2000. There is no Yuma Clapper Rail habitat at the site. The YBCU habitat is excellent and the site was surveyed in 2008.

Big Marsh

Big Marsh is located along the northwestern side of the Virgin River near Mormon Mesa (Figure 4). The marsh is fed by a spring as well as seasonal inflow from the Virgin River, the later depending on the alignment of the river and largely confined to winter and early spring. There was no surface connection between the Virgin River channel and the marsh by early June of 2008. This is the same condition as occurred in 2007.

Overall, habitats along and adjacent to Big Marsh have stabilized since the 2005 floods, but the habitats are complex, both in composition and stature. The margins of the marsh are composed of small strips and patches of sedges and cattail, but primarily dominated by tamarisk. Beyond the margins, the east and southeast habitats are dominated by dense tamarisk stands from 1 to 3 m tall. Beyond the north and northeastern margins, the habitat gradient starts with dense tamarisk and blends into dense stands of Goodding, black, and sandbar willow with a tamarisk understory. The Goodding willow exceeds 7+ m in some areas. The habitat is poor quality for YCRA on the southeast and western margins of the marsh, but moderate on the northern portion of the marsh. A 150 m long “finger” of high quality YCRA habitat, composed entirely of dense cattail, begins approximately 300 m upstream of the confluence of the marsh with the Virgin River. Technically, this “finger” is not part of Big Marsh but rather the northern high water edge of the Virgin River channel.

YBCU habitat also occurs at Big Marsh, but the extent, composition and distribution is likewise complex. Generally speaking, the black willow at Big Marsh extends beyond the

YCRA surveyed area and continues down both banks of the Virgin River (see Figure 4). There are large areas of black willow blending with mature tamarisk on both sides of the Virgin River, that overlap and extend far beyond the YCRA survey area at Long Marsh. Collectively, the YBCU habitat is excellent, and Big Marsh, Long Marsh and associated areas were surveyed concurrently, as in previous years, for YBCU in 2008.

Long Marsh

In previous years, Long Marsh was a 1.5 kilometer linear stretch of marsh habitat that ran parallel to, and down the center of, the Virgin River channel near Mormon Mesa (Figure 4). Aside from large flood events, the active portion of the Virgin River channel has been some distance (approximately 500 m) to the east of Long Marsh since 2005. Historically the habitat was complex. Extensive and robust cattail patches were distributed between and under tall (3+m) dense tamarisk and mature black willow (7+ m). Sandbar willow was a common component in the more mesic areas. By the 2008 survey season, feral cattle and rerouting of the Virgin River after the 2005 floods had resulted in significant changes in the marsh. Cattail were no longer extant to any appreciable level and there was no appreciable water inflow to the marsh. Overall, the marsh is now dry and no longer suitable for YCRA. The black willow and tamarisk have faired better than the marsh habitat. Excepting a 2 ha patch, which was declining for many years now, the vast majority of black willow remain robust and healthy, as does the tamarisk. Habitat at Long Marsh, and beyond, is still good to excellent for YBCU.

A suitability survey was for YCRA was done at Long Marsh at the beginning of the 2008 survey season, but no protocol surveys were conducted due to lack of habitat. Long Marsh, in conjunction with Big Marsh and extended areas (see Figure 4), were surveyed for YBCU in 2008.

East Marsh

East Marsh was a small circular patch of marsh habitat on the east side of the Virgin River, roughly east of Long Marsh (Figure 4). East Marsh has been dry and devoid of live vegetation since the 2005 floods. Conditions remained unchanged in 2008 and no surveys were conducted due to lack of habitat.

Virgin River Landing and *Fisherman's Cove*

In previous years Virgin River Landing and Fisherman's Cove (Figure 5) were inundated by Lake Mead. Reduced lake levels exposed these sites in 2002, which quickly became populated with emergent vegetation. Floods in 2005 scoured both survey sites of vegetation and entrenched the Virgin River channel. The river channel remains entrenched at Virgin River Landing, up to 6 meters deep in some places, and range cattle have grazed off any emergent vegetation. Incipient rail habitat at Fisherman's Cove was grazed off and never developed further. The Virgin River Delta, which was proximal to both sites in 2005, has moved many kilometers south coincident with the continuing drop in water level of Lake Mead. There were no suitable YCRA or YBCU habitats at Virgin River Landing and Fisherman's Cove in 2008.

Muddy River Sites

The survey areas on the Muddy River begin upstream in the Moapa Valley west of

Glendale and terminate near Lake Mead (Figures 1, 6, 7, 8, 9, and 10). The channel and perennial flows are heavily modified and re-directed east of Glendale by a complex series of flood control structures, agricultural channels, agricultural drains, canals, and waterfowl management diversions. Habitats at the Muddy River sites vary greatly in the degree of openness, vegetation composition and vegetative structure. Thus, habitat conditions for YCRA and YBCU vary by site. In general, the habitats consist of cattail, bullrush, and common reed (*Phragmites australis*) with intermixed components of Goodding black willow, sandbar willow, tamarisk, Fremont cottonwood, and honey mesquite. Survey site coordinates are listed in Table 1. Survey site descriptions and habitat suitability for YCRA and YBCU in the 2008 survey season are reported below. YCRA and YBCU habitat suitability and site occupancy along the Muddy River, particularly at the OWMA, has change dramatically over the years. Readers are strongly encouraged to consult previous reports for a comprehensive perspective of habitat dynamics and suitability for both species.

Warm Springs Natural Area (WSNA)

The Warm Springs Natural Area (WSNA) was designated as Warm Springs Ranch in previous reports. Warm Springs Ranch was purchased by SNWA in 2008, which enabled greater access and established the primacy of habitat conservation for the site. The WSNA is located in the Moapa Valley in southern Nevada, approximately nine miles west of Glendale and one mile south of Highway 168 (Figure 6). The site is adjacent to but not on the Muddy River. Surface flows on the site mostly originate from Warm Springs, located approximately 1 k south of the Muddy River. Water from the springs flow through the area in a complex series of canals. Incipient springs can be found in several areas previously used as pastures. Water from the site drains to the Muddy River north of the site. Habitats on the approximately 1,400 acres are complex. Fremont cottonwood, black willow, velvet ash (*Fraxinus velutina*), tamarisk, and fan palms (*Washingtonia filifera)* are associated with many of the canals and drains. Pasture lands, in various stages of succession, occur between the canal and drain networks. Mesquite trees are a major component of the drier areas, either singly or in the form of large mesquite bosques. In general, there is a sub-surface moisture gradient running from the south to north. Trees and perennial shrubs roughly follow this gradient. Where present, tree canopies range from a few meters to 15+ meters. Significant marsh habitats are present, mostly in the south central portion of the site, and consist of cattail, sedges, and other varieties of wetland plants.

High quality YCRA and YBCU habitats occur in large proportions at the site, especially in the southern third. The site has been surveyed for YBCU in previous years by SBCM cooperatively with Bob Furtek of the Nevada Division of Wildlife. Prior to these surveys, WSNA was surveyed for YBCU by an independent group. To our knowledge, the site has never been surveyed for YCRA. Both YCRA and YBCU surveys were conducted in 2008.

Bowman Canal

Bowman Canal is a site along an inflow canal for Bowman Reservoir in the town of Logandale (Figure 7). The canal site is approximately ten meters wide and 250 meters long with three small ponds at the reservoir's intake. In its undisturbed state the vegetation consists of dense cattail lined by willow and cottonwood groves. The canal was cleared of vegetation before the 2006 survey season and the clearing now appears to be an annual event. There was no

suitable rail or cuckoo habitat during the 2008, and no surveys were conducted. Left undisturbed the habitat at this site has the potential to return to suitable YCRA habitat. There is no YBCU habitat at the site.

Grant Bowler Park

The Grant Bowler Park site is located east to northeast of Grant Bowler Park in the town of Logandale (Figure 8). Vegetation at this site are composed of cattails, sedges, tamarisk, willow and cottonwood. The site is deeply entrenched with steep banks. The site has also burned. Habitat at this site was not suitable for rail or cuckoo since 2006 and has remained unchanged. No surveys were performed in 2008. Left undisturbed and with modifications to the banks, the habitat at this site has the potential to return to suitable YCRA habitat. There is no YBCU habitat at the site.

Maverick Ditch

The Maverick Ditch site is located in the town of Overton near the intersection of Cooper Street and Jones Street (Figure 9). The site was named after the Maverick convenience store south of the site. The channel appears to function for irrigation drainage. The site is not on the active flow portion of the Muddy River. The surveyed area is approximately 400 meters long and 50 meters across at its widest point. A majority of the site has been burned annually beginning in 2004, but habitat recovery is rapid. The site is dominated by cattail, bulrush, common reed, tamarisk and yerba mansa averaging one to two meters tall, depending on the time since burning. A tamarisk removal/eradication project appears to be in progress since 2007. The surveyed area is bordered by homes and businesses in a rural setting. Maverick Ditch was surveyed for YCRA in 2008. The habitat is not suitable for YBCU.

Overton Wildlife Management Area (OWMA)

The Overton Wildlife Management area (OWMA), operated by the Nevada Division of Wildlife (NDOW), encompasses multiple survey areas for YCRA and YBCU. Suitable habitats vary in size and quality, depending on the site. Site descriptions are as follows:

Honeybee Pond

Honeybee Pond is located on the northernmost portion of the OWMA near Overton, Nevada (Figure 10). The site was subdivided during past surveys into Eastern and Western sites, but sites were combined in 2004 when the western site was drained. Honeybee Pond is actively managed for waterfowl, thus the habitat is composed of large expanses of cattail and reeds interspersed with open water. The site is bordered on the south by the Muddy River, which is contained by dikes. Habitats along the Muddy River canal are predominately composed of tamarisk. The thalweg of the canal is dredged irregularly among years. Rail habitat at Honeybee Pond is composed of dense monotypic patches of cattail varying in height from 3 to 4 meters tall. Proportions of vegetated versus open water habitat vary among years due to management practices. In 2008, the cattail had expanded considerably, and covered approximately half the surface area of Honeybee Pond by the end of the 2008 survey season. The habitat is excellent for YCRA, other rails and Least Bittern (LEBI). YCRA surveys were conducted in 2008.

Two patches of YBCU habitat occur east and southeast of Honeybee Pond (Figure 10).

Perennial habitat on the eastern patch is composed of palms, willows and cottonwoods, with large intervening areas of cattail and low profile tamarisk. Habitat to the southeast is composed of a dense, mature, linear and compact grove of tamarisk and Goodding's black willow surrounded by cattail marshes and a complex series of dikes with black willow and tamarisk boarders. The extent of perennial habitat at both locations are confined to well defined patches with open and park-like intervening areas of lower profile annual and perennial vegetation dominated by tamarisk. Both patches were surveyed for YBCU in 2008.

Refuge Housing Area

The Refuge Housing Area site (Figure 10) is located, as the name suggests, adjacent to the OWMA housing and OWMA headquarters, mostly south of Wildlife Road. The habitat is park-like, composed of mature cottonwood and locust trees up to 15 meters tall embedded in an open park-like areas. The areas of grass are maintained regularly. The YBCU habitats are within easy "flying distance" of the "Maintenance Shed Site" (see below) for YBCU. Birds using this site likely also to use the Maintenance Shed site. Habitat at the Refuge Housing Area is excellent for YBCU and was surveyed accordingly in 2008. There is no suitable YCRA habitat at this site.

Maintenance Shed

The Maintenance Shed site is located south-southeast of the OWMA housing area (Figure 10). The site was named for the maintenance sheds and "bone" yard used for service operations on the OWMA. Habitat at this site is classically park-like. Access roads are lined by cottonwoods and other areas are composed of grass. A network of narrow canals move water to a series of adjacent ponds on the north and east that are managed for waterfowl or upland game, depending on the prescription. The cuckoo habitat at the site is excellent, but limited. In pervious years, YBCU likely moved freely between the Maintenance Shed site, the Refuge Housing site, the Willow Strip site and possibly beyond. YBCU and surveys were conducted at the Maintenance Shed site in 2008. There was no YCRA habitat at or adjacent to this site in 2008.

Southwestern Willow Flycatcher

The Southwestern Willow Flycatcher site was established in 2005 and surveyed for YBCU through 2007 (Figure 10). The habitat consists of a 300 meter strip of dense, mature Goodding black willow with a sandbar willow and very dense tamarisk understory. The site is on the Muddy River, which is confined by an artificial channel. The site was named after Southwestern Willow Flycatchers that were incidentally found at the site in 2005 by SBCM biologists. Access to the site in 2008 had been compromised by channelization work on the OWMA. However, the site is proximal to the Willow Strip site (see below) and within easy flying distance by YBCU. Due to access problems and its close association with the Willow Strip site, the Southwestern Willow Flycatcher site was not surveyed for YBCU in 2008. There is no suitable YCRA habitat at the site.

Pintail Pond

The Pintail Pond site (Figure 10) is composed of a series of interconnected ponds

managed for waterfowl. The ponds are filled intermittently among years from a network of canals and diversions originating from the Muddy River. Some years the site is bordered by cattails around the margins of the pond. The center of the pond is open shallow water when flooded. The size and extent of rail habitat varies from year to year, depending on the waterfowl management prescriptions being applied. The pond have been dry and devoid of YCRA habitat since 2007. No rail surveys were warranted in 2008 due to lack of habitat.

Willow Strip

The Willow Strip site (Figure 10) is located east of Pintail Pond site. The access dike road is lined with linear strips of mature Goodding's black willow from 3 to 7m tall. Coverages range from continuous to patchy. Habitats bordering the eastern side of the access road, beyond the black willows, are composed of dense tamarisk and mesquite up to 4 meters tall. The Pintail Pond site (see above) lies to the west, the Southwestern Willow Flycatcher site (see above) is approximately 500 m to the north, and Blind 30 (see below) to the south. The habitat at the Willow Strip site in past years has been excellent for YBCU. However, due to the lack of water in the adjacent ponds, the habitat has become increasingly distressed, though still above average for YBCU. The site was surveyed accordingly in 2008. There was no suitable YCRA habitat at the site in 2008.

Blind 30

The Blind 30 site (Figure 10) was established in 2007 for YBCU. The site consists of a large, approximately 20 hectare, water impoundment managed for waterfowl. Goodding's black willow, sandbar willow and tamarisk line the dikes that encompass the impoundment. Perennial heights range from 1 to 7m. The distribution of perennial vegetation around the dike is patchy to continuous, consisting of a few trees to 100+ m stretches of continuous perennial cover, and is most dense along the northern, eastern and southern boarders. YCRA habitat at Blind 30 did not exist in 2007, but significant amounts of rail habitat have since emerged. Suitable to excellent YCRA habitat now exists around the margins of the site. Additional YCRA habitat is also present approximately 100 m to the east and southeast of the site. Habitat at the site is still excellent for YBCU. Blind 30 was surveyed for both YBCU and YCRA in 2008.

Mike's Site

Mike's Site (Figure 10) was first surveyed for YBCU in 2007. The site has two areas. The sites are roughly located along the access road leading to South Marsh (Figure 11). YBCU habitat at the sites consists of small isolated mature cottonwood patches embedded in a vast expanse of tamarisk associated with the OWMA water impoundments and canals. The small patches are within flying distance and YBCU were observed in 2007 flying between the patches. Mike's Site is also within flying distance of the South Marsh (see below) and Blind 30 (see above) sites, and possibly beyond. Fremont cottonwood at the two patches comprising Mike's Site are mature, up to 15 meters tall. The surrounding habitat is mature tamarisk, up to 4 meters tall, dense and continuous. The habitat at Mike's Site is suitable for YBCU, but not YCRA. The site was surveyed for YBCU in 2008.

South Marsh

The South Marsh site (Figure 10) is the southeastern most survey site on the OWMA. The site is composed of two large water impoundments bordered by access roads that surround and bisect the site. Collectively, these impoundments cover several hundred hectares. The habitat is composed of monotypic cattail patches up to 400 meters wide and nearly 1 kilometer long. The access roads on the dikes are irregularly and infrequently lined with Goodding's black willow, cottonwood, sandbar willow and tamarisk. The South Marsh site comprises the best and most extensive YCRA habitat on the OWMA. The site is managed for waterfowl. South Marsh was inundated at the beginning of the 2008 YCRA survey season, but drained shortly afterwards. The site was surveyed for YCRA in 2008 until the habitat was no longer suitable.

Small patches of YBCU habitat, consisting of willows and cottonwoods occur along the western dike road that bisects the two large water impoundments. The small habitat patches are not, in themselves, big enough to support YBCU, however the patches are within reasonable flying distances from Mike's Site. Mike's site (see above), which had YBCU in 2007 (Braden et al. 2008), is proximal to the YBCU habitat at South Marsh. South Marsh was surveyed for YBCU in conjunction with Mike's Site in 2008.

RESULTS

Yuma Clapper Rail

YCRA survey results for 2008 are presented in Table 2 and plotted in Figures 11 and 12. UTM coordinates are tabulated in Table 4. A total of 12 YCRA were detected, with birds occurring at Honeybee Pond, Blind 30 and South Marsh.

At Honeybee Pond (Figures 10 and 11) YCRA were detected on five of seven surveys, with a maximum number of 7 birds detected on 25 June. Dueting pairs were detected on 14 April, 28 May and 10 June. A family group of six were detected on 25 June. And, there were multiple single detections across the survey season (Table 4). Detections were distributed throughout Honeybee Pond.

At Blind 30 (Figures 10 and 12), YCRA were detected on four of six surveys, with the maximum of 4 birds detected on 14 May. One pair was detected on 14 May with the remaining detections being single bird (Table 4). Birds were detected both inside and outside the dike road that encompasses the site. Detections occurred on the east and southeast perimeter of the site with the majority of detections being in the southeastern portion of the surveyed area.

At South Marsh (Figures 10 and 12), one YCRA was detected on a single survey. South Marsh was being drained when the survey season began. By 30 April, the habitat was marginal at best, and there were no further YCRA detections.

Yellow-billed Cuckoo

YBCU survey results are presented in Table 3 and plotted in Figure 13. UTM coordinates are tabulated in Table 4. A total of 3 YBCU were detected. All detections occurred at the Warm Springs Natural Area (Figures 6 and 13). A pair of YBCU were detected on 26 June and were under observation for over one hour. Neither bird could be relocated on subsequent visits. A single YBCU was observed on 8 July. The bird responded behaviorally to

the tape, but not vocally. The bird could not be relocated on subsequent visits.

YCRA and YBCU longterm trends - Results of YCRA and YBCU surveys since 2000 are summarized by year and survey sites in Tables 5 and 6 respectively. The 2008 season had the fourth highest number of YCRA detections since surveys began in 2000. Of the Muddy River sites, the OWMA sites continue to be the most consistently occupied YCRA habitats since 2005. Of the Virgin River sites, the Mesquite Bridge has been the most consistently occupied site over the years.

Longterm YCRA detections and site occurrences continue to suggest cyclical occupancy patterns. The cyclic pattern is coincident with natural and anthropogenic changes in available YCRA habitat. Parsimony suggests fluctuations in available YCRA habitat is the primary factor affecting YCRA occurrences along the Virgin/Muddy River complex.

YBCU detections dropped in 2008 to the third lowest number since surveys began in 2000. In particular, YBCU detections at the OWMA, the most consistent detection sites since 2005, were negative in 2008. As with YCRA, longterm YBCU data also suggest cyclical occupancy, but the ultimate factors responsible for the cyclicity are not well understood.

Other Rails, Bitterns and Moorhens

Detections of other rails, bitterns and Common Moorhen are tabulated in Table 2. A minimum of 72 Virginia Rail (VIRA) were known to present in the 2008 survey season. VIRA were detected at every survey site with suitable rail habitat except Littlefield South. VIRA were the most abundant rail detected, and were most abundant at South Marsh (18 birds on 21 March) until the ponds were drained, after which their numbers declined precipitously. VIRA were likewise the most abundant rail at the Warm Springs Natural Area (17 birds on 16 April), and were consistently abundant throughout the 2008 survey season.

A minimum of 21 Sora were known to be present during the 2008 surveys. This a threefold increase over the 2007 survey season when a total of 7 birds were known to be present. Sora were detected at all survey sites with suitable habitat except the Maverick Ditch. Sora detections and distribution increased significantly from the 2007 survey season.

A minimum of 10 Least Bittern (LEBI) were known to be present during the 2008 surveys. LEBI were detected at the Mesquite Bridge, Mesquite Bridge 3, Warm Springs Natural Area, Honeybee Pond and Blind 30. LEBI were most abundant at Honeybee Pond.

A total of 9 Common Moorhen (COMO) were know to be present during the 2008 surveys. COMO were detected at Mesquite Bridge, Honeybee Pond, Blind 30 and South Marsh. COMO were most abundant at Honeybee Pond.

American Bittern and Black Rail were not detected in the 2008 survey season.

Southwestern Willow Flycatcher

Incidental Southwestern Willow Flycatcher (WIFL) detections were limited to the WSNA. Locations are plotted in (Figure 13), UTM coordinates are tabulated in Table 7. There were 9 detections of WIFL, either as single birds, pairs or combinations of pairs. Based on the date and behavior of the birds, the evidence suggests there were at least 5 WIFL pairs, including a possible polygamous group, breeding on the WSNA in 2008. One abandoned WIFL nest was found 22 July. The nest was apparently unsuccessful as there was no evidence that nestlings had

been present.

It is important to note that WIFL detections/observations did not follow WIFL survey protocol. And, there is a high likelihood WIFL were present at other locations on the WSNA in 2008. Regardless, incidental observations confirm that WIFL were present and breeding at the WSNA in 2008.

Incidental Bird Species Detections

Incidental bird species detected during 2008 YCRA and YBCU surveys are tabulated in Table 8. A total of 146 bird species were incidentally observed. The number is up from 139 birds species detected in 2007. A significant portion of the increase is likely due to greater access to WSNA. Among the more interesting species observed were Southwestern Willow Flycatcher, Solitary Sandpiper and Vermillion Flycatcher. Southwestern Willow Flycatcher have been previously mentioned. The Solitary Sandpiper is a long distance migrant which breeds on the tundra, yet a single individual lingered at the same location (photos available on request) for approximately one month beginning in mid-March. Vermillion Flycatcher were already know to be abundant and breeding on the WSNA, and incidental observations indicate this is still the case in 2008. At least 40 Vermillion Flycatchers were observed at the WSNA in the 2008 survey season.

It is important to note that incidental bird species detections were incidental to YCRA and YBCU surveys. Incidental bird detections should not be over-interpreted, since they are not based on rigorous bird census methodologies. Incidental bird species observations indicate presence, but not absence of a bird species from a site.

DISCUSSION

Yuma Clapper Rail

Twelve YCRA were detected in the 2008 season, down from the 19 YCRA observed in the 2007 season. Part or most of the change can be attributed to changes in the available YCRA habitat at Honeybee Pond, Blind 30, South Marsh and Mesquite Bridge from 2007 to 2008. On the plus side, YCRA habitat at Honeybee Pond nearly doubled in size as a result of cattail and bulrush infiltrations from the margins of the pond into the open water. Proportional cover on Honeybee Pond was about 50% cattail/bulrush and 50% open water at the end of the 2008 survey season, at least double the size of the YCRA habitat in 2007. YCRA occupancy increased accordingly from 3 birds in 2007 to 7 birds (including a family group) in 2008. Also on the plus side, YCRA habitat was not suitable at Blind 30 in 2007, yet in one year, the rail habitat matured, expanded and was occupied by 4 YCRA in 2008.

On the minus side, YCRA habitat at South Marsh, where 14 YCRA occupied the site in 2007, had only 1 detection in 2008. The YCRA habitat at South Marsh degraded rapidly at the start of the 2008 survey season when the marsh was drained. It is unlikely the YCRA detected in 2008 was paired or bred at South Marsh in 2008, since subsequent surveys (from 30 April on) were negative and the habitat in general was no longer suitable (for any rail species) due to lack of water. To some degree, but not all, the new habitat at Blind 30 compensated for habitat lost at

South Marsh in 2008. Also on the minus side, available YCRA habitat at the Mesquite Bridge site had been substantially reduced by suburban encroachment. More specifically, the habitat were a pair of YCRA was detected in 2007 had been replaced by golf greens and houses by 2008. There were no YCRA found at the Mesquite Bridge site in 2008.

WSNA is a promising site for YCRA habitat development. Significant areas of YCRA habitat are already present, and pasturage which had been grazed by the previous tenants was already going through rapid successional recovery by the end of the 2008 survey season. No actions are recommended at this time to facilitate YCRA habitat recovery, other than letting the habitat recover naturally, without further disturbance.

WSNA rail habitat also has potential for Black Rail. No Black Rail were detected in the 2008 surveys, but rail survey times were oriented to YCRA. Black Rail are most active and responsive between 2:00 A.M. to 4:00 A.M. The current data are not adequate to establish either the presence or absence of Black Rail at the WSNA. Presence/absence cannot be determined with confidence until surveys are done at the appropriate time.

Annual changes in YCRA habitat along the Virgin/Muddy River complex are not unusual. The 2005 flood had the greatest single season impact on YCRA habitats on the Virgin/Muddy River complex since YCRA surveys began in 2000. The 2005 survey season was the only year, out of eight years of monitoring, where no YCRA were detected at any site. The 2005 natural flood event affected virtually every survey site (Miller et al 2006). Nevertheless, rail habitat and YCRA had reestablished by 2006 and 2007 (Braden et al 2007, 2008). Habitat disruptions from natural disturbances can be widespread and unavoidable. But survey results confirm the disruptions from natural events are temporary.

In contrast, habitat disturbances from anthropogenic disturbances are more vexing. YCRA habitat is being both created and destroyed by human activities. For example, channelization activities on the Virgin River coincident with the 2005 floods both destroyed and created YCRA habitat. The habitat created below the Mesquite Bridge site has been steadily replaced over the years by golf greens, houses and dike modifications. YCRA, and now WIFL, habitats at the bridge will likely be impacted by upcoming bridge modifications. On the plus side, YCRA habitat upstream of the bridge at the Mesquite Bridge 3 site was intact and flourishing at the end of the 2008 survey season. Anthropogenic activities at the Mesquite sites clearly have great potential to either impact or enhance YCRA habitat.

Another example fo anthropogenic activities both positively and negatively affecting YCRA habitat is at the OWMA. The OWMA is clearly an asset to YCRA in southern Nevada. The OWMA provides thousands of acres of YCRA habitat incidental to water fowl management. And, the OWMA has had the most consistent occurrences and relatively high numbers of YCRA over the last three years. On the other hand, waterfowl management activities on the OWMA have also destroyed many acres of YCRA habitat. For example, Honeybee Pond was drained and cleared of excessive cattails in 2004, and YCRA did not return to the site until 2007. South Marsh had the highest YCRA count of all the sites in 2007 (14 birds), but was drained for maintenance early in the 2008 YCRA season. The conflict between creation and destruction of YCRA habitat on the OWMA might be mitigated by scheduling pond maintenance outside of the YCRA nesting/breeding season. Again, the OWMA is clearly an asset to YCRA, but the beneficial aspects can be significantly enhanced by careful scheduling of waterfowl enhancement

operations.

A third example of anthropogenic activities affecting YCRA is at the Maverick Ditch site. The Maverick Ditch site has burned every year starting in 2004. The burning appears to be preventive fire control as several houses and business are nearby. More recently, the burning may be part of a tamarisk control program, since the tamarisk at the site are being cut and piled. No YCRA have been detected at this site since the annual burning treatments began. Pre-emptive fuel reduction is one means to prevent loss of life and property from uncontrolled fire, which is certainly a priority, but it is not the only treatment option. YCRA and YCRA habitat at the site would be enhanced by using other wildfire control options, such as a fuel buffer zone around the site, or possibly biannual (or tri-annual?) controlled burns in conjunction with buffer zones.

A fourth example of anthropogenic activities affecting YCRA is at the Bowman Canal. The Bowman Canal is an inflow channel from the Muddy River to Bowman Reservoir. Bowman Reservoir is an irrigation reservoir and recreation site in the Moapa Valley. Bowman Canal is mechanically scoured of all vegetation every winter, presumably to facilitate water intake to the reservoir. YCRA habitat would be significantly enhanced by scheduling vegetation removal after the YCRA breeding/nesting season. Another possible option to consider is to scour the thalweg of the canal, leaving the margins to develop into YCRA habitat. There are many other sites and opportunities to enhance YCRA and YCRA habitats on the Virgin and Muddy Rivers complex coincident with anthropogenic activities.

A fifth and final example of anthropogenic effects on bird species on both the Virgin and Muddy Rivers is cattle grazing. Range and feral cattle continue to degrade YCRA habitat on the Virgin and Muddy Rivers. A large group (40+) of apparently feral cattle (no brands or ear tags) continue to degrade YCRA habitats at the Mormon Mesa sites. Further downstream, cattle continue to graze emergent rail habitats at Fisherman's Cove and Virgin River Landing. Cattle have become a pest on the OWMA over the past years, coincident with water elevation decline in Lake Mead. The OWMA has erected an exclusion fence, a proactive move on their part, but the fencing does not include Blind 30, South Marsh and areas to the east. Cattle are also present at Littlefield North and Littlefield South. Clearly, there is a great potential to enhance YCRA and YCRA habitats by controlling/confining range and feral cattle.

Yellow-billed Cuckoo

YBCU detections and observations declined dramatically from 12 in 2007 to 3 in 2008. Detections in 2008 were confined to the WSNA, where one pair and one individual were observed relatively early in the season. Subsequent surveys were negative and there was no further evidence to suggest YBCU nested at any of the survey sites, including the OWMA and Mormon Mesa sites.

The spatial and temporal shifts of cuckoo detections since SBCM surveys began in 2000 remain difficult to interpret. YBCU were relatively abundant on the OWMA in 2007 (8 of 12 detections) but absent in 2008. There were 4 YBCU at Mormon Mesa in 2007, but none in 2008. The conventional wisdom reports a large (7+ pair) YBCU breeding population at WSNA early in this decade, but SBCM and NDOW surveys have never found more then 3 in any one year since

surveys began in 2003, the 3 birds having been detected this survey season.

Putative factors affecting YBCU spatial and temporal breeding season distributions in southern Nevada are many, but there are few answers. Habitat loss and degradation can obviously affect YBCU breeding season occurrences, but YBCU habitats on the Virgin/Muddy River complex, with a few minor exceptions, appear to be stable and predictable since surveys began in 2000. The size of available habitat (patch size) might also affect occupancy. But available habitat for YBCU appears to be extensive, particularly at WSNA, Mormon Mesa, OWMA and Littlefield North. Food resource availability could reasonably affect occupancy. But, there are no data to assess the effects of changes in food availability, if any. The irruptive nature of YBCU in the American Southwest in general has yet to be investigated in a rigorous scientific venue. At this point in time, the mechanism affecting the occurrence of YBCU in southern Nevada are simply not known. The survey data indicate occupancy is cyclic and potentially uncoupled from habitat, but that is all we know. Given this lack of understanding, management for YBCU on the Virgin Muddy River complex is limited to preserving and enhancing existing habitat.

WSNA: Southwestern Willow Flycatcher

WIFL detections at WSNA were incidental, and did not adhere to FWS survey protocol. Nevertheless, detections and observations conclusively establish that WIFL were present and breeding on the WSNA in 2008. The WSNA has great potential for this species, including areas that were not visited, incidentally or otherwise, during our 2008 YCRA and YBCU surveys. Focused WIFL surveys at WSNA should be considered to determine the number of birds, their use areas, avoid impacts and to identify enhancement opportunities for this species.

SUMMARY

Yuma Clapper Rail

1) Twelve (12) YCRA were detected during the 2008 surveys. Detections were confined to the OWMA. YCRA were detected at South Marsh (1), Honeybee Pond (7) and Blind 30 (4). YCRA pairs were detected at Honeybee Pond and Blind 30. One family group was detected at Honeybee Pond.

2) YCRA habitats increased in 2008 at Honeybee Pond, Blind 30 and Littlefield South. YCRA habitat increases appeared to be a result of natural processes and waterfowl management practices.

3) YCRA habitats decreased in 2008 at South Marsh, Long Marsh and Mesquite Bridge. Decreases in YCRA habitat appeared to be a result of natural processes, urban and recreational developments, and waterfowl management practices.

4) Range and feral cattle continue to be a significant hindrance to YCRA habitat recovery, establishment and development.

Yellow-billed Cuckoo

1) Three (3) YBCU were detected during the 2008 surveys. All YBCU detections occurred at the WSNA. Detections consisted of 1 pair and a single individual. There was no convincing evidence that YBCU nested or bred at WSNA or anywhere else in the study area in 2008.

2) YBCU habitats appeared to be stable throughout the study area in 2008.

Southwestern Willow Flycatcher

1) WIFL detections were confined to WSNA. There were 9 incidental WIFL detections composed of at least 5 WIFL pairs, including a possible polygamous group, and one abandoned nest.

RECOMMENDATIONS

1) Continue YCRA and YBCU surveys. Surveys for both species have been conducted since 2000. These surveys are the most comprehensive and continuous surveys of YCRA and YBCU in southern Nevada. Data from these surveys provide fundamental, longterm, baseline information regarding the distribution and abundance of both species on the Virgin and Muddy River complex. This information is fundamental to integrating YCRA and YBCU conservation with water management policies.

2) Encourage and support credible efforts to enhance YCRA habitats throughout the Virgin/Muddy River complex. Specifically; 1) Engage NDOW in regards to the seasonal timing and frequency of waterfowl management prescriptions on the OWMA. 2) Engage the City of Overton in regards to fire prevention prescriptions at the Maverick Ditch site. 3) Engage local, state, federal and/or special interest jurisdictions in regards to maintaining and enhance YCRA in the City of Mesquite.

3) Initiate focused WIFL surveys/studies at the WSNA to determine occupancy, distribution and nesting success.

4) Initiate focused Black Rail surveys on the WSNA to determine presence/absence.

5) Encourage and support credible efforts to maintain and promote YBCU habitats on the Virgin/Muddy River complex. Encourage and promote credible scientific studies of factors affecting YBCU distribution and occurrence.

6) Encourage, support or initiate efforts to remove/contain range and feral cattle on the Virgin/Muddy River complex.

ACKNOWLEDGMENTS

We are thankful for SNWA for funding eight years of YBCU and YCRA surveys and commend them for their proactive determination to integrate species conservation with water policy in southern Nevada. Within SNWA, we especially want to thank Zane Marshall for his determination and foresight in initiating and advocating this project, and David Syzdek for continuing and promoting the effort. No less important has been the help of Bob Furteck at NDOW in orienting our biologists at the WSNA and participating in YBCU surveys. All have been essential. Without their help, this study would not have been possible.

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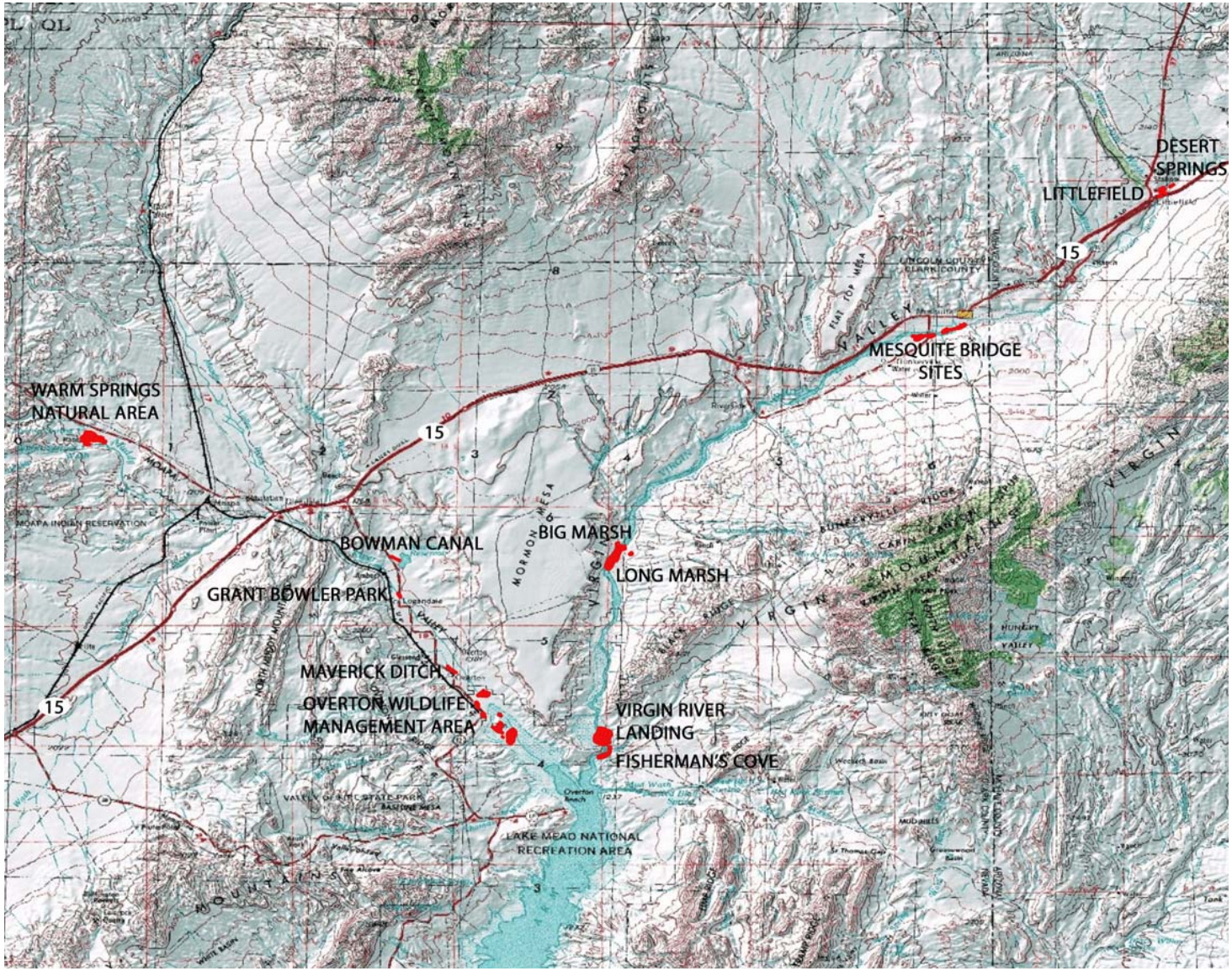


Figure 1. Regional overview of survey sites for Yuma Clapper Rail and Yellow-billed Cuckoo along the Virgin and Muddy Rivers.



