Appendix D

Biological Resources Technical Report

RE Slate Solar Project

Biological Resources Technical Report

November 2018 | REC-06.03

Prepared for:

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San Francisco, CA 94104

Prepared by:

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1.0 INTRODUCTION

HELIX Environmental Planning, Inc. (HELIX) has prepared this Biological Resources Technical Report (BTR) on behalf of the RE Slate Solar Project (project) proposed by RE Slate, LLC (project applicant). The purpose of this report is to provide Kings County (County), trustee agencies, and the public with current data on biological resources necessary for processing the project under the California Environmental Quality Act (CEQA). This report includes a description of the proposed project, the regulatory setting pertinent to biological resources on the project site, information on the current environmental setting and biological resources in the project site, including vegetation and land cover, aquatic resources, general flora and fauna, and special-status species and natural communities. It also describes the methods used to evaluate potential impacts to biological resources, provides an analysis of the potential for regionally-occurring special-status species to occur in the project site, describes potential project impacts to special-status species and other biological resources, and provides proposed measures to avoid, minimize, and offset impacts to biological resources. Figures are provided in Appendix A**.**

2.0 PROJECT DESCRIPTION

2.1 PROJECT LOCATION

The 2,490-acre project site is located in unincorporated Kings County, 0.2 mile southeast of Naval Air Station Lemoore (NAS Lemoore), 3.2 miles southwest of the City of Lemoore, and 10.5 miles west-southwest of the City of Hanford (Figure 1). The project site is generally bound by Avenal Cutoff Road to the northwest, Jackson Avenue to the north, the Kings River floodplain to the east which trends north-south between 22nd Avenue and 23rd Avenue, and Laurel Avenue to the south. The western site boundary generally follows unnamed agricultural driveways. The project site occupies parts of Sections 25, 26, 34, 35, and 36 of Township 19 South, Range 19 East and Sections 1, 2, 11, 12, and 13 of Township 20 South, Range 19 East, Mount Diablo Base and Meridian. The majority of the project site is located within the “Westhaven, CA” and “Stratford, CA” USGS 7.5-minute quadrangles, with a portion of the northernmost parcels located within the “Lemoore, CA” 7.5-minute quadrangle (Figure 2).

The project would include a short (approximately 500-foot) gen-tie electrical transmission line that would connect (“tie-in”) to another gen-tie line to the PG&E Mustang Switching Station (to be constructed as part of the approved RE Mustang Two Solar Generation Facility) at a point off of the project site, south of Kent Avenue near the western project site boundary. Refer to Figure 3 for an aerial map of the project site and Figure 4 for the site plan, the short gen-tie connection, and the route of the shared gen-tie line to the PG&E Mustang Switching Station.

2.2 DESCRIPTION OF THE PROPOSED PROJECT

The proposed project would be composed of a solar facility, an energy storage system (ESS), and a gen-tie line connecting to shared facilities off-site.

Solar Photovoltaic (PV) generating facilities consist of individual modules which are arranged in rows to form solar arrays. The arrays are combined to form larger units called solar blocks or array blocks. For large-scale utility applications, hundreds of array blocks are interconnected as part of the solar power generation facility. Each array block is served by an electrical inverter, which can be located centrally within the array block or distributed within the array footprint. The inverters convert the direct current (DC) output from the array to alternating current (AC) which is then conveyed to the substation and switchyard which steps up the voltage to match the collection system.

The solar facility of the proposed project would consist of solar PV modules and support structures; the energy collection system which would include electrical inverters and intermediate voltage transformers to step up the voltage to 34.5 kV to match the internal collection system voltage; and an ESS which would include electrical enclosures, electrical wiring, transformers, and associated equipment. The proposed project includes one or two electrical substations, which would receive electricity from consolidated intermediate voltage cables from the energy collection system and would step the voltage up to 230 kilovolts (kV) via high voltage transformers located in the individual PV substation or shared facilities. Each substation area would include an electrical control building and would connect with a shared switching station. Either the switching station or the project substation(s) would tie into PG&E's high-voltage 230 kV Mustang Switching Station via infrastructure for the planned RE Mustang Two Solar Generation Facility. Due to the relatively short length of gen-tie to the shared infrastructure, no transmission lines are proposed to be constructed for the proposed project.

Other necessary infrastructure would include one permanent operations and maintenance (O&M) building, a SCADA system, meteorological data system, telecommunications infrastructure, access driveways, a gen-tie line, and security fencing. Buildings, internal driveways, equipment pads, and footings would total approximately 31 acres of impervious surfaces (approximately 1.3 percent of the site). The PV modules would cover approximately 847 acres (34 percent) from an aerial perspective when fully horizontal (parallel to the ground). The County may require replacement of the existing culvert where Murphy Ranch Road crosses the inactive irrigation ditch that runs along Avenal Cutoff Road. If required, the replacement culvert would be situated in the footprint of the existing culvert and there would be no new impacts to the ditch channel.

The project site is transected by existing easements, canals, and Kent Avenue. The solar facility layout would be contained within discrete areas delineated by the various existing infrastructure and easements. Each discrete area of the solar facility would be enclosed by perimeter fencing, with the existing infrastructure and easements fully accessible outside of the facility fencing. Refer to Figure 3 for the site plan.

3.0 REGULATORY SETTING

Policies, regulations, and plans pertaining to the protection of biological resources on the project site are summarized in the following sections.

3.1 FEDERAL REQUIREMENTS

3.1.1 Federal Endangered Species Act

The U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service enforce the provisions stipulated within the Federal Endangered Species Act of 1973 (FESA; 16 USC 1531 *et seq.*). Species identified as federally threatened or endangered (50 CFR 17.11, and 17.12) are protected from take, defined as direct or indirect harm, unless a Section 10 permit is granted to an entity other than a federal agency or a Biological Opinion with incidental take provisions is rendered to a federal lead agency via a Section 7 consultation. Pursuant to the requirements of FESA, an agency reviewing a proposed project within its jurisdiction must determine whether any federally-listed species may be present in the study area and determine whether the proposed project will jeopardize the continued existence of or result in the destruction or adverse modification of critical habitat of such species (16 USC 1536 (a)[3], [4]). Other federal agencies designate species of concern (species that have the potential to become listed), which are evaluated during environmental review under the National Environmental Protection Act (NEPA) or California Environmental Quality Act (CEQA) although they are not otherwise protected under FESA.

3.1.2 Migratory Bird Treaty Act

The Migratory Bird Treaty Act of 1918 (MBTA; 16 USC Subsections 703 to 712) prohibits intentional take of native bird species, their nests, and eggs. These species are listed at 50 CFR Section 10.13. The USFWS has statutory authority and responsibility for enforcing the MBTA.

3.2 STATE REQUIREMENTS

3.2.1 California Endangered Species Act

The California Endangered Species Act (CESA) (California Fish and Game Code Sections 2050 to 2097) is similar to the FESA. The California Fish and Wildlife Commission is responsible for maintaining lists of threatened and endangered species under CESA. CESA prohibits the take of listed and candidate (petitioned to be listed) species. “Take” under California law means to hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch capture, or kill (California Fish and Game Code, Section 86). The California Department of Fish and Wildlife (CDFW) can authorize take of a state-listed species under Section 2081 of the California Fish and Game Code if the take is incidental to an otherwise lawful activity, the impacts are minimized and fully mitigated, funding is ensured to implement and monitor mitigation measures, and CDFW determines that issuance would not jeopardize the continued existence of the species. A CESA permit must be obtained if a project will result in the “take” of listed species, either during construction or over the life of the project. For species listed under both FESA and CESA requiring a Biological Opinion under Section 7 of the FESA, CDFW may also authorize impacts to CESA species by issuing a Consistency Determination under Section 2080.1 of the Fish and Game Code.

3.2.2 California Code of Regulations Title 14 and California Fish and Game Code

The official listing of endangered and threatened animals and plants is contained in the California Code of Regulations Title 14 §670.5. A state candidate species is one that the California Fish and Game Code has formally noticed as being under review by CDFW to include in the state list pursuant to Sections 2074.2 and 2075.5 of the California Fish and Game Code.

Legal protection is also provided for wildlife species in California that are identified as “fully protected animals.” These species are protected under Sections 3511 (birds), 4700 (mammals), 5050 (reptiles and amphibians), and 5515 (fish) of the California Fish and Game Code. These statutes prohibit take or possession of fully protected species at any time. CDFW is unable to authorize incidental take of fully protected species unless any such take authorization is issued in conjunction with the approval of a Natural Community Conservation Plan that covers the fully protected species (California Fish and Game Code Section 2835).

3.2.3 California Environmental Quality Act

Under the California Environmental Quality Act of 1970 (CEQA; Public Resources Code Section 21000 *et seq.*), lead agencies analyze whether projects would have a substantial adverse effect on a candidate, sensitive, or special-status species (Public Resources Code Section 21001I). These “special-status” species generally include those listed under FESA and CESA, and species that are not currently protected by statute or regulation, but would be considered rare, threatened, or endangered under the criteria included in CEQA Guidelines Section 15380. Therefore, species that are considered rare are addressed under CEQA regardless of whether they are afforded protection through any other statute or regulation. The California Native Plant Society (CNPS) inventories the native flora of California and ranks species according to rarity; plants ranked as 1A, 1B, 2A and 2B are generally considered special-status species under CEQA.[1]

Although threatened and endangered species are protected by specific federal and state statutes, CEQA Guidelines Section 15380(d) provides that a species not listed on the federal or state list of protected species may be considered rare if it can be shown to meet certain specified criteria. These criteria have been modeled after the definition in FESA and the section of the California Fish and Game Code dealing with rare or endangered plants and animals. Section 15380(d) allows a public agency to undertake a review to determine if a significant effect on species that have not yet been listed by either the USFWS or CDFW (*i.e.*, candidate species) would occur.

3.2.4 California Native Plant Protection Act

The California Native Plant Protection Act of 1977 (California Fish and Game Code Sections 1900-1913) requires all state agencies to use their authority to carry out programs to conserve endangered and otherwise rare species of native plants. Provisions of the act prohibit the taking of listed plants from the wild and require notification of CDFW at least 10 days in advance of any change in land use (other than changing from one agricultural use to another), which allows CDFW to salvage listed plants that would otherwise be destroyed.

3.2.5 Nesting Birds

California Fish and Game Code Subsections 3503 and 3800 prohibit the possession, take, or needless destruction of birds, their nests, and eggs, and the salvage of dead nongame birds. California Fish and Game Code Subsection 3503.5 protects all birds in the orders of Falconiformes and Strigiformes (birds of prey).

3.2.6 California Food and Agriculture Code Section 403

This section directs the California Department of Food and Agriculture (CDFA) to prevent the introduction and spread of injurious pests including noxious weeds. CDFA Code Section 7271 designates the CDFA as the lead department in noxious weed management responsible for implementing state laws concerning noxious weeds. Representing a statewide program, noxious weed management laws and regulations are enforced locally in cooperation with the County Agricultural Commissioner. Under state law, noxious weeds include any species of plant that is, or is liable to be, troublesome, aggressive,

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1 The California Rare Plant Rank system can be found online at < http://www.cnps.org/cnps/rareplants/ranking.php>

intrusive, detrimental, or destructive to agriculture, silviculture, or important native species, and difficult to control or eradicate, which the director, by regulation, designates to be a noxious weed (CDFA Code Section 5004).

3.3 LOCAL PLANS AND POLICIES

3.3.1 Kings County General Plan

The Kings County General Plan outlines several policies intended for the protection of biological resources County-wide, including the following, which apply to the project:

Policy D1.1.1: Evaluate all discretionary land use applications in accordance with the screening procedures contained in the Biological Resources Survey located in Appendix C. If the results of the project screening indicate the potential for important biological resources to exist on the site a biological evaluation (consistent with Appendix C) shall be performed by a qualified biologist. If the evaluation indicates that the project could have a significant adverse impact, mitigation shall be required, or the project will be redesigned to avoid such impacts. Mitigation shall be provided consistent with the California Environmental Quality Act (CEQA), and applicable state and federal guidelines as appropriate. Mitigation may include habitat improvement or protection, acquisition of other habitat, or payment to an appropriate agency to purchase, improve, or protect such habitat.

Policy D1.1.2: Require project applicants to consult with the California Department of Fish and Game and the United States Fish and Wildlife Service and to obtain appropriate authority for any such take pursuant to Endangered Species Act requirements if new development or other actions are likely to result in incidental take of any threatened or endangered species.

Policy D2.1.1: Follow state and federal guidelines for the protection of natural wetlands. Require developers to obtain authorization from the appropriate local, state, or federal agency prior to commencement of any wetland fill activities.

Policy D2.1.2: Use the California Environmental Quality Act (CEQA) process to assess wetland resources, and require mitigation measures for development which could adversely impact a designated wetland.

Policy D2.1.3: “Prior Converted Croplands” as defined by state and federal regulations shall be exempt from consideration as wetlands under the County planning process.

Policy D3.1.1: Designate the Kings River as a resource conservation area, implemented by use of the Natural Resource Conservation overlay zone district.

Policy D3.1.2: Encourage the Kings River Conservation District to avoid substantial alteration of the Kings River channel and its riparian vegetation, consistent with their flood control responsibilities.

Policy D3.1.3: Evaluate the potential impact on the riparian environment of proposed development adjacent to the Kings River, beyond the boundaries of the designated floodway. Conservation of fish and wildlife habitat and protection of scenic qualities should be the guiding principle.

Policy D3.1.4: Prohibit development within riparian environments over which the County has jurisdiction. However, allow or consider for approval if it is determined that significant disturbance of the riparian environment would not occur, the following passive uses or activities:

- Streamside maintenance and repair for mandated flood control or water delivery purposes, facilities, and equipment;
- Road and utility line crossings;
- Grazing and similar agricultural production activities not involving structures or cultivation;
- Vegetation removal for integrated pest management programs under guidelines;
- Passive recreational uses such as riverside parks and bikeways.

Policy D3.1.5: Refer all discretionary permit applications for projects along the Kings River and Cross Creek to the appropriate local, state, and federal agencies for review and approval.

Policy E1.1.1: Complete the inquiry process outlined in Appendix C in the initial project review for development permits to determine whether the project is likely to have a significant adverse impact on any threatened or endangered species habitat locations, and to assure appropriate consideration of habitat preservation by development. Maintain current copies of California Department of Fish and Game and United States Fish and Wildlife Service maps showing locations of known threatened and endangered species habitat. If shown to be necessary, require the developer to consult with the California Department of Fish and Game, the United States Fish and Wildlife Service, and the United States Army Corps of Engineers as to potential impacts, appropriate mitigation measures, and required permits.

Policy E1.1.2: Require as a primary objective in the review of development projects the preservation of healthy native oaks and other healthy native trees.

Policy E1.1.3: Maintain to the maximum extent practical the natural plant communities utilized as habitat by threatened and endangered species.

3.4 JURISDICTIONAL WATERS

3.4.1 Federal Requirements

Any person, firm, or agency planning to alter or work in "waters of the U.S.," including the discharge of dredged or fill material, must first obtain authorization from the U.S. Army Corps of Engineers (USACE) under Section 404 of the Clean Water Act (CWA; 33 USC 1344). Permits, licenses, variances, or similar authorization may also be required by other federal, state, and local statutes. Section 10 of the Rivers and Harbors Act prohibits the obstruction or alteration of navigable waters of the U.S. without a permit from the USACE (33 USC 403).

Waters of the U.S. are defined as: all waters used in interstate or foreign commerce; all interstate waters including interstate wetlands; all other waters such as intrastate lakes, rivers, streams, mudflats, sand flats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes or natural ponds, where the use, degradation, or destruction of which could affect interstate commerce; impoundments of these waters; tributaries of these waters; or wetlands adjacent to these waters (33 CFR Part 328). With nontidal waters, in the absence of adjacent wetlands, the extent of USACE jurisdiction extends to the ordinary high-water mark (OHWM) – the line on the shore established by fluctuations of water and indicated by a clear, natural line impressed on the bank, shelving, changes in soil character, destruction of terrestrial vegetation, or the presence of litter and debris. Wetlands are defined in 33 CFR Part 328 as:

> *"those areas that are inundated or saturated by surface or ground water at a frequency and duration to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions."*

Federal and state regulations pertaining to waters of the U.S., including wetlands, are discussed below.

Clean Water Act (33 USC 1251-1376). The CWA provides guidance for the restoration and maintenance of the chemical, physical, and biological integrity of the nation's waters.

Section 401 requires that an applicant for a federal license or permit that allows activities resulting in a discharge to waters of the U.S. must obtain a state certification that the discharge complies with other provisions of CWA. The Regional Water Quality Control Board (RWQCB) administers the certification program in California, and may require State Water Quality Certification before other permits are issued.

Section 402 establishes a permitting system for the discharge of any pollutant (except dredged or fill material) into waters of the U.S.

Section 404 establishes a permit program administered by the USACE that regulates the discharge of dredged or fill material into waters of the U.S. (including wetlands). Implementing regulations by the USACE are found at 33 CFR Parts 320-332. The Section 404 (b)(1) Guidelines were developed by the U.S. Environmental Protection Agency in conjunction with the USACE (40 CFR Part 230), allowing the discharge of dredged or fill material for non-water dependent uses into special aquatic sites only if there is no practicable alternative that would have less adverse impacts.

3.4.2 State Requirements

3.4.2.1 Porter-Cologne Act

The Porter-Cologne Water Quality Control Act (Porter-Cologne Act, Water Code Section 13000 *et seq.*) is California's statutory authority for the protection of water quality in conjunction with the federal CWA. The Porter-Cologne Act requires the State Water Resources Control Board (SWRCB) and RWQCBs under the CWA to adopt and periodically update water quality control plans, or basin plans. Basin plans are plans in which beneficial uses, water quality objectives, and implementation programs are established for each of the nine regions in California. The Porter-Cologne Act also requires dischargers of pollutants or dredged or fill material to notify the RWQCBs of such activities by filing Reports of Waste Discharge and authorizes the SWRCB and RWQCBs to issue and enforce waste discharge requirements, National Pollution Discharge Elimination System (NPDES) permits, Section 401 water quality certifications, or other approvals.

3.4.2.2 California Fish and Game Code Section 1602 – Lake and Streambed Alteration Program

Diversions or obstructions of the natural flow of, or substantial changes or use of material from the bed, channel, or bank of any river, stream, or lake in California that supports wildlife resources are subject to regulation by CDFW, pursuant to Section 1602 of the California Fish and Game Code. CDFW requires notification prior to commencement of any such activities, and a Lake or Streambed Alteration Agreement pursuant to Fish and Game Code Sections 1601-1603, if the activity may substantially adversely affect an existing fish and wildlife resource.

4.0 METHODS

Studies conducted in preparation of this report included a database and literature review to identify sensitive biological communities and/or special-status species with the potential to occur on or in the vicinity of the project site, as well as numerous biological field surveys to document baseline conditions and special-status species and/or their habitats on the site. These methods are presented in the following sections.

4.1 DATABASE AND LITERATURE REVIEW

4.1.1 Special-Status Species

For the purposes of this analysis, special-status species are defined as those species meeting one or more of the following criteria:

- Listed as Threatened or Endangered under FESA;
- Listed as Threatened or Endangered under CESA;
- Under review for listing under FESA or CESA (Candidate);
- Designated as “Fully Protected” under California Fish and Game Code Section 3511, 4700, 5050, or 5515;
- Included on the list of Species of Special Concern (SSC) by CDFW;
- Included on the Watch List of species that may qualify as SSC by CDFW, or;
- Having a California Rare Plant Rank (CRPR) of 1A (presumed extinct in California and rare elsewhere), 1B (rare in California and elsewhere), 2A (presumed extinct in California but more common elsewhere), 2B (rare in California but more common elsewhere), or 3 (more information needed).

The most current available lists of special-status species known to occur and/or having the potential to occur in the project region were reviewed to determine the potential for special-status species to occur on the project site or otherwise be affected by project-related activities on the project site. The following lists were reviewed and are included in Appendix B:

- The Sacramento Fish and Wildlife Office list of threatened and endangered species that may occur in the project site and/or may be affected by the project (USFWS 2018a).

- The CNPS list of special-status plants documented in the “Calflax”, “Vanguard”, “Lemoore”, “Hanford”, “Huron”, “Westhaven”, “Stratford”, “Guernsey”, “La Cima”, “Kettleman City”, “Stratford SE”, and “El Rico Ranch” 7.5-minute USGS quads (CNPS 2018).
- The California Natural Diversity Database (CNDDB; CDFW 2019) list of special-status species documented within 10 miles of the project site.

In addition, special-status species identified by CDFW as having the potential to occur in the project area in the *Early Consultation Notice Conditional Use Permit No. 18-01 RE Slate Solar Project* and special-status species identified by USFWS in the letter dated February 22, 2018 commenting on Conditional Use Permit No. 18-01 (08ESMF00-2018-TA-1198) were included in the evaluation in Appendix B.

Appendix C presents the general habitat requirements, status, the potential for the species to occur, and rationale for each regionally-occurring special-status species evaluated. Species determined to have no potential to occur in the project site or be otherwise affected by activities in the site were excluded from further evaluation. Species having the potential to occur in the project site and/or be affected by project activities are evaluated in detail in Chapters 5 and 6 of this report.

4.1.2 Wetlands and Other Resources

The following sources were used to evaluate the potential for wetlands and other biological resources to occur on the project site:

- Aerial photography taken May 1, 2017 downloaded from Google Earth;
- Topographic contours from the USGS 7.5-minute “Westhaven, CA” and “Stratford, CA” 7.5-minute quadrangle maps;
- NRCS’s web soil survey (NRCS 2018);
- Corps of Engineers Wetlands Delineation Manual (USACE 1987);
- USACE’s Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0) (USACE 2008);
- USACE’s 2016 National Wetland Plant List for the Arid West (USACE 2016); and
- USFWS’s National Wetland Inventory online wetland mapper (USFWS 2017).

4.2 BIOLOGICAL SURVEYS

Biological surveys conducted for the project included general biological surveys, botanical surveys, nesting bird surveys, a wetland assessment, protocol/focused surveys for Swainson’s hawk (SWHA; *Buteo swainsoni*), burrowing owl (BUOW; *Athene cunicularia*), San Joaquin kit fox (SJKF; *Vulpes macrotis mutica*), and Tipton kangaroo rat (TKR; *Dipodomys nitratoides nitratoides*), and habitat assessments for SJKF, blunt nosed leopard lizard (BNLL; *Gambelia sila*) and Buena Vista Lake ornate shrew (*Sorex ornatus relictus*).

General biological surveys, botanical surveys, nesting bird surveys, wetland assessments, habitat assessments for Buena Vista Lake ornate shrew and SJKF, and protocol surveys for BUOW and SWHA were conducted by various HELIX biologists and environmental scientists, led by HELIX Senior Biologist/Botanist George Aldridge, Ph.D. and HELIX Senior Scientist. Stephen Stringer, M.S. Other biological surveys, including protocol surveys for SJKF, trapping studies for kangaroo rat, and habitat assessments for kangaroo rat and BNLL were conducted by permitted biologists with Californian Environmental Services (CES), under contract with HELIX.

The dates, personnel, and type of survey is listed in Table 1 and described following the table.

Table 1
BIOLOGICAL SURVEYS CONDUCTED FOR THE PROPOSED PROJECT

Survey Dates	Firm	Personnel	Tasks Performed
April 13-15, 19, 2016	HELIX	George Aldridge Stephen Stringer Devin Barry	General biological survey; botanical inventory
May 25-26, 2016	HELIX	George Aldridge Devin Barry Stephen Stringer	Wetland assessment; general biological survey
June 2-3, 2016	HELIX	George Aldridge Devin Barry Stephen Stringer	Wetland assessment; general biological survey
June 16-17, 2016	HELIX	Stephen Stringer Devin Barry Jameson Honeycutt	Wetland assessment; general biological survey
July 20-August 24, 2016	CES	Multiple biologists	SJKF Protocol Surveys; TKR and BNLL habitat assessments
August 16, 2016	HELIX	Stephen Stringer George Aldridge	Buena Vista Lake ornate shrew habitat assessment
September 11-14, 2017	HELIX	George Aldridge Stephen Stringer Larry Travanti	General biological survey; burrowing owl habitat assessment; Buena Vista Lake ornate shrew habitat assessment
September 14-18, 2017	CES	David Germano Larry Saslaw	Kangaroo rat trapping
April 2-6, 2018	HELIX	Stephen Stringer George Aldridge Daniel Van Essen	General biological survey; BUOW, SWHA, and tri-colored blackbird nest survey; botanical inventory; SJKF habitat assessment
April 16-18, 2018	HELIX	George Aldridge Daniel Van Essen	BUOW and SHWA Survey; botanical inventory
May 10-11, 2018	HELIX	George Aldridge	BUOW and SHWA Survey; botanical inventory
May 21, 2018	HELIX	Stephen Stringer Catherine Silvester	SWHA Survey
June 21-22, 2018	HELIX	George Aldridge	SWHA Survey
June 26-27, 2018	HELIX	George Aldridge	BUOW and SWHA Survey; botanical inventory
July 16, 2018	HELIX	Stephen Stringer	Biological Reconnaissance and canal assessment

4.2.1 General Biological Surveys

HELIX biologists initially conducted general biological surveys of the project site on April 13 - 15, and April 19, 2016. HELIX biologists conducted additional general biological surveys on September 11 - 14, 2017 and April 2 - 6, 2018 to update the status of site conditions. General biological surveys included habitat mapping, botanical and wildlife inventories, and assessments of the potential for special-status species to occur on the site based on the habitats present and site conditions.

General biological surveys were conducted by a combination of walking pedestrian transects and driving on dirt roads and other areas accessible to off-road vehicles. Initial surveys consisted of driving on dirt roads around the perimeter of agricultural fields and assessing habitats using binoculars and aerial imagery to identify areas of potential sensitive habitat or areas that could support special-status species requiring further evaluation. Pedestrian transects were conducted within target areas considered to have the potential to support special-status species such as along canals/ditches, around the perimeter of agricultural fields, and in fields that had been fallow for long enough to support potential habitat for special-status species or other resources such as wetlands. Fields with monospecific stands of remnant agricultural crops intermixed with weeds were not completely covered by pedestrian transects during the general biological surveys. Site photos were taken during biological surveys.

4.2.2 Botanical Inventories

Focused botanical inventories of the site were conducted during general biological surveys initially in April, May, and June 2016 (see Table 1) as well as concurrently with BUOW and SWHA surveys in spring/early summer 2018 to update species lists with any plants not previously observed. The botanical surveys followed the methods for botanical field surveys outlined in the *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Sensitive Natural Communities* (CDFW 2018).

Botanical inventories were conducted primarily in conjunction with general biological surveys, which were timed to coincide with the blooming period of regionally-occurring special-status plants. Per the CDFW Guidelines, botanical surveys were focused within areas of natural or naturalized vegetation as well as areas determined to have a potential to support special-status plants (*e.g.*, salt flats or bare ground areas within fallow fields, canals containing wetlands, fields or portions of fields that had been fallow long enough to support patches of semi-naturalized vegetation). An inventory of plant species observed was prepared during each botanical inventory. All plant species encountered during the botanical inventories were identified to the taxonomic level necessary to determine whether or not they were special-status species. Appendix D is a list of plant and animal species documented on the project site. Floral nomenclature follows Baldwin et al. 2012. Appendix E includes representative site photos.

4.2.3 Focused Wildlife Surveys and Habitat Assessments

Focused surveys were conducted for BUOW, SWHA, SJKF, BNLL, and TKR according to most recent published protocols (SHTAC 2000; CDFW 2012; USFWS 1999a; CDFW 2004; USFWS 2013), or by modified protocols after consultation with USFWS and CDFW. Focused surveys are described in detail in the following sections.

4.2.3.1 Swainson's Hawk

Studies conducted for SWHA included a regional study of SWHA including the project site and an approximately 10-mile radius, protocol nesting surveys of the project site and a 0.5-mile radius, and a comparative study to analyze use of a utility scale solar generation facility for foraging when compared with undeveloped agricultural lands. The undeveloped agricultural lands observed in the comparative foraging use study included the project site, and the study provides information regarding existing use of the project site by SWHA, as well as information relevant to determining actual impacts to the species as a result of the proposed project. All three SWHA studies are included in Appendix F.

Regional Study

Estep Environmental Consulting (Estep) conducted a regional nesting study for SWHA for an adjacent solar project (Estep 2017); portions of the Estep study overlap with the project site and the regional analysis is directly applicable to the Slate Solar Project. Nesting surveys conducted April – July 2016 identified a total of 29 pairs of SWHA nesting in the project region. The majority of those nests are within an approximately 10-mile radius of the project site.

Protocol Nesting Surveys

SWHA surveys were conducted by HELIX biologists in accordance with the guidelines prepared by the Swainson's Hawk Technical Advisory Committee in the *Recommended Timing and Methodology for Swainson's Hawk Nesting Surveys in California's Central Valley* (SHTAC 2000). A total of 12 surveys were conducted in the project site and within a 0.5-mile radius of the site between April and June 2018 by HELIX biologists with extensive experience at SWHA surveys. Details of the survey methods are provided in Appendix F**,** *Swainson's Hawk Survey Report, RE Slate Solar Project, Kings County, California* (HELIX 2018). SWHA nests were found within a 0.5-mile radius of the site and this species is discussed in detail in Chapter 6.

Foraging Use Study

In 2017, HELIX biologists conducted a study to compare SWHA foraging use of an existing utility scale solar PV generation facility with undeveloped lands. The existing solar facility studied was the Mustang Solar Project, which is west of the project site across Avenal Cutoff Road. The study compared SWHA foraging use of the 1,100-acre Mustang Solar Project to an approximately 4,800-acre off-site area that included the Slate Solar Project site and surrounding agricultural lands. The Mustang Solar Project was chosen because the site management was considered conducive to potential foraging use by SWHA, including grassland management and sheep grazing. Surveys were conducted over nine weeks from late May to late July and involved simultaneous observations of the Mustang Solar Project and the off-site area. Details of the study methods are provided in Appendix F.

4.2.3.2 San Joaquin Kit Fox

Surveys for SJKF began with an Early Evaluation conducted in accordance with USFWS protocol (USFWS 1999a). A CNDDB records search was conducted in May 2016 to identify records of SJKF within 10 miles of the project site. The USFWS was also contacted to request any records not included in the CNDDB. The project site was generally surveyed and assessed for suitable SJKF habitat and signs of occupancy during all biological surveys conducted between April and early June 2016. A report of the Early Evaluation findings was submitted to the USFWS on June 7, 2016. The evaluation was repeated in

April 2018, including an updated CNDDB record search and pedestrian survey for suitable burrows. The results of the updated evaluation are provided in Appendix G.

Focused surveys for SJKF were conducted in 2016 by CES according to the most recent protocol (USFWS 1999a). Surveys consisted of pedestrian transects of the entire project site in late July/early August, followed by spotlight surveys and monitoring of motion-activated cameras. A total of 19 motion-activated camera stations were established in the site at regular intervals and monitored for a minimum of 10 days. No SJKF were observed during protocol surveys, but the site was considered a potential movement corridor for SJKF. Details of the survey methodology are provided in the SJKF survey report in Appendix G. This species is discussed in detail in Chapter 6 due to the potential for dispersal through the site.

4.2.3.3 Blunt-Nosed Leopard Lizard

A habitat assessment for BNLL was also conducted in July/August 2016 by CES concurrently with protocol surveys (specifically, walking transect surveys) for SJKF. A habitat assessment report for BNLL was prepared by CES, which states that the project site does not provide suitable habitat for BNLL (Appendix H). The report states that the project site has been heavily cultivated for many years resulting in a homogeneous appearance of soil rows across the site with little natural topography or soil properties remaining. Given the highly altered and degraded condition of the site, the marginal quality of the habitat, the distance to the nearest known occurrence of the species, and the isolation of the site from known locations where the species occurs, there is no potential for BNLL to be present on the project site. BNLL was determined to be absent from the site and is not discussed further in this report.

4.2.3.4 Tipton Kangaroo Rat and Other Special-Status Kangaroo Rats

A field assessment of potential habitat for special-status kangaroo rats at the project site was conducted in July/August 2016 by CES concurrently with the walking transect surveys for SJKF, which covered the entire project site. Although the site was determined to lack suitable habitat for special-status kangaroo rats by CES (pers. comm, Gretchen Padgett-Flohr, Ph.D.), unidentified kangaroo rats were photographed by wildlife cameras placed as part of the surveys for SJKF conducted by CES in August 2016, post-completion of the walking transects. In order to determine whether special-status kangaroo rats were potentially present on the site, live-trapping for special-status kangaroo rat species, specifically TKR, was conducted by CES permitted biologists in September 2017. Live-trapping was performed over five nights.

No special-status kangaroo rats were found during the trapping studies. The report concludes that no suitable habitat for TKR was observed on the project site and that TKR and other special-status kangaroo rats do not inhabit the project site. The report further concludes that any proposed project on the site will not affect TKR or any other special-status kangaroo rats or their habitat. The details of the kangaroo rat trapping are in the report in Appendix I**.** Special-status kangaroo rats were determined to be absent from the site and are not discussed further in this report.

4.2.3.5 Buena Vista Lake Ornate Shrew

A habitat assessment for Buena Vista Lake ornate shrew was conducted by HELIX on September 13, 2017. The assessment included comparing habitat in the project site to designated critical habitat north of Highway 198 near the Kings River. Detailed methods for this assessment is provided in Appendix J. The habitat assessment concluded that there is no suitable habitat for Buena Vista Lake ornate shrew in or adjacent to the project site, and no potential for the shrew to occur in or adjacent to the project site. Therefore, no impacts to Buena Vista Lake ornate shrew would occur as a result of the proposed project. This species was determined to be absent from the project site and is not discussed further in this report.

4.2.3.6 Burrowing Owl

Focused surveys for BUOW were conducted by HELIX biologists in 2016 and again in 2018, according to the survey guidelines contained in the CDFW *Staff Report on Burrowing Owl Mitigation* (CDFW 2012). Details of the burrowing owl survey methodology are provided in Appendix K. Burrowing owls were observed on and adjacent to the project site during focused surveys. BUOW is discussed in detail in Chapter 6.

4.2.3.7 Tri-Colored Blackbird

Surveys for tri-colored blackbird nest sites within the project site were conducted during all general biological surveys. Surveys for tri-colored blackbird nests sites within a 0.5-mile radius of the project site were conducted concurrently with the initial SWHA nest surveys on April 2-6, 2018. No tri-colored blackbirds or nesting colonies were observed on or within a 0.5-mile radius of the project site. This species is not discussed further in this document due to a lack of sightings and suitable habitat on the project site or vicinity.

4.3 ASSESSMENT OF WETLANDS AND OTHER WATERS

An assessment of wetlands and other waters on the project site was conducted on May 25-26, June 2-3, and June 16-17, 2016. The condition of the canals was re-evaluated on July 16, 2018 to confirm/revise the results of the prior assessment based on current conditions. The presence of wetlands and other waters was determined based on the USACE three parameter method described in the *Corps of Engineers Wetlands Delineation Manual* (USACE 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0*; USACE 2008). Other USACE regulations were used to determine the presence/absence of potentially jurisdictional non-wetland waters in the project site such as the definition of waters of the United States (see 33 CFR 328.3(a)), Supreme Court decisions (*e.g.*, SWANCC and Rapanos), or by other regulation. A total of 14 data points were taken in the project site (13, 15, 17, 19, 20, 21, 27, 29, and 31-36) to determine potential presence of wetlands. Data points omitted were taken in areas that are no longer part of the project site. Data points were taken primarily within areas outside of canals that exhibited potential wetland indicators (hydrophytic vegetation, hydric soil, wetland hydrology) in order to determine if wetlands were present on the site outside of active canals. Aquatic resources in the project site were also evaluated for their potential to qualify as waters of the State subject to RWQCB jurisdiction and/or CDFW jurisdiction. Appendix L is the map of aquatic resources in the project site and the data point forms.

4.3.1 Waters of the U.S.

Typically, the USACE and the U.S. EPA will assert jurisdiction over the following types of wetlands and tributaries:

- Traditional navigable waters (TNWs),
- Wetlands adjacent to TNWs,

- Non-navigable tributaries of TNWs that are relatively permanent where the tributaries typically flow year-round or have continuous flow at least seasonally (*e.g.*, typically three months), and
- Wetlands directly abutting such tributaries.

The agencies will decide jurisdiction over the following waters based on a fact-specific analysis to determine whether they have a significant nexus with a TNW:

- Non-navigable tributaries that are not relatively permanent,
- Wetlands adjacent to non-navigable tributaries that are not relatively permanent, and
- Wetlands adjacent to but not directly abutting a relatively permanent non-navigable tributary.

The agencies generally will not assert jurisdiction over the following features:

- Swales or erosional features (*e.g.*, gullies, small washes characterized by low volume, infrequent, or short duration flow), and
- Ditches (including roadside ditches) excavated wholly in and draining only uplands and that do not carry a relatively permanent flow of water.

The agencies apply the significant nexus standard as follows:

> *"A significant nexus analysis will assess the flow characteristics and functions of the tributary itself and the functions performed by all wetlands adjacent to the tributary to determine if they significantly affect the chemical, physical and biological integrity of downstream traditional navigable waters."*

4.3.2 Waters of the State

The term "waters of the State" is defined by California Water Code as "any surface water or groundwater, including saline waters, within the boundaries of the state" (California Water Code Section 13050(e)). The Porter-Cologne Water Quality Control Act (Porter-Cologne Act, Water Code Section 13000 *et seq*.) is California's statutory authority for the protection of water quality in conjunction with the federal CWA. The Porter-Cologne Act requires the SWRCB and its RWQCBs to adopt and periodically update water quality control plans, or basin plans. Basin plans establish beneficial uses, water quality objectives, and implementation for the nine regions of California. The Porter-Cologne Act also requires dischargers of pollutants or dredged or fill material to notify the RWQCB of such activities by filing Reports of Waste Discharge and authorizes the SWRCB and RWQCBs to issue and enforce waste discharge requirements, NPDES permits, Section 401 Water Quality Certifications, or other approvals.

Diversions or obstructions of the natural flow of, or substantial changes or use of material from the bed, channel, or bank of any river, stream, or lake in California that supports wildlife resources are subject to regulation by CDFW, pursuant to Section 1600 *et seq*. of the California Fish and Game Code. The CDFW requires notification prior to commencement of any such activities, and a Lake or Streambed Alteration Agreement pursuant to Fish and Game Code Sections 1601 to 1603, if the activity may substantially adversely affect an existing fish and wildlife resource. A lake under CDFW jurisdiction is defined as "a permanent natural body of water of any size or an artificially impounded body of water of at least one acre, isolated from the sea, and having an area of open water of sufficient depth and permanency to prevent complete coverage by rooted aquatic plants" (CCR Vol. 18 Title 14, Section 1562.1). Streambeds within CDFW jurisdiction are based on the definition of a stream as “a body of water that flows at least periodically or intermittently through a bed or channel having banks and supporting fish or other aquatic life” (CCR Vol. 18 Title 14, Section 1.72).

4.4 INVASIVE SPECIES

Plant species observed in the project site were compared to the list of invasive plants in California maintained by the California Invasive Plant Council (Cal-IPC; Cal-IPC 2006) and the list of noxious weeds maintained by the CDFA (CDFA 2010). Several invasive and noxious weed species listed by Cal-IPC and CDFA occur in the project site, as would be expected due its highly disturbed nature. Invasive and noxious weeds are identified on the plant species observed list in Appendix D.

CDFA List “C” species warrant state-endorsed holding action and eradication only when found in a nursery; actions to retard spread outside of nurseries is conducted at the discretion of the commissioner; and warrant rejection only when found in a crop seed for planting or at the discretion of the commissioner. In addition, the Cal-IPC categorizes plants as “high, moderate, or limited,” reflecting the level of each species’ negative ecological impact in California. Each plant on the list received an overall rating of high, moderate, or limited based on the following evaluation criteria:

- High – These species have severe ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal and establishment. Most are widely distributed ecologically.
- Moderate – These species have substantial and apparent, but generally not severe, ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal, though establishment is generally dependent upon ecological disturbance. Ecological amplitude and distribution may range from limited to widespread.
- Limited – These species are invasive, but their ecological impacts are minor on a statewide level or there was not enough information to justify a higher score. Their reproductive biology and other attributes result in low to moderate rates of invasiveness. Ecological amplitude and distribution are generally limited, but these species may be locally persistent and problematic.

5.0 RESULTS: ENVIRONMENTAL SETTING

5.1 EXISTING LAND USE

As of the time of document production, the project site consists entirely of inactive agricultural crop land. Current land uses in the project site include stock grazing and ground water extraction. There is an extensive system of canals and drains in and around the project site that are fed by wells in the site. The status of individual canals in and around the project site changes often between dry and actively conveying water as wells are activated or deactivated.

Since 2014, the majority of the project site has been uncultivated and used as pastureland or fallowed. As of 2018, the entire project site is fallow agricultural land, with grazing occurring in portions of the site. The site is also used for groundwater extraction with several wells occurring in the northern portion of the site. Except for groundwater wells, there are no existing structures in the project site. The project site has historically been used for various agricultural uses – for the past eight years, the project site has been alternately cropped and irrigated, grazed, and left fallow. The Kings County Agricultural Commissioner's office indicates that the project site has been used to cultivate wheat, oats, alfalfa, corn, cotton, watermelon, pomegranates, grapes, safflower, tomatoes, pistachios, and peppers (Kings County 2017).

The proposed project is located adjacent to and in the immediate vicinity of other existing and approved solar projects. Surrounding land uses are a combination of agriculture and solar PV operations. The project site is currently owned by Westlands Water District and Sandridge Partners L.P.

5.2 PHYSICAL CONDITIONS

5.2.1 Climate

The climate of Kings County is Mediterranean, characterized by wet, cool winters and dry, hot summers. Mean daily maximum and minimum temperatures are 96 and 64 degrees Fahrenheit in July, and 56 and 39 degrees Fahrenheit in January (NESDIS 2016). The mean annual precipitation is 8.4 inches, with over 90 percent occurring as rain from October through April.

5.2.2 Topography

The project site is located in the southern San Joaquin Valley. This area is in the southern portion of the Great Valley geomorphic province of California, which includes all of Kings County. The Great Valley is an approximately 50-mile-wide and 400-mile-long alluvial plain that lies between the mountains and foothills of the Sierra Nevada to the east and the Coast Ranges to the west. The project site and the surrounding areas are naturally flat, and the site has been leveled for past land uses. The site itself is flat with the exception of canals, canal berms, and spoil piles, which provide the only topographic variation in the site. Elevations in the project site range from 195 to 215 feet above mean sea level (amsl) and decrease slightly from northwest to southeast across the approximately 4.5-mile length of the site from north to south.

5.2.3 Soils

Soils in the project site are clays and clay loams in five soil mapping units (Figure 5): Calflax clay loam; Gepford Clay; Pitco Clay, Tulare Variant Clay, and; Lethent clay loam. These soils are described as alluvium, and are derived from igneous, sedimentary, or calcareous rock. Tulare Variant Clay is described as having a depth of 0 inches to the water table; all others have depths of greater than 80 inches to the water table. Lethent clay loam is described as having a natric restrictive layer at depths of 4-8 inches.

5.2.4 Hydrology

The County is in the Tulare Lake Hydrologic Region, which includes all of the San Joaquin Valley south of the San Joaquin River (CA DWR 2003). This portion of the San Joaquin Valley drains southward through the Kings, Kaweah, Tule, and Kern rivers to the Tulare Lake Basin, which historically held Tulare, Buena Vista, and Kern lakes. Flood control on the major rivers and draining of the historic lakes and wetlands beginning in the late 19th Century has converted the Tulare Lake Basin into an expanse of rich agricultural land. Hydrology in the region is now managed through a system of irrigation canals and drains that convey water obtained from the Central Valley Project, State Water Project, local water projects, and groundwater.

Hydrology on the site is currently managed by the Westlands Water District and Empire West Side Irrigation District. The Westlands Water District receives water from San Luis Reservoir under contract from the Central Valley Project, and from wells on lands in the district. Since the closure of the Westlands drain in the early 1980s, irrigation runoff in the Westlands region has been treated in detention basins and does not leave the Westlands region. Irrigation water is not currently applied to any part of the project site; some portions are used as dry pasture, and the majority is fallow. The only current source of water for the project site is direct precipitation; groundwater is exported from the site via wells and canals.