Figure 2. Littlefield, Arizona survey sites for Yuma Clapper Rail and Yellow-billed Cuckoo.



Figure 3. Mesquite, Nevada survey sites for Yuma Clapper Rail and Yellow-billed Cuckoo.



Figure 4. Mormon Mesa survey sites for Yuma Clapper Rail and Yellow-billed Cuckoo.

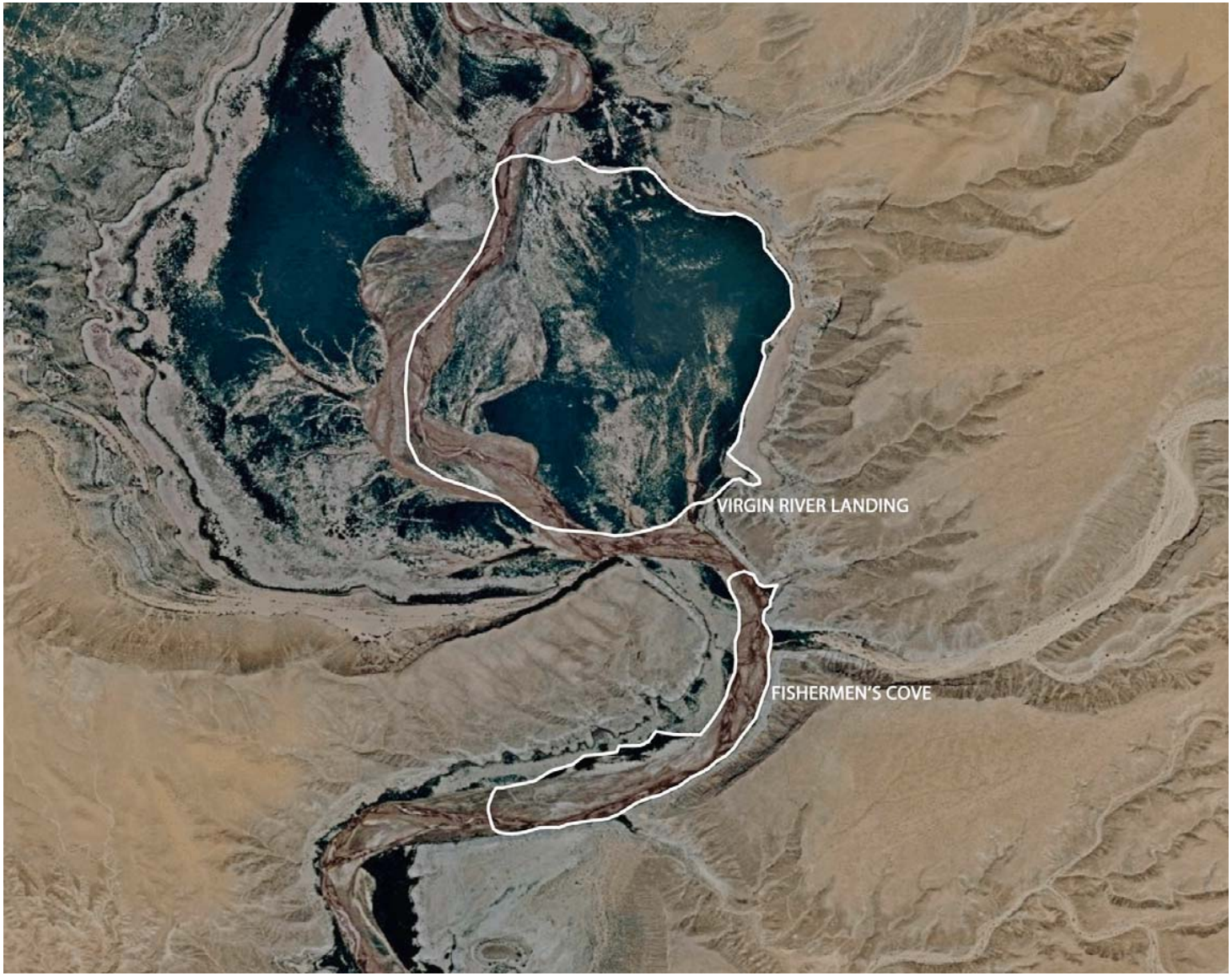


Figure 5. Virgin Delta survey sites for Yuma Clapper Rail and Yellow-billed Cuckoo.

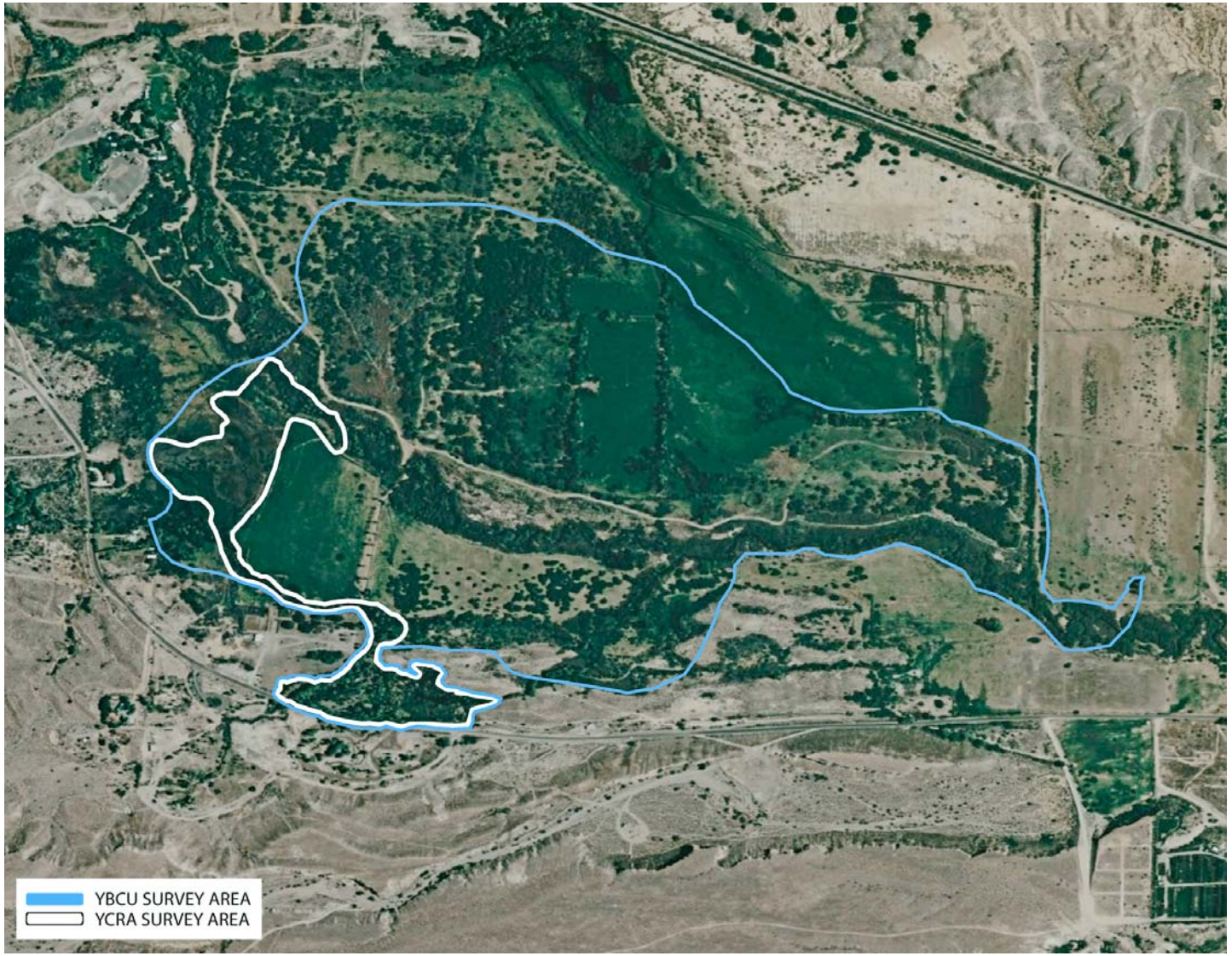


Figure 6. Warm Springs Natural Area survey sites for Yuma Clapper Rail and Yellow-billed Cuckoo.



Figure 7. Bowman Canal survey site for Yuma Clapper Rail.



Figure 8. Grant Bowler Park survey site for Yuma Clapper Rail.



Figure 9. Maverick Ditch survey site for Yuma Clapper Rail.



Figure 10. Overton Wildlife Management Area survey sites for Yuma Clapper Rail and Yellow-billed Cuckoo.



Figure 11. Yuma Clapper Rail detections at Honeybee Pond on the OWMA.

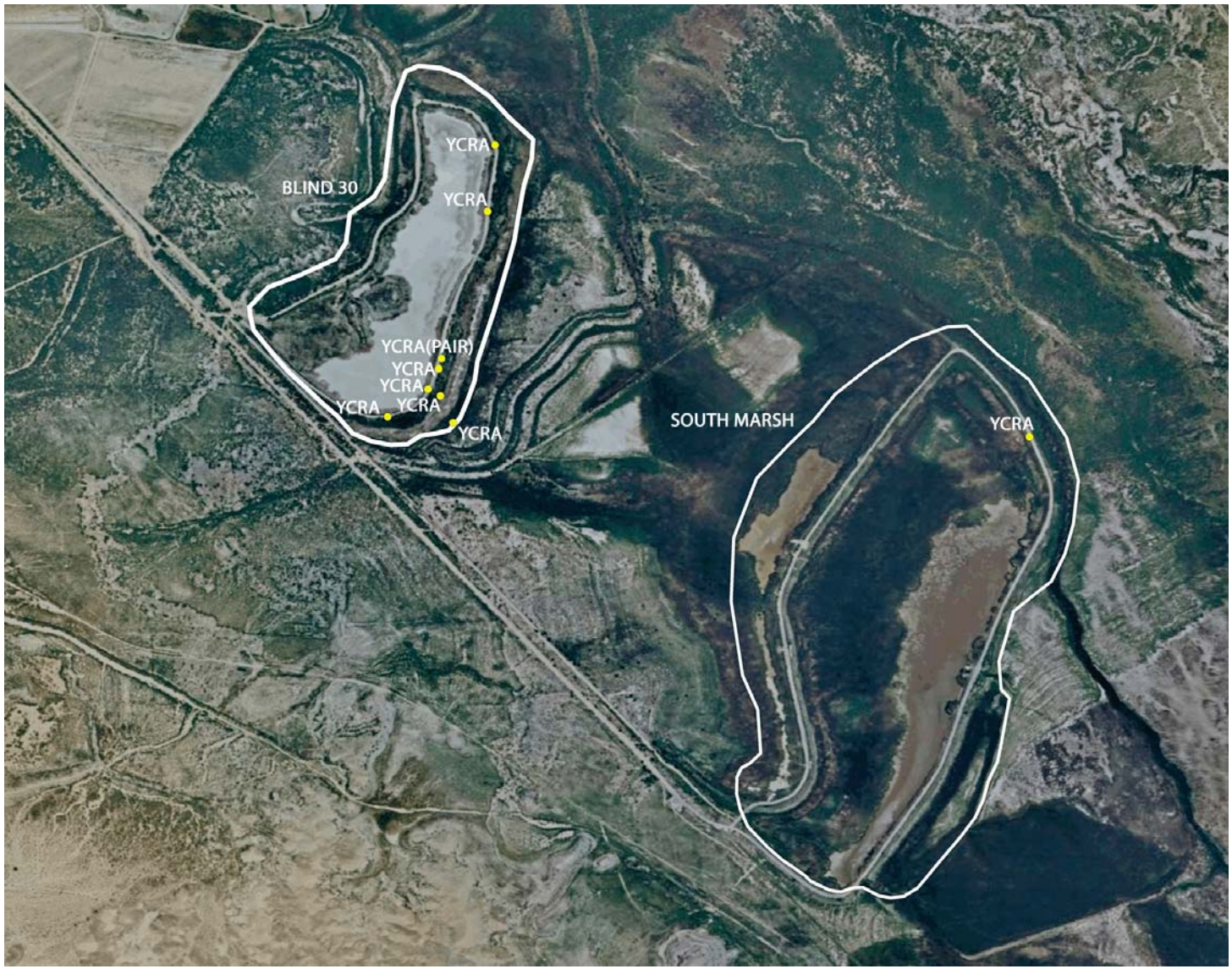


Figure 12. Yuma Clapper Rail detections at Blind 30 and South Marsh on the OWMA.



Figure 13. Yellow-billed Cuckoo and Southwestern Willow Flycatcher detections at the Warm Springs Natural Area.

Table 1: Locations, site names, and geographic coordinates for Yuma Clapper Rail and Yellow-billed Cuckoo survey sites on and along the Virgin and Muddy Rivers in southern Nevada. UTM coordinates are center points, see figures for site/survey polygons.

SITE NAME	LOCATION	UTM (NAD27)
Yuma Clapper Rail		
Big Marsh	Virgin River near Mormon Mesa	11 739484 E 4057710 N
Bowman Canal	Muddy River in Overton, Nevada	11 724864 E 4056419 N
East Marsh	Virgin River near Mormon Mesa	11 740398 E 4057198 N
Fisherman's Cove	Virgin River Delta	11 739236 E 4040878 N
Grant Bowler Park	Muddy River in Overton, Nevada	11 725253 E 4053374 N
Honeybee Pond	Overton Wildlife Management Area	11 731067 E 4045632 N
Littlefield South	Virgin River in Littlefield, Arizona	12 239484 E 4086707 N
Long Marsh	Virgin River near Mormon Mesa	11 739503 E 4057005 N
Maverick Ditch	Muddy River in Overton, Nevada	11 728886 E 4047419 N
Mesquite Bridge	Virgin River in Mesquite, Nevada	11 759109 E 4075353 N
Mesquite Bridge 3	Virgin River in Mesquite, Nevada	11 760997 E 4075951 N
Pintail Pond	Overton Wildlife Management Area	11 731502 E 4043761 N

Table 1 continued: Locations, site names, and geographic coordinates for Yuma Clapper Rail and Yellow-billed Cuckoo survey sites on and along the Virgin and Muddy Rivers in southern Nevada for 2008. UTM coordinates are center points, see figures for site/survey polygons.

SITE NAME	LOCATION	UTM (NAD27)
South Marsh	Overton Wildlife Management Area	11 732913 E 4042176 N
Virgin River Landing	Virgin River Delta	11 739006 E 4042326 N
Warm Springs Natural Area	Muddy River near Glendale, Nevada	11 704207 E 4065398 N
Yellow-billed Cuckoo		
Blind 30	Overton Wildlife Management Area	11 732085 E 4042897 N
Desert Springs	Virgin River near Littlefield, Arizona	12 240324 E 4087636 N
Honeybee Pond	Overton Wildlife Management Area	11 731002 E 4045628 N
Littlefield North	Virgin River in Littlefield, Arizona	12 239710 E 4087177 N
Long Marsh to Big Marsh	Virgin River near Mormon Mesa	11 739265 E 4057004 N
Maintenance Sheds	Overton Wildlife Management Area	11 731028 E 4043840 N
Mesquite Bridge 2	Virgin River in Mesquite, Nevada	11 758742 E 4075114 N
Mike's Site	Overton Wildlife Management Area	11 732310 E 4042176 N
Refuge Housing	Overton Wildlife Management Area	11 730624 E 4044736 N

Table 1 continued: Locations, site names, and geographic coordinates for Yuma Clapper Rail and Yellow-billed Cuckoo survey sites on and along the Virgin and Muddy Rivers in southern Nevada for 2008. UTM coordinates are center points, see figures for site/survey polygons.

SITE NAME	LOCATION	UTM (NAD27)
Southwestern Willow Flycatcher Habitat	Overton Wildlife Management Area	11 732111 E 4043940 N
Warm Springs Natural Area	Muddy River near Glendale, Nevada	11 704674 E 4065648 N
Willow Strip	Overton Wildlife Management Area	11 731933 E 4043495 N

Table 2: Results of Yuma Clapper Rail surveys by the San Bernardino County Museum in 2008 for sites in and along the Virgin and Muddy Rivers in southern Nevada. YCRA = Yuma Clapper Rail. VIRA = Virginia Rail. SORA = Sora, BLRA = Black Rail, LEBI = Least Bittern, AMBI = American Bittern, COMO = Common Moorhen. "s" = single individual, "p"= pair, "f" = family group. Survey times are A.M.

SITE	DATE	SURVEY TIMES	YCRA	VIRA	SORA	BLRA	LEBI	AMBI	COMO
Virgin River Sites									
Big Marsh	21 March	11:00 - 11:45	0	2s	0	0	0	0	0
	15 April	7:00 - 8:45	0	6s	0	0	0	0	0
	29 April	6:30 - 8:30	0	1s	2s	0	0	0	0
	13 May	6:30 - 8:30	0	0	0	0	0	0	0
	27 May	6:00 - 8:00	0	0	0	0	0	0	0
	10 June	6:45 - 8:45	0	0	0	0	0	0	0
Total survey time:		**11 hrs 30 min**							
Long Marsh [a]	21 March	Assessment [1]							
Fisherman's Cove [a]	22 March	Assessment [1]							
	11 June	Assessment [1]							
Virgin River Landing [a]	22 March	Assessment [1]							
	11 June	Assessment [1]							
Littlefield South	23 March	6:45 - 8:00	0	0	0	0	0	0	0
	15 April	9:20 - 9:50	0	0	0	0	0	0	0
	29 April	6:10 - 6:40	0	0	0	0	0	0	0
	13 May	6:10 - 6:40	0	0	1s	0	0	0	0
	27 May	6:20 - 6:40	0	0	0	0	0	0	0
	10 June	6:20 - 7:15	0	0	0	0	0	0	0
Total survey time:		**7 hrs 25 min**							
Littlefield North [a]	23 March	Assessment [1]							
	10 June	Assessment [1]							

Table 2 continued: Results of Yuma Clapper Rail surveys by the San Bernardino County Museum in 2008 for sites in and along the Virgin and Muddy Rivers in southern Nevada. YCRA = Yuma Clapper Rail. VIRA = Virginia Rail. SORA = Sora, BLRA = Black Rail, LEBI = Least Bittern, AMBI = American Bittern, COMO = Common Moorhen. "s" = single individual, "p"= pair, "f" = family group. Survey times are A.M.

SITE	DATE	SURVEY TIMES	YCRA	VIRA	SORA	BLRA	LEBI	AMBI	COMO
Mesquite Bridge	22 March	5:35 - 8:30	0	2s	1s	0	0	0	0
	15 April	6:20 - 8:05	0	6s	0	0	0	0	0
	29 April	7:15 - 9:55	0	7s	3s	0	1s	0	0
	13 May	7:20 - 9:50	0	6s	1s	0	0	0	0
	27 May	7:13 - 10:00	0	4s +2p	1s	0	1s +1p	0	1p
	11 June	6:00 - 8:30	0	2s	0	0	0	0	0
Total survey time:		**20 hrs 49 min**							
Mesquite Bridge 3	22 March	8:30 - 10:20	0	2s +2p	1s	0	0	0	0
	15 April	6:20 - 8:05	0	4s +1p	3s +1p	0	0	0	0
	29 April	7:15 - 9:55	0	4s +3p	1s	0	2s	0	0
	13 May	7:20 - 9:50	0	2s +1p	0	0	0	0	0
	27 May	7:13 - 10:00	0	3s +1p	1s	0	0	0	0
	11 June	6:00 - 8:30	0	4s	1s	0	0	0	0
Total survey time:		**14 hrs 52 min**							
Muddy River Sites									
Warm Springs Natural	22 March	Assessment [1]							
Area	23 March	7:00 - 8:30	0	15s	0	0	0	0	0
	16 April	6:00 - 7:30	0	5s + 6p	0	0	0	0	0
	1 May	5:45 - 7:15	0	7s	3s	0	0	0	0
	15 May	6:00 - 7:30	0	10s	3s	0	0	0	0
	29 May	6:00 - 7:30	0	6s	0	0	0	0	0
	12 June	5:45 - 7:30	0	11s	2s	0	0	0	0

Table 2 continued: Results of Yuma Clapper Rail surveys by the San Bernardino County Museum in 2008 for sites in and along the Virgin and Muddy Rivers in southern Nevada. YCRA = Yuma Clapper Rail. VIRA = Virginia Rail. SORA = Sora, BLRA = Black Rail, LEBI = Least Bittern, AMBI = American Bittern, COMO = Common Moorhen. "s" = single individual, "p"= pair, "f" = family group. Survey times are A.M.

SITE	DATE	SURVEY TIMES	YCRA	VIRA	SORA	BLRA	LEBI	AMBI	COMO
Total survey time:		**18 hrs 30 min**							
Bowman Canal [a]	21 March	Assessment [1]							
	14 April	Assessment [1]							
	14 May	Assessment [1]							
Grant Bowler Park [a]	21 March	Assessment [1]							
	14 April	Assessment [1]							
	14 May	Assessment [1]							
Maverick Ditch	21 March	10:50 - 11:20	0	0	0	0	0	0	0
	29 April	9:30 - 10:30	0	2p	0	0	0	0	0
	27 May	9:00 - 10:00	0	1s +1p	0	0	0	0	0
	10 June	9:45 - 10:45	0	5f	0	0	0	0	0
Total survey time:		**4 hrs**							
Honeybee Pond	21 March	6:50 - 8:30	0	3s	0	0	0	0	0
	14 April	6:00 - 8:03	1p	4s	0	0	0	0	1s
	30 April	6:10 - 7:34	3s	1s	0	0	0	0	4s
	14 May	6:00 - 7:30	0	0	0	0	2s	0	3s
	28 May	8:30 - 10:00	2p	2s	0	0	2s	0	2s
	10 June	5:30 - 7:30	1s + 2p	3s	0	0	3s	0	0
	25 June	8:15 - 9:00	1s + 6f	1s	1s	0	2s	0	0
Total survey time:		**19 hrs 44 min**							
Pintail Pond [a]		Assessment [1]							

Table 2 continued: Results of Yuma Clapper Rail surveys by the San Bernardino County Museum in 2008 for sites in and along the Virgin and Muddy Rivers in southern Nevada. YCRA = Yuma Clapper Rail. VIRA = Virginia Rail. SORA = Sora, BLRA = Black Rail, LEBI = Least Bittern, AMBI = American Bittern, COMO = Common Moorhen. "s" = single individual, "p"= pair, "f" = family group. Survey times are A.M.

SITE	DATE	SURVEY TIMES	YCRA	VIRA	SORA	BLRA	LEBI	AMBI	COMO
Blind 30	14 April	9:00 - 10:00	0	2s +1p	3s	0	2s	0	0
	30 April	8:00 - 9:37	3s	2s	2s	0	1s	0	0
	14 May	7:45 - 9:10	2s +1p	2s	0	0	0	0	0
	28 May	6:00 - 7:45	1s	1s +1p	0	0	1s	0	1s
	10 June	7:45 - 9:30	0	2s	0	0	0	0	0
	25 June	6:35 - 7:35	1s	0	1s	0	0	0	1s
Total survey time:		**16 hrs 45 min**							
South Marsh	21 March	7:30 - 9:00	0	18s	3s	0	0	0	2s
	14 April	6:30 - 8:30	1s	2s + 3p	1s	0	0	0	0
	30 April	6:15 - 8:15	0	0	0	0	0	0	0
	28 May	7:30 - 8:15	0	0	0	0	0	0	0
Total survey time:		**9 hrs 45 min**							
TOTAL BIRDS [2]			**12**	**72**	**21**	**0**	**10**	**0**	**9**
TOTAL SURVEY HOURS		**123 hrs 33min**							

1 – No survey. Dates are field visits for habitat suitability assessment/reassessments.
2 - Sum of the maximum number of birds detected per site. Maximum number of birds = the largest number of birds detected on a single survey event.
a – Habitat unsuitable for Yuma Clapper Rail. Not surveyed in 2008.
p - # of pairs detected, does not include # of single bird detections.
s - # of single birds detected. Does not include the # of pairs detected.
f - Assumed to be a family group when >2 birds were either seen together or vocalizing simultaneously within 5 m of each other.

Table 3: Results of 2008 Yellow-billed Cuckoo surveys by the San Bernardino County Museum for sites in and along the Virgin and Muddy Rivers in southern Nevada. Times are A.M. Numbers in parentheses are number of surveyors.

SITE	DATE	TIME	# YBCU DETECTED
Virgin River Sites			
Desert Springs	25 June	Assessment [1]	
Big Marsh Area	25 June	6:50 - 9:00 (1)	0
	9 July	6:30 - 8:30 (1)	0
	23 July	6:00 - 9:00 (2)	0
	5 August	6:00 - 9:30 (1)	0
Total survey time:		**10 hrs 40 min**	
Long Marsh Area	25 June	9:15 - 11:30 (1)	0
	9 July	6:30 - 9:00 (1)	0
	23 July	6:00 - 9:00 (2)	0
	5 August	5:55 - 7:35 (1)	0
Total survey time:		**9 hrs 25 min**	
Littlefield North	27 June	6:45 - 7:45 (1)	0
	10 July	7:00 - 8:30 (1)	0
	24 July	6:15 - 8:15 (2)	0
	6 August	6:20 - 7:20 (2)	0
Total survey time:		**5 hrs 30 min**	
Littlefield South	27 June	5:45 - 6:30 (1)	0
	10 July	5:30 - 6:15 (1)	0
	5 August	5:30 - 6:00 (1)	0
Total survey time:		**2 hrs 0 min**	
Mesquite Bridge 2	27 June	9:00 - 10:00 (1)	0
	10 July	9:00 - 10:30 (1)	0
	6 August	7:45 - 8:45 (2)	0
Total survey time:		**3 hr 30 min**	

Table 3 continued: Results of 2008 Yellow-billed Cuckoo surveys by the San Bernardino County Museum for sites in and along the Virgin and Muddy Rivers in southern Nevada. Times are A.M. Numbers in parentheses are number of surveyors.

SITE	DATE	TIME	# YBCU DETECTED
Muddy River Sites			
Refuge Housing	25 June	9:05 - 9:15 (2)	0
	9 July	6:05 - 6:30 (2)	0
	23 July	9:15 - 9:30 (2)	0
	5 August	6:00 - 6:20 (1)	0
Total survey time:		**1 hr 10 min**	
Maintenance Sheds	25 June	9:45 - 10:10 (2)	0
	9 July	6:35 - 7:10 (2)	0
	23 July	8:45 - 9:10 (2)	0
	5 August	6:25 - 6:55 (1)	0
Total survey time:		**1 hrs 55 min**	
Willow Strip	25 June	10:15 - 11:00 (2)	0
	9 July	7:15 - 8:15 (2)	0
	23 July	8:00 - 8:35 (2)	0
	5 August	7:00 - 8:00 (1)	0
Total survey time:		**3 hrs 20 min**	
Blind 30	25 June	6:25 - 7:40 (2)	0
	9 July	8:25 - 9:25 (2)	0
	23 July	6:25 - 7:00 (2)	0
	5 August	8:10 - 9:10 (1)	0
Total survey time:		**3 hrs 50 min**	
Mike's Site	25 June	8:00 - 8:45 (2)	0
	9 July	9:35 - 10:10 (2)	0
	23 July	7:45 - 7:55 (2)	0
	5 August	9:20 - 10:05 (1)	0
Total survey time:		**2 hr 15 min**	

Table 3 continued: Results of 2008 Yellow-billed Cuckoo surveys by the San Bernardino County Museum for sites in and along the Virgin and Muddy Rivers in southern Nevada. Times are A.M. Numbers in parentheses are number of surveyors.

SITE	DATE	TIME	# YBCU DETECTED
Honeybee Pond	25 June	8:15 - 9:00 (2)	0
	9 July	10:20 - 10:55 (2)	0
	23 July	9:40 - 10:45 (2)	0
	5 August	8:55 - 9:30 (1)	0
Total survey time:		**3 hrs 0 min**	
Warm Springs Natural Area	26 June	6:20 - 10:55 (4)	2 (paired)
	8 July	5:45 - 9:00 (4)	1[a]
	22 July	6:20 - 11:30 (2)	0
	7 August	5:30 - 8:30 (3)	0
Total survey time:		**16 hrs 0 min**	
TOTAL BIRDS			**3**
TOTAL SURVEY HOURS		**46 hrs 58 min**	

1 – No survey. Dates are field visits for habitat suitability assessment/reassessments.
a - Different location than 26 June sighting of YBCU pair.

Table 4: Yuma Clapper Rail and Yellow-billed Cuckoo detection locations for the 2008 survey season. Coordinates are NAD27.

SPECIES	SITE	DATE	UTM	COMMENTS
Yuma Clapper Rail				
	South Marsh	14 April	11 0733136 E 4042578 N	Unresponsive to tape. Clatter call as the observer was leaving.
	Blind 30	30 April	11 0732145 E 4042713 N	Extended kek calls in response to tape.
	Blind 30	30 April	11 0732223 E 4043158 N	One bird. Clatter call. Southeast of dike road.
	Blind 30	30 April	11 0732214 E 4043020 N	One bird. Clatter call. Southeast of dike road.
	Blind 30	14 May	11 0732058 E 4042590 N	One bird responded to tape. Clatter call.
	Blind 30	14 May	11 0732141 E 4042719 N	Dueting pair.
	Blind 30	14 May	11 0732124 E 4042649 N	One bird. Response to tape. Clatter call.
	Blind 30	28 May	11 0732145 E 4042636 N	One bird. Clatter call in response to tape.
	Blind 30	25 June	11 0732168 E 4042581 N	One bird. Clatter call southeast of dike road in response to tape.
	Honeybee Pond	14 April	11 0730611 E 4045469 N	Dueting pair clatter calls in response to tape.
	Honeybee Pond	30 April	11 0730612 E 4045469 N	One bird responded to tape.
	Honeybee Pond	30 April	11 0730804E 4045574 N	One bird, keking. Visual as it crossed the road.
	Honeybee Pond	30 April	11 0731250 E 4045651 N	One bird responded to tape. Clatter call.

Table 4 continued: Yuma Clapper Rail and Yellow-billed Cuckoo detection locations for the 2008 survey season. Coordinates are NAD27.

SPECIES	SITE	DATE	UTM	COMMENTS
	Honeybee Pond	28 May		
	Honeybee Pond	10 June	11 0731074 E 4045621 N	Clatter call.
	Honeybee Pond	10 June	11 0730927 E 4045748 N	Clatter call.
	Honeybee Pond	25 June		Clatter call. Single bird in response to tape.
	Honeybee Pond	25 June	11 0730888 E 4045475 N	6 YCRA within 5 m of each other. Multiple clatter calls and keks. Very responsive to tape.
Yellow-billed Cuckoo				
	Warm Springs	26 June	11 0705125 E 4065678 N	1 pair. Under observation for over an hour. Initially responsive to tape.
	Warm Springs	8 July	11 0704712 E 4065895 N	Single bird flew over in response to tape. Not vocalizing.

Table 5: Summary of San Bernardino County Museum Yuma Clapper Rail surveys along the Virgin and Muddy Rivers in Southern Nevada from 2000 through 2008. Numbers are the maximum number of detections. (-ns- = not surveyed)

	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Virgin River Sites									
Littlefield North [a]	2	0	0	0	1	ns- [h]	ns- [h]	-ns- [i]	-ns- [i]
Littlefield Bridge	0	0	0	0	-ns- [b]				
Littlefield South	2	0	0	0	1	-ns- [h]	0	-ns- [i]	0
Mesquite Upstream	0	0	0	1	-ns- [c]				
Mesquite Bridge	2	0	2	1	1	-ns- [c, h]	0	2	0
Mesquite Downstream	0	0	0	0	-ns- [c]				
Mesquite Bridge 3	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	0	0
Mormon Mesa: Big Marsh [d]	7 [e]	8-12	3	0	1	0	0	0	0
Mormon Mesa: Long Marsh	6	1	0	0	0	0	0	0	-ns- [i]
Mormon Mesa: East Marsh	5	2	-ns-	-ns-	0	-ns- [h]	-ns- [i]	-ns- [i]	-ns- [i]
Virgin River Landing	-ns-	-ns-	-ns-	0	2	0	0	-ns- [i]	-ns- [i]
Fisherman's Cove	-ns-	-ns-	-ns-	0	0	-ns- [h]	0	-ns- [i]	-ns- [i]
Muddy River Sites									
Warm Springs Natural Area	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	0 [f]
Glendale	-ns-	-ns-	0	0	-ns- [i]	-ns- [i]	-ns- [i]	-ns- [i]	-ns- [i]
Bowman Canal	-ns-	-ns-	-ns-	-ns-	0	0	-ns- [i]	-ns- [i]	-ns- [i]
Grant Bowler Park	-ns-	-ns-	-ns-	0	0	0	-ns- [i]	-ns- [i]	-ns- [i]

Table 5 continued: Summary of San Bernardino County Museum Yuma Clapper Rail surveys along the Virgin and Muddy Rivers in Southern Nevada from 2000 through 2008. Numbers are the maximum number of detections. (-ns- = not surveyed)

	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Maverick Ditch	1	0	4	1	0	0	0	0	0
Honeybee Pond	1	0	0	2	0	0	0	3	7[m]
Pintail Pond	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	0 [j]	-ns- [i]	-ns- [i]
Blind 30	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	4[l]
South Marsh	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	2 [j]	14	1
Total Detections	**26**	**13**	**9**	**5**	**6**	**0**	**2**	**19**	**12**

a - Includes Beaver Dam Wash.
b - Site was split in half and surveyed since 2004 as additions to Little Field North and South.
c - Suitable habitat at Mesquite Upstream and Downstream sites has decreased through time. Sites were combined with Mesquite Bridge site and surveyed with same beginning in 2005.
d - Mormon Mesa sites have been referenced as "Overton" sites in past reports.
e - Includes observations of two fledglings.
f - Survey site new in 2008.
h- Habitat disturbed by floods or bulldozers during winter 2005 flood events.
i - No suitable habitat
j - Survey site new in 2006.
l- Site first established in 2008.
m-Includes 1 family group of 6.