5.3 GENERAL BIOLOGICAL RESOURCES

5.3.1 Vegetation Communities/Land Cover

The entire site is classified as agricultural land cover and is comprised of fallow fields, dirt roads and berms around the perimeter of fields, and canals. There are no native or naturalized habitat types or natural communities on the project site with the possible exception of small patches of emergent wetlands that establish in the canals between periods of vegetation removal. Within the agricultural land cover, fallow fields, berms, and dry canals contain generally the same vegetation composition. Only wetted canals contain a different vegetation community while they contain water, which is dependent on irrigation needs of the surrounding properties. A list of plant and animal species observed during the site visits is included in Appendix D. Representative photos of the site are provided in Appendix E.

5.3.1.1 Agricultural Land

Within the project site, this land cover type is comprised of fallow agricultural land, which are inactive fields that support a depauperate assemblage of relic crop species and ruderal species adapted to colonize disturbed places. Agricultural land also includes dirt roads, berms, and field margins. Actively used dirt roads are generally graded and bare, while unused roads are mostly overgrown with the same vegetation found in the adjacent fallow fields. At the time of document production, agricultural operations in the project site consist only of sheep and cattle grazing in non-irrigated fallow fields. Agricultural fields in the site are heavily dominated by weedy non-crop species such as tumble mustard (*Sisymbrium altissimum*), pigweed (*Chenopodium album*), and wild lettuce (*Lactuca serriola*).

5.3.1.2 Canals

Active and inactive irrigation canals associated with the surrounding agricultural production occur in and adjacent to the project site, as well as a canal carrying treated sewage. Canals in the project site are depicted on the Aquatic Resources Map (Appendix L) and discussed below.

Irrigation Canals

A system of four active canals transect the project site north- to-south in the eastern portion of the project site. The westernmost of those canals is a treated sewage canal and is discussed in the following section. The remaining three canals are active irrigation canals managed by Kings River Conservation

District (KRCD), Westlands Water District (WWD), and Empire West Side Irrigation District (EWSID) and provide water to nearby agricultural fields. None of the water is currently being used on the project site. Additional canals through the project site are managed by local property owners (*e.g.*, Westlake Farms). Many of the canals on the site are inactive and based on the vegetation present and condition of the canals, have not been used in recent years. Active and inactive canals are depicted on the Aquatic Resources Map in Appendix L.

Inactive canals are earthen channels vegetated with weedy upland species similar to the surrounding fallow fields. Active irrigation canals are engineered earthen channels with uniformly steep sides and typically only support a narrow band of green vegetation within a few feet of the water line, or no vegetation at all. Vegetation above that band is sparse and characterized by upland species adapted to arid, alkaline environments such as five-hook bassia (*Bassia hyssopifolia*), alkali mallow (*Malvella leprosa*), and lamb's quarters (*Chenopodium album*). Vegetation near the water line includes a variety of species associated with wetlands such as tall flatsedge (*Cyperus eragrostis*), false daisy (*Eclipta prostrata*), common barnyard-grass (*Echinochloa crus-galli*), Mexican sprangletop (*Leptochloa fusca*), saltgrass (*Distichlis spicata*), and salt heliotrope (*Heliotropium curassavicum*), as well as upland species such as white sweet clover (*Melilotus albus*).

The active irrigation canals are dredged periodically as part of regular maintenance activities to maintain water-carrying capacity. This is evidenced by the presence of dredge spoils lining the canals. Between dredging activities, dense patches of tall, emergent wetland vegetation colonize the canals and include cattail (*Typha latifolia*) and bulrush (*Schoenoplectus acutus*). During the biological reconnaissance conducted in July 2018, only the easternmost of the four parallel canals that runs north/south along the east side of the project site was vegetated (see Figure 6). It featured cattail and bulrush with patches of willow saplings from approximately Kent Avenue to the northern limits of the canal and at the extreme southern end of the project site. However, as previously described, all of the canals on the site periodically support emergent vegetation between the dredging activities; therefore, the site conditions noted in this report are subject to change.

Sewage Canal

As previously mentioned, the canal that carries treated sewage is part of the complex of canals transecting the site from north- to-south in the eastern portion of the site (Appendix L). The source of water is unconfirmed but is assumed to be associated with the NAS Lemoore wastewater treatment basins northwest of the project site. Vegetation in the canal is similar to the adjacent irrigation canals. This canal is also dredged periodically to maintain capacity.

5.3.2 Invasive Species

A total of nine non-native species included on CDFA's Category C list (noxious weeds) and/or having a rating of "high" or "moderate" on the Cal-IPC list were identified in the project site (Appendix D). The only widespread species included on the CDFA list of noxious weeds (List C) is Russian thistle (*Salsola tragus*), which occurs in dense patches in fallow fields in the eastern portion of the project site. Other more widespread invasive species, such as black mustard (*Brassica nigra*) and common ripgut grass (*Bromus diandrus*), are rated "moderate" for invasiveness and not listed in category C.

5.3.3 Wildlife

The agricultural land in the project site provides relatively poor habitat for resident wildlife, due to the long history of agricultural disturbance. The site has been levelled, disked, and furrowed for many years and then left fallow. There has been low recolonization of the site by small mammals within the interior of the fallow fields, which have been subject to an invasion of non-native weeds with nearly monospecific stands of non-native weeds in large areas. Current site grazing has resulted in trampling and denuding of vegetation by livestock.

In general, wildlife habitat is limited within the interior of the fallow fields with notable exception being foraging and nesting by a variety of small birds and habitat for species such as coyote (*Canis latrans*) and other disturbance-tolerant mammals. Field margins and canal banks support high densities of mammals such as California ground squirrel (*Otospermophilus beecheyi*), Botta's pocket gopher (*Thomomys bottae*), Heermann's kangaroo rat (*Dipodomys heermanni*), and desert cottontail (*Sylvilagus audubonii*). Small mammal burrows and coyote dens were abundant throughout the site around the field margins and along canals. Freshwater marsh and aquatic habitat in active canals in and adjacent to the site supports a wide diversity of bird species, including a breeding colony of yellow-headed blackbird (*Xanthocephalus xanthocephalus*) and other common bird species such as red-wing blackbird (*Agelaius phoeniceus*), great egret (*Ardea alba*), great blue heron (*Ardea herodias*), snowy egret (*Egretta thula*), and pied-billed grebe (*Podilymbus podiceps*).

5.4 SENSITIVE SPECIES AND HABITATS

5.4.1 Special-Status Species

The database review identified 36 regionally-occurring special status species (refer to Appendix C); however, based on the individual species' ranges and habitat affinities, a total of seven regionally-occurring special-status species were determined to have the potential to occur in the project site (Table 2). Those species are discussed in detail in Chapter 6.

5.4.2 Sensitive Natural Communities

The database review identified one regionally-occurring sensitive natural community: Valley Sink Scrub. Formerly widespread in the Central Valley from the Tulare Lake Basin north to Glenn County, this community occurred on heavy, saline or alkaline clay soils in areas with a high water table, but has been largely extirpated by flood control, agricultural conversion, and groundwater extraction (Holland 1986). Valley sink scrub is a low, open to dense scrub of succulent perennial shrubs, especially iodine bush (*Allenrolfea occidentalis*) and bush seepweed (*Suaeda nigra*). This community does not occur in the project site. The Kings River and its riparian corridor are a sensitive natural community located east of the project site and is discussed below.

Table 2
SPECIAL-STATUS SPECIES WITH THE POTENTIAL TO OCCUR IN THE PROJECT SITE

Scientific Name/ Common Name	Regulatory Status[1]	Status in the Project Site[2]	Suitable Habitat in the Project Site
Birds			
Athene cunicularia burrowing owl	--/--/SSC	Present	No nesting burrowing owls have been observed on the site. However, burrowing owls have been observed nesting on an adjacent property to the south of the project site since 2016 and transient owls/owl sign has been observed in several locations on the site between spring 2016 and summer 2018.
Buteo swainsoni Swainson's hawk	--/ST/--	Present (foraging)	Fields provide low-quality foraging habitat for individuals nesting in trees on surrounding lands.
Circus cyaneus northern harrier	--/--/SSC	Present (foraging)	No nesting habitat for northern harrier is present in the project site. Fields provide suitable foraging habitat for individuals nesting in offsite wetland habitat.
Eremophila alpestris actia California horned lark	--/--/WL	Present (nesting and foraging)	Disturbed areas along roads and field margins provide suitable foraging and nesting habitat.
Lanius ludovicianus loggerhead shrike	--/--/SSC	Present (nesting and foraging)	Fields with Russian thistle provide suitable nesting and foraging habitat.
Xanthocephalus Yellow-headed blackbird	--/--/SSC	Present	Fields provide foraging habitat for colonies documented nesting in freshwater marsh vegetation in canals on the project site.
Mammals			
Vulpes macrotis mutica San Joaquin kit fox	FE/SE/--	Presumed Absent	Marginal habitat is present along canal banks and road berms but this species was not observed in the site or within a 2-mile radius during protocol surveys.

1 Regulatory Status is ESA listing/CESA listing/Other state status. FE=Federal Endangered; SE=State Endangered; ST=State Threatened; SSC=CDFW Species of Special Concern; WL= CDFW Watch-list.
2 Status in the Project site is based on results of surveys summarized in Table 1.

5.4.2.1 Kings River

The Kings River is a sensitive natural community located east of the project site. The Kings River floodplain and riparian corridor have been modified by adjacent land uses and the banks have been modified by levees. The riparian habitat associated with the river is generally sparse and largely restricted to within the banks of the river. The segment of the river east of the project site is used daily for recreation including fishing, swimming, and off-highway vehicle use. Recreational shooting is common along the river corridor as evidenced by numerous spent ammunition casings on and adjacent to the levee from shotguns and other hand-held firearms. The Kings River provides wildlife habitat primarily in the form of foraging and nesting habitat for a variety of birds including raptors, waterfowl and shorebirds as well as a potential dispersal corridor for wildlife residing in the region. Fish species in the segment of the Kings River east of the site consist primarily of non-native Centrarchids (sunfishes), native and non-native Cyprinids (minnows), and non-native Ictalurids (catfishes) (http://calfish.ucdavis.edu/).

5.4.3 Jurisdictional Waters and Wetlands

Based on the results of the wetland assessment, there are no wetlands or other aquatic resources on the project site outside of engineered, actively managed canals. A map of aquatic resources in the project site and the sample point datasheets are provided in Appendix L. Data points were taken throughout the site in upland areas that were deemed by the delineators to have some potential to quality as wetlands because they either exhibited one of the wetland parameters (hydrophytic vegetation, hydric soil, wetland hydrology), were in a topographic location that may be suitable to support wetlands, or exhibited a unique signature on aerial photography. None of the data points met the three-parameter test for wetlands with the exception of data point 33, which was taken in an active canal.

The canals on the project site are features that were constructed for the purpose of conveying irrigation water or treated sewage. The treated sewage canal is not believed to be waters of the U.S. or State subject to Clean Water Act jurisdiction. Irrigation canals on the project site are potentially waters of the U.S. and State subject to Clean Water Act jurisdiction and may also be subject to regulation by CDFW pursuant to Section 1600 *et seq*. of the California Fish and Game Code.

5.4.4 Raptors and Other Migratory Birds

Native birds fall under the jurisdiction of the MBTA and Fish and Game Code. These species include various common migratory birds and raptor species. Most native birds are not considered special-status species; however, the MBTA and California Fish and Game Code Sections 3503 and 3800 prohibit the possession, take, or needless destruction of birds, their nests, and eggs.

The project site lacks large trees that may be used for nesting, but transmission towers, power poles, and small trees and shrubs and other vegetation in the site provide nesting habitat for a wide variety of native birds common to the San Joaquin Valley, such as western meadowlark (*Sturnella neglecta*), western kingbird (*Tyrannus verticalis*), mourning dove (*Zenaida macroura*), and savannah sparrow (*Passerculus sandwichensis*). Common birds that have been observed nesting in the site include American crow (*Corvus brachyrhynchos*), great horned owl (*Bubo virginianus*), mourning dove, and savannah sparrow. Overhead transmission line poles in the project site provide potential nest sites for red-tailed hawk, great horned owl, and common raven (*Corvus corax*).

6.0 RESULTS: BIOLOGICAL RESOURCES IMPACT EVALUATION

6.1 GUIDELINES FOR DETERMINING IMPACT SIGNIFICANCE

The following threshold criteria from Appendix G of the State CEQA Guidelines were used to evaluate potential effects on biological resources. Based on these criteria, the project would have a significant effect on biological resources if it would:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive or special-status species in local or regional plans, policies, or regulations, or by CDFW or USFWS.
- Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, and regulations or by CDFW or USFWS.
- Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the CWA (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means.
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.
- Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance.
- Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional or state habitat conservation plan.

6.2 IMPACTS TO SPECIAL-STATUS SPECIES

Potential impacts to special-status species as a result of the project are discussed in the following sections. Locations of special-status species observed during biological surveys are depicted on Figure 6.

6.2.1 Special-status Birds

Species descriptions in this section are taken from Shuford and Gardali (2008), or from other sources as noted.

6.2.1.1 Burrowing Owl

Federal status – none
State status – species of special concern

Species Description

Burrowing owls are often found in open, dry grasslands, agricultural and range lands, and desert habitats. They can also inhabit grass, forb, and shrub stages of pinyon and ponderosa pine habitats.

Burrowing owls occur at elevations ranging from 200 feet below mean sea level to over 9,000 feet amsl. In California, the highest elevation where burrowing owls are known to breed is 5,300 feet amsl in Lassen County. In addition to natural habitats, burrowing owls can be found in urban habitats such as at the margins of airports and golf courses and in vacant lots. Burrowing owls forage in adjacent grasslands and other suitable habitats primarily for insects and small mammals, and less often for reptiles, amphibians, and small birds.

Burrowing owls nest in burrows in the ground and commonly perch on fence posts or mounds near the burrow. The owls often use ground squirrel burrows or badger dens or artificial burrows such as abandoned pipes or culverts. Although the more northern burrowing owl populations migrate seasonally, burrowing owls are year-round residents of the San Joaquin Valley. Burrowing owls often form loose colonies, with nest burrows 46 to 2,952 feet apart (Ross 1974; Gleason 1978). In the San Joaquin Valley, the nesting season for burrowing owl can begin as early as February 1 and continues through August 31.

Survey History

Protocol surveys for burrowing owl were performed by HELIX during the breeding season in 2016 and again in 2018. Observations of breeding locations in 2016 were submitted to CNDDB. Details of the survey methods and results are provided in Appendix K. HELIX biologists have conducted a variety of surveys in the site between 2016 and 2018, totaling hundreds of hours in the site. Any anecdotal observations of burrowing owl during these surveys were recorded and are included in the discussion for this report.

The nearest other CNDDB reported occurrences of burrowing owl are from NAS Lemoore, 2-5 miles northwest of the project site.

Habitat Suitability

The project site provides potential foraging habitat for burrowing owl, and mammal burrows along roads and canals throughout the project site provide potential nesting habitat. Mammal burrows are especially common along the west bank of the inactive canal in the center of the site north of Kent Avenue. Suitable burrows were not observed in most open fields despite extensive pedestrian surveys conducted in those areas.

Presence in the Project Site

No nesting by burrowing owls has been documented on the project site during hundreds of hours of surveys. However, several sightings of transient burrowing owl or burrowing owl sign have been documented throughout the site and burrowing owls were documented nesting in pastureland adjacent to the southern boundary of the project site during both 2016 and 2018 surveys. Locations for all sightings of burrowing owl are depicted on Figure 6.

Potential for Significant Adverse Effects

In the absence of proposed mitigation measures, potential adverse effects of the proposed project on burrowing owl could include harm to individual burrowing owls, nest disturbance/loss of occupied burrows, and loss of foraging habitat. Burrowing owl nesting was not observed in the project site and there are no known occupied burrowing owl nesting locations in the project site (reported in the CNDDB or other sources). There is potential for project activities to have adverse effects on burrowing owl residing and/or breeding off-site through noise, vibration, and proximity of construction activities, as there are observations of active breeding burrows within 200 meters (approximately 656 feet) of the project site.

If dispersing or transient burrowing owls were to occupy burrow(s) in the project site prior to construction of the project or decommissioning, such activities could result in direct impacts to burrowing owl individuals through harm as a result of contact with construction equipment or personnel and/or indirect impacts as a result of habitat destruction or loss of burrows. Project construction activities in the vicinity of the occupied burrow location would include access road construction, trenching for low-voltage collection lines, boring for support posts, and installation of solar panel arrays. These activities would be considered low-intensity impacts because the construction disturbance (noise, presence of equipment and personnel) would be comparable in nature to the agricultural practices in the region. Construction of the proposed project would also result in the loss of foraging habitat for burrowing owl in close proximity to occupied burrows and construction and decommissioning activities could impact burrowing owl nesting adjacent to the southern boundary of the site through noise, vibration, and the presence of construction equipment and personnel. This would be a significant impact.

The recommended mitigation measures for burrowing owl contained in Chapter 7 (MM BIO-1a-e) would reduce impacts to this species to less than significant.

6.2.1.2 Swainson's Hawk

Federal status – none
State status – threatened

Species Description

SWHA was state listed as a California threatened species on April 17, 1983. This species has no federal listing status.

SWHAs are breeding season residents of California, currently found primarily in the Central Valley but also in the southern desert regions and the northeast portion of the state. Most individuals migrate to South America in the fall, though some small groups may remain in California year-round (CDFW 1994). SWHAs return to California in March and begin establishing nesting territories. Nest construction continues through April and eggs are usually laid between early April and early May. Incubation lasts 34-35 days, and the young fledge 42-44 days after hatching. The Swainson's Hawk Technical Advisory Committee (SHTAC) recommended protocol for SWHA nesting surveys in the Central Valley defines five survey periods based on breeding season phenology (SHTAC 2000): January – March 20 (Period I); March 20 – April 5 (Period II – courtship/territory establishment); April 5 – April 20 (Period III – nest building); April 21 – June 10 (Period IV – incubating/hatching); June 10 – July 30 (Period V – post-fledging). These dates are based on a typical breeding season for the majority of birds in the Delta region (San Joaquin County to Yolo County) and may shift earlier with decreasing latitude.

SWHAs typically nest in scattered trees or in riparian corridors adjacent to agricultural fields or pastures that are their primary foraging areas (CDFW 1994). SWHA nests are usually located in trees near the edges of riparian stands, in lone trees or groves of trees in agricultural fields, and in mature roadside trees. Valley oak, Fremont cottonwood, walnut, and large willow with an average height of about

58 feet, and ranging from 41 to 82 feet, are the most commonly used nest trees in the Central Valley. Major prey species include California voles, pocket gophers, deer mice, California ground squirrels, mourning doves, ring-necked pheasants, meadowlarks and other passerines, grasshoppers, crickets, and beetles (Estep 1989). SWHAs are active aerial predators that hunt in low circling flights over fields, often following farm equipment. During the breeding season, SWHAs eat mainly vertebrates, shifting to insects during migration.

Agricultural lands considered suitable foraging habitat for SWHA include alfalfa, fallow fields, low-growing row or field crops (*e.g.*, beets, tomatoes), dry-land and irrigated pasture, rice (when not flooded), and cereal crops (CDFW 1994). Suitability for SWHA foraging is driven largely by the interaction of two factors: prey base supported by the crop type, and accessibility of prey to aerial predators (Estep 1989). Accessibility of prey is determined by vegetation structure; dense cover of vegetation over approximately 12-inches height renders prey largely inaccessible and reduces foraging use (Estep 1989, 2009). SWHA use of agricultural lands is often associated with mowing or other activity that disturbs prey and reduces vegetative cover (Estep 1989, Swolgaard *et al.* 2008). The type of agricultural land use determines the suitability for SWHA foraging habitat – those containing high prey abundance and changing vegetation structure throughout the growing season which allow accessibility to prey provide the highest value foraging habitat for the species. Land uses such as perennial grassland, dryland pasture, and fallow fields provide high value foraging habitat for SWHA (Estep 1989, Woodbridge 1998 in Estep 2017).

Estep and Dinsdale (2012) surveyed SWHAs in the central San Joaquin Valley and found that nesting was concentrated along and east of the Kings River/Fresno Slough riparian corridor where nest trees were most abundant. High-value agricultural foraging habitat such as irrigated pasture and alfalfa was also more abundant east of the Kings River, which favored SWHA nesting in that portion of the study area. West of the Kings River, nest trees were scarce and agriculture was more dominated by wheat, cotton, and row crops, and SWHA nesting was consequently reduced. Despite the relative lack of high-value agricultural foraging habitat west of the Kings River, SWHAs would fly from east of the Kings River to forage opportunistically in alfalfa, wheat, and row crops such as tomatoes during harvest or other activities that expose prey.

Comparative studies of foraging habitat use consistently find that SWHAs forage disproportionately in alfalfa and harvested fields (Estep 1989, Babcock 1995, Smallwood 1995, Swolgaard *et al.* 2008, Estep and Dinsdale 2012, Estep 2013, Fleishman *et al.* 2016) because these habitats support large numbers of prey and have low vegetation structure. Conversely, vineyards which consist of linear rows of vines separated by open spaces as opposed to large open areas of low vegetation structure, have often been considered unsuitable foraging habitat because the extent to which SWHAs would attempt to capture prey between rows of tall vegetation is considered negligible (Estep 2013). Similarly, solar generation facilities – which are generally similar to vineyards in overall structure – have often been considered unsuitable foraging habitat because they are usually classified as urban development. However, recent studies indicate that both vineyards and solar facilities provide some foraging habitat value for SWHA (Estep 2013; Swolgaard *et al.* 2008).

Swolgaard *et al.* (2008) studied SWHA use of vineyards in a vineyard-dominated agricultural landscape in northern San Joaquin County and found that SWHAs foraged in vineyards 0.5 times as frequently as would be expected from the proportion of vineyard acreage to the total study area. In the same study, alfalfa was used 12 times as frequently as would be expected. In a similar study conducted in southern Sacramento County, Estep (2013) found that SWHAs foraged in vineyards 0.66 times as frequently as would be expected and in alfalfa 1.9 times as frequently as would be expected. In the former study, vineyards made up 41 percent of the acreage in the study area and alfalfa 2.2 percent. In the latter study, vineyards were 6.5 percent of the total study area and alfalfa 10.7 percent. Estep (2013) included solar facilities in the study area and found that SWHAs foraged in solar facilities 1.8 times as frequently as would be expected from the proportion of solar facility acreage to the total study area.