Table 6: Summary of San Bernardino County Museum Yellow-billed Cuckoo surveys along the Virgin and Muddy Rivers in southern Nevada from 2000 through 2008. Numbers are number of detections. (-ns- = not surveyed)

	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Virgin River Sites									
Desert Springs	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	0	0	-ns-
Littlefield North	2	0	0	0	0	0	0	0	0
Littlefield South	-ns-[i]	-ns-[i]	-ns-[i]	-ns-[i]	-ns-[i]	-ns-[i]	-ns-[i]	-ns-[i]	0
Mesquite Bridge	1	0	0	1	0	-ns-[h, i]	-ns-[i]	-ns-[i]	-ns-[i]
Mesquite Bridge 2	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	0[j]	0	0
Mormon Mesa [k]	3-4	6-10	0	0	0	0	3	4	0
Virgin Delta West	-ns-	2[f]	0	-ns-	-ns-	-ns-[h, i]	-ns-[i]	-ns-[i]	-ns-[i]
Muddy River Sites									
Blind 30	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	2	0
Honeybee Pond	-ns-	-ns-	-ns-	0	0	1	0	0	0
Maintenance Sheds	-ns-	-ns-	-ns-	-ns-	-ns-	1	2	2	0
Mike's Site	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	-ns-	1[l]	0
Refuge Housing	-ns-	-ns-	-ns-	-ns-	-ns-	0	0	0	0

Table 6 continued: Summary of San Bernardino County Museum Yellow-billed Cuckoo surveys along the Virgin and Muddy Rivers in southern Nevada from 2000 through 2008. Numbers are number of detections. (-ns- = not surveyed)

	2000	2001	2002	2003	2004	2005	2006	2007	2008
Southwestern Willow Flycatcher	-ns-	-ns-	-ns-	-ns-	-ns-	0	0	0	-ns-
Warm Springs Natural Area [g]	-ns-	-ns-	-ns-	1	1	1	1	0	3
Willow Strip	-ns-	-ns-	-ns-	-ns-	-ns-	0	0	3	0
Total Detections	**6**	**10**	**0**	**2**	**1**	**3**	**6**	**12**	**3**

a - Includes Beaver Dam Wash.
b - Site was split in half and surveyed since 2004 as additions to Little Field North and South.
c - Suitable habitat at Mesquite Upstream and Downstream sites has been decreased over the years, so both sites were combined with Mesquite Bridge site and surveyed with same since 2004.
d - Mormon Mesa sites have been referenced as “Overton” sites in past reports.
e - Includes observations of two fledglings.
f - Nest, two eggs and fledglings.
g - Warm Springs Natural Area has been surveyed prior to 2003 by individuals not associated with SBCM. Site name prior to 2008 was Warm Springs Ranch.
h- Habitat disturbed by floods or bulldozers during winter 2005 flood events.
i - No suitable habitat
j - Survey site new in 2006.
k- Long Marsh, Big Marsh, and adjacent suitable habitats.
l - Site established in 2007.

Table 7: Incidental Southwestern Willow Flycatcher observations at the Warm Springs Natural Area during the 2008 Yuma Clapper Rail and Yellow-billed Cuckoo survey season. Coordinates are NAD27.

Date	UTM	Comments
29 May	11 0704167 E 4065430 N	Multiple *phitz-bews/whits* for extended periods of time over a large area. Same general area as subsequent observations on 12 June.
12 June	11 0704157 E 4065459 N	Seems to be a pair. *Phitz-bews/whits/wheeos* within a confined territorial area. Interactions with adjacent WIFL pair (see next entry).
12 June	11 0704137 E 4065521 N	Also seems to be a pair. *Phitz-bews/whits* within a confined territorial area. Interactions with adjacent WIFL pair (see previous entry).
12 June	11 0704170 E 4065407 N	Likely two adjacent pairs. Independent of the other 12 June observations. Multiple birds, *phitz-bews*, *whits*, counter singing, squabbling at territory boundary.
26 June	11 0704875 E 4065558 N	Two pairs. *Phitz-bews* at territorial boundaries, changing to *whitts*, occasional *wheeos*. Then silence for long periods of time.
26 June	11 0705125 E 4065678 N	One bird *phitz-bewing* briefly. Habitat is marginal at best. Likely not a breeding territory.
22 July	11 0704717 E 4065871 N	*Phitz-bews/whitts* for ~1.5 minutes then quiet. Occasional *whits* thereafter. One bird? Behavior suggests nest was likely present.
22 July	11 0704170 E 4065407 N	Same location as multiple pair observations on 12 June. Occasional *whits*, but could not locate bird(s).
22 July	11 0704127 E 4065561 N	Current year's nest, abandoned, no evidence that young occupied or fledged from nest.

Table 8: Incidental bird species detected during San Bernardino County Museum Yuma Clapper Rail and Yellow-billed Cuckoo surveys in 2008 along the Virgin and Muddy Rivers in southern Nevada. Detections are incidental and indicate presence only. Absence should not be inferred. See text, table 1, and figures for site locations.

Species	Littlefield North	Littlefield South	Mesquite Bridge 3	Mesquite Bridge	Big Marsh	Long Marsh	Maverick Ditch	Honeybee Pond [1]	Blind 30[1]	OWMA [2]	Warm Springs	Grant Bowler
Canada Goose			X					X	X	X		
Gadwall												
Mallard		X	X	X	X			X	X	X	X	
Cinnamon Teal			X		X			X	X	X		
Northern Shoveler								X	X			
American Widgeon									X			
Northern Pintail								X	X			
Blue-winged Teal									X	X		
Green-winged teal								X	X			
Redhead			X					X	X	X		
Canvasback									X			
Ring-necked Duck								X	X			
Greater Scaup									X			
Lesser Scaup								X	X			
Bufflehead									X	X		
Ruddy Duck								X	X			
Barrow's Golden-eye									X			
Common Golden-eye									X	X		
Ring-necked Pheasant								X	X		X	

Table 8 continued: Incidental bird species detected during San Bernardino County Museum Yuma Clapper Rail and Yellow-billed Cuckoo surveys in 2008 along the Virgin and Muddy Rivers in southern Nevada. Detections are incidental and indicate presence only. Absence should not be inferred. See text, table 1, and figures for site locations.

Species	Littlefield North	Littlefield South	Mesquite Bridge 3	Mesquite Bridge	Big Marsh	Long Marsh	Maverick Ditch	Honeybee Pond [1]	Blind 30[1]	OWMA [2]	Warm Springs	Grant Bowler
Turkey								X	X	X		
Domestic Rooster										X		
Peacock										X		
Gambel's Quail	X	X	X	X			X	X	X	X	X	X
Pied-billed Grebe								X	X	X		
Horned Grebe									X			
Eared Grebe				X				X	X			
Clark's Grebe								X	X	X		
Western Grebe								X	X	X		
American White Pelican									X			
Double-crested Cormorant								X	X			
Least Bittern			X	X				X	X	X		
Great Blue Heron		X	X	X	X			X	X	X	X	
Great Egret			X	X	X			X	X	X	X	
Snowy Egret			X	X				X	X	X		
Cattle Egret				X					X	X		
White-faced Ibis		X						X	X	X	X	
Green Heron			X	X				X	X			
Black-crowned Night-Heron					X			X	X	X	X	

AR074539

Table 8 continued: Incidental bird species detected during San Bernardino County Museum Yuma Clapper Rail and Yellow-billed Cuckoo surveys in 2008 along the Virgin and Muddy Rivers in southern Nevada. Detections are incidental and indicate presence only. Absence should not be inferred. See text, table 1, and figures for site locations.

Species	Littlefield North	Littlefield South	Mesquite Bridge 3	Mesquite Bridge	Big Marsh	Long Marsh	Maverick Ditch	Honeybee Pond [1]	Blind 30[1]	OWMA [2]	Warm Springs	Grant Bowler
Turkey Vulture	X		X	X	X		X	X		X	X	
Osprey										X		
Northern Harrier			X		X			X	X	X	X	
Sharp-shinned Hawk									X		X	
Cooper's Hawk			X					X			X	
Common Black-Hawk	X	X										
Red-tailed Hawk		X	X					X		X	X	
American Kestrel					X				X	X	X	
Merlin									X	X		
Prairie Falcon										X		
Peregrine Falcon									X	X		
Clapper Rail								X	X			
Virginia Rail			X	X	X		X	X	X	X	X	
Sora		X	X	X					X		X	
Common Moorhen			X	X				X	X	X		
American Coot		X	X	X	X			X	X	X		
Killdeer		X	X	X				X	X	X	X	
Black-necked Stilt									X			
American Avocet								X	X	X		
Greater Yellowlegs									X	X		

Table 8 continued: Incidental bird species detected during San Bernardino County Museum Yuma Clapper Rail and Yellow-billed Cuckoo surveys in 2008 along the Virgin and Muddy Rivers in southern Nevada. Detections are incidental and indicate presence only. Absence should not be inferred. See text, table 1, and figures for site locations.

Species	Littlefield North	Littlefield South	Mesquite Bridge 3	Mesquite Bridge	Big Marsh	Long Marsh	Maverick Ditch	Honeybee Pond [1]	Blind 30[1]	OWMA [2]	Warm Springs	Grant Bowler
Solitary Sandpiper											X	
Spotted Sandpiper	X	X		X					X	X	X	
Western Sandpiper									X	X		
Long-billed Curlew								X				
Long-billed Dowitcher									X	X	X	
Wilson's Snipe			X		X						X	
Ring-billed Gull								X	X			
California Gull									X			
Bonaparte's Gull									X			
Forster's Tern									X			
Caspian Tern								X	X	X		
White-winged Dove	X							X	X	X	X	
Mourning Dove	X	X	X	X	X	X	X	X	X	X	X	
Inca Dove											X	
Eurasian Collared Dove	X	X	X	X	X		X	X	X	X	X	
Yellow-billed Cuckoo											X	
Greater Roadrunner	X			X	X				X	X	X	X
Barn Owl											X	
Great Horned Owl	X										X	

AR074541

Table 8 continued: Incidental bird species detected during San Bernardino County Museum Yuma Clapper Rail and Yellow-billed Cuckoo surveys in 2008 along the Virgin and Muddy Rivers in southern Nevada. Detections are incidental and indicate presence only. Absence should not be inferred. See text, table 1, and figures for site locations.

Species	Littlefield North	Littlefield South	Mesquite Bridge 3	Mesquite Bridge	Big Marsh	Long Marsh	Maverick Ditch	Honeybee Pond [1]	Blind 30[1]	OWMA [2]	Warm Springs	Grant Bowler
Lesser Nighthawk					X	X					X	
White-throated Swift	X	X			X				X		X	
Black-chinned Hummingbird			X	X				X				
Anna's Hummingbird	X										X	
Costa's Hummingbird								X				
Belted Kingfisher					X				X			
Northern Flicker	X		X						X		X	
Ladder-backed Woodpecker	X				X						X	
Common Poorwill											X	
Western Wood-Pewee											X	
Willow Flycatcher											X	
Gray Flycatcher										X		
Cordilleran Flycatcher					X						X	
Black Phoebe			X					X		X	X	
Say's Phoebe			X	X		X	X	X		X	X	
Vermillion Flycatcher											X	
Ash-throated Flycatcher				X	X						X	
Brown-crested Flycatcher	X				X	X			X	X	X	

Table 8 continued: Incidental bird species detected during San Bernardino County Museum Yuma Clapper Rail and Yellow-billed Cuckoo surveys in 2008 along the Virgin and Muddy Rivers in southern Nevada. Detections are incidental and indicate presence only. Absence should not be inferred. See text, table 1, and figures for site locations.

Species	Littlefield North	Littlefield South	Mesquite Bridge 3	Mesquite Bridge	Big Marsh	Long Marsh	Maverick Ditch	Honeybee Pond [1]	Blind 30[1]	OWMA [2]	Warm Springs	Grant Bowler
Cassin's Kingbird					X					X	X	
Western Kingbird	X		X		X				X	X	X	
Loggerhead Shrike	X									X	X	
Arizona Bell's Vireo	X			X	X	X			X	X	X	
Warbling Vireo		X						X	X			
Common Raven	X	X	X	X	X					X	X	
Bushtit											X	
Tree Swallow	X	X			X				X		X	
Violet-green Swallow	X								X		X	
Cliff Swallow	X	X			X	X		X	X	X	X	
Northern Rough-winged Swallow	X	X	X	X	X	X		X	X	X	X	
Barn Swallow		X	X	X	X			X	X		X	
Verdin	X		X					X	X	X	X	X
Bewick's Wren	X		X	X	X	X					X	
Marsh Wren			X	X	X			X	X	X	X	
Ruby-crowned Kinglet									X	X		
Blue-gray Gnatcatcher											X	
Black-tailed Gnatcatcher	X		X		X			X	X	X	X	
American Robin		X									X	

Table 8 continued: Incidental bird species detected during San Bernardino County Museum Yuma Clapper Rail and Yellow-billed Cuckoo surveys in 2008 along the Virgin and Muddy Rivers in southern Nevada. Detections are incidental and indicate presence only. Absence should not be inferred. See text, table 1, and figures for site locations.

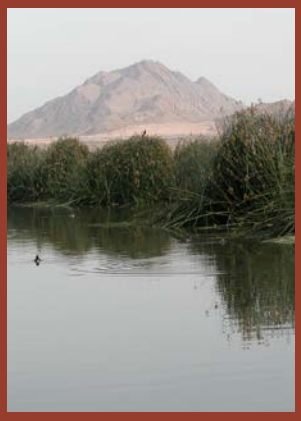
Species	Littlefield North	Littlefield South	Mesquite Bridge 3	Mesquite Bridge	Big Marsh	Long Marsh	Maverick Ditch	Honeybee Pond [1]	Blind 30[1]	OWMA [2]	Warm Springs	Grant Bowler
Northern Mockingbird								X	X	X	X	X
European Starling	X										X	
American Pipit					X	X					X	
Le Conte's Thrasher											X	
Crissal Thrasher										X	X	
Phainopepla									X		X	
Orange-crowned Warbler									X			
Lucy's Warbler					X	X					X	
Yellow-rumped Warbler	X				X			X	X			
Yellow Warbler [a]	X	X	X	X	X	X		X	X	X	X	X
Common Yellowthroat	X	X	X	X	X		X	X	X	X	X	
Wilson's Warbler								X			X	
Yellow-breasted Chat	X	X			X	X		X	X	X	X	
Summer Tanager	X										X	
Western Tanager	X	X	X		X					X	X	
Abert's Towhee	X	X	X		X	X	X	X	X	X	X	
Brewer's Sparrow							X					
Song Sparrow	X	X	X	X	X	X	X	X	X	X	X	X
Lincoln's Sparrow											X	

AR074544

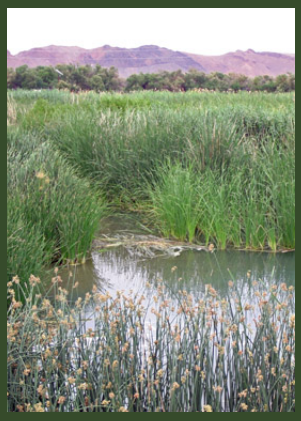
Table 8 continued: Incidental bird species detected during San Bernardino County Museum Yuma Clapper Rail and Yellow-billed Cuckoo surveys in 2008 along the Virgin and Muddy Rivers in southern Nevada. Detections are incidental and indicate presence only. Absence should not be inferred. See text, table 1, and figures for site locations.

Species	Littlefield North	Littlefield South	Mesquite Bridge 3	Mesquite Bridge	Big Marsh	Long Marsh	Maverick Ditch	Honeybee Pond [1]	Blind 30[1]	OWMA [2]	Warm Springs	Grant Bowler
White-crowned Sparrow				X	X			X		X	X	
Blue Grosbeak	X		X		X				X	X	X	
Brewer's Blackbird								X		X	X	
Red-winged Blackbird			X	X	X			X	X	X	X	X
Western Meadowlark								X			X	
Yellow-headed Blackbird			X	X				X	X	X	X	
Great-tailed Grackle			X	X				X	X	X	X	
Brown-headed Cowbird	X		X		X	X	X	X	X	X	X	
Hooded Oriole											X	
Bullock's Oriole	X				X				X	X	X	
Purple Finch	X	X										
House Finch	X	X		X	X			X	X	X	X	
Lesser Goldfinch	X	X							X		X	
House Sparrow								X		X		

a – Includes *marcomi* and *sonorana* races of the Yellow Warbler.
1 – Located on the OWMA.
2 – Combination of Refuge Housing, South Marsh, Willow Strip and Mike's Site.









las vegas wash coordination committee

lvwash.org

Marsh Bird Monitoring, including Yuma Clapper Rail, along Las Vegas Wash, Clark County, Nevada, 2011



January 2012

SOUTHERN NEVADA WATER AUTHORITY

Las Vegas Wash Coordination Committee

AR074547

Marsh Bird Monitoring, including Yuma Clapper Rail, along Las Vegas Wash, Clark County, Nevada, 2011

SOUTHERN NEVADA WATER AUTHORITY
Las Vegas Wash Project Coordination Team

Prepared for:

U.S. Fish and Wildlife Service
Southern Nevada Field Office

and

Las Vegas Wash Coordination Committee

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January 2012

ABSTRACT

The Las Vegas Wash Coordination Committee, a 29-member stakeholder group, is working to stabilize and enhance the Las Vegas Wash (Wash), the channel that drains flows from the Las Vegas Valley to Lake Mead at Las Vegas Bay. The Wash also flows through the 2900-acre Clark County Wetlands Park. Activities associated with the stabilization program and park development include wetland revegetation and expansion. During informal Section 7 consultation on the project, the U.S. Fish and Wildlife Service recommended that annual surveys for Yuma clapper rail (*Rallus longirostris yumanensis*) be conducted during the breeding season to determine the species occurrence within the park. Surveys were conducted by permitted consultants nearly annually from 2000 through 2007 (McKernan and Braden 2001, 2002; SWCA 2002, 2003, 2005, 2006, 2007, 2008). Wanting to obtain information on all secretive marsh bird species that may benefit from wetland enhancement in the study area, the Las Vegas Wash Project Coordination Team began a study using the standardized North American marsh bird monitoring protocol (Conway 2005) in 2007 (Van Dooremolen 2010a).

Six species were targeted during the 2011 surveys: American bittern, least bittern, black rail, clapper rail, Virginia rail, and sora. Detections of pied-billed grebe, common gallinule (formerly common moorhen), and American coot (referred to as non-target species) were also recorded. Surveys were conducted along three survey routes comprising 24 points. No clapper rail, black rail or American bittern were detected. Least bittern, Virginia rail, and sora were detected, as were the three non-target species. Sora continued to be the most abundant of the target species. Including non-target species, American coot was the most abundant. Abundances were greater than or within the range of values from the prior four years of surveys for all species detected. Virginia rail abundance increased the most, with the majority of the detections occurring on the route in the in-lieu fee mitigation ponds (Route 4), which increased from a partial route of just three points in 2010 to a full route of nine points in 2011. The route had the highest total abundance of target and non-target species overall and offers perhaps the widest variety of wetland habitat currently available in the study area. Annual marsh bird surveys along the Wash should continue in order to comply with informal Section 7 consultation measures regarding Yuma clapper rail and to determine whether changes or stability in the abundances of the other marsh bird species represent actual trends.

ACKNOWLEDGEMENTS

I would like to thank the Bureau of Reclamation for providing partial funding to the Southern Nevada Water Authority for this project under assistance agreement number R09AP30017. I would also like to extend my thanks to Seth Shanahan, Marissa Foster, and Carol Lane for assisting with surveys. In addition, I would like to thank Lake Las Vegas Resort for allowing access to their mitigation wetlands. Finally, I would like to thank the Las Vegas Wash Coordination Committee for their continued support for wildlife monitoring research and the implementation of the Las Vegas Wash Comprehensive Adaptive Management Plan and Las Vegas Wash Wildlife Management Plan. These activities have been conducted by Deborah Van Dooremolen under permit no. TE-148556-1 (expired October 11, 2011; renewal in process) and Seth Shanahan under permit no. TE-231424-0 (expires March 18, 2013) as issued by the U.S. Fish and Wildlife Service, Sacramento, California.

Marsh Bird Monitoring, including Yuma Clapper Rail, along Las Vegas Wash, Clark County, Nevada, 2011

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Table 2. Total and per point abundances for 2011 for the 24 points surveyed (Route 2, n=9; Route 3, n=6; Route 4, n=9). LEBI=Least Bittern, VIRA= Virginia Rail, SORA=Sora, PBGR=Pied-billed Grebe, COGA=Common Gallinule (formerly Common Moorhen), AMCO= American Coot. 7

Table 3. Total and per point abundances by year and route for 2007-2010. AMBI=American Bittern, LEBI=Least Bittern, VIRA= Virginia Rail, SORA= Sora, PBGR=Pied-billed Grebe, COGA=Common Gallinule (formerly Common Moorhen), AMCO= American Coot. Route 1, n=9 points in all years but 2010 where n=3; Route 2 n=8 in all years but 2010 where n=9; Route 3, n=7 in 2007, n=9 in 2008, n=8 in 2009 and n=6 in 2010; Route 4 (added in 2010), n=3 8

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Appendix A GPS Coordinates for 2011 Marsh Bird Monitoring Points

1.0 BACKGROUND

The Las Vegas Wash (Wash) is the primary drainage channel for the Las Vegas Valley carrying urban flows, including highly treated wastewater, urban runoff, shallow groundwater, and storm runoff, into Lake Mead at Las Vegas Bay (Figure 1). Although originally an ephemeral stream, the Wash began supporting perennial flows in the 1950s when the discharge of treated wastewater into the channel was initiated. At first these perennial flows created a lush wetland along the channel. However, the volume of flows in the Wash continued to increase with the increasing urban population, and erosion began to drain the wetlands and carry thousands of tons of sediment to Lake Mead. By the late 1990s, headcutting had deeply incised the channel and reduced the wetlands by approximately 90 percent from their peak extent, leaving less than 200 acres.

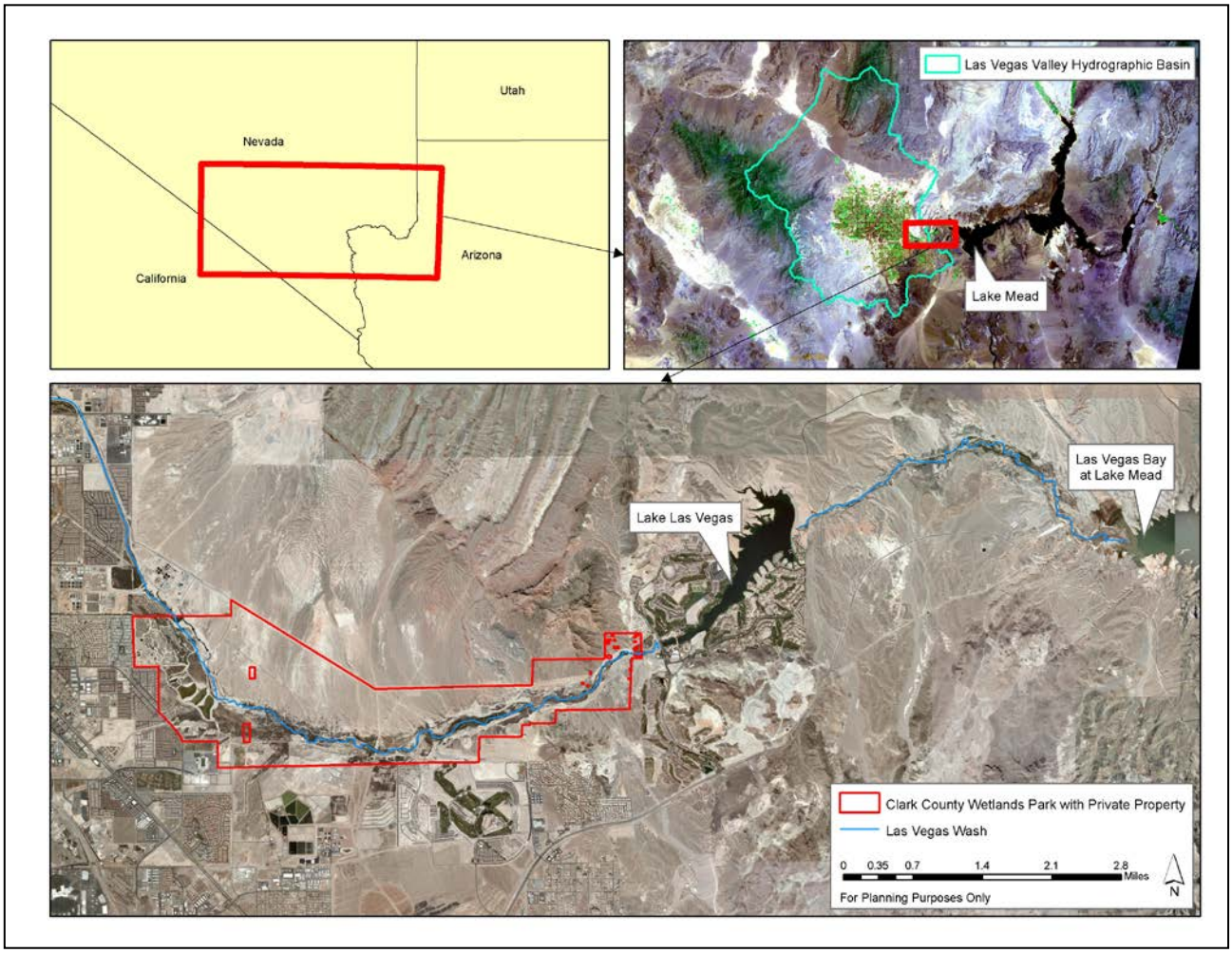

Figure 1: Las Vegas Wash location and general study area map.

In 1998, the Las Vegas Wash Coordination Committee (LVWCC), a now 29-member community stakeholder group, was created to address the degradation of the Wash. The group developed and is implementing the Las Vegas Wash Comprehensive Adaptive Management Plan

to stabilize the Wash and restore its ecological functions. Stabilization and enhancement activities, which include the construction of 22 erosion control structures (weirs) and extensive revegetation, will help deter further erosion and reduce the amount of sediment being deposited in Lake Mead; 12 weirs were in place by spring 2011.

The LVWCC is increasing wetland habitat along the channel by planting bulrush (*Schoenoplectus* spp.) in the impoundments of the weirs and along the weir faces, and cattail (*Typha domingensis*) and common reed (*Phragmites australis*) volunteer from upstream seed sources. Emergent vegetation can also be found in the constructed wetland ponds in the nearby Nature Preserve, the developed portion of the Clark County Wetlands Park (Wetlands Park) through which the Wash flows. The county has created additional wetland habitat within the Wetlands Park in the form of the in-lieu fee mitigation ponds (Figure 2). The increase in wetland habitat along the Wash and throughout the Wetlands Park could have a positive impact on secretive marsh birds (e.g., rails and bitterns), including the federally endangered Yuma clapper rail (*Rallus longirostris yumanensis*).

The Yuma clapper rail is largely restricted to the lower Colorado River watershed and the Salton Sea, inhabiting freshwater and brackish water wetlands (Anderson and Ohmart 1985). Home range size varies seasonally and is greatest during winter and post-breeding (Eddleman 1989, Conway et al. 1993). Eddleman (1989) reported a mean annual home range size of more than 17 acres, while Conway et al. (1993) reported mean annual home range size to be 30 acres. Sites occupied by Yuma clapper rail have a higher percent cover of shallow water (Eddleman 1989). Density of emergent vegetation has also been reported as an important habitat variable although findings differ. Anderson and Ohmart (1985) found that Yuma clapper rail typically reached their highest numbers year-round in the densest stands of emergent vegetation, while Conway et al. (1993) found low stem densities to be an important component. Species preferences also vary. Conway et al. (1993) found that cattail and bulrush are preferred, although Yuma clapper rails have also been detected in wetlands dominated by common reed, salt cedar (*Tamarix ramosissima*) and willow (*Salix* spp.; Eddleman 1989, Hinojosa-Huerta et al. 2001). Differences in preferred density and species of emergent vegetation among different geographic locations may relate to densities of crayfish, the most abundantly consumed prey item of the Yuma clapper rail (Anderson and Ohmart 1985). Habitat use also changes throughout the year, thus Conway et al. (1993) suggest that maintaining shallow, open water areas with stands of emergent vegetation at different successional stages would best support clapper rails year-round.

Alcorn (1988) reported that eight clapper rails were observed in the Las Vegas Sewage disposal drainage ditch on September 6, 1959, and that a lone individual was observed in the same location a few weeks later (the site of the detections is believed to be the present-day City of Las Vegas Water Pollution Control Facility discharge channel, located approximately 1.5 miles upstream of the Wetlands Park boundary; Figure 2). A Yuma clapper rail was also detected along the Wash, within the Wetlands Park, on May 28 and June 18, 1998, in a wet, salt cedar-dominated area upstream of Pabco Road Weir (Southwest Wetlands Consortium 1998; Figure 2). As a result, during informal Section 7 consultation on the proposed development of the Wetlands Park and associated erosion control structures, the U.S. Fish and Wildlife Service required that the Southern Nevada Water Authority (SNWA), the lead agency of the LVWCC, conduct annual surveys to determine the breeding status of Yuma clapper rail within the Wetlands Park.

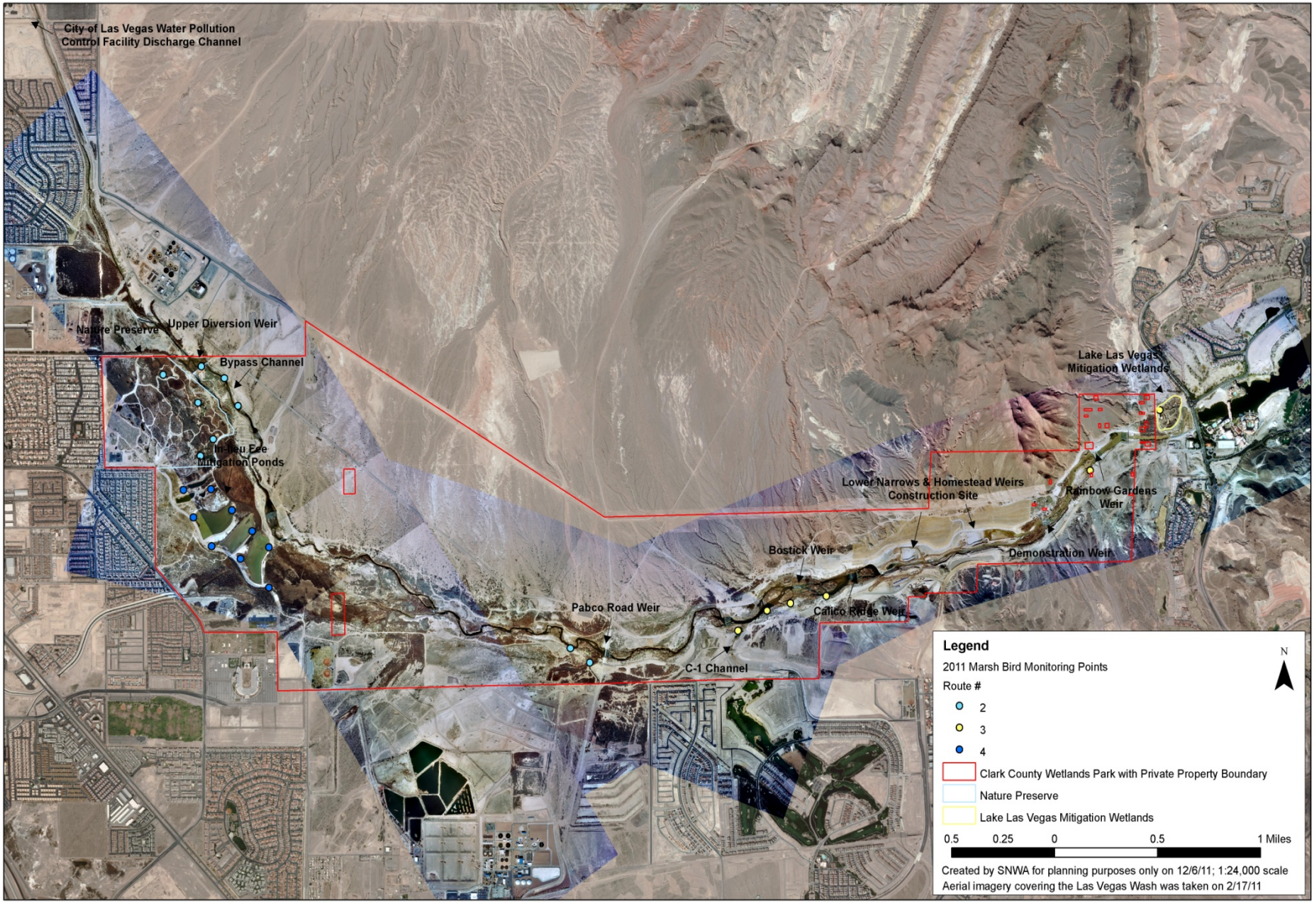

Figure 2: Historical clapper rail detection areas and 2011 marsh bird monitoring points.

SNWA contracted with permitted consultants to perform these surveys from 2000 to 2004 and 2006 to 2007. No Yuma clapper rails were detected from 2000 to 2004, nor in 2007 (Mckernan and Braden 2001, 2002; SWCA 2002, 2003, 2005, 2008). A Yuma clapper rail was detected on May 23, 2005, during surveys for other species. It was calling from emergent habitat in the impoundment of the Demonstration Weir (SWCA 2006; Figure 2). Another was detected in the marsh along the C-1 Channel near where it discharges to the Wash on June 4 and June 7, 2006, also during surveys for other species (SWCA 2007; Figure 2). The portion of the channel where the bird was detected has since been lined with rock and concrete, but emergents are returning.

Conway (2005) developed a protocol for conducting marsh bird monitoring surveys that includes calling for clapper rail. The U.S. Fish and Wildlife Service accepted this protocol as the new official Yuma clapper rail survey protocol in 2006. The survey protocol enables compliance obligations regarding the clapper rail to be met, while also providing information on the status, abundance and distribution of other sensitive species, such as the least bittern (*Ixobrychus exilis*) and black rail (*Laterallus jamaicensis*), which are covered on the Lower Colorado River Multi-Species Conservation Program, that may benefit from wetland revegetation efforts. Consequently in 2007, the Las Vegas Wash Project Coordination Team, the implementation team of the LVWCC, initiated a marsh bird monitoring study along the Wash and within the Wetlands Park (Van Dooremolen 2010a, Van Dooremolen 2010b). Yuma clapper rail could not be surveyed for the first year because the necessary federal permit was not in place. The species was added to the survey in 2008. Results described below are from the 2011 monitoring season.

2.0 METHODS

2.1 Description of Survey Routes

Three routes were surveyed in 2011 along the Wash both within and adjacent to the Wetlands Park (Figure 2). GPS coordinates of the points are included in Appendix A.

Route 1, located upstream of the Wetlands Park between the Clark County Water Reclamation District and the City of Las Vegas Water Pollution Control Facility, was not surveyed in 2011. The cattail habitat had been largely degraded in 2010 and the decision was made to discontinue surveys along the route in favor of surveying a new route in the in-lieu fee mitigation ponds.

Route 2 included nine points in 2011: four within the constructed wetlands ponds at the Nature Preserve, one in the Upper Diversion Weir impoundment, two along the bypass channel, and two along the Wash upstream of Pabco Road Weir (Figure 2). The Nature Preserve ponds (3-acre lower pond, 1.5-acre middle pond complex, and 1.5-acre upper pond) have varying amounts of open water and the vegetation is composed of cattails, California, and hardstem bulrush (*S. californicus* and *S. acutus*), common reed, sandbar willow (*Salix exigua*), Goodding willow (*S. gooddingii*) and cottonwood (*Populus fremontii*). The Upper Diversion Weir point covers the 3.5-acre cattail complex in the impoundment. The bypass channel points include three acres of emergent marsh dominated by bulrush and cattails with some sandbar and Goodding willow and other woody riparian species. The points at Pabco Road Weir cover approximately six acres of wetland habitat, with two points upstream of the weir. The emergent habitat is dominated by cattail and common reed with stands of sandbar and Goodding willows and cottonwood interspersed. The water upstream of the weir is slow-moving and includes a small backwater pond and wetlands created by the City of Henderson Water Reclamation Facility outfall channel.

Route 3 included six points (40 acres of habitat) in 2011 (Figure 2); two additional points were inaccessible or impacted by excessive noise due to construction and so were not surveyed in 2011. The route begins in the small backwater wetland at the discharge of the C-1 Channel into the Wash and continues downstream to the Lake Las Vegas mitigation wetlands, an off-channel wetland located on private property just east of the Wetlands Park boundary. It includes points sampling the impoundments of Bostick Weir, Calico Ridge Weir, and Rainbow Gardens Weir (Figure 2) that have banks and islands covered in cattail, hardstem bulrush, common reed and Goodding willow with lesser amounts of sandbar willow and cottonwood.

Route 4, created as a partial route (three points) in 2010, was expanded to a full route in 2011 of nine points (60 acres of habitat; Figure 2). The route is located in the in-lieu fee mitigation ponds created by Clark County. Eight points were established on the ponds and one immediately to the southeast of the ponds, which covers habitat flooded by Duck Creek. The two points on the smaller ponds are dominated by relatively monotypic stands of cattail with very limited open water. The five points on the larger ponds are dominated by open water (both shallow and deep); vegetation occurs predominantly on the banks in the form of stringers of cattail, bulrush and common reed of varying width. The habitat at the point immediately adjacent to the mitigation ponds consists primarily of cattails, flooded tamarisk, and common reed. The point at the Tropicana Outfall, surveyed the previous year, was dropped.

Along each route, survey points were established a minimum of 656 feet apart. Although Conway (2005) recommends a separation of 1,312 feet, the Wash does not contain enough emergent marsh habitat to allow for such wide spacing while still maintaining a sufficient number of points per route.