Survey History

CNDDB records of SWHA nests within 10 miles of the project site include a total of six locations, all are between 8 and 10 miles from the site. Five locations are along the California Aqueduct near the town of Huron, and one location is on NAS Lemoore. Estep Environmental Consulting (Estep) conducted a regional study for SWHA for an adjacent solar project (Estep 2017) and nesting surveys conducted April – July 2016 identified a total of 29 pairs of SWHA nesting in the project region. The majority of those nests are within an approximately 10-mile radius of the project site; none are on the site.

Protocol nesting surveys for SWHA were conducted by HELIX in and within 0.5 miles of the project site between April and June 2018. Details of the survey methods and results are provided in Appendix F. During those surveys, one active nest was documented along the Kings River at a point approximately 0.5-mile northeast of the project site (Figure 6). The regional study conducted by Estep also documented an active SWHA nest at this location in 2016 (Estep 2017). A second pair of SWHAs was observed exhibiting nesting behavior (*e.g.*, nest building, courtship) in an old willow snag along the Kings River approximately 0.25 mile east of the project site early in the breeding season but was not successful, and the location was abandoned by late May (this location was not documented by Estep in 2016, which corroborates that this location is not an established nesting territory). The nest at this location was only 10-12 feet above the surrounding grade and was exposed with no canopy cover, which is not typical of SWHA nests. During the survey on May 21, 2018 the willow tree appeared to have lost a large branch, which may have led to the nest abandonment.

Habitat Suitability

The project site does not support suitable nesting habitat for SWHA. There are no trees on the site suitable for SWHA nesting. The only trees on the site are willow saplings along segments of canal. Fallow agricultural fields provide suitable foraging habitat for SWHA, although current use of the site by this species is minimal (see discussion below).

There are trees suitable for SWHA nesting at five locations within 0.5 mile of the project site (Appendix F; Swainson's Hawk Survey Report). Nesting pairs of SWHA used trees at two of these locations for at least part of the 2018 breeding season; however, one location was abandoned by late May.

Presence in the Project Site

Due to the lack of suitable nest trees, no SWHA nests are present in the project site.

Because at least one SWHA nest site is present within 0.5 miles of the project site as well as roughly 29 within 10 miles, it is assumed that the project site could be used by foraging SWHA. However, documented use of the site by SWHA has been very low. In 2017, HELIX biologists conducted a study of SWHA foraging that included the project site and immediate vicinity (Appendix F). The study included weekly surveys over 9 weeks from late May to late July which corresponds to the late incubation/hatching period through late post-fledgling. Each survey consisted of two 4-hour sessions, one in the afternoon/evening, and one the following morning for a total of 72 hours of observation. No incidents of SWHA foraging in the project site were recorded during that time.

SWHA have been occasionally seen perched on power poles near the project site or flying over the site; however, red-tailed hawks are very common in the site and may discourage use by SWHA. SWHA have been commonly seen foraging in active wheat and alfalfa fields east of the Kings River and are typically present in wheat fields near the project site during harvest. The lack of regular agricultural activities in the project site likely reduces its attractiveness to SWHA.

SWHA Foraging Use of Developed Solar Sites

Typical solar arrays consist of uniform rows of photovoltaic (PV) modules (panels) with a maximum height of 10 feet at full tilt (45°) and a minimum distance of 14 feet between panels at horizontal (and more space between panels when tilted). The collection systems are almost completely underground, and power is delivered to an onsite solar substation. The array configuration of a typical SGF leaves an average of 60-70 percent of the site in open space. For example, the nearby operational RE Mustang Solar site occupies a total footprint of 1,100 acres, of which approximately 288 acres (26 percent) are covered by modules and other structures and the remaining 812 acres (74 percent) are open space. The estimated acres of solar panel coverage are based on an aerial coverage of the site with the panels fully horizontal or parallel to the ground, in which the greatest footprint would occur. The aerial coverage of the site would be reduced when the panels are tilted. Similarly, the structures supporting the modules in a typical solar generation facility are cylindrical pipes or H-beams which leave the areas below the panels open and minimize the footprint on the ground.

As is typical of utility-scale solar generation facilities, the proposed Slate Solar project includes rights-of-way for canals, roads, overhead transmission lines, and underground utility lines and would have a high percentage of open space in the project footprint. Because much of the typical SGF is composed of open areas, there is potential for use of solar projects by SWHA and other raptors for foraging, particularly if the facility is managed to optimize habitat for prey and the area between the panels is managed as perennial grassland vegetation of a suitable height. As previously mentioned, other land uses with a similar structure, such as vineyards, have also been demonstrated to be used by foraging SWHA, so this concept is not completely new. To test the hypothesis that solar arrays provide foraging habitat for SWHA, Estep (2013) conducted a pilot study in Sacramento County in 2012 to evaluate the foraging use of solar arrays by SWHAs and other raptor species relative to the surrounding agricultural landscape.

In that study, three PV solar generation facilities in Sacramento County, ranging from 105 to 200 acres in size, were evaluated for foraging use by SWHAs and other raptors. All three of the SGF evaluated in the foraging study are located within a diverse agricultural landscape of similarly sized parcels to the solar facilities. The study was conducted after the three facilities had been constructed, operation had commenced, and grass cover had been established. The three facilities were being managed to allow establishment of grasses beneath and between the solar panels. The grass cover at these sites is maintained between 4 and 12 inches in height through a sheep grazing program. The grass ground cover is managed to promote the establishment of rodent populations to provide foraging habitat for raptors as well as refugia for rodents to assist with re-establishment of rodent populations on adjacent farmlands following cultivation.

Results of the study indicated that the solar array fields were used for foraging by SWHA similar to other moderate to high value agricultural cover types and the presence of the solar facilities did not appear to affect the overall use of the landscape by SWHAs or other raptors. As one element of an otherwise diverse agricultural matrix, the solar array fields provided a consistent and an apparently reasonably accessible source of prey, particularly for SWHAs and American kestrels. Surprisingly, the study also indicated that the solar arrays were used at a higher rate than would be expected based on their availability in the landscape, meaning that SWHAs appeared to be selectively foraging within solar arrays over other crop types. The key to this was the fact that the solar sites were managed to provide a continual source of prey that was accessible to the hawks consistently throughout the spring and summer breeding season versus the seasonal availability of prey in agricultural crops due to the planting, growth, and harvesting regime.

Although this was a relatively simple short-term study (*i.e.*, a 5-month study) designed to determine foraging use by SWHAs in 100-200-acre solar arrays within a diverse agricultural matrix, it demonstrated that solar arrays do provide available foraging habitat for SWHAs and are used by this species for foraging. The study also suggests that conversion of otherwise suitable foraging habitat to solar arrays does not necessarily constitute a complete loss of foraging habitat for SWHA and that properly managed solar arrays could provide important foraging habitat for SWHA during periods when surrounding agricultural crops are not suitable.

The foraging study conducted by HELIX (Appendix F) expands on the study by Estep and shows that SWHAs will forage in a large-scale SGF (>1,000 acres) located in an agricultural landscape. In 2017, HELIX biologists conducted a study of SWHA foraging at the RE Mustang SGF, which is west of the project site across Avenal Cutoff Road (Appendix F). The study compared SWHA foraging use of the 1,100-acre solar facility to an approximately 4,800-acre off-site area that included the project site and surrounding active agricultural lands. HELIX found that SWHAs foraged in the operational RE Mustang SGF at a higher intensity (determined by the minutes of forage per unit area) than in surrounding lands and observed no foraging behavior in the vicinity of the proposed Slate Solar Project site. This result is consistent with the findings of Estep (2013), suggesting that SGF managed to promote SWHA foraging may provide higher-value foraging habitat than active and idle agricultural lands.

Potential for Significant Adverse Effects

Impacts to Nesting Habitat

Because there are no trees in the project site, the project would not remove Swainson's hawk nesting habitat. Project construction/decommissioning activities within 0.25-mile of suitable trees could potentially disturb nesting Swainson's hawks using those trees. There was one documented active Swainson's hawk nest within 0.5-mile of the project site in 2018: in a tree 0.35-mile north of the project site along the Kings River.

CDFW management protocols for Swainson's hawk (CDFW 1994) stipulate a 0.25-mile buffer for "intensive new disturbances" around active nests, extended to 0.5-mile outside urban areas where disturbance is not a normal occurrence during the nesting season. CDFW (1994) cites heavy equipment operation, use of cranes or draglines, and rock crushing as examples of "intensive disturbance". Normal agricultural operations in the vicinity of the project site include disking and plowing of fields by large (6-8 wheel) tractors and combine harvesters, and periodic presence of scores of agricultural laborers during planting and harvest. Equipment used for construction of the proposed project would include road graders (bladers), small self-contained drill rigs for boring support post holes, front loaders and fork lifts, and semi-trucks. These vehicles and activities would not cause noise, dust emissions, or vibration greater than that typical of large agricultural equipment used in the region, nor would the impacts from such equipment and activities rise to the level of disturbance caused by heavy equipment, cranes or draglines, or rock crushing. Consequently, an extended (0.5-mile) buffer would not be warranted for the project, and a 0.25-mile buffer would be sufficient to protect active Swainson's hawk nests from disturbance.

The recommended mitigation measure for SWHA contained in Chapter 7 (MM BIO-2) would reduce potential impacts to nesting SWHA to less than significant.

Impacts to Foraging Habitat

The California Department of Fish and Wildlife (CDFW) has developed regional strategies to address land use issues related to SWHA conservation pursuant to both CESA and the CEQA process. The CDFW Region 2 guidelines (CDFW 1994) are often used during CEQA review of proposed projects in the Central Valley. The guidelines recommend acquisition of replacement lands as mitigation for project impacts to SWHA foraging habitat deemed sufficient to be considered a significant impact to the SWHA population under CEQA. The guidelines state that the determining criteria for CEQA significance is removal of any suitable foraging habitat within 10 miles of an active SWHA nest, which is defined as a nest active at any time in the previous 5 years. Compensatory mitigation is recommended at ratios ranging from 1:1 for projects within 1-mile of an active nest, 0.75:1 for projects 1-5 miles from an active nest, to 0.5:1 for projects 5-10 miles from an active nest (CDFW 1994). The guidelines do not consider the size of the potentially affected SWHA population, the amount and quality of existing foraging habitat in the region, or the size of the project relative to the amount of available foraging habitat. However, the guidelines allow for independent assessment of impacts and development of a conservation strategy as an alternative to the guidelines.

The analysis of potential impacts of the RE Slate project on foraging habitat for the regional population of SWHA (*i.e.*, nesting SWHA within roughly 10 miles of the project site) builds upon methods that have been used for the analysis of impacts to SWHA foraging habitat on several other approved utility-scale solar projects in the region (reviewed in Estep 2017). This method more effectively addresses CEQA-based impacts to SWHA than the simpler approach employed in the CDFW guidelines. In order to provide a more robust assessment of CEQA impacts, it is necessary to extend the analysis beyond the scale of the project site and the nearest active SWHA nest, which is the scale of analysis employed in the CDFW guidelines. The larger-scale analysis should consider the size and distribution of the regional population of SWHA, availability of suitable foraging habitat for the regional population, and the effect of project implementation on the availability of resources to the regional population.

Appendix M presents a detailed description of a larger-scale analysis of project impacts to Swainson's hawk that is more rigorous and biologically realistic than the simpler method used in the CDFW guidelines. The analysis used methods employed in other studies of regional Swainson's hawk populations, refined to provide additional analytical rigor in response to methodological issues identified in those studies (Estep 2011, 2015, 2017). The refined approach combined field observations, public and proprietary data, and desktop spatial analysis to estimate the acreage of suitable foraging habitat required to sustain the regional population of Swainson's hawk. Impacts were assessed at the project- and cumulative levels. This section provides a summary of the methods and results presented in Appendix M.

Methods

Land use data were taken from the 2014 California Department of Water Resources (DWR) Land Use Surveys layer, which is available at: https://water.ca.gov/Programs/Water-Use-And-Efficiency/Land-And-Water-Use/Land-Use-Surveys. The data are based on the 2014 Statewide Agricultural Survey conducted by DWR and were downloaded on September 5, 2018. Foraging habitat quality data were overlaid on 2017 aerial imagery and visually reviewed by HELIX biologists for recent conversions to unsuitable land uses or changes in foraging quality.

Data on SWHA nest locations in the study area were obtained from three sources: California Natural Diversity Database (CNDDB) records; a ground survey performed in 2016 in the study area for the adjacent RE Mustang 2 solar project (Estep 2017) which, given the relative size and shape of the two projects, is almost entirely included in the study area for this analysis; and data from a survey of SWHA nests in the central San Joaquin Valley (Estep and Dinsdale 2012). Duplicate records for the same locations among these three data sets were combined into a single record for analysis.

Data on other existing, planned, and reasonably foreseeable solar projects (cumulative projects) in the study area were obtained from Kings County and Fresno County.

The amount of foraging habitat needed to sustain the regional population was estimated using a 6,820-acre average home range size for nesting pairs measured in a telemetry study (Estep 1989). The 6,820-acre home range is the average area that an individual hawk will occupy during the course of the breeding season; however, within this area, foraging occurs opportunistically where conditions provide accessible prey (Estep 2015). Average home range size is a useful baseline that can be adjusted to account for factors that affect the amount of the home range that provides the essential resource base for the SWHA nesting territory and thus determines the amount of habitat required to sustain a nesting pair (Estep 2015). Factors considered to adjust the home range size were: amount of overlap among home ranges in a population, which was estimated at 40 percent (Estep 1989); habitat suitability – most prey capture attempts are in moderate- or high-quality habitat areas (Estep 2105) – which affects the amount of the home range that is likely to provide useful resources to the nesting pair; and foraging outside the study area, which is assumed to increase with distance from the project site as more of the potential foraging habitat available to the nesting pair is outside the 10-mile radius around the project site (Estep 2015). The amount of foraging habitat needed to sustain the regional population was estimated using Equation 1:

$$Y = n \cdot 6{,}820 \cdot p \cdot q \cdot r,$$

where n is the number of SWHA nesting pairs in the regional population; 6,820 is the baseline average home range size; p is the adjustment for average home range overlap (1-average overlap); q is the proportion of the suitable habitat in the study area that is moderate- or high-quality habitat; and r is the weighted average overlap between the study area and the potential foraging areas available to the regional population.

The amount of suitable foraging habitat available in the study area was compared to the total acreage of suitable habitat required to sustain the regional population (Y). The CEQA significance threshold was set at 70 percent of the existing surplus habitat in order to account for variation in the estimates due to interannual variation in the regional population caused by mortality and recruitment, allow for resilience in the regional population to environmental factors outside the scope of this analysis, and to account for other potential sources of error. If the project would result in the surplus of suitable foraging habitat in the study area being reduced to less than 70 percent of the existing surplus, the project would be considered to have a significant impact on the regional population of SWHA under CEQA.

Results

The regional population of SWHA that would potentially be affected by the RE Slate project is 38 nesting pairs in a 276,048-acre study area. A total of 194,719 acres of suitable foraging habitat were identified in the study area; the remaining 81,329 acres were unsuitable land uses. Overall, 73.3 percent of the suitable foraging habitat was moderate- or high-quality habitat. Land uses in the study area are summarized in Table 3. The weighted average overlap of the potential foraging area for all nests and the study area was 0.63.

Table 3
SWHA FORAGING HABITAT IN THE STUDY AREA

Habitat Type	Area (ac)	% of Total
Grand Total	**276,048**	**100.0**
Suitable Habitat	194,719	70.4
High Quality (alfalfa)	17,112	8.8
Moderate Quality	125,678	64.5
Low Quality	51,930	26.7
Unsuitable Habitat	81,329	29.6
Orchards/Vineyards	36,868	45.3
Urban/Developed/Other	44,462	54.7

The total acreage of foraging habitat required in the study area to sustain the regional population of SWHA was calculated using Equation 2:

$$Y = 38 \cdot 6{,}820 \cdot 0.6 \cdot 0.73 \cdot 0.63 = 71{,}513,$$

where 38 is the size of the regional population (n); 6,820 is the baseline average home range size; 0.6 is the correction for 40 percent overlap among home ranges (p); 0.73 is the proportion of the suitable foraging habitat in the study area that is Moderate- or High-quality (q); and 0.63 is the weighted average proportion of potential foraging area for all nest territories in the regional population that is inside the study area (r).

According to Equation 2, the total amount of foraging habitat in the study area required by the regional SWHA population is 71,513 acres. The total amount of suitable foraging habitat in the study area is 194,719 acres; therefore, there is a surplus of 123,206 acres of suitable foraging habitat in the study area. The CEQA significance threshold is 70 percent of the existing surplus, or 86,244 acres (Table 4).

The proposed project would result in conversion of 2,490 acres of undeveloped land in the study area into a solar PV generating facility. Although properly managed solar facilities have been demonstrated to be used by SWHA for foraging, the entire acreage of solar facilities are considered a land use unsuitable for SWHA foraging for purposes of this analysis. Removal of 2,490 acres of habitat would reduce the surplus SWHA foraging habitat in the study area to 120,716 acres, which is 97.9 percent of the existing surplus, and well above the 70-percent CEQA significance threshold (Table 4). The project impact to the regional population of SWHA through foraging habitat loss would be less than significant, and no compensatory mitigation would be required.

Including the proposed RE Slate project, there are a total of 16 existing, planned, or reasonably foreseeable solar projects in the study area. The total area of these cumulative projects is 28,006 acres, of which over 20,000 acres are in the Westlands Solar Park Master Plan area. The proposed project contributes 8.9 percent of the cumulative impact. Development of the cumulative projects would reduce the surplus SWHA foraging habitat in the study area to 95,200 acres, which is 77.3 percent of the existing surplus and above the 70-percent CEQA significance threshold (Table 4).

Table 4
PROJECT IMPACTS AND CEQA SIGNIFICANCE THRESHOLD

		Remaining After Impact			
	Existing	Project 2,490	% of Existing	Cumm. 28,006	% of Existing
Suitable Foraging Habitat	194,719	192,229	98.7	166,713	85.6
Foraging Habitat Required	71,513	--	--	--	--
Surplus	123,206	120,716	97.9	95,200	77.3
CEQA Significance Threshold	86,244	--	--	--	--
Less than Significant Impact[1]	36,962	34,472	93.3	8,956	24.2

1 Impact acreage that would be below the CEQA threshold of significance, or 123,206·(0.3) = 123,206-86,244 = 36,962

Potential project impacts to the regional SWHA population through loss of foraging habitat would be less than significant and no mitigation would be required.

6.2.1.3 California Horned Lark

Federal status – none
State status – watch list

Species Description

Horned lark is a common to abundant resident of a variety of open habitats from coastal grasslands to alpine dwarf shrub habitats. Horned larks usually leave mountainous areas in winter and gather in deserts and lowlands where they form large flocks, augmented by migrants from outside California. Horned larks forage on the ground for insects, snails, spiders, and seeds. Nests are built on the ground in areas of low, sparse vegetation; breeding occurs from March through July (CDFW 1990).

Survey History

Horned larks were observed occasionally in the project site. Individuals were seen along roads and in disturbed areas at the margins of fallow fields. Nesting was not confirmed but it can be assumed that this species is nesting in the project site. There are no CNDDB reported occurrences of horned lark within 10 miles of the project site.

Habitat Suitability

Disturbed areas at the margins of fallow fields provide open, sparsely vegetated habitat suitable for horned lark nesting and foraging. Horned larks were observed in these habitats during the breeding season.

Potential for Significant Adverse Effects

In the absence of proposed mitigation measures, potential adverse effects of the proposed project could include direct or indirect impacts to horned lark. Construction or decommissioning activities during the horned lark breeding season (March – July) would have the potential to disturb nests both directly and indirectly through nest destruction and/or construction equipment and/or personnel causing noise or other disturbance near nests. Disturbance could lead to destruction of nests, eggs, or chicks, or to abandonment of active nests. This would be a significant impact.

The recommended mitigation measures for nesting birds contained in Chapter 7 (MM BIO-4) would reduce impacts to horned lark to less than significant.

6.2.1.4 Loggerhead Shrike

Federal status – none
State status – species of special concern

Species Description

The range of the loggerhead shrike extends throughout the United States and southern Canada, and it is a year-round resident throughout most of its California range. This species prefers open habitats with scattered shrubs, trees, posts, or other perches. It can be found in shrublands or open woodlands with bare ground, or sparse herbaceous cover and is often found in open cropland. Loggerhead shrikes hunt in open areas of short grasses, forbs, or bare ground, and impale prey on thorns or barbed wire. Prey includes large insects, as well as various small reptiles, amphibians, rodents, and birds.

Suitable breeding habitat includes shrublands or open woodlands with grass cover or bare ground. Loggerhead shrikes in the Central Valley typically use riparian edges where they generally place their nests 1 to 2 meters (3.3 to 6.6 feet) above ground in shrubs or trees. Loggerhead shrike habitat includes alfalfa fields, grasslands, non-rice crops, oak groves, orchards, pastures, ponds and seasonally wet areas, riparian areas, disturbed areas, rural residential development, tree groves, and canals.

Survey History

Loggerhead shrike was observed foraging in the project site. These individuals were typically perched on fences or overhead electrical transmission lines and occasionally in stands of dead Russian thistle; no nests of this species were observed. There are no CNDDB reported occurrences of loggerhead shrike within 10 miles of the project site.

Habitat Suitability

The project site provides suitable nesting and perching/hunting habitat for loggerhead shrike. Grazed fields and barbed wire fences provide foraging habitat.

Potential for Significant Adverse Effects

In the absence of proposed mitigation measures, potential adverse effects of the proposed project could include direct or indirect impacts to loggerhead shrike. Construction or decommissioning activities during the shrike breeding season (March – July) would have the potential to disturb nests both directly and indirectly through nest destruction and/or construction equipment and/or personnel causing noise or other disturbance near nests. Disturbance could lead to destruction of nests, eggs, or chicks, or to abandonment of active nests. This would be a significant impact.

The recommended mitigation measures for nesting birds contained in Chapter 7 (MM BIO-4) would reduce impacts to loggerhead shrike to less than significant.