2.2 Survey Protocol

Surveys were performed using the North American marsh bird monitoring protocol developed by Conway (2005). Trained observers conducted the surveys during the breeding season in April and May. Four surveys of each route were conducted. Each route was surveyed on a separate day. Two observers conducted each survey, including at least one permitted individual (Deborah Van Dooremolen [TE-148556-1], Seth Shanahan [TE-231424-0]). Surveys began one half hour before sunrise and concluded by 9 a.m. Although Conway (2005) specifies that the survey route be run in the same direction every time, each route was run in reverse every other survey to ensure that most points were surveyed during the earliest morning hours (the time of peak marsh bird vocalization). Surveys were not conducted if wind reached or exceeded 12 miles per hour, as measured by the Beaufort wind scale, for more than two points.

At each point, surveys began with a five-minute period of passive listening followed by broadcasting the vocalizations of each target species in succession to elicit a response. Target species for the Wash survey included American bittern (*Botaurus lentiginosus*), least bittern, black rail, clapper Rail, Virginia rail (*Rallus limicola*), and sora (*Porzana carolina*). Each species' vocalizations were broadcast for 30 seconds, followed by 30 seconds of silence to listen for responses, for a total of one minute per species. Species' vocalizations were broadcast in succession from most sensitive (i.e., likely to be deterred from responding by hearing the call of another species) to least sensitive: black rail, least bittern, sora, Virginia rail, clapper rail, and American bittern. Vocalizations were broadcast using MP3 players with portable speakers. The

observer(s) recorded all target species heard and/or seen during the survey, making a separate record for each bird and noting each minute of the survey period in which it was heard calling and/or seen. Individuals were also recorded if they were heard or seen at the point immediately before or after the survey. Detections of three other marsh bird species that were not targeted through the broadcast were also recorded, including pied-billed grebe (*Podilymbus podiceps*), common gallinule (formerly common moorhen; *Gallinula chloropus*), and American coot (*Fulica americana*). Given the sheer numbers of coots present at some points, observers often counted them either before or after the survey. Other data collected include the call type heard, the distance and direction to each detected bird, and whether the bird was detected at a previous point. The background noise level was also recorded at each point. Noise designated as loud or intense meant that at least some species could not be heard beyond approximately 165 or 80 feet, respectively.

2.3 Data Analysis

Points had to be surveyed a minimum of three times under appropriate conditions (wind below 12 miles per hour, no loud or intense noise, etc.) to be used in the analysis. Detections of target and non-target species were summarized by route and date to provide an overall picture of when and where birds were detected. However, since multiple detections could be made of the same bird over the course of a survey season, the number of individuals (abundance) per species along each route was also calculated. This number was calculated as the sum of the maximum number of birds of the species that were detected at each point during the season. Whether or not a bird was counted as a unique individual was determined by the following criteria. If one or more individuals of a species were detected at the same point on more than one survey, they were considered to be the same individual(s). If an individual had been detected at a previous point during a survey, the second survey detection was not counted. If an individual was detected at a point within 656 feet of a location where an individual had been detected on a prior survey, and the individual was calling from approximately the same direction where the other bird had been detected, it was considered to be the previously detected bird and was not counted as a new individual. This yielded an estimate of the minimum number of individuals present (referred to as total abundance) for each species.

For each route, the total number of individuals detected of each species, the total number of individuals detected of target species, and the total number of individuals detected regardless of species were divided by the number of points the route contained, yielding a per point abundance for each. Then for the study area as a whole, the total number of individuals detected of each species, the total number of individuals detected of target species, and the total number of individuals detected regardless of species were divided by the total number of points surveyed to yield the total abundance per point for each. Per point abundance provides a more accurate comparison between routes because different numbers of points were surveyed.

3.0 RESULTS

Of the target species, least bittern, Virginia rail, and sora were detected (Table 1). Sora and least bittern were detected on all routes; Virginia rail was detected on Routes 3 and 4. The three non-target species were detected on all routes, and both common gallinule and American coot were identified on all survey replicates on all routes (Table 1).

Route	Date	LEBI	VIRA	SORA	PBGR	COGA	AMCO	Grand Total
2	4/5/2011	1		5	2	7	53	68
	4/20/2011	3		3		5	11	22
	5/3/2011	2			4	2	5	13
	5/17/2011					2	5	7
2 Total		6	0	8	6	16	74	110
3	4/11/2011	2	2	1	2	5	65	77
	4/21/2011			2		3	12	17
	5/4/2011					3	4	7
	5/19/2011	2				3	6	11
3 Total		4	2	3	2	14	87	112
4	4/4/2011		3	5	6	6	46	66
	4/18/2011	2	3	3	3	2	45	58
	5/2/2011	1	9	8	3	4	17	42
	5/16/2011		6		2	2	9	19
4 Total		3	21	16	14	14	117	185
Grand Total		13	23	27	22	44	278	407

Table 1. Total 2011 detections for each species by route and date for the 24 points surveyed (Route 2, n=9; Route 3, n=6; Route 4, n=9). LEBI=Least Bittern, VIRA=Virginia Rail, SORA=Sora, PBGR=Pied-billed Grebe, COGA=Common Gallinule (formerly Common Moorhen), AMCO=American Coot.

Sora was the most abundant of the target species with 0.67 individuals per point (Table 2). American coot was the most abundant of all species with more than seven birds per point, and common gallinule was a distant second at 1.17 birds per point (Table 2).

Route 4, had the highest per point abundance of target species overall and of sora and Virginia rail (Table 2). Least bittern per point abundance was highest on Route 2. Total (all species) per point abundance was highest on Route 3 due primarily to its having the highest abundance of American coots.

	Target Species (TS) abundance (per point)				Non-target Species abundance (per point)			
Route	**LEBI**	**VIRA**	**SORA**	**Total TS**	**PBGR**	**COGA**	**AMCO**	**Grand Total**
2	4 (0.44)	0 (0.00)	5 (0.56)	9 (1.00)	5 (0.56)	11 (1.22)	54 (6.00)	79 (8.78)
3	2 (0.33)	2 (0.33)	2 (0.33)	6 (1.00)	2 (0.33)	8 (1.33)	65 (10.83)	81 (13.50)
4	2 (0.22)	11 (1.22)	9 (1.00)	22 (2.44)	7 (0.78)	9 (1.00)	56 (6.22)	94 (10.44)
Grand Total	8 (0.33)	13 (0.54)	16 (0.67)	37 (1.54)	14 (0.58)	28 (1.17)	175 (7.29)	254 (10.58)

Table 2. Total and per point abundances for 2011 for the 24 points surveyed (Route 2, n=9; Route 3, n=6; Route 4, n=9). LEBI=Least Bittern, VIRA=Virginia Rail, SORA=Sora, PBGR=Pied-billed Grebe, COGA=Common Gallinule (formerly Common Moorhen), AMCO=American Coot.

4.0 DISCUSSION

As in the prior four years of the study (Table 3), no Yuma clapper rail or black rail were detected. There have been no detections of Yuma clapper rail on the Wash now since 2006, making it highly unlikely that there are breeding individuals in the study area at this time. However, breeding colonies exist within approximately 40 miles, on the Muddy River and in the Overton Wildlife Management Area, making colonization a continuing possibility. American bittern has only been detected in one year (Table 3).

		Target Species (TS) abundance (per point)					**Non-target Species** abundance (per point)			
Year	**Route**	**AMBI**	**LEBI**	**VIRA**	**SORA**	**Total TS**	**PBGR**	**COGA**	**AMCO**	**Grand Total**
2007	1	0 (0.00)	1 (0.11)	4 (0.44)	7 (0.78)	12 (1.33)	1 (0.11)	1 (0.11)	15 (1.67)	29 (3.22)
	2	0 (0.00)	4 (0.50)	2 (0.25)	5 (0.63)	11 (1.38)	7 (0.88)	14 (1.75)	81 (10.13)	113 (14.13)
	3	0 (0.00)	4 (0.57)	1 (0.14)	2 (0.29)	7 (1.00)	4 (0.57)	13 (1.86)	68 (9.71)	92 (13.14)
2007 Total		0 (0.00)	9 (0.38)	7 (0.29)	14 (0.58)	30 (1.25)	12 (0.50)	28 (1.17)	164 (6.83)	234 (9.75)
2008	1	0 (0.00)	0 (0.00)	4 (0.44)	6 (0.67)	10 (1.11)	1 (0.11)	1 (0.11)	20 (2.22)	32 (3.56)
	2	0 (0.00)	2 (0.25)	0 (0.00)	5 (0.63)	7 (0.88)	4 (0.50)	15 (1.88)	41 (5.13)	67 (8.38)
	3	0 (0.00)	9 (1.00)	1 (0.11)	5 (0.56)	15 (1.67)	5 (0.56)	12 (1.33)	151 (16.78)	183 (20.33)
2008 Total		0 (0.00)	11 (0.42)	5 (0.19)	16 (0.62)	32 (1.23)	10 (0.38)	28 (1.08)	212 (8.15)	282 (10.85)
2009	1	0 (0.00)	2 (0.22)	2 (0.22)	5 (0.56)	9 (1.00)	0 (0.00)	0 (0.00)	4 (0.44)	13 (1.44)
	2	0 (0.00)	2 (0.25)	0 (0.00)	6 (0.75)	8 (1.00)	4 (0.50)	11 (1.38)	46 (5.75)	69 (8.63)
	3	0 (0.00)	2 (0.25)	2 (0.25)	5 (0.63)	9 (1.13)	4 (0.50)	13 (1.63)	97 (12.13)	123 (15.38)
2009 Total		0 (0.00)	6 (0.24)	4 (0.16)	16 (0.64)	26 (1.04)	8 (0.32)	24 (0.96)	147 (5.88)	205 (8.20)
2010	1	0 (0.00)	0 (0.00)	2 (0.67)	3 (1.00)	5 (1.67)	0 (0.00)	0 (0.00)	0 (0.00)	5 (1.67)
	2	0 (0.00)	2 (0.22)	2 (0.22)	7 (0.78)	11 (1.22)	3 (0.33)	11 (1.22)	28 (3.11)	53 (5.89)
	3	0 (0.00)	2 (0.25)	0 (0.00)	3 (0.50)	5 (0.83)	1 (0.17)	10 (1.67)	50 (8.33)	66 (11.00)
	4	1 (0.33)	0 (0.00)	3 (1.00)	3 (1.00)	7 (2.33)	0 (0.00)	2 (0.67)	3 (1.00)	12 (4.00)
2010 Total		1 (0.05)	4 (0.19)	7 (0.33)	16 (0.76)	28 (1.33)	4 (0.19)	23 (1.10)	81 (3.86)	136 (6.48)
Grand Total		1 (0.01)	30 (0.31)	23 (0.24)	62 (0.65)	116 (1.21)	34 (0.35)	103 (1.07)	604 (6.29)	857 (8.93)

Table 3. Total and per point abundances by year and route for 2007-2010. AMBI=American Bittern, LEBI=Least Bittern, VIRA=Virginia Rail, SORA=Sora, PBGR=Pied-billed Grebe, COGA=Common Gallinule (formerly Common Moorhen), AMCO=American Coot. Route 1, n=9 points in all years but 2010 where n=3; Route 2 n=8 in all years but 2010 where n=9; Route 3, n=7 in 2007, n=9 in 2008, n=8 in 2009 and n=6 in 2010; Route 4 (added in 2010), n=3.

The other three target species have been identified in all survey years (Tables 2 and 3). Of these, sora total abundance at 16 birds was the same as in all prior years but 2007, while per point abundance was in the middle of the range established in previous years. Although sora has always been the most abundant of the target species detected, it is also the only one of the three for which breeding status is still questionable. As in most years (2010 being the only exception), no sora were detected in the fourth survey and sora breeding has not been confirmed during the study. It is possible that most, if not all, detections are of overwintering individuals that haven't yet departed for their breeding grounds and migrating birds passing through the area. (See Van

Dooremolen 2010a and 2010b for further discussion on the status of sora and the other species in the Wash.)

Virginia rail total and per point abundance reached their peaks in 2011 at nearly twice the value of any previous year (Tables 2 and 3). The large increase is due to detections on Route 4. As a partial route in 2010, it had a high per point abundance of the species, and that abundance increased in 2011. The mitigation ponds and adjacent area clearly offer the best habitat for Virginia rail in the study area.

Least bittern total and per point abundance increased from the lower values of the past few years and were approximately in the middle of the range established from 2007-2010 (Tables 2 and 3).

Route 4 had the highest total and per point abundances (by a large margin) of target species overall and of sora and Virginia rail. It also had the highest total abundance when including all species, although Route 3 had the highest abundance per point. Route 4 offers perhaps the widest variety of wetland habitat currently available in the study area, which likely accounts for the high abundance values recorded there.

5.0 RECOMMENDATIONS

Annual variations in the abundances of individual bird species are common, so more years of data are needed to show whether the changes in some species' abundances and the stability in others represent actual trends. Also, annual monitoring for Yuma clapper rail is needed to comply with informal Section 7 consultation measures. It is recommended that marsh bird monitoring continue in 2012.

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Appendix A

GPS Coordinates for 2011
Marsh Bird Monitoring Points

Route	Point	Eastings	Northings	Comments
2	1	678178	3996968	
2	1.5	678276	3997090	
2	2	678155	3997357	
2	3	677879	3997558	
2	4.5	678178	3997623	
2	4.6	678357	3997540	
2	4.7	678468	3997338	
2	5	681090	3995598	
2	6	681245	3995496	
3	1.5	682400	3995747	
3	2	682626	3995895	
3	3	682808	3995954	
3	4	683088	3996010	
3	7	685136	3996960	
3	8	685673	3997411	
4	0.5	678726	3996304	
4	1	678730	3996008	Same as in 2010
4	2.5	678502	3996216	Moved pt 2 from 2010 across road to pond 6, so changed name to 2.5
4	3.5	678591	3996420	Dropped pt 3 from 2010 (Tropicana Outfall) and created 3.5 on pond 5
4	4	678276	3996306	
4	5	678130	3996515	
4	6	678051	3996715	
4	7	678266	3996725	
4	8	678431	3996573	

U.S. Fish & Wildlife Service

Addressing Avian Impacts at Solar Projects

XXXXX name

Add forum for presentation



Solar Popularity Globally

Projects in China:

- 23 Gigawatts Installed
- Goal of 35 Gigawatts in 2015

Projects in Japan:

15 Gigawatts Installed

- Goal of 28 Gigawatts in 2020

1GW = 1 billion watts

Projects in US:

- 16 Gigawatts Installed - powers about 3 million homes
- Approx. ½ of this is in CA

DOI Renewable Goals



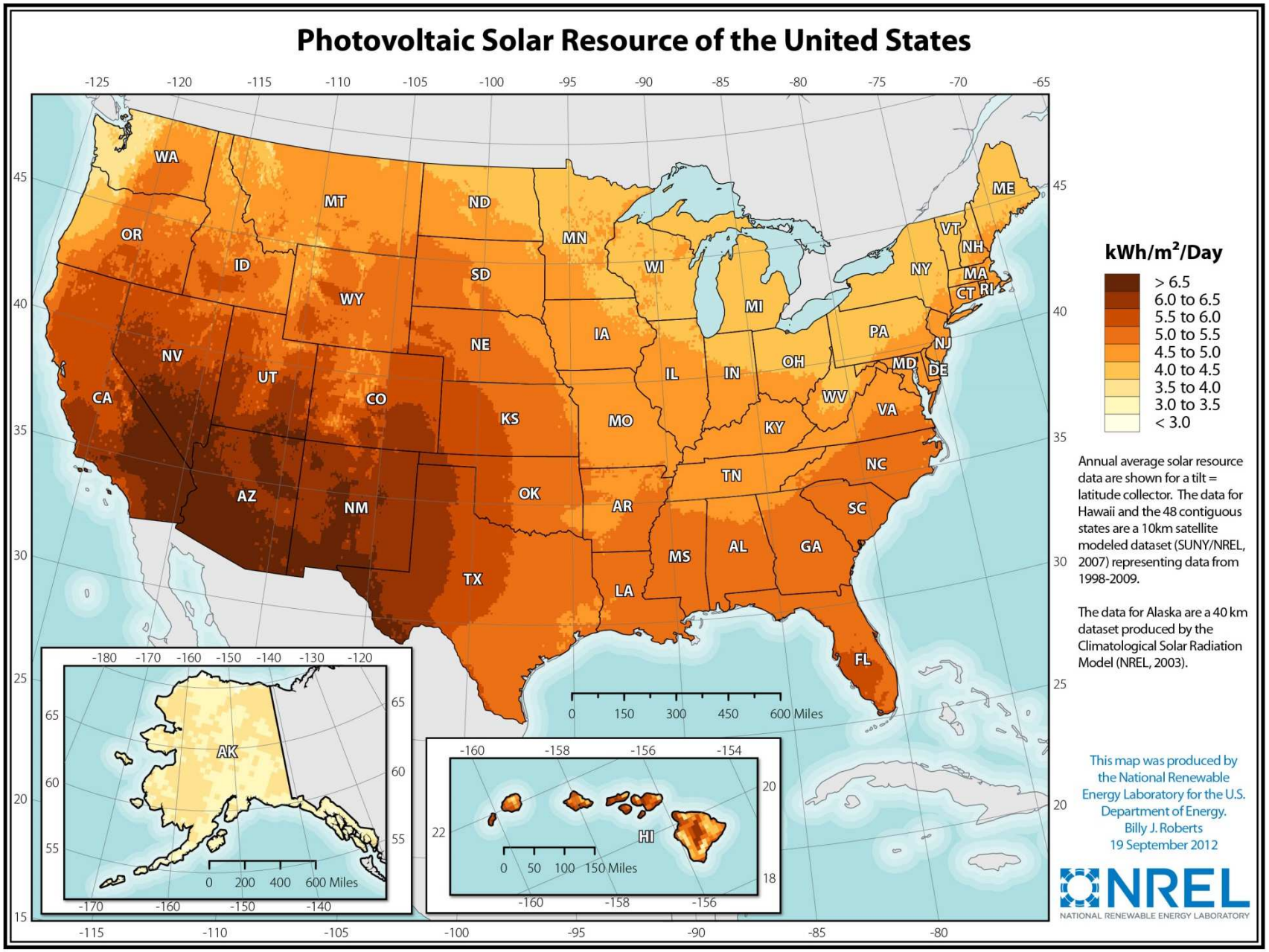
Projects on BLM land approved since 2009 will:

- Produce >10,000 MW of energy
- Power about 3,500,000 homes
- Create about 13,000 jobs



Streamlined Permitting

- Many solar projects permitted in under 18 months
- Standard practices would have taken 24 months or more


Photovoltaic Solar Resource of the United States
kWh/m²/Day
> 6.5
6.0 to 6.5
5.5 to 6.0
5.0 to 5.5
4.5 to 5.0
4.0 to 4.5
3.5 to 4.0
3.0 to 3.5
< 3.0
Annual average solar resource data are shown for a tilt = latitude collector. The data for Hawaii and the 48 contiguous states are a 10km satellite modeled dataset (SUNY/NREL, 2007) representing data from 1998-2009.
The data for Alaska are a 40 km dataset produced by the Climatological Solar Radiation Model (NREL, 2003).
This map was produced by the National Renewable Energy Laboratory for the U.S. Department of Energy.
Billy J. Roberts
19 September 2012
NREL
NATIONAL RENEWABLE ENERGY LABORATORY
0 150 300 450 600 Miles
0 200 400 600 Miles
0 50 100 150 Miles
WA
OR
CA
ID
NV
MT
WY
UT
AZ
CO
NM
ND
SD
NE
KS
OK
TX
MN
IA
MO
AR
LA
WI
IL
MS
MI
IN
KY
TN
AL
OH
WV
GA
FL
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MA
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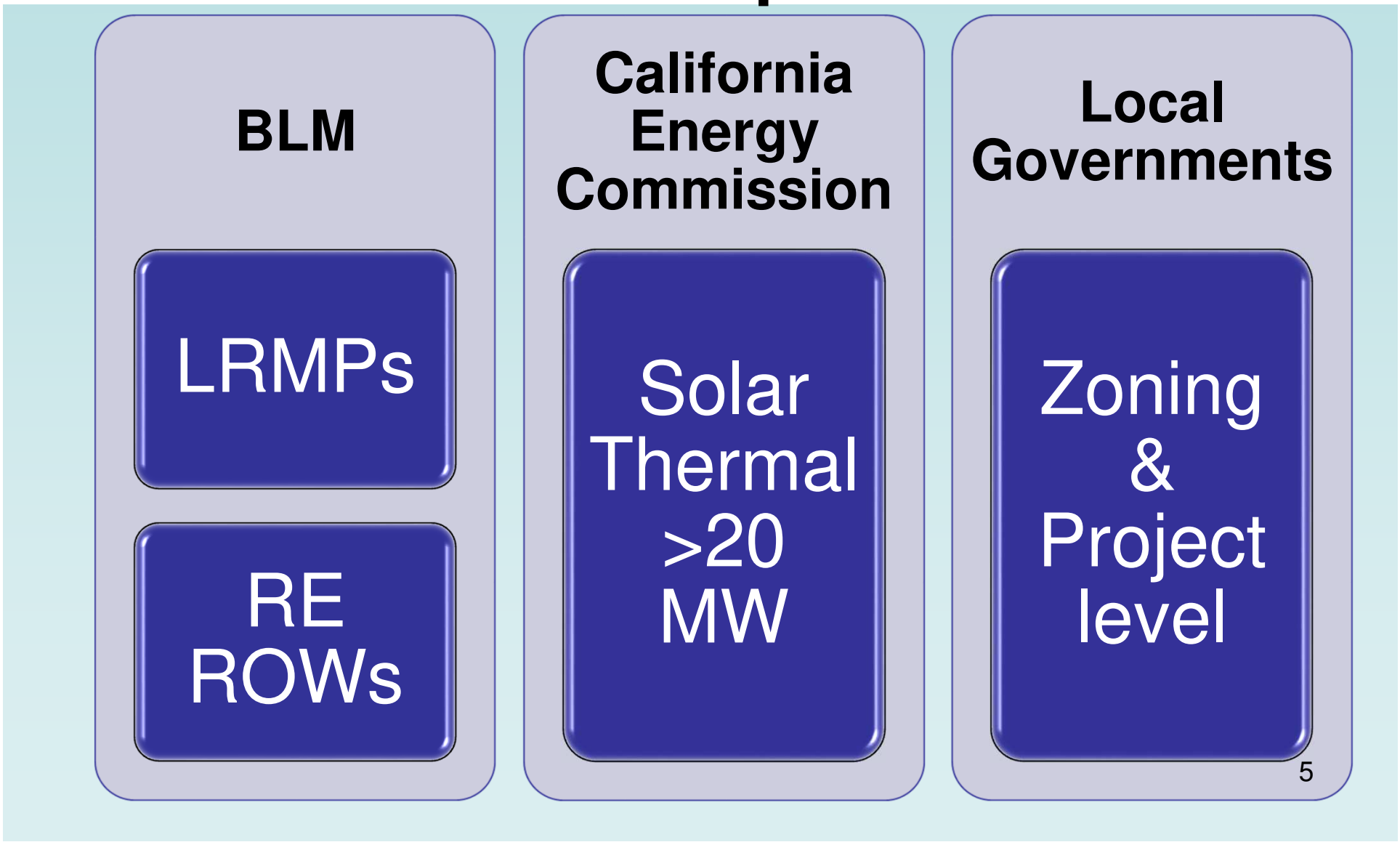
FWS Technical Assistance
Avian Impacts



FWS Recommends:

- **Similar to Wind Energy Guidelines**
  - Early and frequent communication
  - Early landscape-level assessments
  - Site-specific avian use surveys
  - Risk assessment
  - Minimization and avoidance measures
  - Systematic mortality monitoring
  - Adaptive management



FWS Recommendations

Bird and Bat Conservation Strategies

Eagle Conservation Plans ??



Avian Impacts

Direct Effects: Collisions

power lines



fences



Collisions with panels are common





Parabolic Trough



New Concentrated Solar Technologies

Power Tower



Fresnel Systems



Avian Impacts

Direct Effects

Solar Flux (power tower projects)

- Feather damage
- Tissue damage ?
- Cornea damage ?



Example of Feather Damage



Example of Feather Damage



Example of Feather Damage



ISEGS Efforts

- Exploring new ideas
  - Concentrated grape juice extract vapor
  - Detect and deter systems
- Installing anti-perching devices on towers
- New software developments
  - Minimize the need for standby points
  - Disperse solar flux levels during start-up hours



Other Species Impacts at ISEGS

- Desert Tortoise
  - ongoing relocation efforts
- Bats – no listed species
  - screening intake fan
  - testing sonic deterrents



- Insects – monarch butterfly (recent ESA petition)
  - replacing conventional lighting with LEDs
  - turning off facility lights on the towers at night (except FAA required lighting)

Avian Impacts

Indirect Effects

- Habitat loss and fragmentation
- Behavioral modification
- Invasive species
- Cumulative effects



Information Needs:

- When – timing (day or night)
- Why – attractant and/or unidentified barrier
- Where – are there differences based on project location
- Are there differences in avian taxa affected and does it differ based on solar technology?
- And of course … What is the cumulative scale of this impact?



The Path Forward:

- Avian use surveys and mortality monitoring designed to answer specific questions
- Avian Solar Working Group (stakeholders and agencies)
- Collaborative funding of research and adaptive management
- Develop of BMPs



Questions?



Received
So. Nevada Field Office
DEC 10 2007
Las Vegas, NV

2006 Survey for Yuma Clapper Rails and Southwestern Willow Flycatchers Along Las Vegas Wash, Clark County, Nevada

Prepared for

Southern Nevada Water Authority

Prepared by

SWCA Environmental Consultants

April 2007

2006 SURVEY FOR YUMA CLAPPER RAILS AND SOUTHWESTERN WILLOW FLYCATCHERS ALONG LAS VEGAS WASH, CLARK COUNTY, NEVADA

Submitted to

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April 2007

EXECUTIVE SUMMARY

Systematic surveys for Yuma clapper rails (*Rallus longirostris yumanensis*) were conducted within potential habitat along the Las Vegas Wash (Wash) in Clark County, Nevada, from April through May. The survey techniques included playback recordings of the Yuma clapper rail in accordance with standardized survey protocol (McKinstry 1995). No clapper rails were detected during the official 2006 surveys. However, one Yuma clapper rail was visually detected by Aaron Miller, with the San Bernardino County Museum, June 4, 2006 at 07:00 hours in the C-1 Channel while doing general bird surveys along the Wash. Subsequently, three additional Yuma clapper rail playback surveys were conducted at the C-1 Channel and on the third a Yuma clapper rail responded to the call.

Systematic surveys for southwestern willow flycatchers (*Empidonax traillii extimus*) were conducted along the Wash from May through July 2006. The survey techniques included playback recordings of the southwestern willow flycatcher in accordance with standardized survey protocol (Sogge et al. 1997). One willow flycatcher was detected within the boundaries of the Clark County Wetlands Park (Park), and one was detected approximately 100 m upstream of the Park. A third *Empidonax* individual was visually detected but did not respond to the playback recordings.

While no official surveys were conducted for the western yellow-billed cuckoo (*Coccyzus americanus occidentalis*), special care was taken to listen for the species and estimate potential habitat while conducting southwestern willow flycatcher surveys. No individuals were observed.

Previous survey reports (SWCA 2002, 2003, 2004) have identified both increases and losses of potential Yuma clapper rail habitat. Generally, construction of erosion control structures has continued to increase the quantity of emergent wetland habitat within the boundaries of the Park. However, some areas have become channelized, reducing the habitat quality within these areas, and presently, the Wash still provides only marginal habitat for nesting Yuma clapper rails.

Previous survey reports (SWCA 1999, 2000, 2001, 2002, 2003, 2004, 2005) have identified losses of potentially suitable southwestern willow flycatcher habitat. Habitat losses have continued into 2006 and were primarily associated with ongoing construction of erosion control and bank stabilization structures and large-scale revegetation efforts within the survey area. These activities, while causing additional losses of tamarisk, are likely to lead to long-term improvements in potentially suitable southwestern willow flycatcher habitat, as well as potentially suitable rail and western yellow-billed cuckoo habitats. Cottonwood and willow plantings continue to mature, thus improving riparian habitat structure and suitability for cuckoos and flycatchers.

Recommended Citation: SWCA Environmental Consultants. 2006. Survey for Yuma clapper rails and southwestern willow flycatchers along Las Vegas Wash, Clark County, Nevada. Prepared by SWCA Environmental Consultants, Salt Lake City. Final report prepared for the Southern Nevada Water Authority, Las Vegas.

ACKNOWLEDGMENTS

This study was funded by the Southern Nevada Water Authority (SNWA). Seth Shanahan and Debbie Van Dooremolen have contributed greatly to project administration and coordination. They also assisted with field surveys and provided critical review of the draft report. Thank you to the SWCA field staff (Spencer Martin, Bryan Brown, Amanda Christensen, Rob Wilson and Thomas Sharp) that conducted the surveys. These activities have been conducted under the auspices of Endangered Species Permit No. TE-040239-1 for Clark County, Nevada, as issued to Spencer Martin by the U.S. Fish and Wildlife Service, Portland, Oregon.

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1.0 INTRODUCTION

This study was undertaken in order to further examine the breeding status of the federally endangered Yuma clapper rail (*Rallus longirostris yumanensis*) and southwestern willow flycatcher (*Empidonax traillii extimus*) along Las Vegas Wash (Wash) in Clark County, Nevada. In 1997, as part of the environmental permitting process associated with the proposed development of the Clark County Wetlands Park (Park), it was recognized that potentially suitable southwestern willow flycatcher habitat existed along the Wash and could be affected by the installation of erosion control structures and development of other Park facilities. At that time, agency biologists recommended that a systematic survey be undertaken to determine whether or not these species breed within the Park boundary. Initial surveys for the southwestern willow flycatcher were conducted in 1998 (SWCA 1998), and follow-up surveys have been conducted every year, beginning in 1999 (SWCA 1999, 2000, 2001, 2002, 2003, 2004, 2005). Systematic surveys for the Yuma clapper rail and western yellow-billed cuckoo (*Coccyzus americanus occidentalis*) were initiated in 2000 and undertaken by San Bernardino County Museum. These surveys were repeated by San Bernardino County Museum in 2001 (McKernan and Braden 2001, 2002) and then by SWCA in 2002, 2003, and 2004 (SWCA 2002, 2003, 2004).

The results of the 2006 survey effort for the southwestern willow flycatcher and Yuma clapper rail are presented in this report. Western yellow-billed cuckoo surveys were not conducted in 2006. However, any incidental detections of this species during the southwestern willow flycatcher surveys were recorded, as were any and all changes in their potential habitat since 2005.

The purpose of this report is twofold:

1. Document the results of the 2006 surveys with respect to the distribution and abundance of Yuma clapper rails and southwestern willow flycatchers in the Wash, and
2. Qualitatively estimate the utility of existing and future potential habitat to nesting southwestern willow flycatchers and Yuma clapper rails and, to a lesser degree, western yellow-billed cuckoos.

2.0 STUDY AREA

The general study area for this survey consists of an approximately 405-ha (1,000-acre) portion of the Wash, dominated by tamarisk (*Tamarix ramosissima*; Bureau of Reclamation 1988) and contained within the boundaries of the Park (Figure 1). This area is spread along an 11-km (7-mile) reach of the Wash and includes portions of the City of Henderson, as well as private, county, and Bureau of Reclamation lands. The study area was defined in 1998 in consultation with Clark County, the Bureau of Reclamation, the Southern Nevada Water Authority (SNWA), and the U.S. Fish and Wildlife Service (USFWS). It includes areas that have been and will be revegetated with native species as well as areas that could be affected by future construction of, and have been affected by past construction of, erosion and grade control structures, roads, trails and other facilities associated with the development of the Park.

3.0 METHODS

3.1 YUMA CLAPPER RAIL

Yuma clapper rail habitat tends to consist primarily of freshwater or brackish marshlands and riparian areas (Grinnell and Miller 1944). The species generally requires a wet substrate, such as mud flats, sandbars, and drainage bottoms that are densely vegetated with herbs or woody vegetation at least 40 centimeters (15.8 inches) in mean canopy height. The presence of ponds and/or flowing water is also critical for the presence of Yuma clapper rails. "Large unbroken stands of vegetation in wet situations without emergent soils do not seem to be optimum habitat" (Todd 1986). The species apparently distributes its territories along the land-water interface where standing water in the marsh gives way to gently-sloping saturated soil (usually not steeply sloping). In large, deep-water marshes, rail territories may extend 50 meters (164 feet) or more from shore when dead, decadent, and lodged or floating vegetation from the previous year provides an above-water substrate for foraging and nesting (Todd 1986:43).

Yuma clapper rails primarily occupy marshes dominated by cattail (*Typha* spp.), bulrush (*Schoenoplectus* spp.), and/or reed (*Phragmites australis*) in all seasons, although they reach their greatest densities in cattail-bulrush marshes of moderate foliage density (Anderson and Ohmart 1985). Therefore these habitats were targeted during the 2006 clapper rail surveys in the Wash. These areas include isolated patches of emergent marsh habitat occurring in the active floodplain of the Wash.

The presence/absence of Yuma clapper rails was determined by conducting three censuses during the early breeding season (March 15 to May 30) from 30 minutes before sunrise to no later than 09:00 hours (McKinstry 1995; Harlow 2000). The actual dates of the surveys were April 14, May 5, and May 22. The census technique employed taped calls played along established transect routes by observers on foot.

3.2 SOUTHWESTERN WILLOW FLYCATCHER

Within the general study area, southwestern willow flycatcher survey efforts focused on areas containing tamarisk and other species such as Fremont cottonwood *(Populus fremontii)* and Goodding willow *(Salix gooddingii)*, which have the proper structure to be potentially suitable for use by southwestern willow flycatchers. For the purposes of the study, potentially suitable habitat was defined as dense woody riparian vegetation greater than 3.0 m (9.8 feet) in height with greater than 75% canopy cover. Areas dominated by desert scrub vegetation and other upland habitats known to be unsuitable for southwestern willow flycatchers were not surveyed as part of this effort.

Surveys for southwestern willow flycatchers were conducted from May through July 2006, using a tape-recorded playback of a southwestern willow flycatcher song and call notes (*fitz-bew* and *britt*) according to the standard protocol described by Sogge et al. (1997). The five-visit protocol described in McKernan and Braden (1998) and currently mandated by the USFWS was used. Trained observers conducted five surveys of the study area in the three established survey

periods: one survey each in the May 15-31 and June 1-21 periods, and three surveys within the June 22-July 17 period. Surveys in 2006 were conducted on the following dates: May 23-24, June 6-7, June 22-23, June 29-30 and July 6-7.

Surveys were initiated approximately 30 minutes before sunrise and were terminated by 10:00 a.m. (Pacific Daylight Time). Observers played the tape recordings at approximately 20-30-m (65-98-foot) intervals in potential nesting habitat. Excluded from the surveys were extensive areas of dense cattail, common reed, and quailbush (*Atriplex lentiformis*), stands of recently burned tamarisk, and large areas of tamarisk that exhibited low stature and less than 75% canopy cover. Survey routes primarily followed the edges of dense riparian patches and were designed to permit efficient and effective coverage of as large an area as feasible. Survey routes also followed the water's edge; this was not always possible, especially in the portion of the Park downstream of Pabco Road, where the steep, eroded, and high (ca. 10-15 m, or 30-50 feet) banks of the Wash prevent access to the water's edge in some places. Surveys were conducted in this area by walking the "rim" of the Wash and broadcasting the taped song and call notes to the habitat below.

It should be noted that construction activities, while removing potentially suitable habitat in some locations, have also provided access to the active floodplain and improved our ability to survey these areas. Vegetation clearing has also allowed us to survey areas that formerly had been inaccessible due to impenetrable stands of tamarisk, quailbush, or a combination thereof.

3.3 Western Yellow-billed Cuckoo

No systematic surveys were done for western yellow-billed cuckoos in 2006. However, special care was taken to listen and look for this species while surveying for southwestern willow flycatchers. Additionally, qualitative observations of the habitat conditions for western yellow-billed cuckoo were recorded.

4.0 Results and Discussion

4.1 Yuma Clapper Rail

4.1.1 Results

One Yuma clapper rail was detected during the 2006 surveys. Aaron Miller with San Bernardino County Museum visually detected a Yuma clapper rail on June 4, 2006 at 07:00 hours in the C-1 Channel (Figure 1). This observation occurred after the official Yuma clapper rail survey had already been completed. No detections had been made during the official surveys. Once news of the detection was received, three additional Yuma clapper rail playback surveys were conducted at the C-1 Channel, one at 10:00 on June 6 and two on June 7, the first at 05:45 and the second at 08:10. During the 08:10 tape playback, a Yuma clapper rail responded to the call. The lack of response to the previous taped playback call is most likely due to the fact that most rails do not respond to taped calls. Even at the peak of the early nesting season only 40% of Yuma clapper rail individuals may respond (Conway et al. 1993).