6.2.1.5 Yellow-headed Blackbird

Federal status – none
State status – species of special concern

Species Description

Yellow-headed blackbird breeds commonly in California east of the Cascades and Sierra Nevada, the Central Valley, and the Imperial and Colorado River valleys. It is uncommon in the Central Valley during winter; most populations migrate south to the Imperial Valley. This species nests in dense freshwater marsh vegetation, usually near deep water, and forages in agricultural fields, grasslands, and along shorelines. Nests are always constructed over water, and most foraging is on moist ground.

Survey History

Yellow-headed blackbird was observed in canals along 23rd Avenue during surveys in 2016 and 2018, nesting in large numbers (see Figure 6). These individuals inhabited patches of freshwater marsh vegetation in the canals and foraged in fields in the project site. This species was not observed during surveys conducted after mid-June. Yellow-headed blackbird occurrences were submitted to the CNDDB. There are no other CNDDB reported occurrences of yellow-headed blackbird within 10 miles of the project site.

Habitat Suitability

Freshwater marsh vegetation in active canals in the project site provides nesting habitat and foraging habitat.

Potential for Significant Adverse Effects

The project has potential for significant adverse effects to yellow-headed blackbird nesting habitat due to the proposed canal crossings and directional drilling/boring under canals. Although these activities would not directly impact the canals, construction related disturbance could occur in close proximity to nests. Disturbance could lead to destruction of nests, eggs, or chicks, or to abandonment of active nests. This would be a significant impact.

The recommended mitigation measures for nesting birds contained in Chapter 7 (MM BIO-4) would reduce impacts to yellow-headed blackbird to less than significant.

6.2.1.6 Northern Harrier

Federal status – none
State status – species of special concern

Species Description

Northern harrier is widespread throughout North America from southern Canada to northern Mexico and is a year-round resident in California. Population sizes increase during the non-breeding season due to over-wintering migrants. Northern harriers breed in a variety of open habitats including marshes, wet meadows, weedy shorelines, grasslands, weed fields, pastures, sagebrush flats, desert sinks, and croplands. Northern harriers nest on the ground in patches of dense, tall vegetation in undisturbed areas. Breeding occurs from March to August. Northern harriers feed on a wide variety of vertebrate prey, including rodents, songbirds, waterfowl, and lizards.

Survey History

Northern harrier was observed foraging throughout the project area during biological surveys in 2018. No nests or nesting pairs were observed. There are no CNDDB reported occurrences of northern harrier within 10 miles of the project site.

Habitat Suitability

The project provides marginally suitable nesting habitat for northern harrier in undisturbed portions of fields and along canals.

Potential for Significant Adverse Effects

In the absence of proposed mitigation measures, potential adverse effects of the proposed project could include direct or indirect impacts to northern harrier. Construction or decommissioning activities during the northern harrier breeding season (March – August) would have the potential to disturb nests both directly and indirectly through nest destruction and/or construction equipment and/or personnel causing noise or other disturbance near nests. Disturbance could lead to destruction of nests, eggs, or chicks, or to abandonment of active nests. This would be a significant impact.

The recommended mitigation measures for nesting birds contained in Chapter 7 (MM BIO-4) would reduce impacts to northern harrier to less than significant.

6.2.2 Special-Status Mammals

6.2.2.1 San Joaquin Kit Fox

Federal status – Endangered
State status – Endangered

Species Description

San Joaquin kit fox was listed as "threatened with extinction" under the Endangered Species Preservation Act of October 15, 1966 (16 U.S.C. 668aa(c); 32 FR 4001) and is currently listed as "Endangered" under the Endangered Species Act of 1973 (16 U.S.C. 1531-1544).

San Joaquin kit fox inhabits a wide range of open and shrubby habitats, including grassland, scrublands, agricultural areas where dens are available (*e.g.*, unplowed fields, row crops, vineyards, or orchards), non-irrigated pastures, vernal pool grasslands, playas, and alkali meadows. San Joaquin kit fox dens are typically located on slopes less than 40 degrees, and pupping dens are usually on level ground; den entrances are typically 8 – 10 inches in diameter. San Joaquin kit foxes use many dens in a season, and occupied dens often show no signs of use. Common signs of use include a dirt ramp leading to the entrance, flattened grass around the entrance, scat, tracks, and prey remains.

The largest extant populations of San Joaquin kit fox are at the western margins of the Central Valley and the eastern Coast Ranges. Population centers occur in western Kern County (Elk Hills and Pixley National Wildlife Refuge), eastern San Luis Obispo County (Carrizo Plain), western Fresno County and eastern San Benito County (Ciervo – Panoche Natural Area), Southern Monterey County (Fort Hunter-Liggett and Camp Roberts), western Merced County, and eastern Contra Costa County. These population centers generally form a metapopulation lying west of Interstate 5 and/or south of Allensworth, with only isolated occurrences in the remainder of the valley. By 2006, San Joaquin kit fox was determined to be largely eliminated from the central San Joaquin Valley (USFWS 2010a).

Survey History

A search of the CNDDB was conducted in December 2017 to identify records of San Joaquin kit fox within 10 miles of the project site; this search was updated in June 2018 with no change in the results. The USFWS was also contacted to identify any records not contained in the CNDDB. During general site reconnaissance surveys in 2016, the site was surveyed to evaluate the suitability of the habitat on-site to support San Joaquin kit fox. A report of the Early Evaluation findings was submitted to the USFWS on June 22, 2016. This evaluation was updated following surveys in 2018, with no change in the results.

San Joaquin kit fox was not observed in the project site during the protocol surveys described in Chapter 4.2.3.2. The Project site contains no known dens. Details of the habitat assessment and protocol survey are provided in Appendix G.

There are a total of 14 CNDDB reported occurrences of San Joaquin kit fox within 10 miles of the project site, 11 of which are more than 5 miles from the site. The most recent occurrence record for San Joaquin kit fox is dated 2002, and located 2.5 miles north of the project site, on West Grangeville Avenue. This record is of a single fox sighted in a fallow agricultural field. The only other occurrence record dated after 1990 is of single fox sighted in a walnut orchard southwest of Hanford. Most of the remaining occurrence records for San Joaquin kit fox within 10 miles of the project site date from the early 1970s and are based on distribution maps published in 1975. The most recent record of a San Joaquin kit fox den is located 8 miles east of the project site at Kansas Ave and 17th Avenue and is dated 1988.

CNDDB occurrence records for San Joaquin kit fox generally form 3 clusters: a cluster of records in alkali sink habitat located east of the project site southwest of Hanford; a cluster of records located in grassland habitat on NAS Lemoore, and; a cluster of records located along the California Aqueduct southeast of Huron. Most of the records in the first 2 clusters date from the 1970s and the records in the 3rd cluster date from 1981.

Habitat Suitability

The entire project site provides potential dispersal, denning, and foraging habitat for San Joaquin kit fox. Suitable denning habitat is concentrated along canal banks and berms at the margins of fields. Prey and suitable dens are scarce in the interior of fields. Coyotes (*Canis latrans*) are common in the project site and may discourage use by San Joaquin kit fox.

Potential for Significant Adverse Effects

San Joaquin kit fox is believed to be absent from the project site because no occupied dens were observed in the project site, there were no sightings of this species during protocol presence/absence surveys conducted in and within a 2-mile radius of the project site, and there are no recent occurrence records of the species within 5 miles of the project site. However, potentially suitable foraging and denning habitat is present in the project site. Because San Joaquin kit fox is a highly mobile animal, there is a low potential for San Joaquin kit fox to occupy the project site prior to commencement of the project or to occur in the project site as transient individuals either foraging or dispersing through the site during construction and decommissioning. In the absence of proposed mitigation measures, the project would have a low potential for adverse effects on San Joaquin kit fox. This would be a significant impact.

Implementation of the recommended mitigation measures for San Joaquin kit fox contained in Chapter 7 (MM BIO-3a-c) would avoid take of this species and would reduce impacts to San Joaquin kit fox to less than significant.

6.2.3 Migratory Birds and Raptors

Project construction and decommissioning activities during the avian breeding season have potential to result in direct and indirect disturbance to nesting birds that may lead to destruction or abandonment of nests and mortality of eggs and chicks. Routine project operation is not expected to result in take of birds, nests, or eggs, as operation activities do not include ground disturbance or high levels of noise. Destruction of nests, eggs, or chicks by vegetation clearing or ground-disturbing activities during the avian breeding season (March – August) would be considered a violation of the Migratory Bird Treaty Act and California Fish and Game Code and would be a significant impact.

MM BIO-4 in Chapter 7 would reduce impacts to nesting birds, including migratory birds and raptors, to less than significant.

There is a potential for small birds to enter hollow vertical piles in the solar arrays and in fence posts. Birds could become entrapped and unable to extricate themselves, potentially resulting in mortality. This could occur with both common and special-status bird species. Mitigation Measure BIO-5 would be implemented to reduce impacts to less than significant.

As with other manmade structures (such as buildings, windows, and communications towers), avian species may potentially collide with the project's PV modules. However, any impacts to avian species resulting from collision with the project's PV modules are expected to be less than significant for several reasons. Firstly, PV panels do not pose the type of collision risk associated with taller structures; taller structures have a greater collision risk than shorter structures. Second, avian mortality resulting from collision with manmade structures is typically highest when projects are sited in areas of high bird use and the project site is not located in an area of high bird use. Finally, bird populations that might interact with the project site—including waterbirds—regularly withstand substantial morality rates from a variety of other sources such as buildings, windows, vehicles, predation, communication towers, yet maintain sustainable population levels. Thus, while some avian mortality may be expected to occur on the project site, it would likely be minimal due to the low-lying nature of the project's PV modules and other structures, and the project's location in an area that is not subject to high bird use. For these reasons, impacts are expected to be less than significant.

A recent publication by the U.S. Department of Energy reviewed the current state of knowledge concerning avian mortality at utility-scale solar facilities (Walston *et al*. 2015). The report included discussion of the potential for PV SGF to cause death and injury to waterfowl that mistake fields of PV panels for waterbodies – a phenomenon called the "lake effect." The report concluded that few empirical data are available on the number of birds killed or injured at SGFs generally, and by the lake effect specifically. In addition, the authors state that no scientific studies testing the reality of the lake effect had been conducted up to the time of publication. Due to the lack of scientific data on the lake effect, it is not possible to meaningfully analyze potential project impacts to migrating waterfowl and other birds resulting from the lake effect.

Waterfowl are common and seasonally abundant in the active canals in and near the project site. Typical species include mallard (*Anas platyrhynchos*), black-necked stilt (*Himantopus mexicanus*), snowy egret (*Egretta thula*), great egret (*Ardea alba*), and great blue heron (*Ardea herodias*). Because there are currently no data on the reality or magnitude of the lake effect in regard to large-scale PV SGF, there are no standard mitigation measures to avoid or reduce impacts to waterfowl resulting from it. While there is potential for the lake effect as a result of the project to affect migrating waterfowl, analysis of such impacts would be purely speculative. No mitigation is recommended.

6.3 SENSITIVE NATURAL COMMUNITIES

There are no native or naturalized vegetation communities in the project site. The entire site consists of fallow agricultural land that supports cultivated and ruderal non-native species. The Kings River is a sensitive natural community east of the project site. Other than potential impacts to special-status species and migratory birds and raptors discussed in Chapter 6.2, the project is not expected to impact the Kings River corridor or wildlife using the Kings River. At its closest point, the project site is greater than 500 feet from the river and is separated from the river by a levee berm with an access road as well as recreational dirt roads and parking areas for fishing and other recreational use. Along the eastern boundary of the site, the project limits generally range between 1,000 feet to greater than one mile from the Kings River. During construction, elevated noise levels and levels of human presence are not expected to disturb wildlife use of the Kings River as the area is regularly subjected to human disturbance. The presence of personnel and vehicles associated with ongoing operations of the project similarly is not expected to increase disturbance beyond baseline conditions.

Exterior lighting would be shielded and directed downward to minimize the potential for glare or spillover onto adjacent properties, including the Kings River corridor. Lighting would be installed along perimeter fencing, at the facility entrances and interior gates, the O&M facilities, the inverter and transformer equipment areas, and the substations/switching stations. The lighting may be either motion sensitive or light activated to automatically come on in the evening and shut off in the morning. All lighting also would conform to applicable Kings County rules and regulations for outdoor lighting. Therefore, exterior lighting is not expected to affect wildlife using the Kings River.

The project would not result in significant impacts to sensitive native or naturalized vegetation communities and no mitigation is recommended.

6.4 JURISDICTIONAL WATERS AND WETLANDS

The project has been designed to avoid impacts to canals. The project will use existing roads/bridges over the canals where feasible and any new canal crossings required will utilize clear-span bridges to avoid any impacts to canals. Utility crossings will utilize directional drilling to install electrical conduit far enough under the canals to avoid any impacts to the canals. Entry/exit pits for directional drilling will be placed beyond the jurisdictional limits of canals. The existing culvert where Murphy Ranch Road crosses the inactive irrigation ditch along Avenal Cutoff Road may be replaced at the request of the County. If required, the replacement culvert would be situated in the footprint of the existing culvert, with no new impact to the ditch channel. The inactive irrigation ditch does not currently convey flows and does not support any wetland or riparian habitat or wildlife resources. For this reason, the inactive irrigation ditch is not subject to CDFW jurisdiction. Under the USACE Regulatory Guidance Letter (RGL) 07-02, *Exemptions for Construction or Maintenance of Irrigation Ditches and Maintenance of Drainage Ditches under Section 404 of the Clean Water Act*, the proposed activities associated with culverting the irrigation ditch and/or replacing an existing culvert in the irrigation ditch at Murphy Ranch Road are exempt from Clean Water Act jurisdiction. Such activities would qualify as construction or maintenance of an irrigation ditch and the discharge would not be part of an activity whose purpose is to convert an area of the waters of the U.S. into a use to which it was not previously subject (known as the Recapture Provision). Therefore, the proposed project has no potential for a substantial adverse effect on jurisdictional waters and wetlands. Implementation of Mitigation Measure BIO-6 would reduce the potential for incidental impacts to jurisdictional waters and wetlands to less than significant.

6.5 WILDLIFE NURSERIES AND MOVEMENT CORRIDORS

The project site is not included in any corridors mapped by the California Essential Habitat Connectivity Project and does not provide any unique movement or dispersal habitat relative to surrounding lands for several miles in all directions. The project site and surrounding lands currently provide extensive open, un-fenced dispersal habitat for wildlife movement in the region. Fencing the project site could potentially interfere with movement and predator avoidance for local wildlife. Mitigation is recommended under fencing guidelines for San Joaquin kit fox.

6.6 LOCAL POLICIES

The Kings County General Plan includes several policies intended to promote conservation of existing high-value biological resources in the county and assure no net loss of sensitive resources and special-status species. The project area has been subject to a long history of agricultural land use that has severely reduced the biological value of the site compared to undisturbed natural habitats. The project has potential for impacts to special-status species, and includes avoidance, minimization, and mitigation measures that will reduce impacts to special-status species to below the level of significance (Chapter 7). Therefore, the project would not conflict with local policies and ordinances protecting biological resources and no additional mitigation is recommended.

6.7 HABITAT CONSERVATION PLANS

The project site is not within the boundaries of any habitat conservation plan. Therefore, the project would not conflict with any provisions of an adopted habitat conservation plan and no mitigation is recommended.

6.8 POTENTIAL FOR SPREAD OF INVASIVE SPECIES

The project would likely reduce the spread of invasive species in the region compared to existing conditions, because maintenance of the solar facility would include regular weed control. Mowing and sheep grazing would periodically remove invasive species such as Russian thistle. No mitigation is recommended.

7.0 MITIGATION MEASURES

7.1 MITIGATION FOR POTENTIAL EFFECTS ON BURROWING OWL

MM BIO-1a: If feasible, construction-related ground disturbance activities shall begin outside of the burrowing owl nesting season (February 1 through August 31) and during construction the site shall be maintained in a manner that is inhospitable to burrowing owl such as keeping the site free of vegetation, ground squirrel control (the use of poison baits or other substances that could be potentially harmful to San Joaquin kit fox would not be allowed per Mitigation Measure BIO-4c), and maintaining regular site disturbance by construction equipment and personnel. This will discourage burrowing owl from occupying the project site. If feasible, decommissioning-related ground disturbing activities shall begin outside of the burrowing owl nesting season (February 1 through August 31).

MM BIO-1b: No more than 14 days prior to initiation of ground disturbing activities associated with project construction or decommissioning, a qualified biologist shall conduct a Take Avoidance survey of the project site and surrounding areas to a distance of 150 meters in accordance with the methods outlined in the CDFW Staff Report on Burrowing Owl Mitigation (2012) or most recently adopted guidance. The first pre-construction will cover all areas within 150 meters of the portion of the site in which construction/decommissioning is scheduled to start. Surveys will be phased based on the construction/decommissioning schedule such that the surveys are conducted no more than 14 days ahead of the start of ground disturbance in new areas. If construction/decommissioning activities in portions of the site cease for a period of 14 days, those portions of the site will be resurveyed for burrowing owls prior to the resumption of construction/decommissioning activities. If no occupied breeding or wintering owl burrows are identified, no further mitigation will be required. If occupied burrows are identified on the site or within 150 meters, one of the following actions shall be taken: (1) permanent avoidance of the burrow or (2) establishment of a temporary avoidance buffer followed by passive relocation and compensatory mitigation for loss of habitat in conjunction with the measures below:

- If an occupied wintering burrow is discovered during pre-construction surveys, a 50-meter buffer area will be established around the burrow until the owl leaves on its own (if the burrow is more than 50 meters offsite and/or more than 50 meters from the work area, no buffer is necessary). Ground-disturbing work conducted during the nonbreeding (winter) season (September 1 to January 31) can proceed near the occupied burrow so long as the work occurs no closer than 50 meters to the burrow, and the burrow is not directly affected by the project activity. A smaller buffer may be established in consultation with CDFW and monitored at the discretion of a qualified biologist. If the 50-meter buffer cannot be maintained for the duration of occupancy by the owl, owls may be excluded from an occupied wintering burrow in accordance with the conditions of the project's *Burrowing Owl Exclusion Plan* (Appendix N), which will be submitted for approval by CDFW prior to passive relocation of any burrowing owls.

- If an occupied nesting burrow is discovered during pre-construction surveys, an avoidance buffer of 200 meters shall be established around the burrow location and maintained until a qualified biologist has determined that the nest has fledged or is no longer active (a 200-meter avoidance buffer is appropriate for low-intensity impacts near nesting burrows during breeding season [CDFW 2012]). No project activities shall take place within the 200-meter buffer during the time in which it is in place. A smaller buffer may be established in consultation with CDFW and monitored at the discretion of a qualified biologist.

- If an occupied burrow cannot be avoided, and the burrow is not actively in use as a nest, a 200-meter buffer will be established until the burrowing owls can be excluded from burrows in accordance with the project's *Burrowing Owl Exclusion Plan*, which will be submitted for approval by CDFW prior to passive relocation of any burrowing owls. The Burrowing Owl Exclusion Plan is based on the recommendations made in the *Staff Report on Burrowing Owl Mitigation* (CDFW 2012) or most recently adopted guidance and shall include the following information for each proposed passive relocation:

    - Confirmation by site surveillance that the burrow(s) is empty of burrowing owls and other species;
    - Type of scope to be used and appropriate timing of scoping;
    - Occupancy factors to look for and what shall guide determination of vacancy and excavation timing;
    - Methods for burrow excavation;
    - Removal of other potential owl burrow surrogates or refugia on-site;
    - Methods for photographic documentation of the excavation and closure of the burrow;
    - Monitoring of the site to evaluate success and, if needed, to implement remedial measures to prevent subsequent owl use to avoid take. Methods for assuring the impacted site shall continually be made inhospitable to burrowing owls and fossorial mammals.

MM BIO-1c: If an occupied burrowing is identified off-site within 150 meters and passive exclusion is deemed necessary to protect the owls, burrowing owls may be excluded from burrows if permission is granted by the land owner and in accordance with the project's *Burrowing Owl Exclusion Plan*, which will be submitted for approval by CDFW prior to passive relocation of any burrowing owls. If burrowing owls cannot be excluded from an off-site burrow and it is not feasible to maintain an avoidance buffer as stated above, coordination will be conducted with CDFW to determine appropriate measures to minimize impacts to off-site burrowing owls. Such measures could include but are not limited to:

(1) installation of barriers between the construction or decommissioning area and the occupied burrows to block noise and views of construction or decommissioning equipment and personnel, and (2) regular monitoring by a qualified biologist to determine if construction or decommissioning activities are resulting in disturbance of the owls that could lead to nest abandonment or harm to adult owls or their young. If such disturbance was occurring, the biological monitor would have the authority to halt construction or decommissioning activities until further modifications could be made to avoid disturbance of the owls.

MM BIO-1d: If nesting burrowing owl pairs are passively relocated, compensatory mitigation for lost wintering/breeding habitat shall be provided either through dedication of 6.5 acres of suitable habitat (per pair of relocated owls) at an off-site location in accordance with the conditions of the project's *Burrowing Owl Exclusion Plan* or through purchase of credits at a CDFW-approved mitigation bank in the region. The service area of the Kern Water Bank Authority Mitigation Bank includes the project site in Kings County, and burrowing owl mitigation credits are available. No compensatory mitigation is required for passive relocation or eviction of transient, unpaired owls.

MM BIO-1e: If permanent avoidance buffers are established, such areas shall be managed for the duration of the project to preserve current values as foraging habitat for burrowing owl. Management shall include: (1) exclusion of all project activities throughout the construction, operation, and decommissioning phases, including staging, parking, driving, or dumping; (2) vegetation management by grazing or mowing to preserve open, low-growing vegetation; (3) fencing to discourage human incursion; (4) signage identifying the area as a biologically sensitive area managed for burrowing owl, and; (5) a worker education and awareness program for all personnel working on the site including contractors and sub-contractors.

7.2 MITIGATION FOR POTENTIAL EFFECTS ON SWAINSON'S HAWK

7.2.1 Nesting

Because there are no trees in the project site, the project would not remove Swainson's hawk nesting habitat. Project construction/decommissioning activities within 0.5 mile of suitable trees could potentially disturb nesting Swainson's hawks using those trees. Implementation of MM BIO-2 would reduce the potential for project impacts to nesting Swainson's hawk to less than significant.