Information on the status of Yuma clapper rails along the Wash prior to 1998 is limited, however, Alcorn (1988:126) reports that eight clapper rails were observed in the Las Vegas Sewage disposal drainage ditch on September 6, 1959 and a single clapper rail was detected in the same location on September 19, 1959. This ditch drains in to the Wash, approximately 2.5 kilometers (1.5 miles) upstream of the Park boundary. No other historical records of clapper rail detections have been found. The 1998 southwestern willow flycatcher surveys resulted in Yuma clapper rail detections on May 28 and June 18, just upstream of Pabco Road (SWCA 1998). One Yuma clapper rail was detected during the 2005 southwestern willow flycatcher surveys. The Yuma clapper rail was detected May 23, 2005 at 09:23 hours. The call was emanating from the area referred to as the Big Marsh. Prior to 2006, these were the only Yuma clapper rail detections made within the boundaries of the Park, despite the systematic surveys for this species that were carried out in 2000 and 2001 by San Bernardino County Museum (McKernan and Braden 2001, 2002) and in 2002, 2003, and 2004 by SWCA (SWCA 2002, 2003, 2004).

4.1.2 Observations on Suitability of Existing and Potential Future Habitat

Our qualitative observations of habitat conditions in spring and summer 2006 indicate that the construction of erosion control structures has continued to increase the quantity of potential Yuma clapper rail habitat within the boundaries of the Park. However, the Big Marsh area has become channelized, which in turn has transitioned the marsh from cattail-dominated to reed-dominated, reducing the quality of habitat within this area. This channelization occurred because of a shift in the elevation of the Demonstration Weir, a temporary erosion control structure just downstream of the Big Marsh. Unlike the other weirs on the Wash, this structure was constructed as a temporary, un-confined rock riprap structure and was not engineered to withstand heavy flood waters. Consequently, portions of the temporary structure slumped when large flood flows shifted the rock riprap in the winter of 2005. The Wash then incised the marsh as it cut its way down to the new elevation. This lowered the water table in the impoundment and facilitated the transition to a reed-dominated community.

Channelization of emergent wetland habitats resulting from floods and also sedimentation in weir impoundments are proving to be continuing problems, limiting the extent and longevity of potentially suitable Yuma clapper rail habitat. As these areas become dryer and increasingly dominated by reed, their habitat value for rails declines. Yet, channelization should not be as problematic in the future as stabilization activities along the Wash progress. With continued construction of erosion control weirs and growth of emergent marsh vegetation upstream of these weirs, we anticipate that potential Yuma clapper rail habitat will continue to become established within different stretches of the Wash. Presently, though, the Wash still provides only marginal habitat for nesting Yuma clapper rails due to the small patch sizes (less than 3.50 ha [8.75 acres]) and continued channelization of the area.

Seven distinct sites were surveyed as potential Yuma clapper rail habitat (Figure 1). There were a total of 11 calling stations at these seven sites. The areas surveyed were different than those surveyed in 2004 as the Wash and the potential Yuma clapper rail habitat have changed.

1. Border Marsh - This site is located just north and upstream of the Clark County Wetlands border. Although this site is technically outside of the Wetlands Park, it is directly

adjacent to the Park and has a rather large stand of emergent marsh. The future of this site is uncertain. People living in the surrounding neighborhood have been observed throwing trash into the Wash. There is one calling station at this site.

2. Scenic Drive - This site occurs along the newly constructed Scenic Drive area. There is a small creek and some emergent vegetation though overall it is dominated by common reed. The future of this site is uncertain though it likely will not grow into better Yuma clapper rail habitat. There is one calling station at this site
3. Pabco Road - The Pabco Road erosion control structure has created the potential for the development of future Yuma clapper rail habitat. The habitat here, which is made up of cattail, bulrush and reed, is rather patchy. This area has continued to improve over the last two years. Three calling stations were established at this site: two upstream of the weir and one downstream of it.
4. Historic Lateral - This site has filled in with cattail and reeds and is strongly associated with wading birds, ducks and red-winged blackbirds (*Agelaius phoeniceus*). However, the potential Yuma clapper rail habitat is small in size and structure. There is one calling station at this site.
5. C-1 Channel - This site has filled in over the last few years with a relatively thick marsh of emergent vegetation. The water source of this site is runoff from the golf course and other projects to the south of the Wash. The area is filled with cattail, bulrush and reeds and is quite active with bird life. The site does not have the ability to grow any larger and may begin to lose some of its value if it becomes channelized in the future and common reed begins to dominate the area. There is one calling station at this site.
6. Bostick Weir - Potentially suitable clapper rail habitat has been developing in the southwest corner of the large pool just upstream of the Bostick Weir. It has continued to fill in with tules and the potential for providing clapper rail habitat has improved enough over the last few years that in 2004 it warranted surveying. Additionally, marsh vegetation has become well developed on and just downstream of the weir. In 2006 three calling stations were established at this site: one upstream of the weir and two downstream.
7. Big Marsh - In 2004, this area appeared to contain the best quantity and quality of potential clapper rail habitat along the Wash. However, this site has continued to become more channelized and increasingly dominated by common reed, reducing the habitat quality for clapper rails. However, during the southwestern willow flycatcher surveys in 2005 a Yuma clapper rail was heard within this site. This site is very active with wading and water birds. There is one calling station at this site.

4.2 Southwestern Willow Flycatcher

4.2.1 Results

Two willow flycatchers, not necessarily southwestern willow flycatchers, were detected, both singing (*fitz-bew*), during the 2006 surveys. The first, detected at 09:55 on May 3, was singing spontaneously while the second, detected at 08:55 on June 7, was in response to a playback recording. Neither of the two individuals was visually confirmed. The first detected individual was located roughly 100 meters (328 ft) upstream of the northern border of the Park, as shown

on Figure 1. This individual was singing spontaneously when the surveyors approached the area to survey for Yuma clapper rails. The second willow flycatcher was detected just north of the Model Airplane airport (see Figure 1). We returned to the site of the detection just before 10:30 hours on the same morning and replayed the tape, but the willow flycatcher was not seen. Surveys on subsequent dates failed to detect any willow flycatchers at or near any of these locations. Therefore, the two willow flycatcher detections were assumed to be migrants, and since it is not known where they nested it remains unknown whether they were southwestern willow flycatchers or a different subspecies. Since no resident southwestern willow flycatchers were detected, the nest-searching protocol of Martin and Geupel (1993) was not initiated, and nest-monitoring activities were deemed unnecessary.

On June 6, 2006, there was also a visual detection of an *Empidonax* flycatcher on the north side of the Wash roughly 200 meters (656 ft) from the boundary of the Park (see Figure 1). The flycatcher was perched on roots that had been exposed through erosion, which now hung over the Wash. From this location the bird would sally out to grab insects, continually returning to the same perch. The surveyors felt relatively certain that this bird was a willow flycatcher. However, the *Empidonax* would not respond or react in any way to the playback recording. Therefore, the surveyors were not able to confirm the species.

The 2006 southwestern willow flycatcher survey represents the ninth annual systematic survey for this species within the boundaries of the Park. During the 1998 survey, two willow flycatchers were detected during the first survey period at a point approximately 2.4 km (1.5 miles) downstream of Pabco Road. It was later concluded that these individuals were migrants due to the fact that they were detected only in the first of the three survey periods. In 1999, 2001 and 2005, no willow flycatchers were detected. Seven willow flycatchers were detected during the 2000 surveys. However, because no nesting behavior or activity was observed, and no willow flycatchers were detected on the third and final survey despite special care taken to search for the previously detected birds, all seven willow flycatcher detections were considered to be migrants. Two willow flycatchers were detected during both the 2002 and 2003 surveys. Again, these individuals were later concluded to be migrants. Eighteen willow flycatchers were detected in 2004 during the first survey period (May 18-19), and it was speculated that surveys had coincided with a migratory wave. Because no willow flycatchers were detected in the last four surveys, all eighteen detections were later concluded to be migrants.

4.2.2 Observations on Suitability of Existing and Potential Future Habitat

Our qualitative observations of habitat conditions in spring and summer of 2006 indicate that the construction of erosion control weirs and clearing of tamarisk associated with restoring native plant communities in the interval between the 2005 and 2006 survey periods has continued to substantially reduce the amount of potentially suitable southwestern willow flycatcher nesting habitat available along the Wash. Similar to previous years, the majority of the construction has occurred downstream in the lower one-third of the Wash, however construction has continued upstream of Pabco Road, specifically just upstream of Pabco Road on the south bank. The many areas that were burned between the 2001 and 2002 field seasons, eliminating nearly one-third of

the potential southwestern willow flycatcher nesting habitat in the northeastern portion of the study area, have still not regenerated to the point of being suitable habitat.

Lateral erosion, although likely still occurring within portions of the active floodplain, has been minimized by the construction of erosion control structures and was not observed to have had a major effect on southwestern willow flycatcher habitat in the last year. While lateral erosion will, in the short term, likely continue to result in the incremental loss of existing riparian habitat, the associated widening of the floodplain will tend to create more braided channels, abandoned meander loops, and isolated floodplain depressions over time. The creation of these habitat elements should eventually increase the extent of moist-soil and standing shallow-water habitats that are useful to southwestern willow flycatchers. It should be noted that development of this habitat tends to occur at the expense of the marginal southwestern willow flycatcher habitat associated with relict floodplains and old alluvial terraces located high above the active floodplain.

While lateral erosion of the floodplain can help to create substrate conditions favorable to the development of southwestern willow flycatcher habitat, this process is tempered by catastrophic flooding and vertical erosion (i.e., headcutting). To the extent that the existing erosion control structures dissipate floodwater energy (which, in turn, counters headcutting and lateral scour), future conditions should be more favorable for the development of suitable southwestern willow flycatcher habitat along this reach of the Wash.

Another aspect of southwestern willow flycatcher habitat suitability, somewhat independent of vegetative structure, involves factors associated with other members of the Wash's avian community. True colonization of the study area by the southwestern willow flycatcher would eventually require successful reproduction. But breeding within the study area may prove difficult for southwestern willow flycatchers due to their susceptibility to brood parasitism by the brown-headed cowbird, which has been shown to significantly reduce their nesting success (Brown 1994; Sogge et al. 1997; USFWS 1995). All nine southwestern willow flycatcher survey years have shown cowbirds to be abundant (more than 50 seen on a daily basis, see Appendix A), and one of the most common if not the most common bird found within the study area. In addition, the somewhat fragmented habitat, which presently is becoming more fragmented due to ongoing construction, fires and other activities, makes potential southwestern willow flycatcher nests more susceptible to this type of parasitism than they would be in habitats with more contiguous canopy coverage.

4.3 YELLOW-BILLED CUCKOO

No migrant or resident western yellow-billed cuckoos were detected during the 2006 southwestern willow flycatcher surveys. Information on the status of the western yellow-billed cuckoo along the Wash prior to 1998 is lacking. In 1998, a western yellow-billed cuckoo was detected within what is now the Nature Preserve area (SWCA 1998). The 2000 and 2001 surveys (McKernan and Braden 2001, 2002) were the first systematic surveys for this species within the boundaries of the Park. No migrant or resident western yellow-billed cuckoos were detected during either of these surveys. SWCA continued the systematic surveys in 2002, 2003 and 2004,

but no migrant or resident western yellow-billed cuckoos were detected in these years either (SWCA 2002, 2003, 2004).

Potential cuckoo habitat has slightly improved since the 2004 season. Some of the cottonwoods established between Pabco Road and the Historic Lateral have grown to a sufficient size. However, potentially suitable western yellow-billed cuckoo habitat along the Wash still appears to be of, at best, marginal quality. Although the cuckoo is known to use tamarisk in Arizona and New Mexico (Howe 1986; Corman and Magill 2000), the patch size and stature of the tamarisk presently within the Park appear suboptimal. In addition, some of the best potential western yellow-billed cuckoo habitat was destroyed by wildfire between the 2001 and 2002 surveys and still has not regenerated. The Park has good potential for developing suitable cuckoo habitat in the future, provided that revegetation efforts for cottonwood and willow continue to be successful.

4.4 DISCUSSION

The detection of a Yuma clapper rail during each of the 2005 and 2006 survey seasons, along with the fact that potentially suitable clapper rail habitat along the Wash has continued to increase in size over the past few years, suggests that if colonization by Yuma clapper rails has not taken place already, it has the potential to occur in the near future. Additionally, the recently installed erosion control weirs have created and will continue to create microhabitats more favorable to Yuma clapper rails, possibly providing further impetus for this species to colonize the area. Also, as continued weir construction occurs channelization of wetland habitats should decrease. This along with active wetland revegetation efforts should continue to increase the quality and extent of potential Yuma clapper rail habitat in the Wash, with the main limiting factor being the width of the channel itself.

Nine consecutive years of intensive, systematic surveys for southwestern willow flycatchers along the Wash have not detected nesting southwestern willow flycatchers and, therefore, indicate an extremely low probability that the species is a regular breeding resident. However, there are three compelling reasons to suggest that colonization of the Wash by southwestern willow flycatchers may occur in the near future. First, the 1998, 2000, 2002, 2003 and 2004 surveys detected willow flycatchers within the study area. Although these detections could represent part of a normal willow flycatcher migration pattern, it may be that willow flycatchers are adjusting their migratory route to take advantage of the riparian habitat in the Wash. If so, there would be an increased probability of the Wash being colonized by a migrant, wandering, or dispersing pair of southwestern willow flycatchers. Second, the erosion control weirs that are presently being installed will make the habitat more favorable to southwestern willow flycatchers, possibly providing further impetus for this species to stay in the area and nest. Third, there are three known, active southwestern willow flycatcher nesting areas within close proximity of the Wash: Mesquite, Nevada, approximately 81 km (50 miles) northeast of Las Vegas; Pahranagat, Nevada, approximately 122 km (75 miles) north-northeast of Las Vegas; and Mormon Mesa on the Virgin River, approximately 97 km (60 miles) east of Las Vegas. In the summer of 2006, there were 28 total southwestern willow flycatchers and 21 active nests in Mesquite. There were 34 total southwestern willow flycatchers and 18 active nests in Pahranagat

and 21 southwestern willow flycatchers and 9 active nests in Mormon Mesa. Individuals from these populations have the potential to colonize the Wash.

The western yellow-billed cuckoo does not seem likely to colonize the Wash in the near future. Although there was a single detection of a western yellow-billed cuckoo in 1998 during the southwestern willow flycatcher surveys, existing habitat is still sparse and small in stature, compared to optimal cuckoo nesting habitat. Much of the Wash's best potential cuckoo habitat was destroyed by fire in 2002. However, enhancements presently being made at the Wash will eventually result in long-term cuckoo habitat improvements, as native cottonwoods and willows become established and mature. Thus, the likelihood that western yellow-billed cuckoos will colonize the area will increase over time but, at present, the habitat for such colonization does not exist. SWCA recommends that cuckoo surveys resume in three to five years, after cottonwood and Goodding willow-dominated riparian habitats have had a chance to fill in.

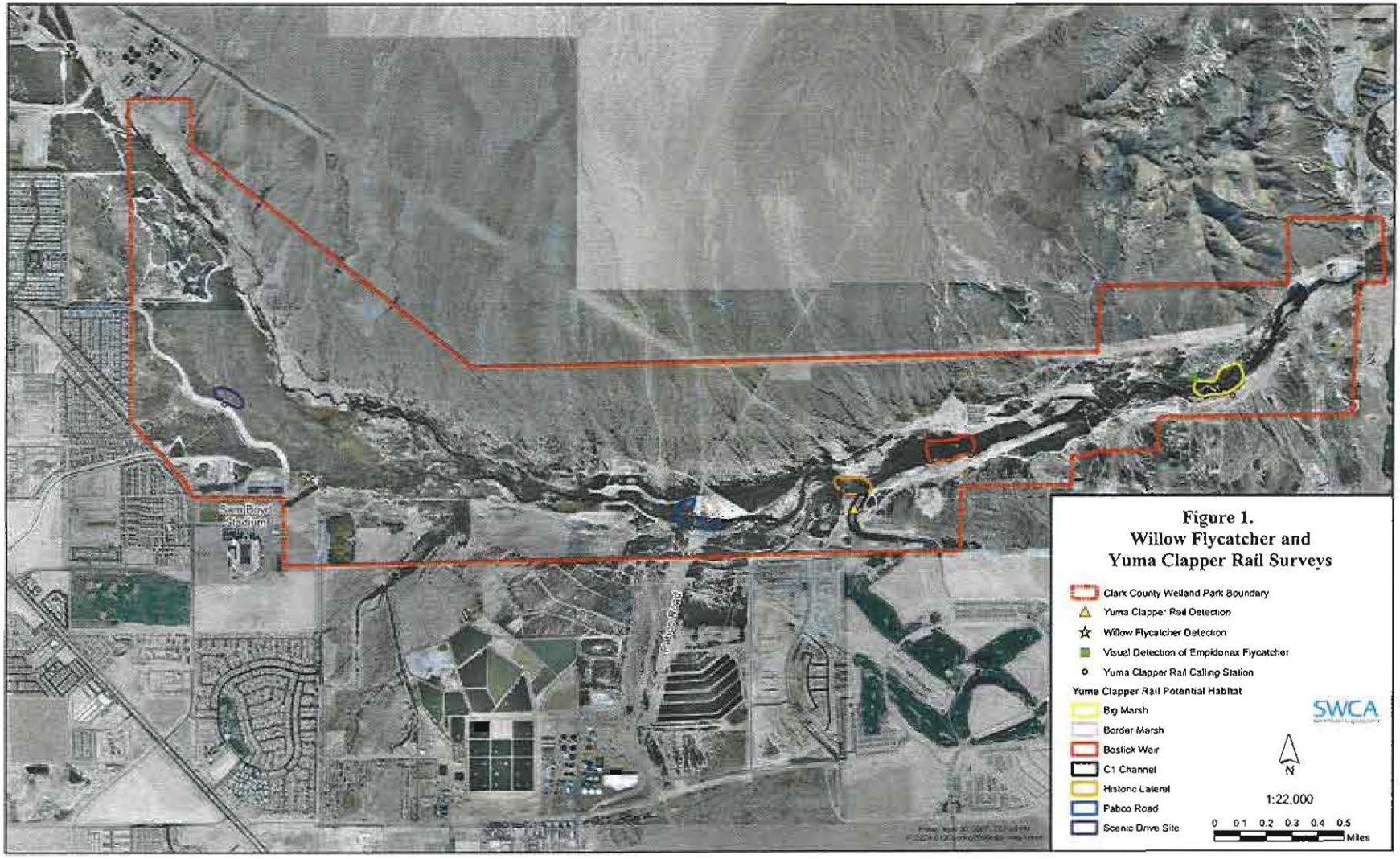

Figure 1. Willow Flycatcher and Yuma Clapper Rail surveys.

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APPENDIX A: ANNOTATED CHECKLIST OF BIRD SPECIES DETECTED IN CLARK COUNTY WETLANDS PARK, APRIL THROUGH JULY 2006

This annotated checklist identifies the bird species that were detected along the Las Vegas Wash in Clark County Wetlands Park, Nevada, during surveys for Yuma clapper rails and southwestern willow flycatchers from mid April through early July 2006. Presumed status is from Ryser (1985), Alcorn (1988), and/or our field observations. Relative abundance categories are modified after Phillips et al. (1964); abundance of a given species is based on our field observations. Common names and phylogenetic order conform to ornithological standards established by the American Ornithologists' Union (AOU 1998) and subsequent revisions.

Common Name	Scientific Name	Presumed Status	Relative Abundance
Pied-billed grebe	*Podilymbus podiceps*	R	R
Western grebe	*Aechmophorus occidentalis*	R	R
Double-crested cormorant	*Phalacrocorax auritus*	R	U
Least bittern	*Ixobrychus exilis*	R	R
Great blue heron	*Ardea herodias*	R	FC
Great egret	*Ardea alba*	R	U
Snowy egret	*Egretta thula*	M	FC
Green heron	*Butorides virescens*	R	FC
Black-crowned night-heron	*Nycticorax nycticorax*	R	FC
White-faced ibis	*Plegadis chihi*	M	U
Turkey vulture	*Cathartes aura*	R	R
Mallard	*Anas platyrhynchos*	R	FC
Cinnamon teal	*Anas cyanoptera*	R	R
Osprey	*Pandion haliaetus*	M	R
Northern harrier	*Circus cyaneus*	R	R
Cooper's hawk	*Accipiter cooperii*	R	R
Red-tailed hawk	*Buteo jamaicensis*	R	R
American kestrel	*Falco sparverius*	R	R
Peregrine falcon	*Falco peregrinus*	R	R
Gambel's quail	*Callipepla gambelii*	R	C
Clapper rail	*Rallus longirostris*	U	R
Common moorhen	*Gallinula chloropus*	R	U
American coot	*Fulica americana*	R	C
Killdeer	*Charadrius vociferus*	R	FC
Black-necked stilt	*Himantopus mexicanus*	M	R

Common Name	Scientific Name	Presumed Status	Relative Abundance
Spotted sandpiper	*Actitis macularia*	R	FC
American avocet	*Recurvirostra americana*	R	R
Rock pigeon	*Columba livia*	R	R
White-winged dove	*Zenaida asiatica*	R	C
Mourning dove	*Zenaida macroura*	R	A
Greater roadrunner	*Geococcyx californianus*	R	U
Barn owl	*Tyto alba*	R	R
Great horned owl	*Bubo virginianus*	R	R
Lesser nighthawk	*Chordeiles acutipennis*	R	FC
White-throated swift	*Aeronautes saxatalis*	R	FC
Black-chinned hummingbird	*Archilochus alexandri*	R	C
Anna's hummingbird	*Calypte anna*	R	R
Broad-tailed hummingbird	*Selasphorus platycercus*	R	R
Western wood-pewee	*Contopus sordidulus*	R	R
Willow flycatcher	*Empidonax traillii*	M	R
Black phoebe	*Sayornis nigricans*	R	FC
Say's phoebe	*Sayornis saya*	R	U
Ash-throated flycatcher	*Myiarchus cinerascens*	R	FC
Western kingbird	*Tyrannus verticalis*	R	U
Loggerhead shrike	*Lanius ludovicianus*	R	R
Bell's vireo	*Vireo bellii*	R	R
Common raven	*Corvus corax*	R	U
Northern rough-winged swallow	*Stelgidopteryx serripennis*	R	A
Cliff swallow	*Petrochelidon pyrrhonota*	R	R
Verdin	*Auriparus flaviceps*	R	C
Bushtit	*Psaltriparus minimus*	M	R
Rock wren	*Salpinctes obsoletus*	R	R
Bewick's wren	*Thryomanes bewickii*	R	A
Marsh wren	*Cistothorus palustris*	R	C
Blue-gray gnatcatcher	*Polioptila caerulea*	R	U
Black-tailed gnatcatcher	*Polioptila melanura*	R	C
Northern mockingbird	*Mimus polyglottos*	R	U
Crissal thrasher	*Toxostoma crissale*	R	R
Lucy's warbler	*Vermivora luciae*	R	C
Yellow warbler	*Dendroica petechia*	R	FC
Common yellowthroat	*Geothlypis trichas*	R	C

Common Name	Scientific Name	Presumed Status	Relative Abundance
Yellow-breasted chat	*Icteria virens*	R	C
Abert's towhee	*Pipilo aberti*	R	C
Song sparrow	*Melospiza melodia*	R	C
Blue grosbeak	*Passerina caerulea*	R	C
Red-winged blackbird	*Agelaius phoeniceus*	R	C
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*	R	FC
Great-tailed grackle	*Quiscalus mexicanus*	R	C
Brown-headed cowbird	*Molothrus ater*	R	A
House finch	*Carpodacus mexicanus*	R	U

Presumed Status

Resident (R)	Species apparently occurs in the area throughout the spring and summer nesting season, probably nesting.
Migrant (M)	Species apparently passes through the area during migration, probably not nesting.
Unknown (U)	The presumed status is in question because insufficient information existed for evaluation of status.

Relative Abundance

Abundant (A)	Species is easily detected in large numbers (50<) on a daily basis.
Common (C)	Species is easily detected on a daily basis, but not in large numbers (5-50).
Fairly Common (FC)	Species regularly detected in small numbers (2-4) on a daily basis.
Uncommon (U)	Species regularly detected in very small numbers, although not necessarily every day.
Rare (R)	Species detected irregularly in very small numbers.

APPENDIX B: SWCA PERSONNEL CONDUCTING THE 2006 STUDY

Project Scientist ..... R. Spencer Martin, M.E.M.
Project Manager/Field Coordinator ..... Thomas Sharp, M.S.
Field Ornithologist ..... Bryan Brown, Ph.D.
Field Ornithologist ..... Amanda Christensen, B.S.
Field Ornithologist ..... Robert Wilson, M.S.

Ash Meadows National Wildlife Refuge
Yuma Clapper Rail Summary Report
2007-2012

Memorandum

Date: 31 July 2012

From: Darrick Weissenfluh, Fish Biologist, Ash Meadows Fish Conservation Facility, Amargosa Valley, Nevada

Subject: Yuma Clapper Rail Surveys (2007-2012): Summary Report

Introduction:
Since 2007, three to seven marsh bird monitoring routes have been surveyed within Ash Meadows National Wildlife Refuge (Refuge). There were two primary objectives of conducting the surveys: 1) to obtain baseline information on the relative abundance of marsh birds in the Refuge and 2) to contribute to a continent-wide marsh bird database available to land managers. Nine marsh bird focal species have been detected with the Refuge including Yuma clapper rail, Virginia rail (*Rallus limicola*), sora (*Porzana Carolina*), black rail (*Laterallus jamaicensis*), least bittern (*Ixobrychus exilis*), American bittern (*Botaurus lentiginosus*), pied-billed grebe (*Podilymbus podiceps*), common moorhen (*Gallinula chloropus*) and American coot (*Fulica Americana*). The only federally-listed marsh bird species detected in the Refuge is the Yuma clapper rail. All Take of Yuma clapper rail is associated with the broadcast of marsh bird calls while conducting formal surveys, following a standardized protocol.

Methodology:
All surveys were conducted following the Standardized North American Marsh Bird Monitoring Protocols (Conway 2008), which specifies three replicate surveys are to occur along each route. Refer to Attachments 1-6 for maps of transect point locations, site descriptions, and additional summary information. In-depth data analysis on the Refuge's marsh bird dataset has not been performed. All data has been entered into the Marsh Birds Population Assessment and Monitoring Project online database managed by the U.S. Geological Survey-Patuxent Wildlife Research Center.

Results:
Yuma clapper rail detections are summarized by year (2007-2012); tables are organized by the route name and the date the survey was completed. It should be noted that in 2008 there were two observers collecting data independently on most surveys; only data collected by Carl Lundblad is provided in the 2008 table. It also is worth noting that in some cases the same bird could have moved during a call broadcast sequence (resulting in two or more detections of the same bird), could have been heard calling from more than one survey point (e.g. the same bird could have been recorded at PR-1 and PR-2), or a bird might have been located at a different route (e.g. a bird could have been recorded at HR-1 while surveying from PR-1). Fortunately, the raw data sheet for marsh bird surveys includes columns for a distance and direction associated with each detection, as well as a column where observers can indicate whether they believe the same bird was detected at a previous site (which is included in each of the tables). The following

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data summary tables consist of all detections recorded at a given survey point and whether the surveyor believed they detected the bird at a previous point, as this most likely represents the maximum amount of take associated with each Yuma clapper rail survey; however, the actual amount of take may be less than the data suggests for the reasons given above.

In 2007, marsh bird monitoring surveys were conducted along three routes within the Refuge between April 11th and May 14th, 2007. The three routes included Lower Crystal Marsh, Peterson Reservoir, and Jackrabbit Outflow. A single Yuma clapper rail was detected at Peterson Reservoir. Table 2 summarizes the detections of Yuma clapper rail in 2011.

Table 1. 2007 Yuma Clapper Rail (CLRA) Detections-Ash Meadows NWR

Route Name	Station Number	Date	Survey Replicate Number	Number CLRA Detected	Detected At Previous Site
Peterson Reservoir	PR-6	04/12/2007	1	1	N

In 2008, marsh bird monitoring surveys were conducted along six routes within the Refuge between April 21st and May 28th, 2008. The six routes included Lower Crystal Marsh, Carson Slough, Peterson Reservoir, Crystal Reservoir, Horseshoe Reservoir, and Jackrabbit Outflow. Yuma clapper rail was detected at only Peterson Reservoir. Table 2 summarizes the detections of Yuma clapper rail in 2008.

Table 2. 2008 Yuma Clapper Rail (CLRA) Detections-Ash Meadows NWR

Route Name	Station Number	Date	Survey Replicate Number	Number CLRA Detected	Detected At Previous Site
Peterson Reservoir	PR-4	04/22/2008	1	1	N
Peterson Reservoir	PR-2	05/05/2008	2	1	N
Peterson Reservoir	PR-3	05/05/2008	2	1	N

In 2009, marsh bird monitoring surveys were conducted along six routes within the Refuge between April 19th and May 26th, 2009. The six routes included Lower Crystal Marsh, Carson Slough, Peterson Reservoir, Crystal Reservoir, Horseshoe Reservoir, and Jackrabbit Outflow. Yuma clapper rail was detected at three of six survey routes including Peterson Reservoir, Lower Crystal Marsh, and Horseshoe Reservoir. Table 3 summarizes the detections of Yuma clapper rail in 2009.

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Table 3. 2009 Yuma Clapper Rail (CLRA) Detections-Ash Meadows NWR

Route Name	Station Number	Date	Survey Replicate Number	Number CLRA Detected	Detected At Previous Site
Peterson Reservoir	PR-3	04/22/2009	1	1	N
Peterson Reservoir	PR-1	05/07/2009	2	1	N
Peterson Reservoir	PR-2	05/07/2009	2	1	N
Peterson Reservoir	PR-4	05/07/2009	2	1	N
Peterson Reservoir	PR-1	05/21/2009	3	1	N
Peterson Reservoir	PR-2	05/21/2009	3	1	Y
Peterson Reservoir	PR-4	05/21/2009	3	1	N
Peterson Reservoir	PR-5	05/21/2009	3	2	N
Peterson Reservoir	PR-6	05/21/2009	3	1	Y
Lower Crystal Marsh	LCM-1	05/05/2009	2	1	N
Lower Crystal Marsh	LCM-2	05/05/2009	2	1	N
Lower Crystal Marsh	LCM-5	05/19/2009	3	1	N
Horseshoe Reservoir	HR-3	05/18/2009	3	1	N

In 2010, marsh bird monitoring surveys were conducted along six routes within the Refuge between April 20th and May 20th, 2010. The six routes included Lower Crystal Marsh, Carson Slough, Peterson Reservoir, Crystal Reservoir, Horseshoe Reservoir, and Jackrabbit Outflow. Yuma clapper rail was detected at three of six survey routes including Peterson Reservoir, Lower Crystal Marsh, and Horseshoe Reservoir. Table 4 summarizes the detections of Yuma clapper rail in 2010.

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Table 4. 2010 Yuma Clapper Rail (CLRA) Detections-Ash Meadows NWR

Route Name	Station Number	Date	Survey Replicate Number	Number CLRA Detected	Detected At Previous Site
Lower Crystal Marsh	LCM-1	04/24/2010	1	1	N
Lower Crystal Marsh	LCM-2	04/24/2010	1	1	N
Lower Crystal Marsh	LCM-1	05/04/2010	2	1	N
Lower Crystal Marsh	LCM-2	05/04/2010	2	1	Y
Lower Crystal Marsh	LCM-3	05/04/2010	2	1	Y
Lower Crystal Marsh	LCM-1	05/19/2010	3	1	N
Peterson Reservoir	PR-1	050/5/2010	2	1	N
Peterson Reservoir	PR-2	05/05/2010	2	1	Y
Peterson Reservoir	PR-3	05/05/2010	2	1	Y
Peterson Reservoir	PR-4	05/05/2010	2	1	N
Peterson Reservoir	PR-5	05/05/2010	2	1	N
Peterson Reservoir	PR-1	05/20/2010	3	2	N
Peterson Reservoir	PR-4	05/20/2010	3	1	N
Peterson Reservoir	PR-6	05/20/2010	3	1	N

In 2011, marsh bird monitoring surveys were conducted along seven routes within the Refuge between April 19th and June 24th, 2012. The seven routes included Fairbanks, Lower Crystal Marsh, Carson Slough, Peterson Reservoir, Crystal Reservoir, Horseshoe Reservoir, and Jackrabbit Outflow. Yuma clapper rail was detected at three of seven survey routes including Lower Crystal Marsh, Horseshoe Reservoir, and Peterson Reservoir. Table 5 summarizes the detections of Yuma clapper rail in 2011.

Table 5. 2011 Yuma Clapper Rail (CLRA) Detections-Ash Meadows NWR

Route Name	Station Number	Date	Survey Replicate Number	Number CLRA Detected	Detected At Previous Site
Horseshoe Reservoir	HR-2	04/19/2011	1	2	N
Lower Crystal Marsh	LCM-1	04/20/2011	1	1	N
Lower Crystal Marsh	LCM-2	04/20/2011	1	1	N
Lower Crystal Marsh	LCM-2	04/20/2011	1	1	Y
Lower Crystal Marsh	LCM-2	05/07/2011	2	1	N
Lower Crystal Marsh	LCM-1	05/31/2011	3	1	N
Peterson Reservoir	PR-3	05/06/2011	2	1	N
Peterson Reservoir	PR-4	05/06/2011	2	1	Y
Peterson Reservoir	PR-5	05/06/2011	2	1	Y
Peterson Reservoir	PR-4	05/26/2011	3	1	N

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In 2012, marsh bird monitoring was conducted along six routes within the Refuge between April 19th and May 30th, 2012. The routes included Jackrabbit outflow, Horseshoe Reservoir, Crystal Reservoir, Peterson Reservoir, Fairbanks outflow, and Lower Crystal Marsh. The Carson Slough transect was discontinued during the 2012 monitoring season due to a lack of detections during previous seasons and the routes replacement with the Fairbanks Outflow route.

Yuma clapper rail was detected at three of the six routes surveyed including Horseshoe Reservoir, Peterson Reservoir, and Fairbanks Outflow. Two Yuma clapper rail were detected during single survey events at both Peterson Reservoir and Fairbanks outflow during 2012. These included the detection of two individuals at Peterson reservoir, and the detection of a paired duet clatter along the Fairbanks Outflow route. Table 6 summarizes the detections of Yuma clapper rail in 2012.

Table 6. 2012 Yuma Clapper Rail (CLRA) Detections-Ash Meadows NWR

Route Name	Station Number	Date	Survey Replicate Number	Number CLRA Detected	Detected At Previous Site
Horseshoe Reservoir	HR-1	04/23/2012	1	1	N
Peterson Reservoir	PR-3	04/30/2012	1	2	N
Peterson Reservoir	PR-4	04/30/2012	1	1	Y
Fairbanks Outflow	FO-2	05/03/2012	2	1	N
Fairbanks Outflow	FO-3	05/03/2012	2	1	Y
Peterson Reservoir	PR-3	05/07/2012	2	1	N
Fairbanks Outflow	FO-2	05/19/2012	3	2	N
Peterson Reservoir	PR-3	05/29/2012	3	1	N

Conclusion:
Ash Meadows may be the northernmost location where Yuma clapper rail has been positively detected and was considered, until recently, as an accidental in Nevada (Floyd et al. 2007). Yuma clapper rail has been detected in the Refuge each year since 2007 when the marsh bird monitoring surveys were first implemented; it has been detected every year on at least one survey replicate at Peterson Reservoir. There has been only one survey year (2009) when Yuma clapper rail were detected during all three replicate surveys at the same location (Peterson Reservoir). Based on six years of marsh bird survey data, Yuma clapper rail are present in relatively low abundance in the Refuge during the breeding season; however, the amount of recruitment, if any, is unclear as these surveys do not address that question. However, Yuma clapper rail paired duet clatters have been recorded on two occasions on the Refuge (Peterson Reservoir, 2010, PR-1, Survey Replicate Number 3; and Fairbanks Outflow, 2012, FO-2, Survey Replicate Number 3), which suggests breeding may be taking place.

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Mostly between the 1960's-1980's, the landscape within Ash Meadows experienced large anthropogenic alterations that included the draining of wetlands and the impoundment of water into man-made reservoirs. No data is known to exist on the relative abundance of marsh birds species prior to the large-scale habitat manipulation occurring before the Refuge was established; however, it is reasonable to assume the amount and quality of habitat for marsh birds and the 12 other endemic, federally-listed species in the Refuge was diminished as a result of the habitat manipulation. Since the Refuge was established in 1984 to protect and conserve threatened and endangered species, and especially over the last decade, the Refuge has undertaken the substantial task of rehabilitating the Ash Meadows ecosystem by completing tasks such as restoring hydrology by removing water impoundments and controlling native and non-native invasive species.