MM BIO-2: Prior to initiation of construction/decommissioning activities during the Swainson's hawk breeding season (March 1 – September 15), the applicant shall determine the presence of active Swainson's hawk nests within 0.25-mile of the project site using the most recent published survey protocols (*i.e.*, 3 surveys by a qualified biologist in each of the two periods preceding the construction start date; SHTAC 2000). If an active Swainson's hawk nest is discovered within a 0.25-mile radius of the project site, the applicant shall initiate consultation with CDFW prior to starting any construction-related activities within 0.25-mile of the nest(s). Construction-related activities may commence in parts of the project site greater than 0.25-mile from the nest(s). If no active nests are discovered, no further action is required.

7.2.2 Foraging Habitat

The project would result in conversion of Swainson's hawk foraging habitat to unsuitable uses, which would reduce the amount of foraging habitat available to the regional population. Under the most conservative assumption, the entire project site would be converted to an unsuitable land use. Consequently, the project impact to Swainson's hawk foraging habitat would be 2,490 acres. In light of the previous discussion of Swainson's hawk use of solar facilities, the actual project impact to foraging habitat may be considerably less.

7.2.2.1 Project-Level Impacts

The project-level impact to foraging habitat available to the regional population would be less than significant, as the project impact (2,490 acres) represents only 2.1 percent of the surplus foraging habitat available to the regional population (123,206 acres). Therefore, the project would only reduce the surplus foraging habitat available to the regional population of SWHA to 97.9 percent of the existing surplus, which is well above the 70-percent threshold of significance. Therefore, impacts would be less-than-significant, and no compensatory mitigation would be required for project-level impacts to SWHA foraging habitat.

7.2.2.2 Cumulative Impacts

Including the 2,490-acre project impact with the 25,516 acres of existing, planned, and reasonably foreseeable solar energy projects in the study area, the project would contribute to a cumulative impact to SWHA foraging habitat of 28,006 acres. Removing this amount of foraging habitat from the existing surplus of 123,206 acres would reduce the surplus foraging habitat in the study area to 95,200 acres, which is 77.3 percent of the existing surplus and above the 70-percent threshold of significance. Therefore, the project would not contribute to a significant cumulative impact on the regional population of Swainson's hawk and no compensatory mitigation would be required.

7.3 MITIGATION FOR POTENTIAL EFFECTS ON SAN JOAQUIN KIT FOX

MM BIO-3a: A qualified biologist shall conduct a preconstruction survey no more than 14 days prior to the beginning of ground disturbance and/or construction/decommissioning activities, or any other project activity likely to impact San Joaquin kit fox, to determine if potential San Joaquin kit fox dens are present in or within 500 feet of the project site (inaccessible areas outside of the project site can be surveyed using binoculars or spotting scopes from public roads). The surveys shall be conducted in all areas of suitable habitat for San Joaquin kit fox. Surveys need not be conducted for all areas of suitable habitat at one time; they may be phased so that surveys occur within 14 days prior to disturbance of any particular portion of the site. If potential dens are observed and avoidance of the dens is determined to be feasible by a qualified biologist in consultation with the project proponent and the County, the following minimum buffer distances shall be established prior to construction/decommissioning activities (consistent with USFWS 2011):

- Potential den: 50 feet
- Atypical den: 50 feet
- Known den: 100 feet
- Natal/pupping den: at least 500 feet – **USFWS must be contacted**.

- Buffer establishment shall follow the *USFWS Standardized Recommendations for Protection of the Endangered San Joaquin Kit Fox Prior to or During Ground Disturbance* (USFWS 2011) under "Exclusion Zones."

- If occupied San Joaquin kit fox dens are observed on the site, USFWS must be contacted.

MM BIO-3b: If avoidance of the potential dens is not feasible, the following measures are required to avoid potential adverse effects to the San Joaquin kit fox:

- If the qualified biologist determines that potential dens are inactive, the biologist shall excavate these dens by hand with a shovel to prevent foxes from re-using them during construction.

- If the qualified biologist determines that a potential non-natal den may be active, an on-site passive relocation program may be implemented with prior concurrence from the USFWS. This program shall consist of excluding San Joaquin kit foxes from occupied burrows by installation of one way doors at burrow entrances, monitoring of the burrow for one week to confirm usage has been discontinued, and excavation and collapse of the burrow to prevent reoccupation. After the qualified biologist determines that the San Joaquin kit foxes have stopped using active dens within the project boundary, the dens shall be hand-excavated with a shovel to prevent re-use during construction with prior concurrence from USFWS.

MM BIO-3c: In addition, the following avoidance and minimization measures for San Joaquin kit fox shall be implemented during construction/decommissioning of the project (USFWS 2011):

- Project-related vehicles shall observe a daytime speed limit of 20 mph and a nighttime speed limit of 10 mph throughout the project site, except on County roads and state and federal highways. Off-road traffic shall be prohibited outside of designated project areas.

- To prevent inadvertent entrapment of kit foxes or other animals during the construction or decommissioning phases of the project, all excavated, steep-walled holes or trenches more than 2-feet deep should be covered at the close of each working day by plywood or similar materials. If the trenches cannot be closed, one or more escape ramps constructed of earthen-fill or wooden planks should be installed. Before such holes or trenches are filled, they should be thoroughly inspected for trapped animals. If at any time a trapped or injured kit fox is discovered, the USFWS and the CDFW should be contacted as noted under measure l. referenced below.

    a. Kit foxes are attracted to den-like structures such as pipes and may enter stored pipes and become trapped or injured. All construction pipes, culverts, or similar structures with a diameter of 4-inches or greater that are stored at a construction site for one or more overnight periods should be thoroughly inspected for kit foxes before the pipe is subsequently buried, capped, or otherwise used or moved in any way. If a kit fox is discovered inside a pipe, that section of pipe should not be moved until the USFWS has been consulted. If necessary, and under the direct supervision of the biologist, the pipe may be moved only once to remove it from the path of construction activity, until the fox has escaped.

b. All food-related trash items such as wrappers, cans, bottles, and food scraps should be disposed of in securely closed containers and removed at least once a week from a construction or project site.

c. No firearms shall be allowed on the project site.

d. No pets, such as dogs or cats, should be permitted on the project site to prevent harassment, mortality of kit foxes, or destruction of dens.

e. Use of rodenticides, herbicides, poison baits, or other substances potentially harmful to San Joaquin kit fox shall be restricted. This is necessary to prevent primary or secondary poisoning of kit foxes and the depletion of prey populations on which they depend. Use of such compounds should observe label and other restrictions mandated by the EPA, CDFA, and other State and Federal legislation, as well as additional project-related restrictions deemed necessary by the USFWS. If rodent control must be conducted, zinc phosphide should be used because of a proven lower risk to kit fox.

f. An employee education program shall be implemented and required for all personnel approved to work on the site during construction, operations, maintenance, and decommissioning. The program shall consist of a brief presentation by persons knowledgeable in kit fox biology and legislative protection to explain endangered species concerns to contractors, their employees, and military and/or agency personnel involved in the project. The program shall include the following: A description of the San Joaquin kit fox and its habitat needs; a report of the occurrence of kit fox in the project area; an explanation of the status of the species and its protection under the Endangered Species Act; and a list of measures being taken to reduce impacts to the species during project construction and implementation. A fact sheet conveying this information shall be prepared for distribution to the previously referenced people and anyone else who may enter the project site.

g. A representative shall be appointed by the project proponent who will be the contact source for any employee or contractor who might inadvertently kill or injure a kit fox or who finds a dead, injured or entrapped kit fox. The representative will be identified during the employee education program and their name and telephone number shall be provided to the Service.

h. Upon completion of the project, all areas subject to temporary ground disturbances, including storage and staging areas, temporary roads, pipeline corridors, etc. shall be re-contoured if necessary, and revegetated to promote restoration of the area to pre-project conditions. An area subject to "temporary" disturbance means any area that is disturbed during the project, but after project completion will not be subject to further disturbance and has the potential to be revegetated. Appropriate methods and plant species used to revegetate such areas shall be determined on a site-specific basis in consultation with the USFWS, CDFW, and revegetation experts.

i. In the case of trapped animals, escape ramps or structures should be installed immediately to allow the animal(s) to escape, or the USFWS should be contacted for guidance.

j. Any contractor, employee, or military or agency personnel who are responsible for inadvertently killing or injuring a San Joaquin kit fox should immediately report the incident to their representative. This representative should contact the CDFW immediately in the case of a dead, injured or entrapped kit fox. The CDFW contact for immediate assistance is State Dispatch at (916) 445-0045. They will contact the local warden or the wildlife biologist at (530) 934-9309. The USFWS should be contacted at Endangered Species Division, 2800 Cottage Way, Suite W2605, Sacramento, CA 95825, (916) 414-6620 or (916) 414-6600.

k. The Sacramento Fish and Wildlife Office and CDFW shall be notified in writing within three working days of the accidental death or injury to a San Joaquin kit fox during project related activities. Notification must include the date, time, and location of the incident or of the finding of a dead or injured animal and any other pertinent information.

l. New sightings of kit fox shall be reported to the CNDDB. A copy of the reporting form and a topographic map clearly marked with the location of where the kit fox was observed should also be provided to the USFWS at the address listed under measure l.

m. Fencing of the project site shall incorporate wildlife-friendly fencing design. Fencing plans may use one of several potential designs that would allow kit foxes to pass through the fence while still providing for project security and exclusion of other unwanted species (*i.e.*, domestic dogs and coyotes). Raised fences or fences with entry/exit points of at least 6 inches in diameter spaced along the bottom of the fence to allow species such as San Joaquin kit fox access into and through the project site would be appropriate designs.

7.4 MITIGATION FOR POTENTIAL EFFECTS ON NESTING BIRDS AND RAPTORS

The project has potential for impacts to nesting birds and raptors through ground disturbance, vegetation clearing, noise, and human presence around active nests. Implementation of MM BIO-3 would reduce the potential for project impacts to nesting birds and raptors to less than significant.

MM BIO-4: If project ground-disturbing or vegetation clearing and grubbing activities commence during the avian breeding season (February 15 – August 31), a qualified biologist shall conduct a pre-construction nesting bird survey no more than 14 days prior to initiation of project activities. The survey area shall include suitable raptor nesting habitat within 300 feet of the Project boundary. Pre-construction surveys are not required in areas where project activities have been continuous since prior to February 15. Areas that have been inactive for more than 14 days during the avian breeding season must be re-surveyed prior to resumption of project activities. If no active nests are identified, no further mitigation is required. If active nests are identified, the following measures are required:

A suitable buffer (*e.g.,* 200-300 feet for raptors; 100 feet for special-status passerines; 30-50 feet for common passerines) shall be established around active nests and no construction within the buffer allowed until a qualified biologist has determined that the nest is no longer active (*i.e.,* the nestlings have fledged and are no longer reliant on the nest, or the nest has failed). Encroachment into the buffer may occur at the discretion of a qualified biologist.

MM BIO-5: Should any vertical tubes, such as solar mount poles, chain link fencing poles, or any other hollow tubes or poles be used on the project site, the tubes or poles shall be capped immediately after installation to avoid entrapment of birds.

7.5 MITIGATION FOR POTENTIAL EFFECTS ON JURISDICTIONAL WATERS

MM BIO-6: The USACE, RWQCB, and CDFW will be contacted prior to commencement of any construction activity that would impact the bed or bank of any active canal on the project site (except for activities exempted under RGL 07-02, which may not require notification of the USACE and RWQCB) and permits will be obtained as required. Impacts to jurisdictional waters will be mitigated in accordance with agency requirements at a minimum ratio of 1:1 (*i.e.*, 1 acre created per 1 acre impacted) to ensure no net loss of acreage or value to waters of the U.S. and/or waters of the state, except where exempted by regulation. This may be accomplished by purchasing credits in a mitigation bank approved by the USACE, RWQCB, and CDFW, or creation/preservation/or enhancement of waters in the project site or Off-site Reserves.

Construction activities would be required to follow standard engineering practices that reduce impacts to water quality. These practices include reduction of sediment loading and sediment disturbance as well as other standard BMPs for maintaining water quality in the project area. Avoidance and minimization measures that would be implemented to reduce impacts to waters on the project site may include, but are not limited to, the following:

- Standard construction BMPs will be implemented throughout construction, in order to avoid and minimize adverse effects to water quality within the project site. Appropriate erosion control measures will be used (e.g., hay bales, filter fences, vegetative buffer strips or other accepted equivalents, mulching, and seeding) to reduce siltation and contaminated runoff from entering waters and to stabilize disturbed soils.

- Construction by-products and pollutants such as petroleum products, chemicals, or other deleterious materials shall not be allowed to enter into canals. A plan for the emergency clean-up of any spills of fuel or other materials should be available when construction equipment is in use. A frac-out plan shall be prepared prior to any directional drilling under canals.

- Equipment and vehicles will be staged, maintained, refueled, and serviced at designated construction staging areas, which will be a minimum of 100 feet from the wetted width of a canal to prevent contamination of soil or water and staging areas will be bermed to prevent the discharge of pollutants to ground and runoff water. All construction material and fill shall be stored and contained in a designated area that is located away from channel areas to prevent transport of materials into adjacent waterbodies. In addition, a silt fence shall be installed to collect any discharge, and adequate materials should be available for spill clean-up and during storm events.

- Construction vehicles and equipment shall be maintained to prevent contamination of soil or water from external grease and oil or from leaking hydraulic fluid, fuel, oil, and grease.

- Storage areas containing hazardous or potentially toxic materials such as herbicides and petroleum products shall have an impermeable membrane between the ground and the hazardous material and shall be bermed to prevent the discharge of pollutants to ground water and runoff water.

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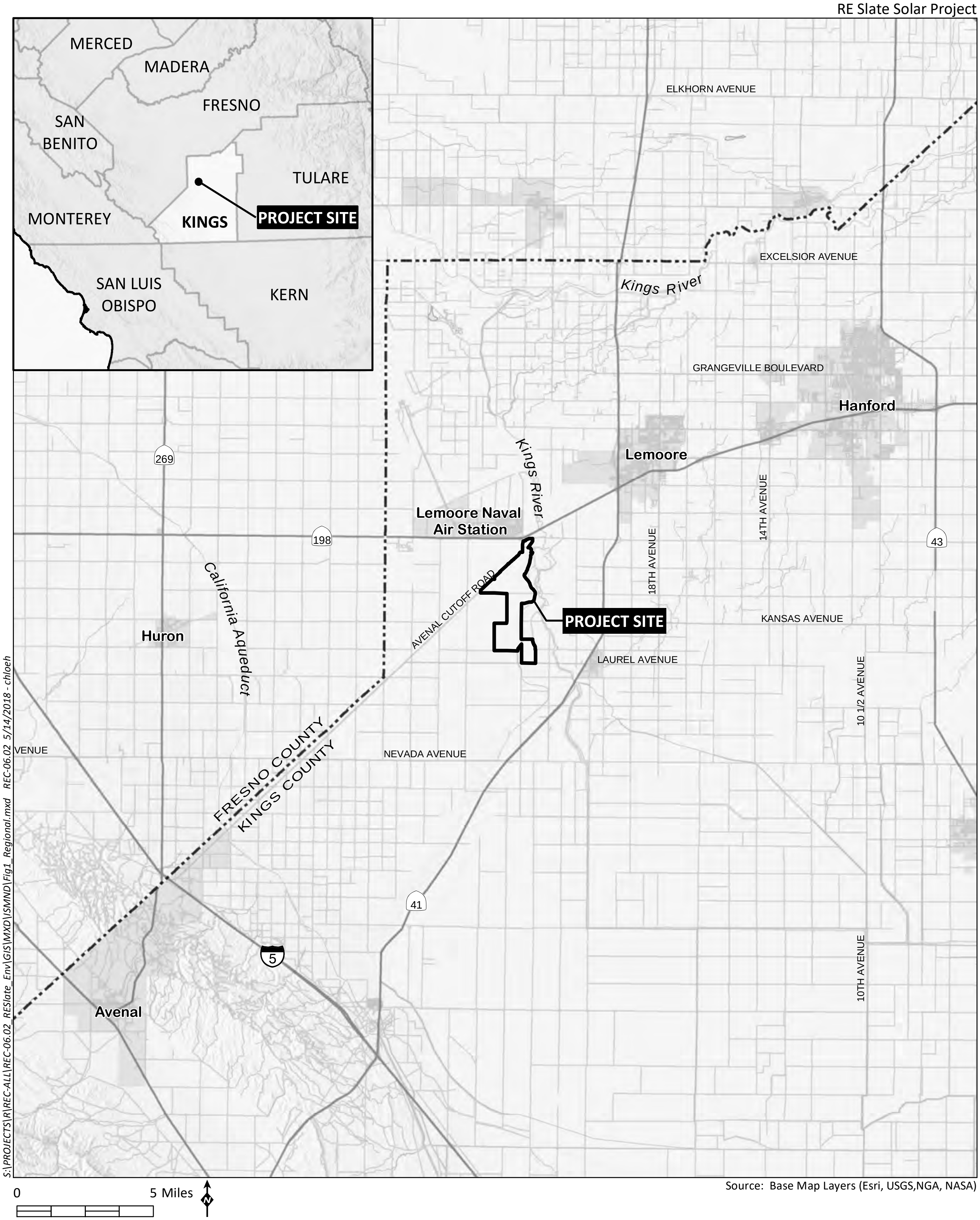
8.2 PERSONAL COMMUNICATIONS

Email and phone communications between Gretchen Padgett-Flohr, Ph.D. (CES) and Stephen Stringer, M.S. (HELIX) in August 2016.

Appendix A

Figures 1-6: Regional Location, USGS 7.5-Minute Quadrangle Map, Aerial Map, Site Plan, Soils Map, Sensitive Resources

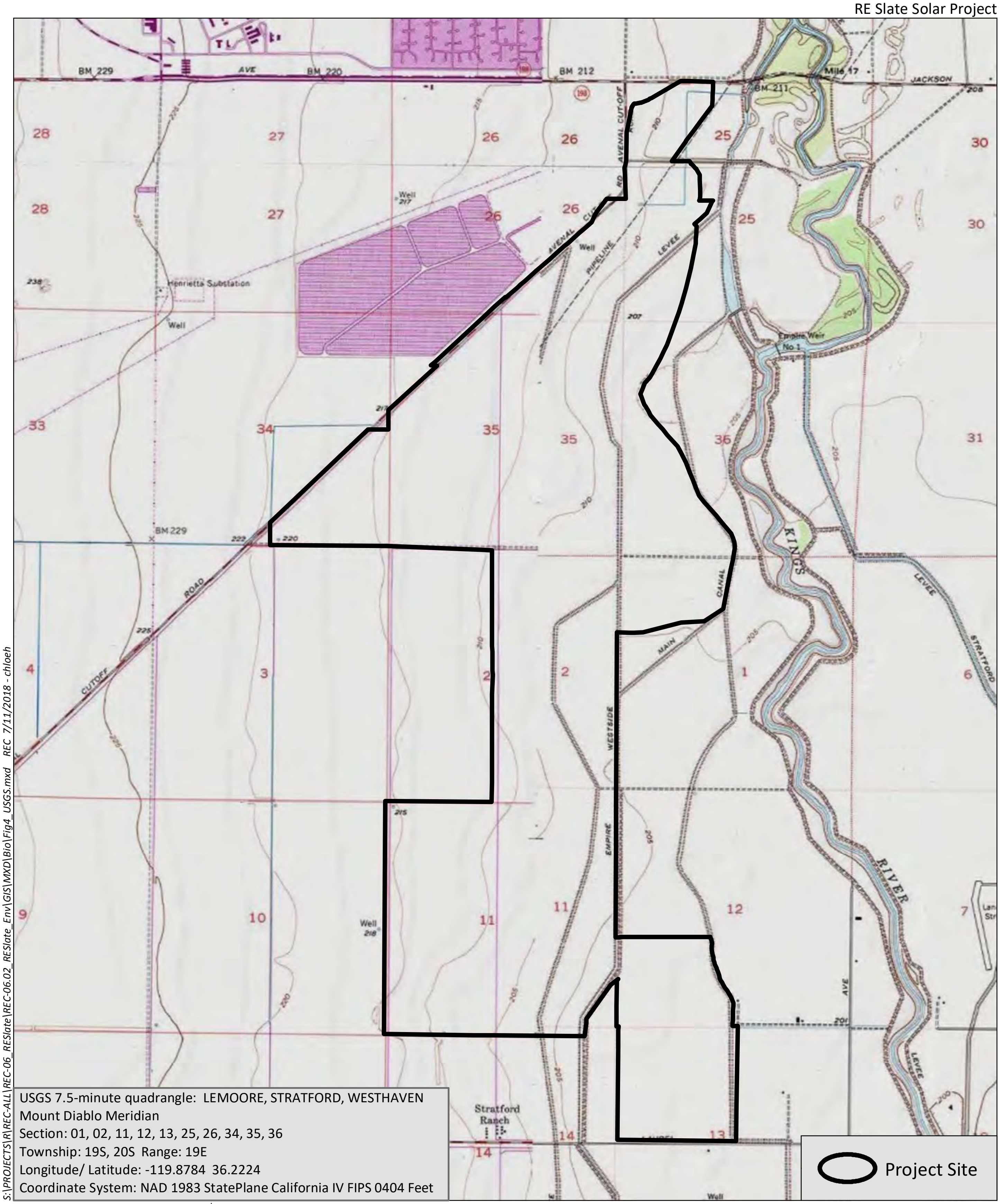


Source: Base Map Layers (Esri, USGS,NGA, NASA)