The detection of Yuma clapper rails, especially a paired duet clatter, along the Fairbanks Outflow transect in 2012 is very important. The Upper Carson Slough was drained and mined for peat in the 1960s and most of the spring outflow channels were confined to man-made ditches. In 2010, the Fairbanks and Soda springs restoration project (Phase 1) returned Fairbanks outflow water to its approximate historic location in the Upper Carson Slough, forming an emergent marsh of bulrush (*Schoenoplectus* sp.) and cattail (*Typha* sp.) near the terminal end of Phase 1 (approximately 2 miles downstream of Fairbanks Spring). The detection of Yuma clapper rails in the marsh in 2012 (Fairbanks Outflow transect) occurred less than two years after restoration activities in that area were completed. This indicates suitable emergent vegetation for Yuma clapper rail can be present very shortly after rehabilitation activities occur and further illuminates the importance of those activities in the Refuge. Therefore, I recommend the Refuge continue rehabilitating the Ash Meadows ecosystem (including removal of man-made reservoirs and impoundments) to achieve is management objectives for the recovery of numerous federally listed and endemic aquatic species, including, but not limited to, Yuma clapper rail.

The detection of Yuma clapper rails in 2011 and 2012 at Horseshoe Reservoir also is notable. Prescribed fires were conducted in February 2011 and January 2012 at Horseshoe Reservoir to reduce hazardous fuels and cattail density; the latter in hope of encouraging bulrush growth over cattail. In April of both 2011 and 2012, Yuma clapper rails were detected during marsh bird monitoring surveys; the only other year they were detected at Horseshoe Reservoir was May 2009. Given the detections of Yuma clapper rail in Ash Meadows are rare and relatively infrequent, it's not possible to discern whether prescribed fire has positively or negatively impacted the species. However, because fire is a natural process important to the Ash Meadows landscape and one that has been demonstrated to benefit numerous wildlife species, including Yuma clapper rail elsewhere (Conway et al. 2010), and because Yuma clapper rail were detected at Horseshoe Reservoir after both prescribed fires 2011 and 2012, I recommend the Refuge continue with rehabilitation actions such as prescribed fire as necessary to meet management objectives for the recovery of all federally listed and endemic aquatic species.

The implementation of marsh bird surveys annually in Ash Meadows has resulted in the first

confirmed detections of Yuma clapper rail and has resulted in five years of baseline data on the relative abundance of all marsh birds at numerous sites in the Refuge. If personnel and funding are available, I recommend the Refuge continue implementing marsh bird surveys annually. However, if staffing is limited, it is understandable that it may be necessary to reduce the survey effort only to priority sites (e.g. proposed or recently completed rehabilitation sites), to reduce the frequency of surveys (e.g. biennially), or to discontinue conducting surveys until additional funding and/or staffing is available.

Attachment 1: Map with UTM Coordinates of All Marsh Bird Routes within AHME.
Attachment 2: 2007 AHME Bird Monitoring Report-FINAL.
Attachment 3: 2008 AHME Bird Monitoring Report-FINAL.
Attachment 4: 2009 AHME Bird Monitoring Report-FINAL.
Attachment 5: 2010 AHME Bird Monitoring Report-FINAL.
Attachment 6: 2011 AHME Bird Monitoring Report-FINAL.

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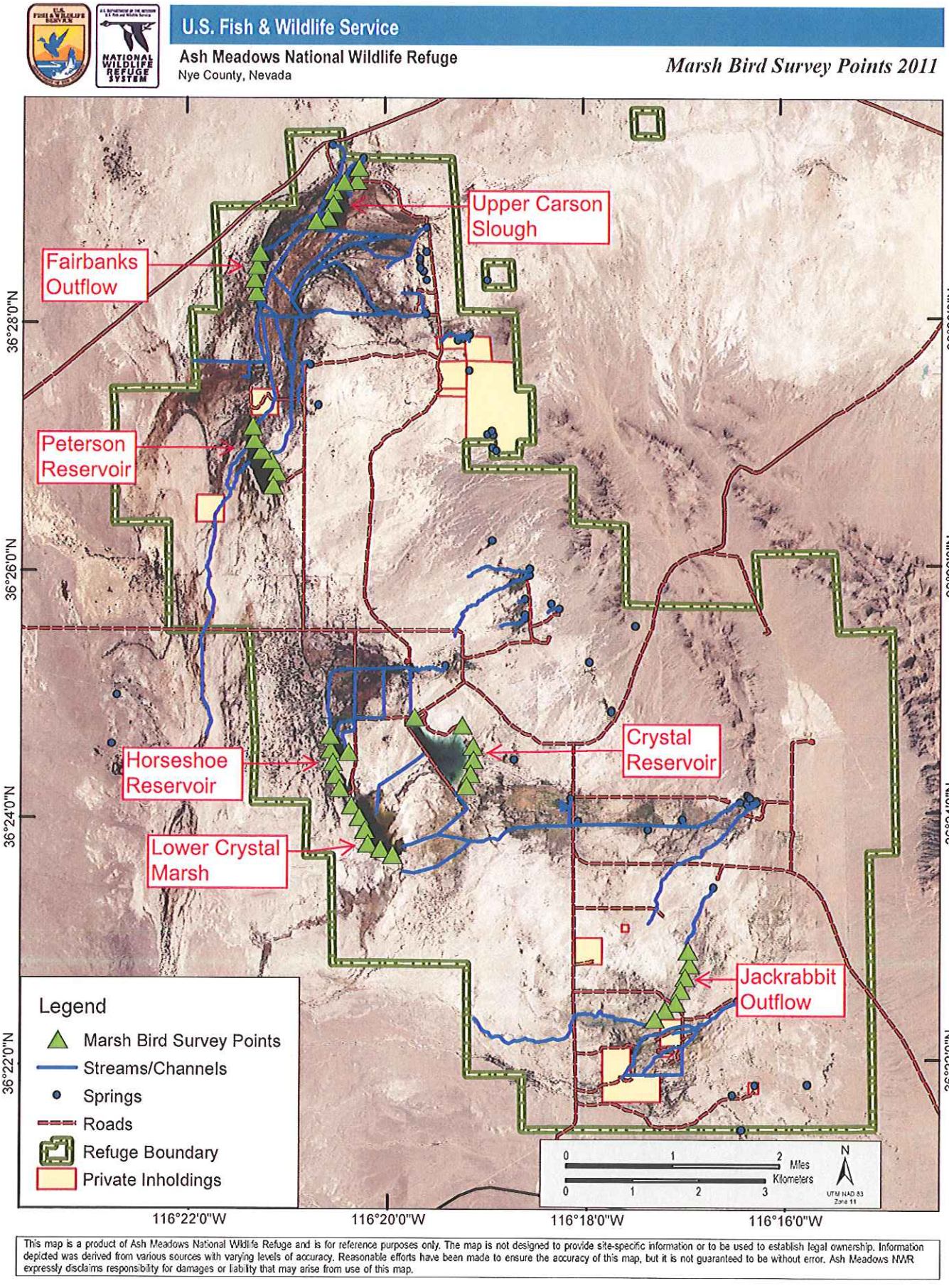
U.S. Fish & Wildlife Service
Ash Meadows National Wildlife Refuge
Nye County, Nevada
Marsh Bird Survey Points 2011
Upper Carson Slough
Fairbanks Outflow
Peterson Reservoir
Horseshoe Reservoir
Crystal Reservoir
Lower Crystal Marsh
Jackrabbit Outflow
36°28'0"N
36°26'0"N
36°24'0"N
36°22'0"N
116°22'0"W
116°20'0"W
116°18'0"W
116°16'0"W
Legend
Marsh Bird Survey Points
Streams/Channels
Springs
Roads
Refuge Boundary
Private Inholdings
0 1 2 Miles
0 1 2 3 Kilometers
N
UTM NAD 83
Zone 11
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UTM Coordinates (NAD 83, Zone 11N) for All Marsh Bird Survey Stations in Ash Meadows

Route Name: **Peterson Reservoir**		
Station Number	X	Y
pr-1	558041.60	4033456.25
pr-2	558102.59	4033650.49
pr-3	558009.07	4033834.20
pr-4	557870.72	4033976.49
pr-5	557754.56	4034139.94
pr-6	557733.44	4034335.95

Route Name: **Lower Crystal Marsh**		
Station Number	X	Y
lcm-1	559244.29	4028672.28
lcm-2	559365.86	4028501.17
lcm-3	559444.78	4028309.00
lcm-4	559489.89	4028103.66
lcm-6	559679.91	4028025.93
lcm-7	559866.51	4027939.53

Route Name: **Jackrabbit Outflow**		
Station Number	X	Y
jo-1	564323.66	4026508.23
jo-2	564343.52	4026306.94
jo-3	564279.91	4026110.21
jo-4	564208.45	4025918.78
jo-5	564136.02	4025729.70
jo-6	563971.48	4025615.96
jo-7	563820.65	4025484.56

Route Name: **Fairbanks Outflow**		
Station Number	X	Y
FAIR_1	557778.79	4036346.03
FAIR_2	557753.38	4036541.00
FAIR_3	557787.13	4036745.49
FAIR_4	557820.19	4036941.86

Route Name: **Crystal Reservoir**		
Station Number	X	Y
cr-1	560191.34	4029993.62
cr-2	561076.18	4029563.64
cr-3	560913.52	4029870.50
cr-4	561083.37	4029357.55
cr-5	561038.41	4029148.82
cr-6	560978.79	4028974.81

Route Name: **Carson Slough**		
Station Number	X	Y
cs-1	559316.26	4038212.25
cs-2	559284.35	4038015.29
cs-3	559088.07	4037993.32
cs-4	558934.66	4037863.72
cs-5	558928.63	4037662.88
cs-6	558850.85	4037471.14
cs-7	558668.99	4037413.61

Route Name: **Horseshoe Reservoir**		
Station Number	X	Y
hr-1	559201.35	4029476.15
hr-2	559065.86	4028933.03
hr-3	559002.82	4029128.20
hr-4	558963.72	4029319.75
hr-5	558923.47	4029514.49
hr-6	558920.41	4029722.01

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An Annual Report for Desert Tortoise Translocation Research at the Fort Irwin Southern Expansion Translocation Area

2010 Progress



Prepared for:
U.S. Army National Training Center
Natural Resource Program Manager

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY
WESTERN ECOLOGICAL RESEARCH CENTER

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By K. Kristina Drake, Todd C. Esque, Kenneth E. Nussear, Christina Aiello, Patrick Emblidge, and Philip A. Medica

U.S. GEOLOGICAL SURVEY
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An Annual Report for Desert Tortoise Translocation Research at the Fort Irwin Southern Expansion Translocation Area

By K. Kristina Drake, Todd C. Esque, Kenneth E. Nussear, Christina Aiello, Patrick Emblidge, and Philip A. Medica

ABSTRACT

The threatened status of the Mojave population of the desert tortoise (*Gopherus agassizii*), in conjunction with the expansion of the Fort Irwin National Training Center (NTC), necessitated the development of a Translocation Plan to remove tortoises from military lands prior to training expansion (Esque *et al*. 2005). We conducted baseline studies on tortoises residing in the proposed release areas to evaluate the current status of resident populations, and to provide a point of reference for later evaluation of the success of the translocation efforts. From 2005-2007, we conducted studies researching movements, habitat use, behavior, and physiological characteristics of tortoises that would serve as residents and controls during impending translocations (Drake *et al*. 2006, Walden *et al*., 2007, Drake *et al*. 2008). Habitat condition was also characterized (2005, 2007-2010) using annual and perennial plant surveys on randomly located transects throughout the Southern Expansion Translocation Area (SETA).

In March 2008, we translocated 38 desert tortoises as part of a much larger translocation effort at Fort Irwin (Drake *et al.* 2009). These translocated tortoises, along with a subset of resident and control tortoises within the SETA, have been closely monitored to determine whether there are any measurable physiological stresses that may be associated with translocation of this species. These efforts have included tracking via radio telemetry, monthly blood collection during months of above-ground activity (April-October), and habitat characterization. In 2010, we continued to monitor the physiological effects of translocation among translocated and resident tortoises in comparison to controls throughout the study area.

Since its initiation, the Fort Irwin Translocation Project has facilitated a wealth of information on the ecology, behavior, habitat use, and distribution of desert tortoises. Collaborating researchers have used this comprehensive dataset in studies that include: research on GIS decision support systems to prioritize translocation sites (Jill Heaton; University of Nevada-Reno, Thomas Leuteritz and others; Redlands Institute; Heaton *et al.* 2008), research on health and disease status (Kristin Berry, USGS), a study on the potential risk of predation due to ravens throughout the SETA (Wendy McIntyre, Redlands Institute, University of Redlands; McIntyre *et al.* 2007, comparisons of the efficiency and cost effectiveness of trained dog search teams (K9) and human search teams (Mary Cablk, Desert Research Institute; Jill Heaton, University of Nevada-Reno; Nussear *et al.* 2008), research on stress physiology associated with translocation in desert tortoises (Richard Tracy, Ken Hunter, Amy Barber, and Sally DuPre-University of Nevada-Reno; Drake *et al.* In Prep) as well as understanding the effects of human population density, resource variability and subsidized predators on desert tortoise populations (Andrew Walde, Peter Woodman, William Boarman-ITS-QinetiQ; Roy Averill-Murray-U.S. Fish and Wildlife Service; Jeremy Mack, Kristin Berry-USGS; and Jill Heaton- University of Nevada-Reno; Esque *et al*. 2010).

INTRODUCTION

The desert tortoise (*Gopherus agassizii*) was listed as a threatened species by the U.S. Fish and Wildlife Service (FWS) in 1990, and critical habitat for the Mojave population was designated in 1994 (FWS 1990, 1994). In 2004, President George W. Bush signed the Fort Irwin Military Lands Withdrawal Act of 2001, authorizing Fort Irwin to expand its training activities into 110,000 acres of military land that had been designated as critical habitat, some of which were previously used for military training prior to the listing of the desert tortoise. As mitigation for disturbance of desert tortoise critical habitat, the U.S. Army and the FWS determined that all tortoises inhabiting the proposed UTM 90 Area [Southern Expansion Area (SEA), 23,214 acres], and Superior Valley [Western Expansion Area (WEA), 70,045 acres] would be translocated prior to military activity. Work described in this report includes some tortoises that originally resided in the SEA and were translocated in the spring of 2008, and others that reside in the Southern Expansion Translocation Area (SETA) where tortoises from the SEA were moved.

We refer to three different experimental populations of desert tortoises: resident tortoises, control tortoises, and translocated tortoises. The distinction is important because one premise of this study is that each experimental population may respond to translocation differently and the research design is planned to test several hypotheses about multiple responses. Tortoises that originated in the SEA are referred to as translocated tortoises, and will keep that designation throughout the life of the study. This includes an estimated 640 adult tortoises, and 300 sub-adult and juvenile tortoises that were moved to 13 release sites in the Superior Cronese Desert Wildlife Management Area (DWMA), within the general area described in the Translocation Plan (Esque *et al*. 2005).

Prior to translocation (March 27, 2008), tortoises in the SETA were considered to be residents if they resided spatially within a 200 meter buffer of a selected translocation release plot. All tortoises initially located outside the designated release plots were originally designated control tortoises. After translocation, kernel utilization distributions were calculated each month to identify spatial overlap between translocated and control tortoises. If a control tortoise was found to overlap spatially with the distribution of translocated tortoises, its treatment type was changed to resident. Once a tortoise was designated as a resident, that designation was permanent. A population of over 300 resident and control tortoises residing in the SETA has been part of our research prior to and after translocation for the last six field seasons.

Previous studies on translocation of desert tortoises have examined movements, site fidelity, survivorship, reproduction, habitat use, and pre-release conditions (Field 1999, Nussear 2004, and Field *et al*. 2007). Additional ecological parameters that were recommended for potential study in the Translocation Plan as a result of Fort Irwin expansion included stress, growth, incidence of disease, nesting success, recruitment, nutritional ecology, behavior, social interaction, and habitat characteristics including vegetation and geomorphology (Esque *et al*. 2005). We hypothesized that physiological stress may be particularly useful in measuring the potential effects of translocation on both translocated and resident tortoises in comparison with their control counterparts.

Animals respond physiologically to an array of external noxious or stressful stimuli (e.g. predation attempts, harsh weather, habitat change and anthropogenic disturbances) through a rapid cascade of endocrine secretions within the hypothalamic-pituitary-adrenal (HPA) axis

(Axelrod and Reisine 1984, Wingfield *et al*. 1997). While the stress response is complex and involves a variety of endogenous mediators, the glucocorticoid hormones (corticosterone or cortisol) generated via the HPA axis are most often associated with stress response. In particular, elevated levels of cortisol or corticosterone (CORT) are seen in both acute and chronic stress, and these hormones have been used as "biomarkers" of a measurable physiological response.

Capture, handling, and restraint of wild animals (which are all activities that occur during translocation to new habitats) have all been shown to cause rapid elevations in CORT. These elevated levels of CORT typically decrease within a short period of time following release, and may or may not have cascading impacts on immune function or other physiological factors; however this has not been studied in depth, especially in this species. There is a dearth of research quantifying the long-term effects of translocations on CORT levels, and almost none correlating these protracted elevations in CORT (chronic stress) on the function of the immune system or long-term key life history factors. Thus, a very important element of assessing stress in desert tortoises as a function of translocation is making an explicit connection of the physiology of stress as assessed by endocrine markers to immune competence as measured by ability to mobilize immune mechanisms over time. We suspect that if an animal's physiology is altered due to chronically elevated stress then we would expect to see impacts to ecological performance, such as reproduction, movements, habitat use, and behavior.

It seems likely that the translocation may cause acute stress in tortoises and that CORT levels may be elevated as a result. However, it is unknown whether this acute stress is important to the immune competence of translocated tortoises or if translocation will cause a more chronic stress to translocated tortoises as they continue to adjust in their new environments. It is also unknown what stress (acute or chronic) might occur in resident tortoises whose populations have been supplemented by translocated tortoises or if any of the acute or chronic stresses affecting translocated or resident tortoises will result in a loss of immune competence or long term ecological compromise; although previous translocation studies have documented equivalent reproductive effort between residents and translocated tortoises (Nussear 2004). If any of these stressors compromise immunity or key life history factors, then the process of translocation could subject individual tortoises to increased vulnerability and potentially then be transferred to the population at large.

MATERIALS AND METHODS

Study Area

The SETA is an ~ 1000 km^2 area of the Superior-Cronese DWMA, located within the Western Mojave Recovery Unit. It is bounded on the south by Interstate 15, on the north by the southernmost boundary of Fort Irwin, on the west by the 508000 East Universal Transverse Mercator (UTM) line, and on the east by the 568000 East UTM line (Figure 1). The Translocation Plan originally discussed 12 figurative plots of 1.6 km^2 (1 mi^2) that were to serve as release sites for 50 to 70 translocated tortoises each (Esque *et al*. 2005*)*. These plots were originally established in 2006 (Drake *et al.* 2006), but due to changes in landscape use, property ownership, prevalence of disease and site accessibility prior to translocation, several of these sites were removed as release sites. The USGS used plots 1.5, 3, 5, and 8 as research sites.

Additional plots (6, 7, 9, 10, 11, 12.5, 13, and SDT) were also used by other researchers as release sites for translocated tortoises.

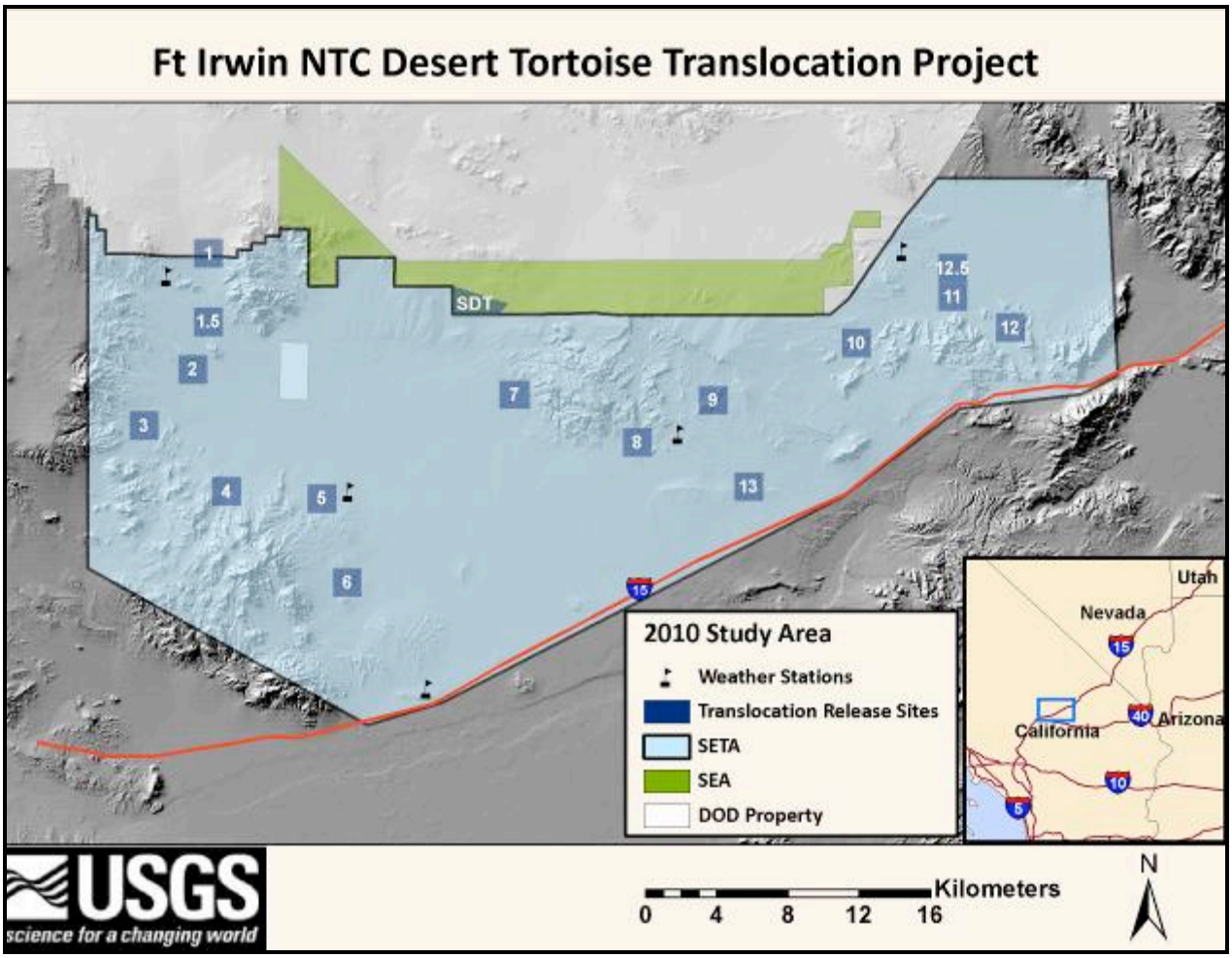

Figure 1. Map of the desert tortoise research study area in 2010. The Southern Expansion Translocation Area (SETA) is highlighted in light blue and the Southern Expansion Area (SEA) is highlighted in green.

The SEA covers approximately 94 km^2 of land along the Southern and edge of the Fort Irwin NTC. The SEA is bounded on the north by the 3890000 North UTM line, on the south by the 3887000 North UTM line, on the east by the 550000 East UTM line, and on the west by the 523000 East UTM line (Figure 1). The Southern border of the SEA contains designated tortoise habitat that is not fenced off from the surrounding BLM land. A tortoise fence divides the Northern border of this designated habitat from the Fort Irwin NTC range (Figure 1).

Study Animals

During 2005 and 2006, 306 tortoises were encountered and measured by USGS personnel to establish a robust sample of resident and control populations in the SETA. Most of these were originally marked in 2005 (n=258) with an additional 48 being added in 2006. These tortoises were tracked monthly using radio telemetry as required by FWS and the California Department of Fish and Game (CDFG) permits and blood was collected from a subset to ascertain baseline

stress values (and provided to Kristin Berry for disease testing and research). In 2007, to reduce interference with concurrent research projects, we re-focused our efforts to monitor and collect blood from a subset of 120 tortoises (80 resident/control and 40 translocated). Blood samples collected during these three years provide a representative baseline for stress levels that can be compared with post-translocation levels.

In 2008, we continued to monitor these animals and added an additional 6 tortoises to the study for a new population of 126 research animals (86 resident/control and 40 translocated). On March 27, 2008, we translocated 38 tortoises from the SEA to four release plots (1.5, 3, 5 and 8) within the SETA. Tracking commenced daily for the translocated tortoises for a period of 4 weeks, followed by weekly tracking of all tortoises in the study. In 2009 and 2010, we continued monitoring these animals as well as collecting blood monthly from April-October.

A total of 393 tortoises have been encountered and measured throughout the study area over the last six years. In addition to the 306 tortoises found in 2005-2006, 56 tortoises that had previously been marked by other researchers were incorporated into the stress assessment. In 2010, an additional 29 tortoises were added to the study; 12 transferred from other researchers and 17 from the inclusion of unmarked individuals.

Animal Capture

1. Data Collection and Measurements

Data collected upon each encounter with a tortoise included date, time, observer, local weather, microhabitat, and geographic location. Some encounters resulted in the handling of animals for the purposes of measurement, transmitter attachment or maintenance, or blood sampling. For those encounters we also recorded temperature, mass, and shell dimensions of animals, general signs of health status, and information associated with transmitter attachment and/or the collection of blood samples (Appendix 1). Data were recorded using Trimble Juno SB Handheld Computers running Pendragon Software (v 5.3) as well as on paper datasheets.

2. Physical Measurements and Marking

Tortoises were measured using metal calipers during their initial capture and/or at the beginning of the activity season for each year. All tortoises were captured when temperatures were below 95° F within 5 cm of the shaded ground surface. Measurements (mm) included the midline carapace length (CL) measured from the tip of the nuchal to the tip of the supracaudal scutes, the length of the plastron between the notches of the gular and anal scutes, the shell width between the fifth and sixth marginals, and the maximum shell height. Tortoises were weighed to the nearest ~30g using a field portable digital scale. A uniquely numbered ID tag was attached with epoxy to a depressed portion of a vertebral scute for identification.

In May 2008, most tortoises in our study were notched using the Highly Modified Honegger System, which is a modification of a system developed by Froese and Burghardt (1975) and uses numbers 1, 2, 4 and 7 along the marginal scutes (Honegger 1979, Appendix 2). There were some exceptions with animals used in a previous study with non-numeric designations (ADG, ABR and BCI).

3. General Health Assessment
Each tortoise was visually inspected for injuries, morphological anomalies, ectoparasites (e.g., ticks), and obvious symptoms of shell disease (cutaneous dyskeratosis), osteoporosis, and upper respiratory tract disease (URTD) when first marked, and upon each encounter if the tortoise was visible. This basic health assessment was recorded for general characterization only. A more thorough health assessment of these animals was conducted by Kristin Berry (USGS).

4. Microhabitat Characterization
Several microhabitat characteristics were recorded upon each encounter with a tortoise. These included general characteristics of the tortoise's location (e.g. hill, wash, open scrub), soils (e.g. cobble, sandy loam, sand), and specific microhabitat and exposure (e.g. sun, shade, burrow), and the tortoise's behavior (e.g. basking, eating; Appendix 1). When the microhabitat of the tortoise was associated with perennial vegetation, the species and dimensions of the vegetation were recorded for later analysis.

Burrows used by tortoises were identified by a uniquely numbered non-reflective burrow tag attached with epoxy to a rock near the burrow. Burrow azimuth was also recorded.

5. Transmitters
Holohhil Systems Limited® RI-2B transmitters were attached to all tortoises included in the stress study (CL ≥ 180 mm). The mass of the attached transmitter was 9.7 g, 13.8-15.0g, 17.0 g, 19.5g, or 25.5-27.5 g depending on the size of the tortoise and availability of transmitters. The different transmitter sizes were due to different battery configurations, where larger and heavier batteries provide longer transmitter life.

Transmitters were attached to the first costal scute with putty epoxy, and only one segment of plastic tubing was used to attach the antenna to the second costal scute. The rest of the antenna was allowed to trail freely. A small dab of silicone sealant was placed between the head of the transmitter and the first tubing segment to reduce the risk of entanglement (e.g., with low lying branches of shrubs).

If a transmitter that had already been attached to a tortoise was discovered to be functioning improperly or was nearing the end of its expected battery life, it was removed by carefully levering the putty off of the scute while avoiding damage to the carapace. Once the transmitter was safely removed, all remaining putty was removed and a new transmitter was affixed.

6. Blood Collection
Between May 10, 2005 and July 25, 2006, blood samples were collected using a 1.91 cm, 25-gauge needle-IV infusion set and 3 cc sterile syringe to obtain blood from the jugular vein (Jacobson *et al*. 1992). Between May 11, 2006 and October 7, 2010, blood samples were collected using a 3.81 cm, 23-gauge or 25-gauge needle and 3 cc sterile syringe coated in heparin to obtain blood from the subcarapacial sinus (Hernandez-Divers *et al*. 2002). Once collected, blood was transferred into labeled microtainers® containing lithium heparin to prevent coagulation. In 2010, blood (~ 0.5 ml) was collected from most individuals each month. Additional blood (>1.2 ml) was collected from select individuals requiring blood for heath screening. Blood samples were immediately stored on ice in small portable coolers for no more than five hours. The samples were centrifuged at 3400 rpm for ten minutes to separate the plasma from the red blood cells. Plasma and red blood cells were extracted using a micropipette

and placed into labeled cryogenic vials and stored in liquid nitrogen. All samples were stored at field stations in Barstow, California and Las Vegas, Nevada until they were transported to the University of Nevada-Reno for analysis.

We recorded notes during blood collection describing the sample color, consistency, and unusual characteristics. Ocular estimation based on the percentage of packed red blood cells (hematocrit) and percentage of lymphatic fluid present in each sample was used to categorize the amount of lymphatic fluid present: free (0%), low (1-15%), medium (16-30%), or high (31%+).

7. Plasma Analysis

Plasma samples yielded from most blood samples collected from 2005-2009 from wild tortoises were analyzed for total CORT concentration using a commercially available ^{125}I radioimmunoassay (RIA) from MP Biomedicals (Costa Mesa, CA; cat. no.: 07-120-102), which is comparable to commercial enzyme-immunoassays (EIA). This RIA kit has been used successfully in a variety of non-laboratory species including birds, reptiles and mammals (Martin *et al*. 2007). This assay is highly specific, having low cross-reactivity with other steroids. Unlike older RIA protocols, this assay does not require additional steroid extraction steps and includes a CORT binding globulin (CBG) blocking agent, allowing the concentration of total CORT to be measured, without additional chemical or heating steps to denature the CBG protein.

The MP Biomedicals RIA has been validated for the measurement of total CORT in the desert tortoise. The assay can detect concentrations of CORT in the high (pg/ml) to low (ng/ml) range, sufficiently sensitive for measurements of total CORT in the desert tortoise, which typically show plasma CORT concentrations < 10 ng/ml most times of the year (Lance *et al.* 2001).

8. Animal Movements

Each transmittered tortoise involved in our stress research study was tracked at least monthly from December 2009 to December 2010. However, the tracking schedule was not constant for all tortoises. Some tortoises traveled further from their last known location than was detectable by telemetry and thus we required longer periods of time to locate them. Regular attempts to track problematic animals were made and recorded at least monthly.

We analyzed movement patterns for each tortoise by calculating the linear distance (m) between the first and last site where tortoises were found each month throughout the activity season (April-October). Using those data, we calculated the average monthly distance by sex and treatment group each year using a linear mixed-effect model for repeated measures. Post-hoc, pair-wise contrasts were evaluated in Rv2.12.1 (R Development Core Team 2010) using the package contrast.

9. Treatment Designation

Tortoises that originated in the SEA are referred to as translocated tortoises, and retained that designation throughout the study. Prior to translocation (March 27th, 2008), tortoises in the SETA were considered residents if they resided spatially within a 200 m buffer of a translocation release plot. All tortoises that were located outside the buffer of the designated release plots were considered control tortoises. After translocation, kernel utilization distributions were calculated each month to identify spatial overlap between translocated and control tortoises. Tortoise locations (n=56,000) collected from collaborating researchers were incorporated into a monthly analysis to calculate kernel utilization distributions in R using the package adehabitat v

1.8.2 (Calenge 2006). We used the ad hoc method to calculate a smoothing parameter (h) and a 90% confidence level. Utilization distributions were then imported into ArcGIS and evaluated for spatial overlap between treatment groups. If a control tortoise intersected the distribution kernel of a translocated tortoise, its treatment designation was reclassified from control to resident, and that animal retained that designation thereafter.

Habitat Characterization

1. Annual Vegetation Sampling

We characterized annual plant productivity by surveying 107 randomly selected plots (900 m^2 in area) throughout the SETA (Figure 2). Starting points for each plot were chosen from a set of randomly generated points used for vegetation analysis in 2005-2009. Sampling for annual grasses and forbs occurred from 12 April 2010 through 20 April 2010 during peak production. Each 30 m × 30 m plot consisted of thirty 0.1 m^2 nested quadrats (50 cm × 20 cm) evenly spaced at 6 m intervals. Total aboveground annual plant mass was collected from each quadrat. Shoots of all annual species contained within the production quadrat were clipped at ground level and placed in labeled paper bags. Bags were dried in a convection oven at 50ºC to a constant mass and weighed. Annual production (g / m^2) was calculated for each plot and used to estimate mean annual production in the SETA. The intensity of harvesting on the monitoring plots impacted < 0.002% of the area and did not diminish the overall natural recovery of desert tortoise habitat or forage available to tortoises.

2. Soil Sampling

Soil samples (n=107) were collected approximately 30 cm from the start point of each vegetation plot. Samples were collected using a plastic trowel scrapping the surface (approximately 30 cm in surface diameter) about 5 cm in depth. Samples were placed in labeled plastic gallon-size zip-lock bags and stored for further analysis of surface soil texture.

3. Climate

Winter precipitation (mm) was calculated from winter months (October-February) each year using from the nearest weather station in Barstow, California (NOAA 2006, 2007, 2008, 2009).

We installed five HOBO® U30 weather station units in the SETA in August 2010 (Table 1, Figure 1). Each station was placed in desert tortoise habitats varying in elevation and vegetation composition across the SETA.

Table 1. Weather station locations deployed in August 2010.

Study Area	Location Description	UTM Easting (NAD 83 Zone 11S)	UTM Northing (NAD 83 Zone 11S)
SETA	Plot 1.5	510179	3889133
SETA	Plot 5	520415	3877007
SETA	Minneola	524801	3865888
SETA	Plot 8	538975	3880255
SETA	Plot 11	551574	3890525

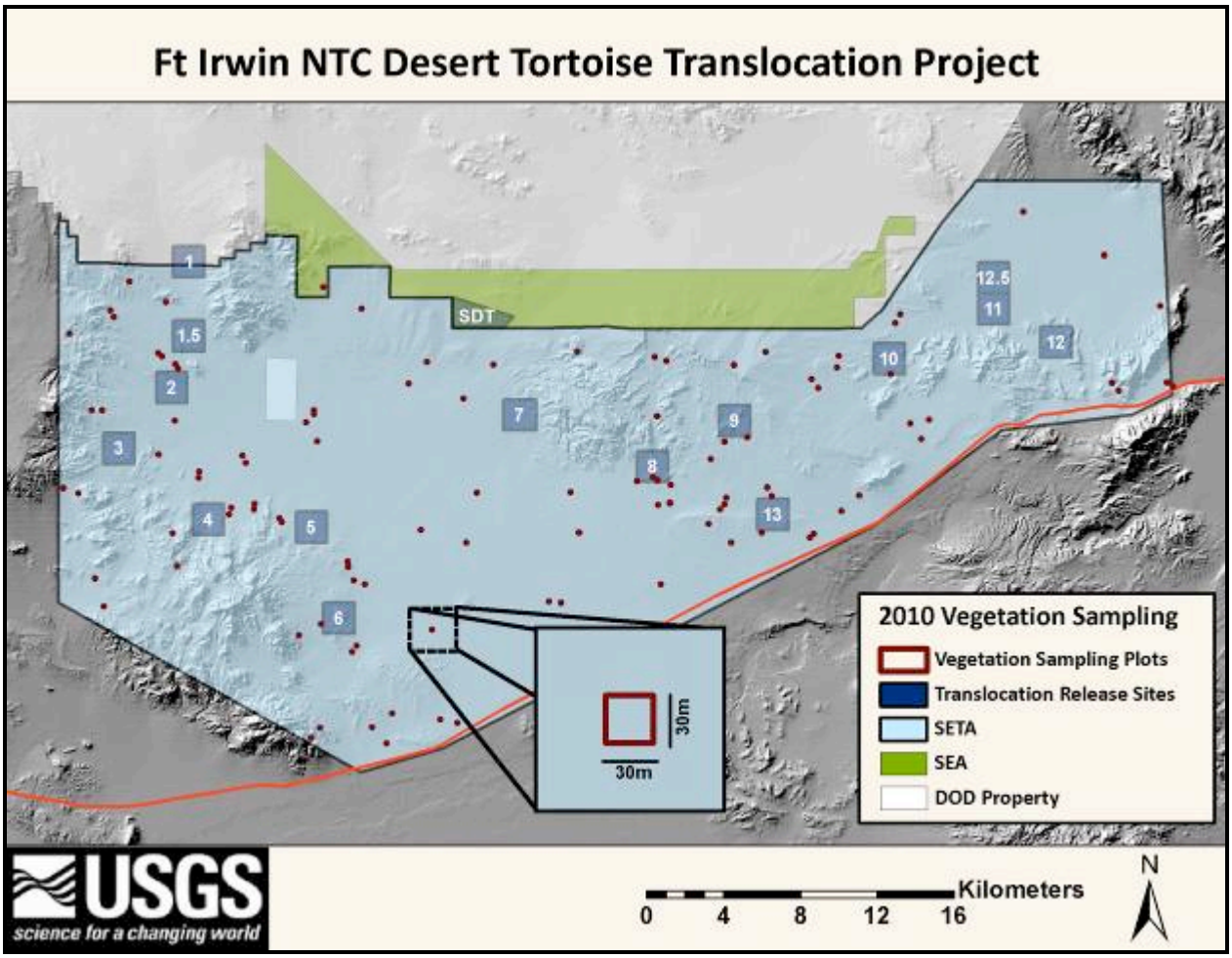

Figure 2. Vegetation transects sampled in 2010.

RESULTS

Results for this project have been reported annually: 2005 in Drake *et al*. 2006, 2006 in Walden *et al.* 2007, 2007 in Drake *et al*. 2008, 2008 in Drake *et al*. 2009, and 2009 in Drake *et al*. 2010. This report includes results from November 24, 2009 through December 20, 2010 (2010). However, some results from 2005-2009, have been included within select figures and tables for comparison among years and are indicated where applicable.

Summary of Encounters

Our research focused this year on monthly monitoring and sampling of a select group of tortoises within each experimental population. In January 2010, these tortoises included 6 control tortoises, 42 resident tortoises, and 10 translocated tortoises (Table 2). All further analyses in this report will use population designations as of January 2010 unless otherwise noted. Tortoises in our study this year ranged from 188 mm to 291 mm in carapace length.

Table 2. Number of tortoises in each experimental population by month in 2010.

Month	Control	Resident	Translocated	Total
January	6	42	10	58
February	9	40	9	58
March	19	43	11	73
April	19	46	13	78
May	20	46	14	80
June	20	42	16	78
July	20	40	16	76
August	20	39	17	76
September	19	39	17	75
October	19	39	17	75
November	18	40	17	75
December	18	40	17	75

Marking Desert Tortoises

In 2010, seventeen unmarked tortoises were found and included in the study. Based on proximity to translocated tortoises, sixteen were classified as controls and one as a resident. ID tags (in the FW-3800 to FW-3823 range) and transmitters were attached to each individual. An additional 43 transmitters were replaced throughout the year due to expected battery failure. A detailed list of transmitter serial numbers, frequencies, and associated tortoises is provided in Appendix 3.

Animal Movement

Each tortoise was tracked at least monthly in 2010, resulting in 2,119 observations between November 24, 2009 and December 20, 2010 (tortoise locations in December are displayed in Figure 3). All locations associated with deceased tortoises were excluded from analysis. Some dead tortoises were located distances greater than 1 km away from the last known location and we suspect that predators or scavengers may have relocated the carcasses.

Mean monthly distances travelled by male and female tortoises from 2007-2010 ranged from 12.3 ± 1.7 m to 1,596.7 ± 417.8 m (Table 3; Figure 4). The best model each year explaining animal movement contained an interaction of sex, month, and experimental treatment group. Male tortoises moved greater distances each month in general than females ($F_{1,168}$=8.33, p<0.01). Translocated tortoises moved greater distances each year than resident and control tortoises ($F_{2,1,338}$=10.24, p<0.01), and the increased movement can be attributed mostly to variation in movements during the month of May. In May, female translocated tortoises moved greater distances than female resident ($T_{1,670}=1.76$, $p=0.08$; $T_{1,470}=2.93$, $p<0.01$) and female control ($T_{1,670}=3.14$, $p<0.01$; $T_{1,470}=2.93$, $p<0.01$) tortoises in 2007 and 2008 respectively. Differences in female movement between months were not observed in 2009 and 2010. In males, translocated tortoises moved further than residents each year during the month of May (*2007-* $T_{1,670}=2.01$, $p<0.04$; *2008-* $T_{1,470}=5.84$, $p<0.01$; *2009-* $T_{1,360}=2.18$, $p=0.03$; *2010-* $T_{1,392}=5.16$, $p<0.01$). After translocation, male translocatees moved greater distances than control tortoises (Table 3) during the month of May in 2008 ($T_{1,470}=4.86$, $p=<0.01$), 2009 ($T_{1,360}=2.40$, $p=0.02$), and 2010 ($T_{1,392}=5.16$, $p<0.01$).

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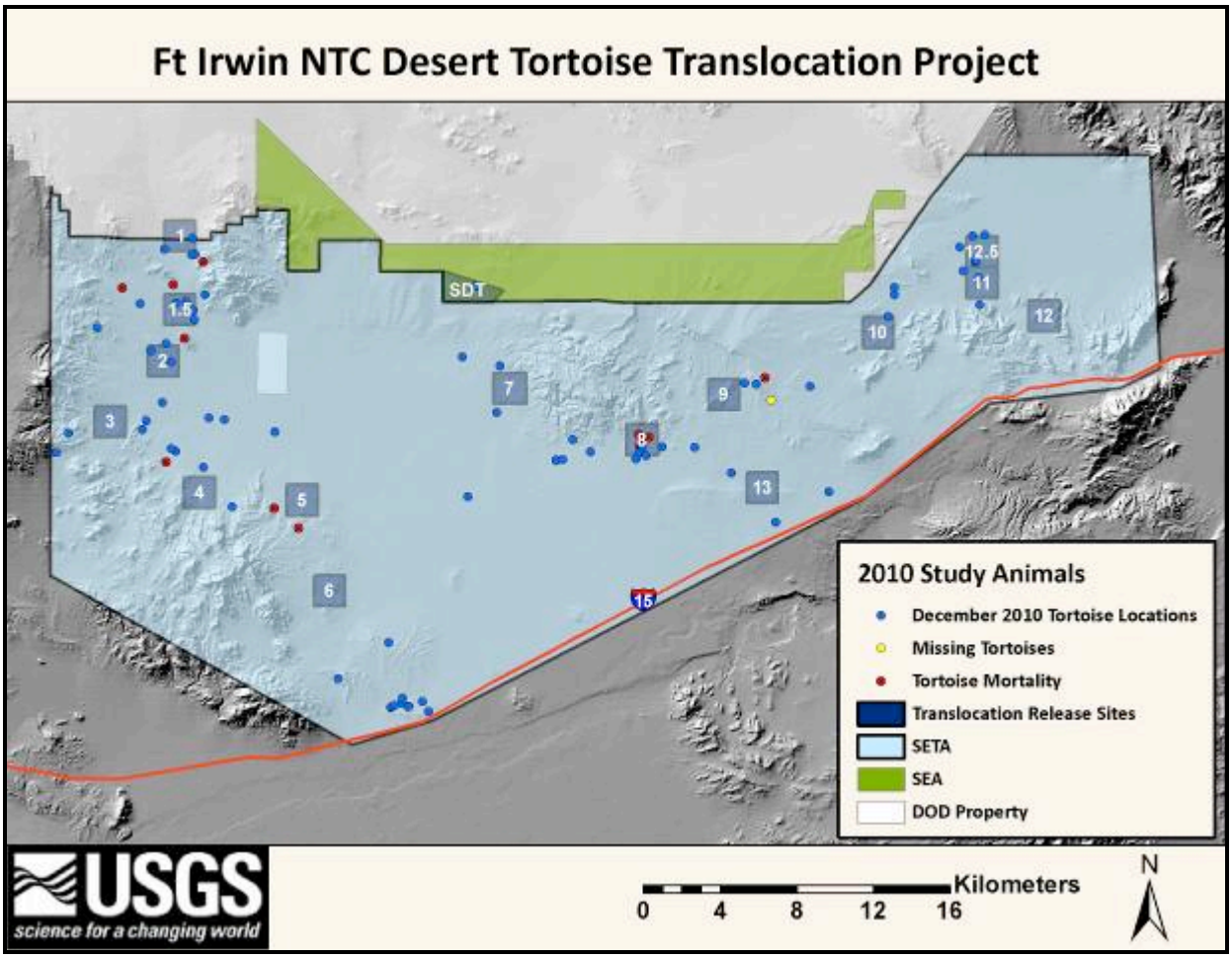

Figure 3. Map of desert tortoise locations in December 2010.

Table 3. Calculated monthly distance (meters) for desert tortoises within each experiment treatment throughout the activity season (April-October) during the study (2007-2009). Corresponding letters indicate statistical differences between one another.

Year	Treatment	Sex	May	June	July	August	September	October
2007	Control	F	65.4 ± 12.6	136.0 ± 21.0	91.1 ± 20.9	72.7 ± 22.5	102.8 ± 47.6	201.1 ± 46.2
		M	185.0 ± 29.4	130.2 ± 33.9	66.4 ± 25.0	131.6 ± 31.2	191.3 ± 43.8	230.7 ± 45.5
	Resident	F	136.4 ± 41.6	107.6 ± 32.9	97.5 ± 30.2	97.2 ± 35.9	41.5 ± 19.8	133.6 ± 26.0
		M	124.4 ± 52.0	152.2 ± 33.3	74.8 ± 34.3	168.3 ± 67.7	263.4 ± 51.3	284.9 ± 79.5
	Translocated	F	240.4 ± 35.2	174.7 ± 40.2	140.4 ± 38.7	148.0 ± 41.8	117.3 ± 50.1	159.5 ± 30.0
		M	241.6 ± 48.8	214.2 ± 35.7	134.1 ± 34.8	196.6 ± 42.7	184.8 ± 46.7	204.8 ± 40.8
2008	Control	F	128.42 ± 41.27	221.8 ± 46.6	248.2 ± 158.7	154.7 ± 79.6	136.6 ± 47.4	438.3 ± 382.4
		M	270.9 ± 93.6	181.0 ± 70.6	27.2 ± 11.5	72.4 ± 49.2	218.7 ± 78.4	160.5 ± 77.2
	Resident	F	263.9 ± 88.5	233.8 ± 58.6	225.7 ± 71.0	59.6 ± 13.8	476.9 ± 380.3	119.9 ± 23.8
		M	437.0 ± 55.1	250.4 ± 45.8	125.9 ± 32.5	137.8 ± 30.6	238.6 ± 41.3	316.8 ± 75.8
	Translocated	F	1023.8 ± 399.1	442.8 ± 101.5	117.2 ± 43.5	932.7 ± 880.4	66.4 ± 37.7	127.0 ± 56.7
		M	1,596.7 ± 417.8	468.1 ± 140.1	47.2 ± 14.0	69.8 ± 25.1	285.3 ± 148.4	396.4 ± 160.9
2009	Control	F	183.7 ± 57.4	92.5 ± 7.51	151.9 ± 94.3	37.0 ± 30.2	61.3 ± 46.1	176.9 ± 26.8
		M	624.4 ± 196.7	300.9 ± 63.3	156.3 ± 76.9	38.0 ± 24.9	290.9 ± 115.6	364.0 ± 75.1
	Resident	F	209.5 ± 48.7	208.4 ± 34.4	160.7 ± 44.0	29.9 ± 7.3	39.1 ± 17.01	73.8 ± 15.7
		M	466.9 ± 65.6	264.2 ± 45.9	115.4 ± 31.8	159.8 ± 62.2	280.9 ± 62.4	284.8 ± 59.1
	Translocated	F	261.5 ± 108.1	208.0 ± 19.9	44.3 ± 26.4	35.9 ± 16.8	113.9 ± 51.2	88.8 ± 83.8
		M	717.4 ± 236.2	680.5 ± 416.0	30.9 ± 18.1	12.3 ± 1.7	31.3 ± 12.9	151.1 ± 87.4
2010	Control	F	275.6 ± 55.2	317.2 ± 77.3	129.7 ± 39.9	81.5 ± 43.4	135.0 ± 52.2	83.4 ± 29.0
		M	709.4 ± 140.1	577.8 ± 117.8	184.4 ± 40.6	10.8 ± 6.2	221.7 ± 63.6	191.7 ± 43.4
	Resident	F	207.3 ± 42.9	278.8 ± 57.8	292.0 ± 51.6	45.1 ± 23.3	135.7 ± 32.5	143.7 ± 34.1
		M	396.5 ± 74.1	353.6 ± 55.3	298.4 ± 57.9	92.7 ± 24.0	313.8 ± 56.9	415.4 ± 67.3
	Translocated	F	335.0 ± 124.2	208.9 ± 139.3	310.3 ± 143.1	7.4 ± 4.7	171.7 ± 70.2	153.2 ± 62.9
		M	1,111.2 ± 544.9	591.5 ± 249.6	278.6 ± 80.0	39.5 ± 31.5	157.7 ± 27.9	363.7 ± 172.4

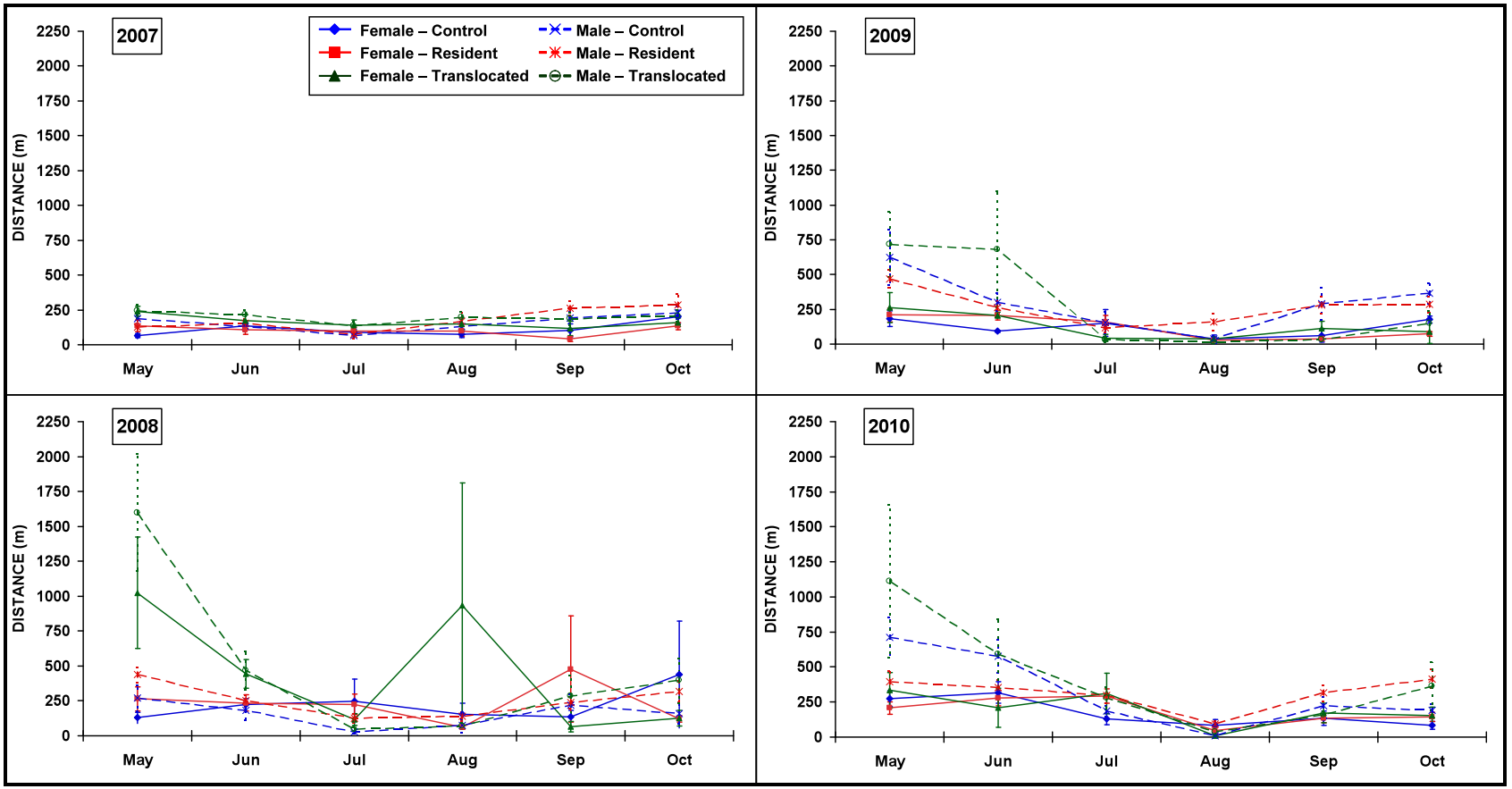

Figure 4. Calculated monthly distance (meters) moved by female (solid lines) and male (dashed lines) desert tortoises for control (blue lines), resident (red lines) and translocated (green lines) treatment groups during the activity season (May-October) from 2007-2010.

Blood Sample Collection

Blood samples (n=212) were collected from April 5, 2010 through October 7, 2010 (Table 4, Table 5). A detailed list of collected blood samples and associated tortoises is provided in Appendix 4.

Table 4. Venipuncture site and number of blood samples collected.

Year	Jugular	Subcarapacial
2005	138	0
2006	3	223
2007	0	795
2008	0	605
2009	0	419
2010	0	212

Plasma Analysis

Laboratory analyses to measure plasma total corticosterone (CORT) were completed for most blood samples (n=2,180) collected during 2005-2009. Samples collected in 2010 are pending and will be reported when available. A detailed description of results (2007-2009) is provided in Appendix 5.

Vegetation Sampling

Annual plant productivity was estimated by sampling 107 plots distributed throughout the SETA. Sampling occurred for thirty quadrats (0.1 m^2) within each plot for a total of 3,210 quadrats (321 m^2). The estimated mean annual plant production in 2010 was 17.67 $g/m^2 \pm 1.07$ SE, the highest level of plant production in five years of sampling (Table 6). High levels of winter precipitation may have contributed to the increased production measured in 2010 (NOAA 2010, Table 6).

Tortoise Mortality

Tortoise mortality rates were lower in 2010 than the previous year (Appendix 6). In 2010, 11 tortoises were found dead (1 control, 9 resident, 1 translocated), compared to 32 in 2009 and 59 in 2008. Although six of the deaths had evidence of canid presence (eg. scat, hair, burrow excavations, etc.), in most cases it was impossible to determine whether the death was due to a canid attack or if scavenging took place after a death by natural or other causes. Using a 3-sample test for equality of proportions, the number of tortoises found dead within each experimental population was not statistically different ($X^2 = 0.7094$, df = 2, p-value = 0.7014). Mortality locations in 2010 are displayed in Figure 2.

Table 5. Blood samples were collected over 3 seasonal periods in the Translocation Area in 2005, over 5 months in the Translocation Area and SEA in 2006, over 7 months in the Translocation Area and the SEA in 2007, and over 7 months in the Translocation Area in 2008 and 2009.

Year	Season/Month	Collection Date (mm/dd/yyyy)	Samples
2005	Spring	05/10/2005 -05/25/2005	11
	Summer	06/20/2005 -08/11/2005	79
	Fall	08/31/2005 -09/16/2005	48
	2005	**05/10/2005 -09/16/2005**	**138**
2006	May	05/11/2006 05/25/2006	53
	June	06/12/2006 06/21/2006	44
	July	07/19/2006 -07/25/2006	37
	August	8/16/2006 – 08/22/2006	47
	September	09/18/2006 09/21/2006	45
	2006	**05/11/2006 09/21/2006**	**226**
2007	April	04/03/2007 04/10/2007	117
	May	05/01/2007 05/11/2007	116
	June	06/05/2007 06/08/2007	114
	July	07/02/2007 07/10/2007	112
	August	08/06/2007 08/09/2007	113
	September	09/04/2007 09/11/2007	115
	October	10/02/2007 10/04/2007	108
	2007	**04/3/2007 – 10/04/2007**	**795**
2008	April	04/02/2008 -04/09/2008	96
	May	05/05/2008 -05/08/2008	99
	June	06-02-2008 -06/05/2008	91
	July	06/30/2008 -07/02/2008	85
	August	08/04/2008 -08/07/2008	80
	September	09/02/2008 -09/04/2008	79
	October	10/01/2008 -10/03/2008	75
	2008	**04/02/2008 -10/03/2008**	**605**
2009	April	04/06/2009-04/09/2009	73
	May	05/04/2009-05/06/2009	64
	June	06/08/2009-06/14/2009	63
	July	07/06/2009-07/07/2009	55
	August	08/03/2009-08/04/2009	50
	September	09/08/2009-09/09/2009	61
	October	10/05/2009-10/06/2009	53
	2009	**04/06/2009-10/06/2009**	**419**
2010	April	4/5/2010-4/6/2010	66
	May	5/3/2010-5/4/2010	72
	June	6/1/2010-6/2/2010	66
	October	10/7/2010	8
	2010	**04/06/2009-10/06/2009**	**212**
Combined	**2005-2010**	**5/10/2005-10/07/2010**	**2395**

Table 6. Annual plant production in g/m^2 ± SE and winter precipitation (Oct. through Feb) for five years of sampling. Annual plant production was not recorded in 2006.

Year	Plant Production (g/m^2)	SE	# Transects	Winter Precipitation (mm)
2005	1.96	0.6	89	249.94
2006				41.91
2007	1.71	1.84	30	17.27
2008	11.46	4.67	99	73.66
2009	16.4	5.38	110	75.95
2010	17.67	1.07	107	123.7

DISCUSSION

The major focus of our research during 2005 was to track, locate and mark as many resident and control tortoises as possible, while simultaneously collecting information on their ecology, physiology, habitat use, and habitat condition. Because we were able to mark a robust sample size of animals in 2005, our research focus in 2006 was to acquire blood samples, as well as locate and monitor all tortoises. In 2007-2010, we streamlined our efforts to include a more intensive sampling effort each month to collect blood for tortoises within the three experimental populations during the activity season (April to October). Efforts were made to capture and sample each animal during optimal temperatures and periods of expected activity throughout the day. As a result of this combined effort, we encountered, weighed, and measured 338 tortoises and attached transmitters to 241 tortoises throughout the study area. On March 27, 2008, we translocated 38 study animals located in the SEA into four selected release plots within the SETA.

To evaluate potential physiological effects (e.g. increased stress) of translocation on desert tortoise populations, we evaluated adrenal glucocortoicoids, specifically corticosterone (CORT) for three years prior to and three years after translocation. Blood samples were collected from 265 tortoises for a total of 2,395 samples over the past six years to determine physiological stress within each treatment group (resident, control, and translocated). Repeated measurements of individuals are vitally important to understanding individual responses to translocation. Repeated measurements on animals make it possible to detect changes in the status of tortoises relative to stress, site fidelity, movements, disease, and habitat change, while accounting for the predicted changes of endocrine levels and associated parameters.

In 2010, we continued to collect blood samples to add to our dataset examining the potential influence of translocation on stress levels in desert tortoises, but these samples have yet to be analyzed. All previous data indicates that translocation did not cause a measurable physiological stress response in CORT levels (Drake *et al.* In Prep). Analyses for additional parameters (e.g. winter precipitation, annual forage, perennial cover, and elevation) potentially influencing these annual fluctuations in CORT are ongoing.

Similar to previous results (Drake *et al.* 2009), tortoise mortality increased starting in January 2008 resulting in suspected deaths from canid species. This rise in predation was likely indirectly attributed to periods of low winter precipitation (NOAA 2006, 2007, 2008). Periods of drought may indirectly increase mortality through increased predation on adult tortoises as the result of a

functional response (prey switching) of predators to a decrease in prey availability (Woodbury and Hardy, 1948; Peterson, 1994). A more thorough review of tortoise predation related to environmental and anthropogenic impacts found that translocation did not affect the probability of predation: translocated, resident, and control tortoises all had similar levels of predation (Esque *et al.* 2010). Since 2008, winter precipitation has increased (NOAA 2009, 2010) and tortoise mortality has diminished in response. Recorded deaths decreased from 59 tortoises in 2008 to 32 tortoises in 2009 and continued to decrease further in 2010 to 11 recorded tortoise deaths.

Analysis on monthly movements revealed a significant difference between experimental treatment groups. Both male and female translocated tortoises traveled greater distances than resident and control tortoises; however, these differences in movement occurred within the month of May. This suggests that translocation treatment is affecting movement patterns for desert tortoises. Habitat characteristics, including vegetation composition, soils, and levels of disturbance, vary across our research sites and have been documented throughout the study. We need to further examine the role these environmental factors play in influencing the movements of our treatment groups.

In 2011, we plan to continue to monitor and collect blood from all study animals involved in our research. We plan to complete laboratory analysis for plasma total corticosterone and testosterone values for all samples, and investigate the potential for cascading impacts of stress on immune function and other physiological factors. We will continue habitat characterization (i.e., primary production, annual vegetation structure, etc.) so that differences in habitat among the translocation sites are well documented.

The Fort Irwin Translocation Project has provided vast amounts of data regarding the ecology, behavior, habitat use, and distribution of desert tortoises. Through extensive coordination and collaboration among researchers collectively more than 57,000 tortoise observations have been recorded over the past six seasons. Thanks to such cooperation, this comprehensive dataset has enabled us to understand habitat use and movements of both translocated and resident populations to an extent that would otherwise not have been possible.

ACKNOWLEDGEMENTS

This research would not have been possible without the help of the U.S. Geological Survey, U.S. Department of the Army-Ft. Irwin, U.S. Fish and Wildlife Service, California Department of Fish and Game and the Bureau of Land Management. Our thanks are extended to Clarence Everly, Mickey Quillman, Andrew Walde, Peter Woodman, William Boarman, Kat Darst, Roy Averill-Murray, Becky Jones, and Charles Sullivan, for providing project guidance and expertise to the research design and data collection. We thank USGS staff including Andrew Berger, Felicia Chen, Martin Kang, Santino Lauricella, Jose Lopez, Andrew Modlin, Claire Phillips, Bryant Reynolds, Robert Saulino, and Vanessa Van Zerr for their hard work and assistance throughout this project. In addition, we would like to thank the following Student Conservation Association volunteers: Marcus Bianco, Emma Fraser, Jillian Gleave, Carolyn Moore, Kerri Oddenino, Daniel Oquendo, Marianne Richter, and Annamarie Saenger for their field assistance in vegetation and tortoise monitoring. Any use of trade, product or firm names in this publication is for descriptive purposes only and does not imply endorsement by the US government.

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APPENDICES

Appendix 1. Sample of data sheet completed for each desert tortoise encounter in the SETA and SEA in 2005-10 (Attached Separately)

Appendix 2. Highly Modified Honegger System notching diagram (Attached Separately)

Appendix 3. List of radio transmittered tortoises monitored in 2010. (Attached Separately)

Appendix 4. List of blood samples collected in 2010 (Attached Separately)

Appendix 5. Draft Manuscript for Drake, K. K., T.E. Esque, K.E. Nussear, A.M. Barber, K.M. Nolte, and P.A. Medica. In Preparation. Does translocation influence physiological stress in desert tortoises (*Gopherus agassizii*) (Attached Separately)

Appendix 6. List of tortoise mortalities in 2010 (Attached Separately)

UTM NAD 83 PDA Proof_____DataBase Proof_____

Ft. Irwin Tortoise Encounter

Tracking Attempted Only (Could not Locate Animal) ☐

Tortoise_____
Date_____
Time_____
Observer_____
Easting_____
Northing_____
AirTemp._____(ºF)

TortTemp. Neck_____(°F)
TortTemp. Tail _____(°F)
Location Description_____

Gender_____
Mass Pre____lbs_____oz
Mass Post ____lbs____oz
Carapace Length_____mm
Tort Width_____ mm
Tort Height_____mm
Plastron Length_____ mm

RadioFreq._____
Factory Freq._____
Radio Serial_____
PIT Tag #_____
Notched_Yes or No__
Notched Number_____
Burrow Number_____
Burrow Azimuth_____
Photo Taken: _____

Location · Burrow · Mouth · Pallet · Veg · Open-Sun · Open-Shade · Other_____
Veg Species_____Height (cm)_____Width 1 (cm)_____Width 2 (cm)_____
Behavior · Inact ·At Rest-act · Eat · Move · Antagonist · Sex ·Drink · Dig · Bask ·Dead
Habitat · Pavement · Open Scrub · Sm Wash · Lg Wash · Hill · Road
Condition · Good · Poor Shell · Poor Eyes · Poor Nares · Head Not Visible · Tort Not Visible · Dead · Notes_____
Soil · Sand · Sandy Loam · SL+C ·Cobble · Rock · Caliche
Weather · Clear · Partly Cloudy · Overcast · Dry · Rain · Hail · Calm · Wind · Breeze
Blood · Yes ·No · Attempted · Tapped
Death Cause · Canid · Heat Stress · Natural · Moribund · Unknown-Shell Intact · Vehicle
Encounter Notes:_____
_____
_____
_____

Blood Information
Tortoise _____
Date _____
Bled By _____
Location Subcarp/___
Stick Side Center/____
# of Sticks _____
Filter Papers _____
Field Blood Notes:
_____
_____
_____

Sample 1 Time Bled_____
Sample 1 Volume_____
Sample 1 Lymph Yes / No
Sample 1 Time on Ice_____
Sample 1 # Microtainers_____
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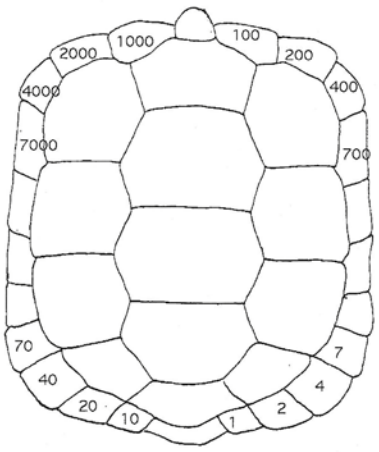
Sample 2 Time Bled_____
Sample 2 Volume_____
Sample 2 Lymph Yes / No
Sample 2 Time on Ice_____
Sample 2 # Microtainers_____



Processor	Plasma Color	Hematocrit	Plasma	Lymph
	☐ Dark Yellow	☐ Normal	☐ Normal	☐ None
Time Processed	☐ Yellow	☐ Low	☐ Thick	☐ Low (1-15%)
	☐ Light Yellow	☐ High	☐ Watery	☐ Medium (16-30%)
1 2 3 **RBC Vials**	☐ Clear			☐ High (31%+)
1 2 3 **Plasma Vials**	☐ Hemolyzed			

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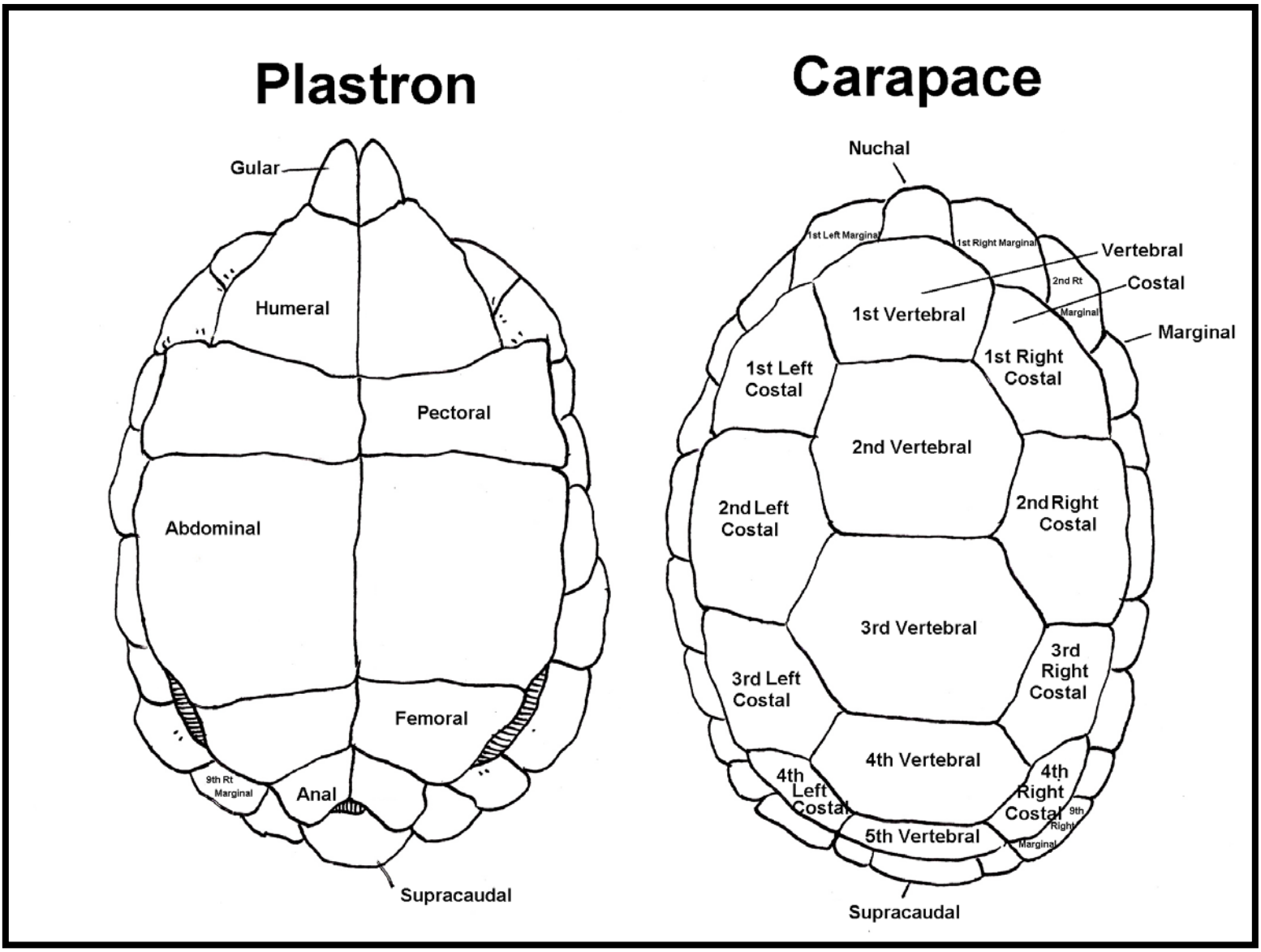
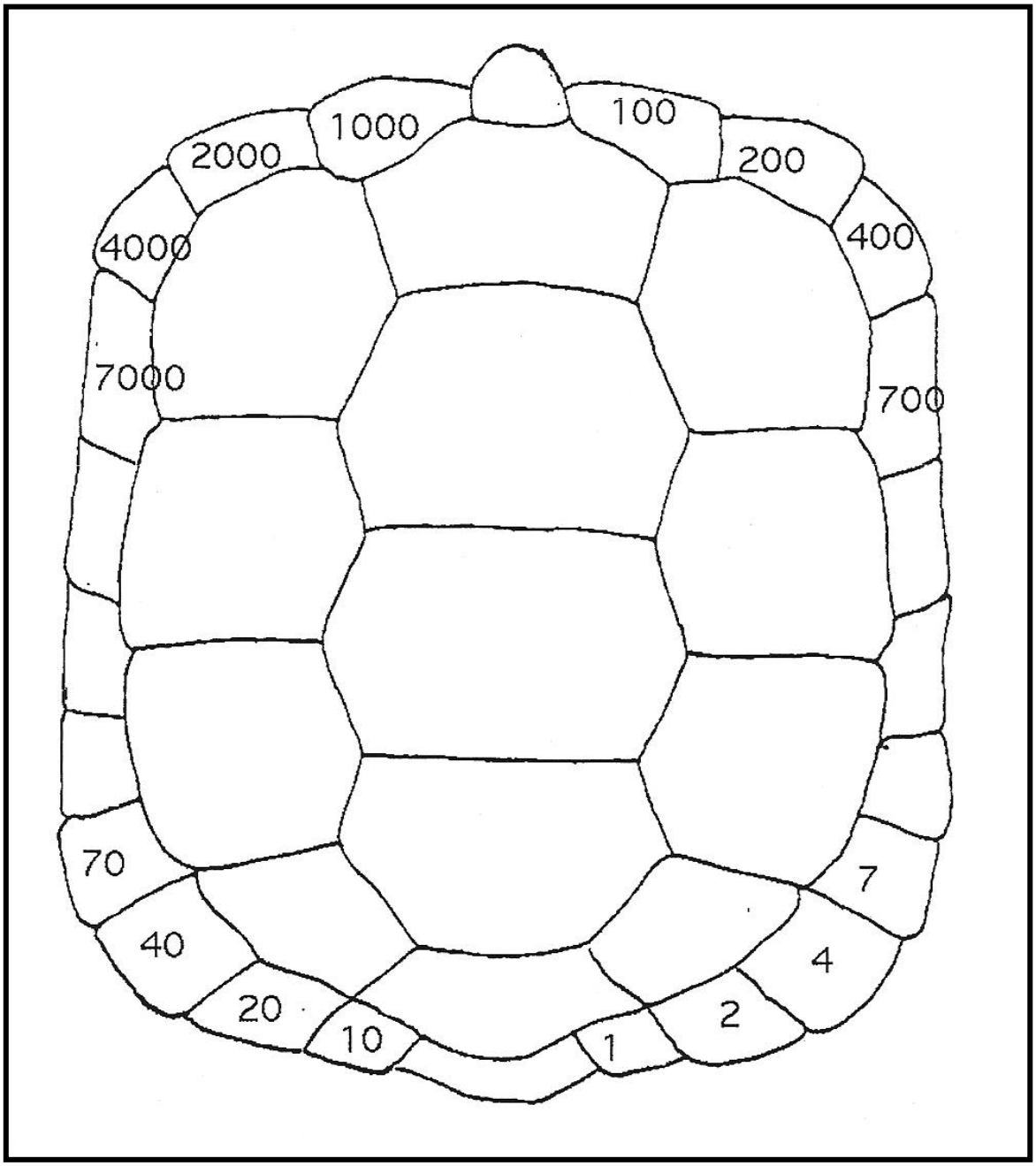
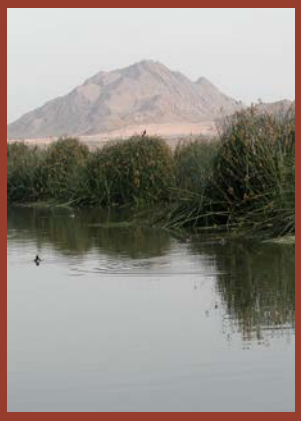


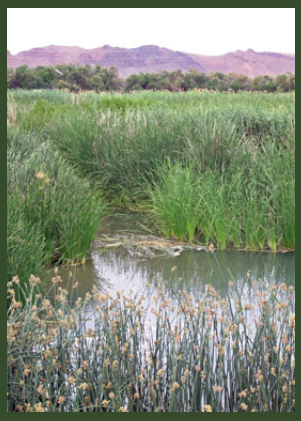
Commonly misspelled terms: cutaneous dyskeratosis, scute, subcarapacial, osteoporosis

Appendix 2. Highly Modified Honegger System notching diagram











las vegas wash coordination committee

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Marsh Bird Monitoring, including Yuma Clapper Rail, along Las Vegas Wash, Clark County, Nevada, 2011



January 2012

SOUTHERN NEVADA WATER AUTHORITY

Las Vegas Wash Coordination Committee

AR074644

Marsh Bird Monitoring, including Yuma Clapper Rail, along Las Vegas Wash, Clark County, Nevada, 2011

SOUTHERN NEVADA WATER AUTHORITY
Las Vegas Wash Project Coordination Team

Prepared for:

U.S. Fish and Wildlife Service
Southern Nevada Field Office

and

Las Vegas Wash Coordination Committee

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January 2012

ABSTRACT

The Las Vegas Wash Coordination Committee, a 29-member stakeholder group, is working to stabilize and enhance the Las Vegas Wash (Wash), the channel that drains flows from the Las Vegas Valley to Lake Mead at Las Vegas Bay. The Wash also flows through the 2900-acre Clark County Wetlands Park. Activities associated with the stabilization program and park development include wetland revegetation and expansion. During informal Section 7 consultation on the project, the U.S. Fish and Wildlife Service recommended that annual surveys for Yuma clapper rail (*Rallus longirostris yumanensis*) be conducted during the breeding season to determine the species occurrence within the park. Surveys were conducted by permitted consultants nearly annually from 2000 through 2007 (McKernan and Braden 2001, 2002; SWCA 2002, 2003, 2005, 2006, 2007, 2008). Wanting to obtain information on all secretive marsh bird species that may benefit from wetland enhancement in the study area, the Las Vegas Wash Project Coordination Team began a study using the standardized North American marsh bird monitoring protocol (Conway 2005) in 2007 (Van Dooremolen 2010a).