HELIX Environmental Planning

Regional Location

Figure 1



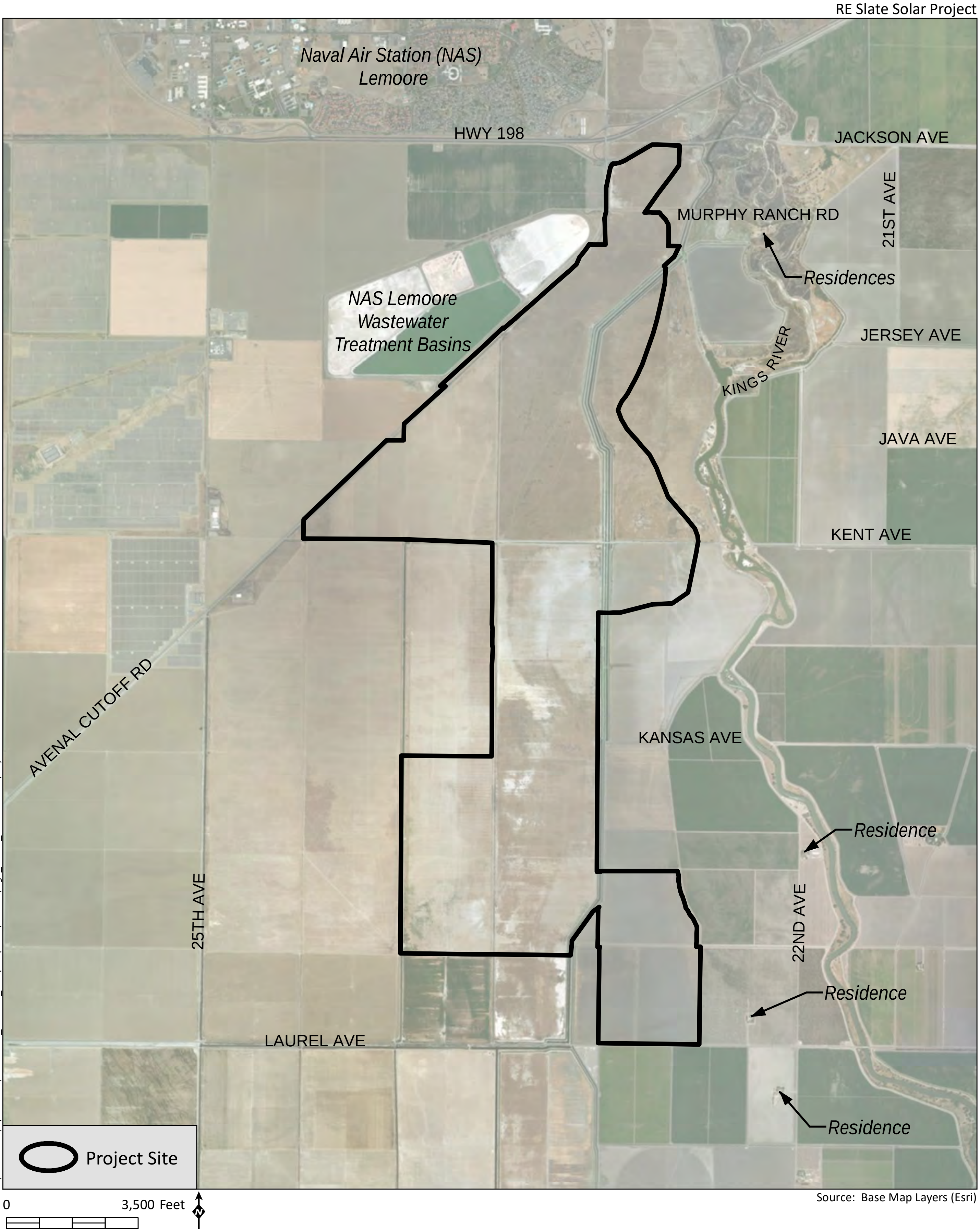
Source: Base Map Layers (National Geographic Society)

0 3,000 Feet

HELIX Environmental Planning

USGS 7.5-minute Quadrangle Map

Figure 2



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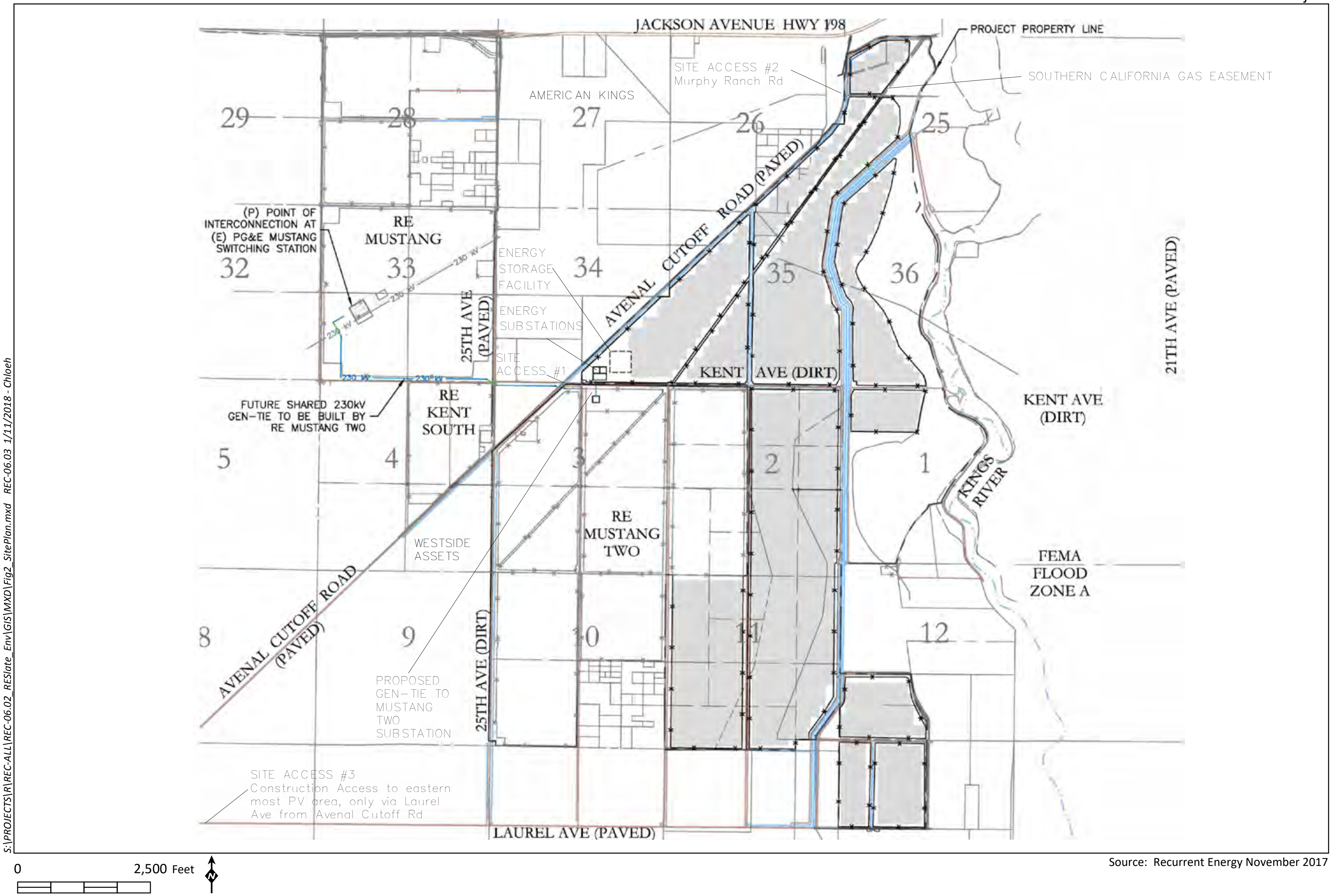
Source: Base Map Layers (Esri)

HELIX Environmental Planning

Aerial Map

Figure 3

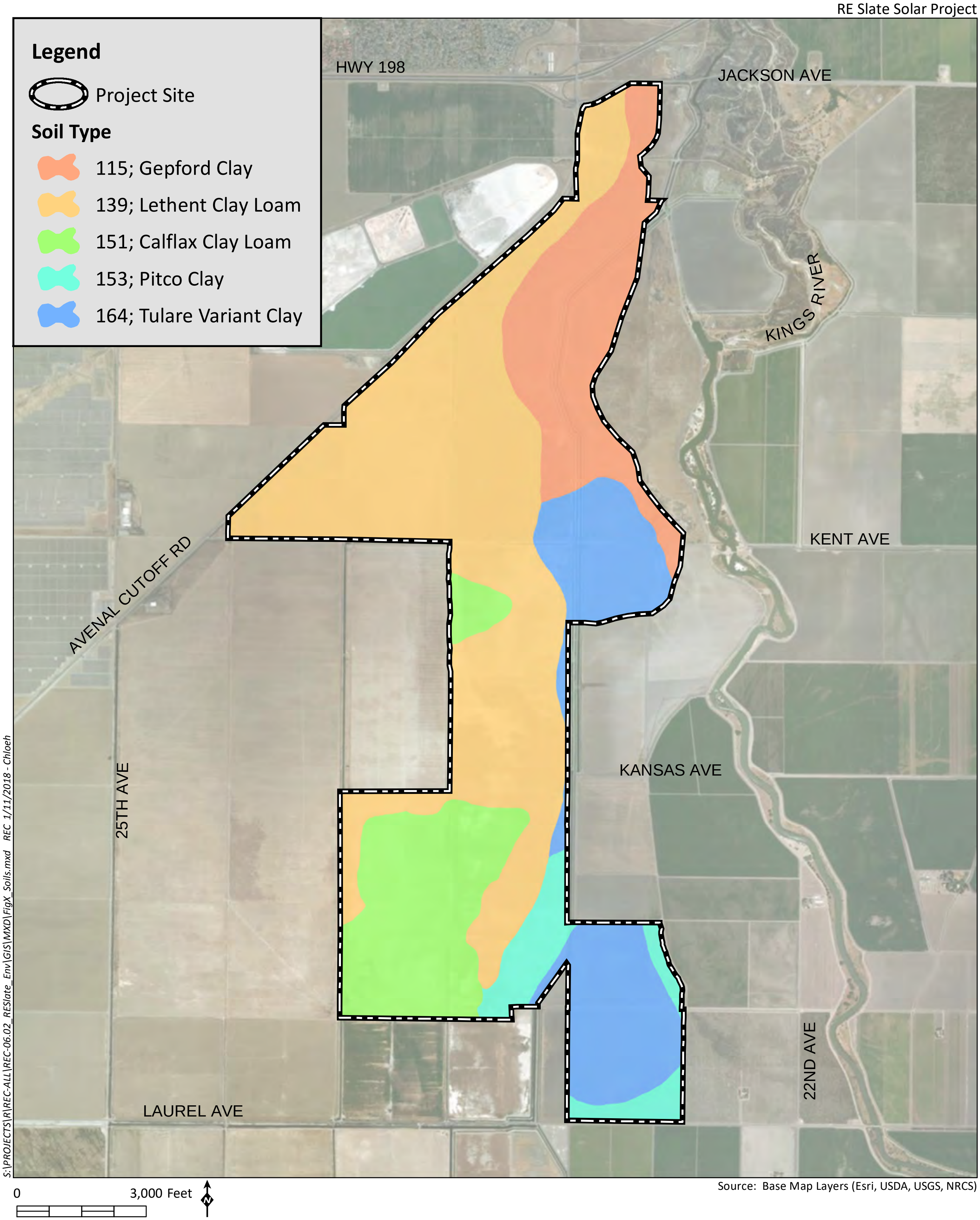


Source: Recurrent Energy November 2017

HELIX Environmental Planning

Site Plan

Figure 4

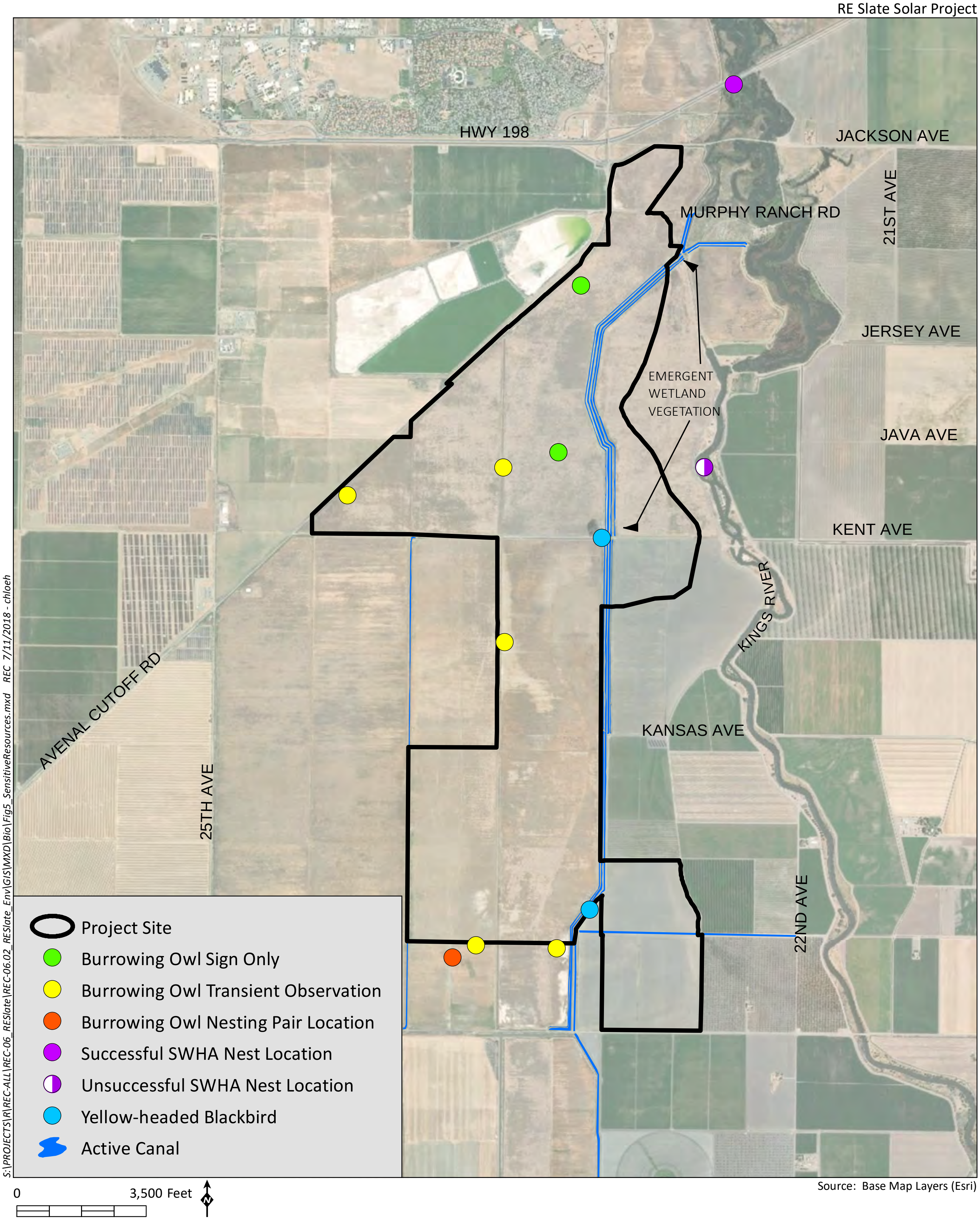


Source: Base Map Layers (Esri, USDA, USGS, NRCS)

HELIX Environmental Planning

Soils Map

Figure 5



Source: Base Map Layers (Esri)

HELIX
Environmental Planning

Sensitive Resources

Figure 6

Appendix B

USFWS, CNDDB, and CNPS Lists of Regionally Occurring Special-Status Species

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
Phone: (916) 414-6600 Fax: (916) 414-6713

In Reply Refer To: June 19, 2018
Consultation Code: 08ESMF00-2018-SLI-0568
Event Code: 08ESMF00-2018-E-07075
Project Name: RE Slate Solar

Subject: Updated list of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, under the jurisdiction of the U.S. Fish and Wildlife Service (Service) that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the Service under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Please follow the link below to see if your proposed project has the potential to affect other species or their habitats under the jurisdiction of the National Marine Fisheries Service:

http://www.nwr.noaa.gov/protected_species/species_list/species_lists.html

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
(916) 414-6600

Project Summary

Consultation Code: 08ESMF00-2018-SLI-0568

Event Code: 08ESMF00-2018-E-07075

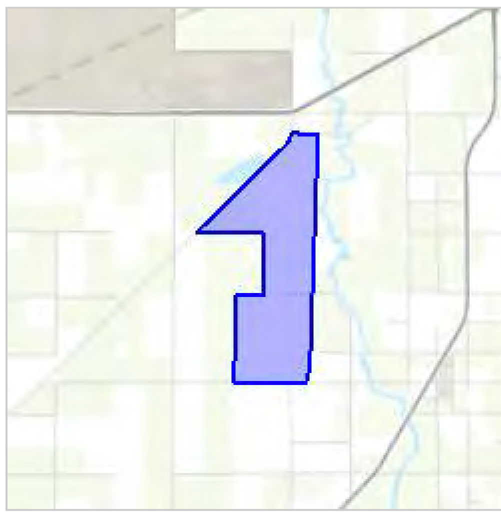
Project Name: RE Slate Solar

Project Type: POWER GENERATION

Project Description: 300-MW solar photovoltaic facility in Kings County, CA

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/36.219869275248456N119.87043655255604W



Counties: Kings, CA

Endangered Species Act Species

There is a total of 11 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Fresno Kangaroo Rat *Dipodomys nitratoides exilis* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5150 Species survey guidelines: https://ecos.fws.gov/ipac/guideline/survey/population/37/office/11420.pdf	Endangered
Giant Kangaroo Rat *Dipodomys ingens* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6051	Endangered
San Joaquin Kit Fox *Vulpes macrotis mutica* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/2873	Endangered
Tipton Kangaroo Rat *Dipodomys nitratoides nitratoides* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/7247 Species survey guidelines: https://ecos.fws.gov/ipac/guideline/survey/population/40/office/11420.pdf	Endangered

Birds

NAME	STATUS
Western Snowy Plover *Charadrius alexandrinus nivosus* Population: Pacific Coast population DPS-U.S.A. (CA, OR, WA), Mexico (within 50 miles of Pacific coast) There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8035	Threatened

Reptiles

NAME	STATUS
Blunt-nosed Leopard Lizard *Gambelia silus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/625	Endangered
Giant Garter Snake *Thamnophis gigas* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/4482	Threatened

Amphibians

NAME	STATUS
California Red-legged Frog *Rana draytonii* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2891	Threatened

Fishes

NAME	STATUS
Delta Smelt *Hypomesus transpacificus* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/321	Threatened

Crustaceans

NAME	STATUS
Vernal Pool Fairy Shrimp *Branchinecta lynchi* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/498	Threatened
Vernal Pool Tadpole Shrimp *Lepidurus packardi* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2246	Endangered

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Query Criteria: Imported file selection

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Agelaius tricolor tricolored blackbird	ABPBXB0020	None	Threatened	G2G3	S1S2	SSC
Ammospermophilus nelsoni Nelson's antelope squirrel	AMAFB04040	None	Threatened	G2	S2S3	
Athene cunicularia burrowing owl	ABNSB10010	None	None	G4	S3	SSC
Buteo swainsoni Swainson's hawk	ABNKC19070	None	Threatened	G5	S3	
Charadrius alexandrinus nivosus western snowy plover	ABNNB03031	Threatened	None	G3T3	S2S3	SSC
Cicindela tranquebarica ssp. San Joaquin tiger beetle	IICOL0220E	None	None	G5T1	S1	
Dipodomys nitratoides exilis Fresno kangaroo rat	AMAFD03151	Endangered	Endangered	G3TH	SH	
Dipodomys nitratoides nitratoides Tipton kangaroo rat	AMAFD03152	Endangered	Endangered	G3T1T2	S1S2	
Emys marmorata western pond turtle	ARAAD02030	None	None	G3G4	S3	SSC
Falco columbarius merlin	ABNKD06030	None	None	G5	S3S4	WL
Gambelia sila blunt-nosed leopard lizard	ARACF07010	Endangered	Endangered	G1	S1	FP
Nycticorax nycticorax black-crowned night heron	ABNGA11010	None	None	G5	S4	
Puccinellia simplex California alkali grass	PMPOA53110	None	None	G3	S2	1B.2
Spea hammondii western spadefoot	AAABF02020	None	None	G3	S3	SSC
Valley Sink Scrub Valley Sink Scrub	CTT36210CA	None	None	G1	S1.1	
Vulpes macrotis mutica San Joaquin kit fox	AMAJA03041	Endangered	Threatened	G4T2	S2	
Xanthocephalus xanthocephalus yellow-headed blackbird	ABPBXB3010	None	None	G5	S3	SSC

Record Count: 17

Plant List

6 matches found. *Click on scientific name for details*

Search Criteria

California Rare Plant Rank is one of **[1A, 1B, 2A, 2B, 3]**, Found in Quads **3611938, 3612031, 3611937, 3611936, 3612021, 3611928, 3611927, 3611926, 3612011, 3611918 3611917** and **3611916**;

Modify Search Criteria Export to Excel Modify Columns Modify Sort Display Photos

Scientific Name	Common Name	Family	Lifeform	Blooming Period	CA Rare Plant Rank	State Rank	Global Rank
Caulanthus californicus	California jewelflower	Brassicaceae	annual herb	Feb-May	1B.1	S1	G1
Delphinium recurvatum	recurved larkspur	Ranunculaceae	perennial herb	Mar-Jun	1B.2	S2?	G2?
Eremalche parryi ssp. kernensis	Kern mallow	Malvaceae	annual herb	Jan,Mar,Apr,May(Feb)	1B.2	S2	G3G4T2
Hordeum intercedens	vernal barley	Poaceae	annual herb	Mar-Jun	3.2	S3S4	G3G4
Monolopia congdonii	San Joaquin woollythreads	Asteraceae	annual herb	Feb-May	1B.2	S2	G2
Nama stenocarpa	mud nama	Namaceae	annual / perennial herb	Jan-Jul	2B.2	S1S2	G4G5

Suggested Citation

California Native Plant Society, Rare Plant Program. 2018. Inventory of Rare and Endangered Plants of California (online edition, v8-03 0.39). Website http://www.rareplants.cnps.org [accessed 19 June 2018].