Six species were targeted during the 2011 surveys: American bittern, least bittern, black rail, clapper rail, Virginia rail, and sora. Detections of pied-billed grebe, common gallinule (formerly common moorhen), and American coot (referred to as non-target species) were also recorded. Surveys were conducted along three survey routes comprising 24 points. No clapper rail, black rail or American bittern were detected. Least bittern, Virginia rail, and sora were detected, as were the three non-target species. Sora continued to be the most abundant of the target species. Including non-target species, American coot was the most abundant. Abundances were greater than or within the range of values from the prior four years of surveys for all species detected. Virginia rail abundance increased the most, with the majority of the detections occurring on the route in the in-lieu fee mitigation ponds (Route 4), which increased from a partial route of just three points in 2010 to a full route of nine points in 2011. The route had the highest total abundance of target and non-target species overall and offers perhaps the widest variety of wetland habitat currently available in the study area. Annual marsh bird surveys along the Wash should continue in order to comply with informal Section 7 consultation measures regarding Yuma clapper rail and to determine whether changes or stability in the abundances of the other marsh bird species represent actual trends.

ACKNOWLEDGEMENTS

I would like to thank the Bureau of Reclamation for providing partial funding to the Southern Nevada Water Authority for this project under assistance agreement number R09AP30017. I would also like to extend my thanks to Seth Shanahan, Marissa Foster, and Carol Lane for assisting with surveys. In addition, I would like to thank Lake Las Vegas Resort for allowing access to their mitigation wetlands. Finally, I would like to thank the Las Vegas Wash Coordination Committee for their continued support for wildlife monitoring research and the implementation of the Las Vegas Wash Comprehensive Adaptive Management Plan and Las Vegas Wash Wildlife Management Plan. These activities have been conducted by Deborah Van Dooremolen under permit no. TE-148556-1 (expired October 11, 2011; renewal in process) and Seth Shanahan under permit no. TE-231424-0 (expires March 18, 2013) as issued by the U.S. Fish and Wildlife Service, Sacramento, California.

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1.0 BACKGROUND

The Las Vegas Wash (Wash) is the primary drainage channel for the Las Vegas Valley carrying urban flows, including highly treated wastewater, urban runoff, shallow groundwater, and storm runoff, into Lake Mead at Las Vegas Bay (Figure 1). Although originally an ephemeral stream, the Wash began supporting perennial flows in the 1950s when the discharge of treated wastewater into the channel was initiated. At first these perennial flows created a lush wetland along the channel. However, the volume of flows in the Wash continued to increase with the increasing urban population, and erosion began to drain the wetlands and carry thousands of tons of sediment to Lake Mead. By the late 1990s, headcutting had deeply incised the channel and reduced the wetlands by approximately 90 percent from their peak extent, leaving less than 200 acres.

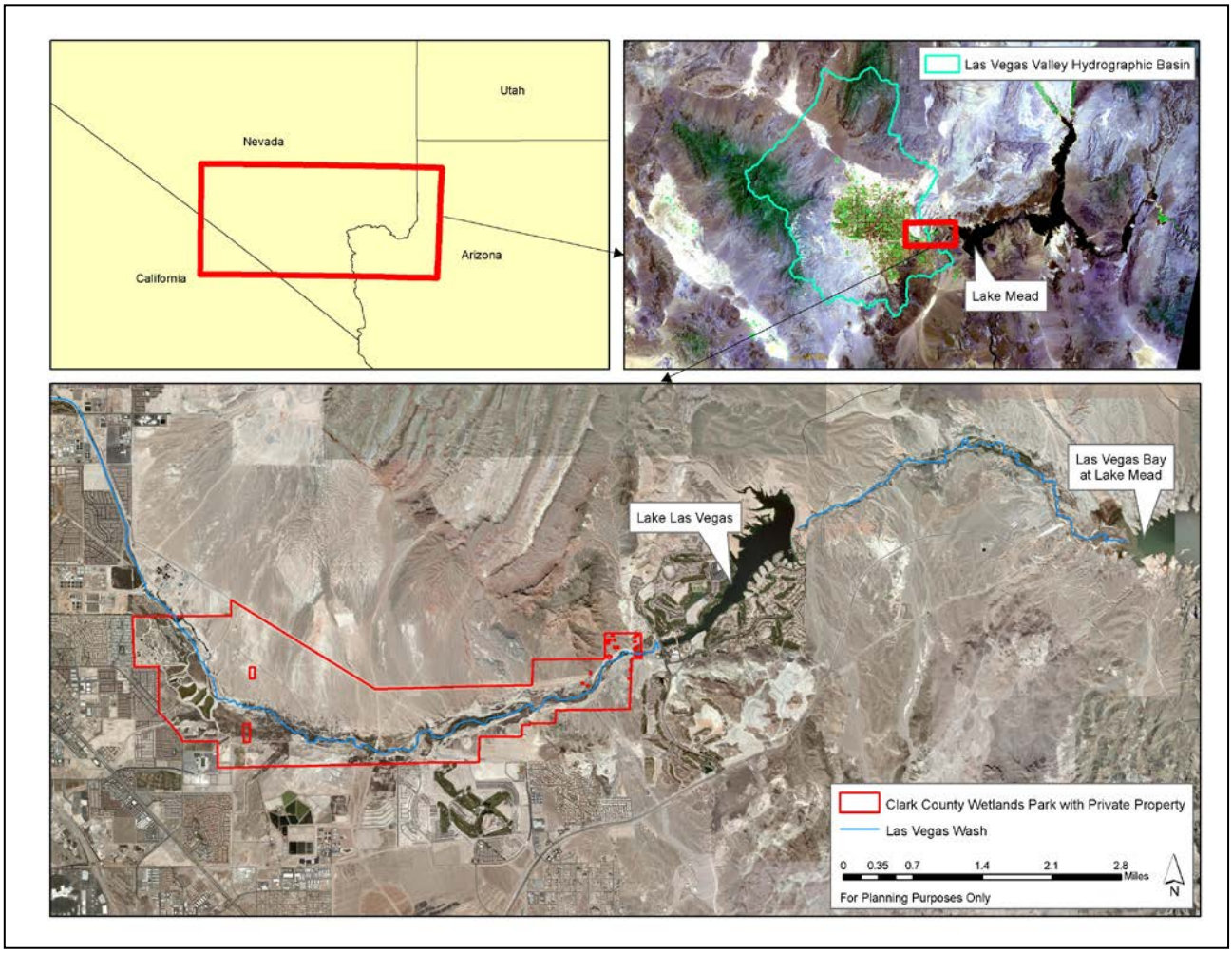

Figure 1: Las Vegas Wash location and general study area map.

In 1998, the Las Vegas Wash Coordination Committee (LVWCC), a now 29-member community stakeholder group, was created to address the degradation of the Wash. The group developed and is implementing the Las Vegas Wash Comprehensive Adaptive Management Plan

to stabilize the Wash and restore its ecological functions. Stabilization and enhancement activities, which include the construction of 22 erosion control structures (weirs) and extensive revegetation, will help deter further erosion and reduce the amount of sediment being deposited in Lake Mead; 12 weirs were in place by spring 2011.

The LVWCC is increasing wetland habitat along the channel by planting bulrush (*Schoenoplectus* spp.) in the impoundments of the weirs and along the weir faces, and cattail (*Typha domingensis*) and common reed (*Phragmites australis*) volunteer from upstream seed sources. Emergent vegetation can also be found in the constructed wetland ponds in the nearby Nature Preserve, the developed portion of the Clark County Wetlands Park (Wetlands Park) through which the Wash flows. The county has created additional wetland habitat within the Wetlands Park in the form of the in-lieu fee mitigation ponds (Figure 2). The increase in wetland habitat along the Wash and throughout the Wetlands Park could have a positive impact on secretive marsh birds (e.g., rails and bitterns), including the federally endangered Yuma clapper rail (*Rallus longirostris yumanensis*).

The Yuma clapper rail is largely restricted to the lower Colorado River watershed and the Salton Sea, inhabiting freshwater and brackish water wetlands (Anderson and Ohmart 1985). Home range size varies seasonally and is greatest during winter and post-breeding (Eddleman 1989, Conway et al. 1993). Eddleman (1989) reported a mean annual home range size of more than 17 acres, while Conway et al. (1993) reported mean annual home range size to be 30 acres. Sites occupied by Yuma clapper rail have a higher percent cover of shallow water (Eddleman 1989). Density of emergent vegetation has also been reported as an important habitat variable although findings differ. Anderson and Ohmart (1985) found that Yuma clapper rail typically reached their highest numbers year-round in the densest stands of emergent vegetation, while Conway et al. (1993) found low stem densities to be an important component. Species preferences also vary. Conway et al. (1993) found that cattail and bulrush are preferred, although Yuma clapper rails have also been detected in wetlands dominated by common reed, salt cedar (*Tamarix ramosissima*) and willow (*Salix* spp.; Eddleman 1989, Hinojosa-Huerta et al. 2001). Differences in preferred density and species of emergent vegetation among different geographic locations may relate to densities of crayfish, the most abundantly consumed prey item of the Yuma clapper rail (Anderson and Ohmart 1985). Habitat use also changes throughout the year, thus Conway et al. (1993) suggest that maintaining shallow, open water areas with stands of emergent vegetation at different successional stages would best support clapper rails year-round.

Alcorn (1988) reported that eight clapper rails were observed in the Las Vegas Sewage disposal drainage ditch on September 6, 1959, and that a lone individual was observed in the same location a few weeks later (the site of the detections is believed to be the present-day City of Las Vegas Water Pollution Control Facility discharge channel, located approximately 1.5 miles upstream of the Wetlands Park boundary; Figure 2). A Yuma clapper rail was also detected along the Wash, within the Wetlands Park, on May 28 and June 18, 1998, in a wet, salt cedar-dominated area upstream of Pabco Road Weir (Southwest Wetlands Consortium 1998; Figure 2). As a result, during informal Section 7 consultation on the proposed development of the Wetlands Park and associated erosion control structures, the U.S. Fish and Wildlife Service required that the Southern Nevada Water Authority (SNWA), the lead agency of the LVWCC, conduct annual surveys to determine the breeding status of Yuma clapper rail within the Wetlands Park.

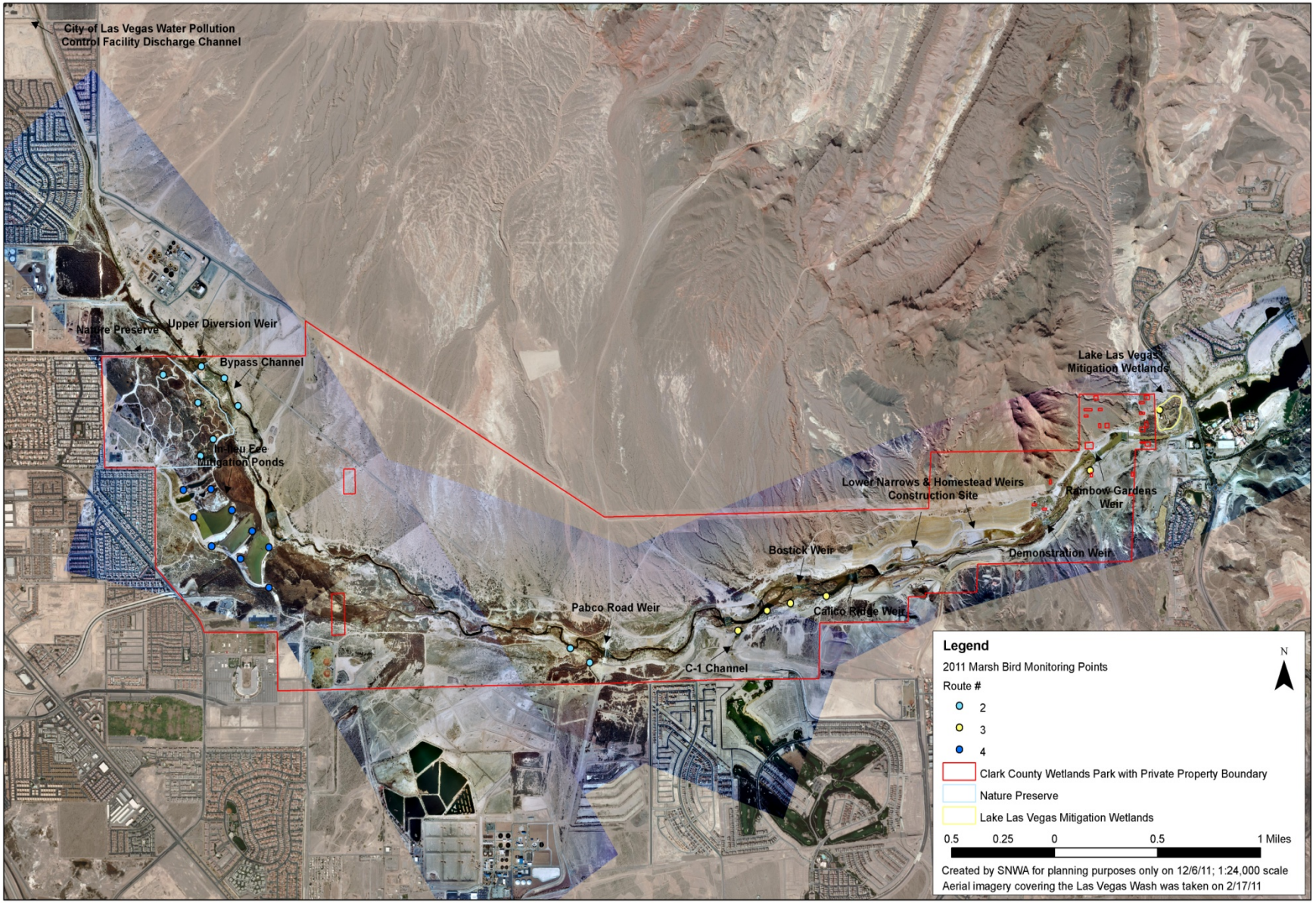

Figure 2: Historical clapper rail detection areas and 2011 marsh bird monitoring points.

SNWA contracted with permitted consultants to perform these surveys from 2000 to 2004 and 2006 to 2007. No Yuma clapper rails were detected from 2000 to 2004, nor in 2007 (Mckernan and Braden 2001, 2002; SWCA 2002, 2003, 2005, 2008). A Yuma clapper rail was detected on May 23, 2005, during surveys for other species. It was calling from emergent habitat in the impoundment of the Demonstration Weir (SWCA 2006; Figure 2). Another was detected in the marsh along the C-1 Channel near where it discharges to the Wash on June 4 and June 7, 2006, also during surveys for other species (SWCA 2007; Figure 2). The portion of the channel where the bird was detected has since been lined with rock and concrete, but emergents are returning.

Conway (2005) developed a protocol for conducting marsh bird monitoring surveys that includes calling for clapper rail. The U.S. Fish and Wildlife Service accepted this protocol as the new official Yuma clapper rail survey protocol in 2006. The survey protocol enables compliance obligations regarding the clapper rail to be met, while also providing information on the status, abundance and distribution of other sensitive species, such as the least bittern (*Ixobrychus exilis*) and black rail (*Laterallus jamaicensis*), which are covered on the Lower Colorado River Multi-Species Conservation Program, that may benefit from wetland revegetation efforts. Consequently in 2007, the Las Vegas Wash Project Coordination Team, the implementation team of the LVWCC, initiated a marsh bird monitoring study along the Wash and within the Wetlands Park (Van Dooremolen 2010a, Van Dooremolen 2010b). Yuma clapper rail could not be surveyed for the first year because the necessary federal permit was not in place. The species was added to the survey in 2008. Results described below are from the 2011 monitoring season.

2.0 METHODS

2.1 Description of Survey Routes

Three routes were surveyed in 2011 along the Wash both within and adjacent to the Wetlands Park (Figure 2). GPS coordinates of the points are included in Appendix A.

Route 1, located upstream of the Wetlands Park between the Clark County Water Reclamation District and the City of Las Vegas Water Pollution Control Facility, was not surveyed in 2011. The cattail habitat had been largely degraded in 2010 and the decision was made to discontinue surveys along the route in favor of surveying a new route in the in-lieu fee mitigation ponds.

Route 2 included nine points in 2011: four within the constructed wetlands ponds at the Nature Preserve, one in the Upper Diversion Weir impoundment, two along the bypass channel, and two along the Wash upstream of Pabco Road Weir (Figure 2). The Nature Preserve ponds (3-acre lower pond, 1.5-acre middle pond complex, and 1.5-acre upper pond) have varying amounts of open water and the vegetation is composed of cattails, California, and hardstem bulrush (*S. californicus* and *S. acutus*), common reed, sandbar willow (*Salix exigua*), Goodding willow (*S. gooddingii*) and cottonwood (*Populus fremontii*). The Upper Diversion Weir point covers the 3.5-acre cattail complex in the impoundment. The bypass channel points include three acres of emergent marsh dominated by bulrush and cattails with some sandbar and Goodding willow and other woody riparian species. The points at Pabco Road Weir cover approximately six acres of wetland habitat, with two points upstream of the weir. The emergent habitat is dominated by cattail and common reed with stands of sandbar and Goodding willows and cottonwood interspersed. The water upstream of the weir is slow-moving and includes a small backwater pond and wetlands created by the City of Henderson Water Reclamation Facility outfall channel.

Route 3 included six points (40 acres of habitat) in 2011 (Figure 2); two additional points were inaccessible or impacted by excessive noise due to construction and so were not surveyed in 2011. The route begins in the small backwater wetland at the discharge of the C-1 Channel into the Wash and continues downstream to the Lake Las Vegas mitigation wetlands, an off-channel wetland located on private property just east of the Wetlands Park boundary. It includes points sampling the impoundments of Bostick Weir, Calico Ridge Weir, and Rainbow Gardens Weir (Figure 2) that have banks and islands covered in cattail, hardstem bulrush, common reed and Goodding willow with lesser amounts of sandbar willow and cottonwood.

Route 4, created as a partial route (three points) in 2010, was expanded to a full route in 2011 of nine points (60 acres of habitat; Figure 2). The route is located in the in-lieu fee mitigation ponds created by Clark County. Eight points were established on the ponds and one immediately to the southeast of the ponds, which covers habitat flooded by Duck Creek. The two points on the smaller ponds are dominated by relatively monotypic stands of cattail with very limited open water. The five points on the larger ponds are dominated by open water (both shallow and deep); vegetation occurs predominantly on the banks in the form of stringers of cattail, bulrush and common reed of varying width. The habitat at the point immediately adjacent to the mitigation ponds consists primarily of cattails, flooded tamarisk, and common reed. The point at the Tropicana Outfall, surveyed the previous year, was dropped.

Along each route, survey points were established a minimum of 656 feet apart. Although Conway (2005) recommends a separation of 1,312 feet, the Wash does not contain enough emergent marsh habitat to allow for such wide spacing while still maintaining a sufficient number of points per route.

2.2 Survey Protocol

Surveys were performed using the North American marsh bird monitoring protocol developed by Conway (2005). Trained observers conducted the surveys during the breeding season in April and May. Four surveys of each route were conducted. Each route was surveyed on a separate day. Two observers conducted each survey, including at least one permitted individual (Deborah Van Dooremolen [TE-148556-1], Seth Shanahan [TE-231424-0]). Surveys began one half hour before sunrise and concluded by 9 a.m. Although Conway (2005) specifies that the survey route be run in the same direction every time, each route was run in reverse every other survey to ensure that most points were surveyed during the earliest morning hours (the time of peak marsh bird vocalization). Surveys were not conducted if wind reached or exceeded 12 miles per hour, as measured by the Beaufort wind scale, for more than two points.

At each point, surveys began with a five-minute period of passive listening followed by broadcasting the vocalizations of each target species in succession to elicit a response. Target species for the Wash survey included American bittern (*Botaurus lentiginosus*), least bittern, black rail, clapper Rail, Virginia rail (*Rallus limicola*), and sora (*Porzana carolina*). Each species' vocalizations were broadcast for 30 seconds, followed by 30 seconds of silence to listen for responses, for a total of one minute per species. Species' vocalizations were broadcast in succession from most sensitive (i.e., likely to be deterred from responding by hearing the call of another species) to least sensitive: black rail, least bittern, sora, Virginia rail, clapper rail, and American bittern. Vocalizations were broadcast using MP3 players with portable speakers. The

observer(s) recorded all target species heard and/or seen during the survey, making a separate record for each bird and noting each minute of the survey period in which it was heard calling and/or seen. Individuals were also recorded if they were heard or seen at the point immediately before or after the survey. Detections of three other marsh bird species that were not targeted through the broadcast were also recorded, including pied-billed grebe (*Podilymbus podiceps*), common gallinule (formerly common moorhen; *Gallinula chloropus*), and American coot (*Fulica americana*). Given the sheer numbers of coots present at some points, observers often counted them either before or after the survey. Other data collected include the call type heard, the distance and direction to each detected bird, and whether the bird was detected at a previous point. The background noise level was also recorded at each point. Noise designated as loud or intense meant that at least some species could not be heard beyond approximately 165 or 80 feet, respectively.

2.3 Data Analysis

Points had to be surveyed a minimum of three times under appropriate conditions (wind below 12 miles per hour, no loud or intense noise, etc.) to be used in the analysis. Detections of target and non-target species were summarized by route and date to provide an overall picture of when and where birds were detected. However, since multiple detections could be made of the same bird over the course of a survey season, the number of individuals (abundance) per species along each route was also calculated. This number was calculated as the sum of the maximum number of birds of the species that were detected at each point during the season. Whether or not a bird was counted as a unique individual was determined by the following criteria. If one or more individuals of a species were detected at the same point on more than one survey, they were considered to be the same individual(s). If an individual had been detected at a previous point during a survey, the second survey detection was not counted. If an individual was detected at a point within 656 feet of a location where an individual had been detected on a prior survey, and the individual was calling from approximately the same direction where the other bird had been detected, it was considered to be the previously detected bird and was not counted as a new individual. This yielded an estimate of the minimum number of individuals present (referred to as total abundance) for each species.

For each route, the total number of individuals detected of each species, the total number of individuals detected of target species, and the total number of individuals detected regardless of species were divided by the number of points the route contained, yielding a per point abundance for each. Then for the study area as a whole, the total number of individuals detected of each species, the total number of individuals detected of target species, and the total number of individuals detected regardless of species were divided by the total number of points surveyed to yield the total abundance per point for each. Per point abundance provides a more accurate comparison between routes because different numbers of points were surveyed.

3.0 RESULTS

Of the target species, least bittern, Virginia rail, and sora were detected (Table 1). Sora and least bittern were detected on all routes; Virginia rail was detected on Routes 3 and 4. The three non-target species were detected on all routes, and both common gallinule and American coot were identified on all survey replicates on all routes (Table 1).

Route	Date	LEBI	VIRA	SORA	PBGR	COGA	AMCO	Grand Total
2	4/5/2011	1		5	2	7	53	68
	4/20/2011	3		3		5	11	22
	5/3/2011	2			4	2	5	13
	5/17/2011					2	5	7
2 Total		6	0	8	6	16	74	110
3	4/11/2011	2	2	1	2	5	65	77
	4/21/2011			2		3	12	17
	5/4/2011					3	4	7
	5/19/2011	2				3	6	11
3 Total		4	2	3	2	14	87	112
4	4/4/2011		3	5	6	6	46	66
	4/18/2011	2	3	3	3	2	45	58
	5/2/2011	1	9	8	3	4	17	42
	5/16/2011		6		2	2	9	19
4 Total		3	21	16	14	14	117	185
Grand Total		13	23	27	22	44	278	407

Table 1. Total 2011 detections for each species by route and date for the 24 points surveyed (Route 2, n=9; Route 3, n=6; Route 4, n=9). LEBI=Least Bittern, VIRA=Virginia Rail, SORA=Sora, PBGR=Pied-billed Grebe, COGA=Common Gallinule (formerly Common Moorhen), AMCO=American Coot.

Sora was the most abundant of the target species with 0.67 individuals per point (Table 2). American coot was the most abundant of all species with more than seven birds per point, and common gallinule was a distant second at 1.17 birds per point (Table 2).

Route 4, had the highest per point abundance of target species overall and of sora and Virginia rail (Table 2). Least bittern per point abundance was highest on Route 2. Total (all species) per point abundance was highest on Route 3 due primarily to its having the highest abundance of American coots.

	Target Species (TS) abundance (per point)				Non-target Species abundance (per point)			
Route	**LEBI**	**VIRA**	**SORA**	**Total TS**	**PBGR**	**COGA**	**AMCO**	**Grand Total**
2	4 (0.44)	0 (0.00)	5 (0.56)	9 (1.00)	5 (0.56)	11 (1.22)	54 (6.00)	79 (8.78)
3	2 (0.33)	2 (0.33)	2 (0.33)	6 (1.00)	2 (0.33)	8 (1.33)	65 (10.83)	81 (13.50)
4	2 (0.22)	11 (1.22)	9 (1.00)	22 (2.44)	7 (0.78)	9 (1.00)	56 (6.22)	94 (10.44)
Grand Total	8 (0.33)	13 (0.54)	16 (0.67)	37 (1.54)	14 (0.58)	28 (1.17)	175 (7.29)	254 (10.58)

Table 2. Total and per point abundances for 2011 for the 24 points surveyed (Route 2, n=9; Route 3, n=6; Route 4, n=9). LEBI=Least Bittern, VIRA=Virginia Rail, SORA=Sora, PBGR=Pied-billed Grebe, COGA=Common Gallinule (formerly Common Moorhen), AMCO=American Coot.

4.0 DISCUSSION

As in the prior four years of the study (Table 3), no Yuma clapper rail or black rail were detected. There have been no detections of Yuma clapper rail on the Wash now since 2006, making it highly unlikely that there are breeding individuals in the study area at this time. However, breeding colonies exist within approximately 40 miles, on the Muddy River and in the Overton Wildlife Management Area, making colonization a continuing possibility. American bittern has only been detected in one year (Table 3).

		Target Species (TS) abundance (per point)					**Non-target Species** abundance (per point)			
Year	**Route**	**AMBI**	**LEBI**	**VIRA**	**SORA**	**Total TS**	**PBGR**	**COGA**	**AMCO**	**Grand Total**
2007	1	0 (0.00)	1 (0.11)	4 (0.44)	7 (0.78)	12 (1.33)	1 (0.11)	1 (0.11)	15 (1.67)	29 (3.22)
	2	0 (0.00)	4 (0.50)	2 (0.25)	5 (0.63)	11 (1.38)	7 (0.88)	14 (1.75)	81 (10.13)	113 (14.13)
	3	0 (0.00)	4 (0.57)	1 (0.14)	2 (0.29)	7 (1.00)	4 (0.57)	13 (1.86)	68 (9.71)	92 (13.14)
2007 Total		0 (0.00)	9 (0.38)	7 (0.29)	14 (0.58)	30 (1.25)	12 (0.50)	28 (1.17)	164 (6.83)	234 (9.75)
2008	1	0 (0.00)	0 (0.00)	4 (0.44)	6 (0.67)	10 (1.11)	1 (0.11)	1 (0.11)	20 (2.22)	32 (3.56)
	2	0 (0.00)	2 (0.25)	0 (0.00)	5 (0.63)	7 (0.88)	4 (0.50)	15 (1.88)	41 (5.13)	67 (8.38)
	3	0 (0.00)	9 (1.00)	1 (0.11)	5 (0.56)	15 (1.67)	5 (0.56)	12 (1.33)	151 (16.78)	183 (20.33)
2008 Total		0 (0.00)	11 (0.42)	5 (0.19)	16 (0.62)	32 (1.23)	10 (0.38)	28 (1.08)	212 (8.15)	282 (10.85)
2009	1	0 (0.00)	2 (0.22)	2 (0.22)	5 (0.56)	9 (1.00)	0 (0.00)	0 (0.00)	4 (0.44)	13 (1.44)
	2	0 (0.00)	2 (0.25)	0 (0.00)	6 (0.75)	8 (1.00)	4 (0.50)	11 (1.38)	46 (5.75)	69 (8.63)
	3	0 (0.00)	2 (0.25)	2 (0.25)	5 (0.63)	9 (1.13)	4 (0.50)	13 (1.63)	97 (12.13)	123 (15.38)
2009 Total		0 (0.00)	6 (0.24)	4 (0.16)	16 (0.64)	26 (1.04)	8 (0.32)	24 (0.96)	147 (5.88)	205 (8.20)
2010	1	0 (0.00)	0 (0.00)	2 (0.67)	3 (1.00)	5 (1.67)	0 (0.00)	0 (0.00)	0 (0.00)	5 (1.67)
	2	0 (0.00)	2 (0.22)	2 (0.22)	7 (0.78)	11 (1.22)	3 (0.33)	11 (1.22)	28 (3.11)	53 (5.89)
	3	0 (0.00)	2 (0.25)	0 (0.00)	3 (0.50)	5 (0.83)	1 (0.17)	10 (1.67)	50 (8.33)	66 (11.00)
	4	1 (0.33)	0 (0.00)	3 (1.00)	3 (1.00)	7 (2.33)	0 (0.00)	2 (0.67)	3 (1.00)	12 (4.00)
2010 Total		1 (0.05)	4 (0.19)	7 (0.33)	16 (0.76)	28 (1.33)	4 (0.19)	23 (1.10)	81 (3.86)	136 (6.48)
Grand Total		1 (0.01)	30 (0.31)	23 (0.24)	62 (0.65)	116 (1.21)	34 (0.35)	103 (1.07)	604 (6.29)	857 (8.93)

Table 3. Total and per point abundances by year and route for 2007-2010. AMBI=American Bittern, LEBI=Least Bittern, VIRA=Virginia Rail, SORA=Sora, PBGR=Pied-billed Grebe, COGA=Common Gallinule (formerly Common Moorhen), AMCO=American Coot. Route 1, n=9 points in all years but 2010 where n=3; Route 2 n=8 in all years but 2010 where n=9; Route 3, n=7 in 2007, n=9 in 2008, n=8 in 2009 and n=6 in 2010; Route 4 (added in 2010), n=3.

The other three target species have been identified in all survey years (Tables 2 and 3). Of these, sora total abundance at 16 birds was the same as in all prior years but 2007, while per point abundance was in the middle of the range established in previous years. Although sora has always been the most abundant of the target species detected, it is also the only one of the three for which breeding status is still questionable. As in most years (2010 being the only exception), no sora were detected in the fourth survey and sora breeding has not been confirmed during the study. It is possible that most, if not all, detections are of overwintering individuals that haven't yet departed for their breeding grounds and migrating birds passing through the area. (See Van

Dooremolen 2010a and 2010b for further discussion on the status of sora and the other species in the Wash.)

Virginia rail total and per point abundance reached their peaks in 2011 at nearly twice the value of any previous year (Tables 2 and 3). The large increase is due to detections on Route 4. As a partial route in 2010, it had a high per point abundance of the species, and that abundance increased in 2011. The mitigation ponds and adjacent area clearly offer the best habitat for Virginia rail in the study area.

Least bittern total and per point abundance increased from the lower values of the past few years and were approximately in the middle of the range established from 2007-2010 (Tables 2 and 3).

Route 4 had the highest total and per point abundances (by a large margin) of target species overall and of sora and Virginia rail. It also had the highest total abundance when including all species, although Route 3 had the highest abundance per point. Route 4 offers perhaps the widest variety of wetland habitat currently available in the study area, which likely accounts for the high abundance values recorded there.

5.0 RECOMMENDATIONS

Annual variations in the abundances of individual bird species are common, so more years of data are needed to show whether the changes in some species' abundances and the stability in others represent actual trends. Also, annual monitoring for Yuma clapper rail is needed to comply with informal Section 7 consultation measures. It is recommended that marsh bird monitoring continue in 2012.

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Appendix A

GPS Coordinates for 2011
Marsh Bird Monitoring Points

Route	Point	Eastings	Northings	Comments
2	1	678178	3996968	
2	1.5	678276	3997090	
2	2	678155	3997357	
2	3	677879	3997558	
2	4.5	678178	3997623	
2	4.6	678357	3997540	
2	4.7	678468	3997338	
2	5	681090	3995598	
2	6	681245	3995496	
3	1.5	682400	3995747	
3	2	682626	3995895	
3	3	682808	3995954	
3	4	683088	3996010	
3	7	685136	3996960	
3	8	685673	3997411	
4	0.5	678726	3996304	
4	1	678730	3996008	Same as in 2010
4	2.5	678502	3996216	Moved pt 2 from 2010 across road to pond 6, so changed name to 2.5
4	3.5	678591	3996420	Dropped pt 3 from 2010 (Tropicana Outfall) and created 3.5 on pond 5
4	4	678276	3996306	
4	5	678130	3996515	
4	6	678051	3996715	
4	7	678266	3996725	
4	8	678431	3996573	