Appendix C

Potential for Special-Status Species and Critical Habitats in the Region to Occur in the Project Site

APPENDIX C. Potential for Special-Status Species and Critical Habitats in the Region to Occur in the RE Slate Solar Project Site[1]

Scientific Name/ Common Name	ESA/CESA/CRPR ; Other Status[2]	General Habitat Description	Status in the Project Site[3]	Rationale
Invertebrates				
Branchinecta lynchi vernal pool fairy shrimp	FT/--/--	Occurs in vernal pools ranging from small, clear, sandstone rock pools to large, turbid, alkaline, grassland valley floor pools. It is most frequently found in pools measuring less than 0.05 acre; although has been collected from vernal pools exceeding 25 acres. The known range within California includes the Central Valley and southern California (USFWS 2005).	Will not occur	The Project site does not contain vernal pool habitat.
Cicindela tranquebarica ssp. San Joaquin tiger beetle (undescribed subspecies)	--/--/--; G5T1; S1	Occurs in playa and alkali sink habitats in Tulare and Kings counties. Other subspecies of *Cicindela tranquebarica* inhabit a variety of habitats and range from Death Valley to San Francisco Bay.	Will not occur	The Project site does not contain playa and alkali sink habitats.
Lepidurus packardi vernal pool tadpole shrimp	FE/--/--	Vernal pools from 54 square feet to 89 acres, containing clear- to highly-turbid water. Its known range is within the Central Valley of California and in the San Francisco Bay area (USFWS 2005)	Will not occur	The Project site does not contain vernal pool habitat.
Fishes				
Hypomesus transpacificus Delta smelt	FT/--/--	Delta smelt spawn in shallow, fresh or slightly brackish water upstream of the mixing zone. Most spawning happens in tidally-influenced backwater sloughs and channel edgewaters. Although spawning has not been observed in the wild, the eggs are thought to attach to substrates such as cattails, tules, tree roots and submerged branches. Delta smelt are found only from Suisun Bay upstream through the Delta in Contra Costa, Sacramento, San Joaquin, Solano and Yolo counties (USFWS 1995).	Will not occur	The Project site does not include suitable tidally-influenced brackish water habitat and is outside the range of the species.
Amphibians				
Rana draytonii California red-legged frog	FT/--/SSC	The California red-legged frog occupies a fairly distinct habitat, combining both specific aquatic and riparian components. The adults require dense, shrubby or emergent riparian vegetation	Will not occur	The canals in the Project site are not suitable for this species due to high summer water temperatures and the presence

Scientific Name/ Common Name	ESA/CESA/CRPR ; Other Status[2]	General Habitat Description	Status in the Project Site[3]	Rationale
		closely associated with deep (greater than 2 1/3-foot deep) still or slow-moving water. The largest densities of California red-legged frogs are associated with deep-water pools with dense stands of overhanging willows (*Salix* spp.) and an intermixed fringe of cattails (*Typha latifolia*). Well-vegetated terrestrial areas within the riparian corridor may provide important sheltering habitat during winter. California red-legged frogs aestivate (enter a dormant state during summer or dry weather) in small mammal burrows and moist leaf litter. They have been found up to 100 feet from water in adjacent dense riparian vegetation. Studies have indicated that this species cannot inhabit water bodies that exceed 70° F, especially if there are no cool, deep portions (USFWS 2001).		of non-native predatory fishes (e.g. carp, catfish). In addition, this species is considered extirpated from the floor of the Sacramento/San Joaquin Valley (see USFWS 2002).
Spea hammondii western spadefoot	--/--/SSC	Western spadefoot requires temporary rain pools with water temperatures below 86 degrees Fahrenheit, that last at least 3 weeks, in order to successfully breed. Pools must be free of fish, crayfish, and bullfrogs (Jennings and Hayes 1994).	Will not occur	The Project site does not contain vernal pools or temporary rain pools.
Reptiles				
Emys marmorata western pond turtle	--/--/SSC	Western pond turtle occurs from the west coast of North America from southern Washington, USA to northern Baja California, Mexico. Many populations have been extirpated and others continue to decline throughout the range, especially in southern California. This species requires aquatic habitats with suitable basking sites. Nest sites most often characterized as having gentle slopes (<15%) with little vegetation or sandy banks (Jennings and Hayes 1994).	Will not occur	There is no suitable habitat for this species in the Project site. Canals in the Project site do not provide basking sites and do not have shallow, sandy banks.
Gambelia sila blunt-nosed leopard lizard	FE/SE /FP	Blunt-nosed leopard lizard is endemic to the southern Coast Ranges and Central Valley, from Santa Clara and Merced Counties south to	Will not occur	There is no suitable alkali sink scrub habitat in the Project site. The habitat assessment

Scientific Name/ Common Name	ESA/CESA/CRPR ; Other Status[2]	General Habitat Description	Status in the Project Site[3]	Rationale
		Ventura and Los Angeles Counties. Occurs in alkali sink, playa, and saltbush scrub habitats in the Central Valley, and grassland habitats in the foothills. The principal threat to the species is loss of habitat to agriculture and urban development (USFWS 2010b).		concluded that there is no potential for this species to occur on the site due to the highly altered and degraded condition of the Property, the marginal quality of the habitat, the distance to the nearest known occurrence of the species, and the isolation of the site from known locations where the species occurs (CES 2017) (Appendix H).
Thamnophis gigas giant garter snake	FT/ST/--	The giant garter snake is endemic to the San Joaquin and Sacramento Valley floors. Counties include Butte, Colusa, Contra Costa, Fresno, Glenn, Kern, Madera, Merced, Sacramento, San Joaquin, Solano, Sutter, Yolo, and Yuba. Inhabits agricultural wetlands and other waterways such as irrigation and drainage canals, sloughs, ponds, small lakes, low gradient streams, and adjacent uplands. Requires adequate water during its active season (early spring through mid-fall) to provide food and cover, emergent, herbaceous wetland vegetation for foraging and cover, grassy banks and openings in waterside vegetation for basking, and higher elevation uplands for cover and refuge from flood waters during its dormant season (winter). Inhabits small mammal burrows and other soil crevices with sunny exposure along south and west facing slopes, above prevailing flood elevations when dormant. Primarily found in marshes and sloughs as well as slow-moving creeks but are absent from large rivers. Often bask on emergent vegetation such as cattails and tulles (USFWS 1999b).	Will not occur	The Project site is within the historic range of the species; however, this species is no longer known to occur south of the San Joaquin River in Fresno County - approximately 45 miles north of the Project site (USFWS 1999).

Scientific Name/ Common Name	ESA/CESA/CRPR ; Other Status[2]	General Habitat Description	Status in the Project Site[3]	Rationale
Birds				
Falco mexicanus Prairie falcon	--/--/WL	Prairie falcons breed in open country on bluffs and cliffs from sea level to about 11,000 feet. Breeding habitats include grasslands, shrub-steppe desert, areas of mixed shrubs and grasslands, or alpine tundra that supports abundant ground squirrel or pika populations. The majority of Prairie Falcons winter in the Great Plains and Great Basin. (https://www.allaboutbirds.org/guide/Prairie_Falcon/lifehistory).	Will not occur	There is no suitable nesting habitat for this species in the project site.
Agelaius tricolor tri-colored blackbird	FC/ST/--	Common locally throughout central California. Nests and seeks cover in emergent wetland vegetation, specifically cattails and tules. Nesting area must be large enough to support a minimum colony of 50 pairs as they are a highly colonial species. Forages on ground in croplands, grassy fields, flooded land, and edges of ponds.	Will not occur	The project site lacks suitable nesting habitat for this species. Patches of emergent vegetation in the canals are small and subject to routine disturbance both through periodic dredging and regular human presence. Marginal habitat occurs in portions of the Kings River within a 0.5-mile radius of the site, but this species was not observed, and these areas are also subject to a relatively high level of human disturbance from fishing and other recreational uses of the river. Tri-colored blackbird nests were not observed in the project site or within a 0.5-mile radius during numerous nesting bird surveys.
Athene cunicularia **burrowing owl**	**--/--/SSC**	**Forages in grasslands, agricultural fields, and disturbed places where burrowing mammals are abundant. Nests in burrows, especially those of California ground squirrel (*Spermophilus beecheyi*).**	**Present**	**Observed in the project site north of Kent Avenue in 2017 and along the southern edge of the project site in 2018.**

Scientific Name/ Common Name	ESA/CESA/CRPR; Other Status[2]	General Habitat Description	Status in the Project Site[3]	Rationale
Buteo swainsoni **Swainson's hawk**	**--/ST/--**	**Forages in grasslands, suitable grain or alfalfa fields, or livestock pastures adjacent to nesting habitat. Nests on large trees in open areas.**	**Present (foraging only)**	**There is no suitable nesting habitat for SWHA in the project site. However, two active nests were observed within 0.25-mile of the site during surveys in 2018. This species was observed foraging in the site.**
Charadrius alexandrinus nivosus western snowy plover	FT/--/SSC	Federal listing applies only to coastal populations that nest on sand beaches above the high tide line. Interior populations nest on barren to sparsely vegetated flats along the shores of lakes, braided river systems, salt ponds, and agricultural sumps. Adults feed on insects and brine shrimp (Shuford and Garaldi 2008).	Not expected	Suitable habitat for this species is not present on the Project site. This species was not observed on the site during numerous biological surveys.
Circus cyaneus **northern harrier**	**--/--/SSC**	**Widespread throughout North America; year-round resident of California. Northern harriers breed in a variety of open habitats including marshes, wet meadows, weedy shorelines, grasslands, weed fields, pastures, sagebrush flats, desert sinks, and croplands. Northern harriers nest on the ground in patches of dense, tall vegetation in undisturbed areas. Breeding occurs from March to August. Northern harriers feed on a wide variety of vertebrate prey, including rodents, songbirds, waterfowl, and lizards (Shuford and Gardali 2008).**	**Present (foraging only)**	**Individuals observed foraging in the Project site during surveys in 2016. There is no suitable nesting habitat in the site.**
Eremophila actia alpestris **California horned lark**	**--/--/WL**	**Occurs in a variety of open habitats from coastal grasslands to alpine dwarf shrub habitats. Forages on the ground for insects, snails, spiders, and seeds. Nests are built on the ground in areas of low, sparse vegetation; breeding occurs from March through July (CDFW 1990).**	**Present (nesting and foraging)**	**Individuals observed in the Project site during surveys in 2016. No nests were observed, but suitable nesting habitat is abundant in the site.**
Falco columbarius merlin	--/--/WL	An uncommon winter migrant in California; breeds in Alaska and Canada. Uses a variety of habitats but requires trees close to water for	Not expected	The Project site is adjacent to marginally suitable riparian tree cover along the Kings River; however, the site is not near the

Scientific Name/ Common Name	ESA/CESA/CRPR ; Other Status[2]	General Habitat Description	Status in the Project Site[3]	Rationale
		cover and is usually found near coastlines, lakeshores, and wetlands (CDFW 1999).		coast or a lakeshore and does not include wetlands.
Lanius ludovicianus **loggerhead shrike**	**--/--/SSC**	**Widespread in the United States and southern Canada and is a year-round resident in most of California. Prefers open habitats with scattered shrubs, trees, posts, or other perches; found in shrublands or open woodlands with bare ground, or sparse herbaceous cover, and is often found in open cropland. Hunts in open areas of short grasses, forbs, or bare ground, and impales prey on thorns or barbed wire. Nests in shrubs or trees (Shuford and Gardali 2008).**	**Present (nesting and foraging)**	**Individuals observed foraging in the Project site during surveys in 2016. Presumed to nest on the site.**
Nycticorax nycticorax black-crowned night heron	--/--/--; G5, S4	Roosts in trees around fresh- and salt-water habitats including marshes, swamps, rivers, ponds, canals, and rice fields. Common year-round in the Central Valley. Once threatened by DDT, populations are recovering and considered stable (Audubon Society 2017).	Not expected	There is no suitable roosting habitat for this species in the Project site.
Xanthocephalus xanthocephalus **yellow-headed blackbird**	**--/--/SSC**	**Occurs in California mainly as a summer migrant, but small numbers over-winter in the southern San Joaquin Valley and deserts. Breeds in marshes with tall emergent vegetation, generally along edges over deep water. Usually forages on seeds and aquatic insects within individual territories but may use nearby agricultural fields if resources are scarce (Shuford and Gardali 2008).**	**Present**	**This species was documented nesting on the site in two locations within the canals adjacent to 23rd Avenue (see Figure 5 in Appendix A).**
Mammals				
Ammospermophilus nelsoni Nelson's antelope squirrel	--/ST/--	Suitable habitat for Nelson's antelope squirrel has widely scattered shrubs, annual forbs, and grasses, distributed over broken terrain with small gullies and washes. Squirrels dig burrows in sandy, loamy soils at the base of shrubs. Historic range has been reduced by conversion of land to cultivation (CDFW 2005).	Will not occur	The Project site does not include suitable areas of broken terrain with gullies and washes, shrubs, and sandy or loamy soils. Only recorded occurrence within 10 miles of the project site is dated 1951 (CNDDB 2017). This species was not observed during walking

Scientific Name/ Common Name	ESA/CESA/CRPR; Other Status[2]	General Habitat Description	Status in the Project Site[3]	Rationale
				transects that achieved 100% coverage of the site.
Dipodomys ingens giant kangaroo rat	FE/SE/--	Inhabits annual grasslands with well-drained sandy-loam soils. Currently known from 6 major population centers, the closest of which is the Kettleman Hills in southwestern Kings County (USFWS 1998).	Will not occur	The Project site does not provide suitable habitat for this species. The closest known extant population is in the Kettleman Hills, approximately 13 miles southwest of the site. A habitat assessment and focused trapping for special-status kangaroo rats was conducted and no special-status kangaroo rats were found on the site (Appendix I).
Dipodomys nitratoides brevinasus Short-nosed kangaroo rat	--/--/SSC	Short-nosed kangaroo rats generally occupy grassland with scattered shrubs and desert-shrub associations on friable soils. They inhabit highly saline soils around Soda Lake, on the Carrizo Plain, and less saline soil elsewhere. On the Valley floor, south of Los Banos, Merced County, small populations, whose taxonomic identity is uncertain (*exilis* or *brevinasus*) live on levees secure from winter flooding, then move into seasonally flooded iodine bush shrublands during the summer months, where at least some individuals reproduce. Over most of their current range they are generally more numerous in lighter, friable soils such as the sandy bottoms and banks of arroyos and other sandy areas. (http://esrp.csustan.edu/publications/pubhtml.php?doc=sjvrp&file=chapter02M03.html)	Will not occur	There is no suitable habitat on the project site. A habitat assessment and focused trapping for special-status kangaroo rats was conducted and no special-status kangaroo rats were found on the site (Appendix I).
Dipodomys nitratoides exilis Fresno kangaroo rat	FE/SE/--	Historically found in the southern San Joaquin Valley between the Merced River and Tulare Lake, as far west as Fresno Slough. No longer known from its historic range, and with no confirmed extant populations (USFWS 2010c).	Will not occur	There is no suitable alkali sink scrub habitat in the Project site. A habitat assessment and focused trapping for special-status kangaroo rats was conducted and no special-status

Scientific Name/ Common Name	ESA/CESA/CRPR; Other Status[2]	General Habitat Description	Status in the Project Site[3]	Rationale
				kangaroo rats were found on the site (Appendix I).
Dipodomys nitratoides nitratoides Tipton kangaroo rat	FE/SE/--	Historically found in the Tulare Lake basin, this subspecies of Fresno kangaroo rat inhabits areas with friable, sandy soils that are free of seasonal flooding. It digs shallow burrow systems around the bases of shrubs, and feeds mainly on seeds (USFWS 1998).	Will not occur	There is no suitable alkali sink scrub habitat in the Project site. There are sighting records located east of SR-41 north of Stratford; however, these locations are separated from the Project site by miles of active agricultural land and the Kings River. A habitat assessment and focused trapping for special-status kangaroo rats was conducted and no special-status kangaroo rats were found on the site (Appendix I).
Onychomys torridus tularensis Tulare grasshopper mouse	--/SSC/--	Inhabits hot, arid grasslands and scrubland; currently known from the western foothills of the San Joaquin Valley and Carrizo Plain. No recent records from the Tulare Basin (USFWS 1998).	Will not occur	There is no suitable grassland or scrubland habitat in or near the Project site, and the site is outside of the current known range of this species. The only records of the species from within 10 miles of the Project site date from the 1930s.
Sorex ornatus relictus Buena Vista Lake ornate shrew	FE/--/--	A small, short-lived mammal that feeds on insects and is active day and night, year-round. Requires a complex riparian vegetation structure with thick leaf litter or dense mats of low-growing herbaceous species, moist soil supplied by a high water table or nearby surface water, and abundant insect prey available year-round. Known from a storm water detention basin immediately north of SR-198 between 21st Avenue and the Kings River (USFWS 2012).	Will not occur	A habitat assessment conducted for this species (Appendix J) concluded that the canals in the project site are not suitable habitat. Banks of active canals in the Project site are mostly bare soil and do not support suitable habitat of dense, low-growing grasses and forbs near surface water. In addition, the canals are periodically dredged to maintain capacity.

Scientific Name/ Common Name	ESA/CESA/CRPR ; Other Status[2]	General Habitat Description	Status in the Project Site[3]	Rationale
Taxidea taxus American badger	--/SSC/--	Inhabits drier open stages of most shrub, forest, and herbaceous habitats with loose, friable soils. Preys on a wide variety of mammals, reptiles, birds, and carrion, and hunts mostly by digging out fossorial prey. Also occasionally takes prey on the surface.	Presumed absent	The project site includes potentially suitable habitat and is within the known range of the species, however, no sign of badger or potential badger dens have been observed on the site during numerous surveys including complete walking transects of the site for SJKF and surveys for burrowing owl. Both of these above-mentioned surveys focused on presence/absence of subterranean holes. Also, this species has not been detected in the array of camera stations operated across the site for 10 consecutive nights.
Vulpes macrotis mutica **San Joaquin kit fox**	**FE/ST/--**	**Inhabits grasslands, agricultural areas, playas, and scrublands. Formerly widespread in the Central Valley; now primarily found in foothills at the margins of the Central Valley and in the interior Coast Ranges. Uses natural and artificial burrows with entrances between 8 and 10 inches in diameter, and occupies many different burrows in a single season (USFWS 1998).**	**Presumed Absent**	**The project site includes potentially suitable habitat and is within the known range of the species, but it was not observed in the project site or within a 2.0-mile radius of the site during USFWS protocol surveys (see Appendix G). This species is discussed in the main body of the report due to the potential for dispersing individuals to traverse the Project site even though it was not detected during surveys.**

Scientific Name/ Common Name	ESA/CESA/CRPR; Other Status[2]	General Habitat Description	Status in the Project Site[3]	Rationale
Plants				
Caulanthus californicus California jewelflower	--/--/1B.1	An annual herb found in chenopod scrub, pinyon-juniper woodland, and valley and foothill grassland from 61 – 1000 meters in elevation. Currently known from Fresno, Kern, San Luis Obispo, and Santa Barbara counties; presumed extirpated from Kings County. Blooms February to May (CNPS 2018).	Presumed Absent	Marginally suitable habitat for this species is present in the Project site. However, this species was not observed on the Project site during botanical surveys conducted during the blooming season. This species is presumed extirpated from Kings County.
Delphinium recurvatum recurved larkspur	--/--/1B.2	An annual herb found on alkaline soils in chenopod scrub, cismontane woodland, and valley and foothill grassland from 3 to 790 meters in elevation. Currently known to occur in Alameda, Contra Costa, Fresno, Glenn, Kings, Kern, Madera, Merced, Monterey, San Joaquin, San Luis Obispo, Solano, Sutter, and Tulare counties. Blooms March to June (CNPS 2018).	Presumed Absent	Marginally suitable habitat for this species is present in the Project site. However, this species was not observed on the Project site during botanical surveys conducted during the blooming season. The only known occurrence of this species within 15 miles of the Project site is dated 1914 and located 14 miles to the east (CNDDB 2016).
Eremalche parryi ssp. *kernensis* Kern mallow	--/--/1B.2	An annual herb found in sandy to clay soils in valley and foothill grassland, chenopod scrub, and pinyon and juniper woodland from 70 to 1,290 meters in elevation. Currently known to occur in Kern, Kings, San Luis Obispo, Santa Barbara, Tulare, and Ventura counties. Blooms January to May (CNPS 2018).	Presumed Absent	Marginally suitable habitat for this species is present in the Project site. However, this species was not observed on the Project site during botanical surveys conducted during the blooming season. There are no recorded occurrences of this species within 10 miles of the Project site. The nearest known occurrences are south of Shafter (CNPS 2017).
Hordeum intercedens vernal barley	--/--/3.2	An annual herb found in coastal dunes, coastal scrub, saline flats and depressions within valley and foothill grassland, and vernal pools from 5 to	Presumed Absent	Marginally suitable alkaline habitat is present within the Project site. The species is known

Scientific Name/ Common Name	ESA/CESA/CRPR; Other Status[2]	General Habitat Description	Status in the Project Site[3]	Rationale
		1,000 meters in elevation. Currently known to occur in Fresno, Kern, and Kings counties, as well as many others throughout southern and central California. Blooms March to June (CNPS 2018).		from Lemoore Station, northwest of the project site (CNPS 2017). However, this species was not observed on the Project site during botanical surveys conducted during the blooming season.
Layia munzii Munz's tidy-tips	--/--/1B.2	An annual herb found in chenopod scrub and alkaline clay areas within valley and foothill grassland from 150 to 700 meters in elevation. Currently known to occur in Fresno, Kern, San Benito, and San Luis Obispo counties. Blooms March to April (CNPS 2018).	Presumed Absent	Marginally suitable alkaline habitat is present within the Project site. However, this species was not observed on the Project site during botanical surveys conducted during the blooming season.
Monolopia congdonii San Joaquin woollythreads	FE/--/1B.2	An annual herb found in sandy soils in valley and foothill grassland and chenopod scrub from 60 to 800 meters in elevation. Currently known to occur in Fresno, Kern, Kings, San Benito, San Luis Obispo, and Santa Barbara counties. Blooms February to May (CNPS 2018).	Presumed Absent	Marginally suitable sandy soil habitat is present within the Project site. However, this species was not observed on the Project site during botanical surveys conducted during the blooming season. There are no historic occurrences of this species within 10 miles of the Project site and only 1 presumed extant occurrence within 15 miles – west of I-5 (CNDDB 2016).
Nama stenocarpa mud nama	--/--/2B.2	An annual or perennial herb found in marshes and swamps on riverbanks and lake margins from 5 to 500 meters in elevation. Currently known to occur in Kings, Orange, Riverside, and San Diego counties. Blooms January to July (CNPS 2018).	Will not occur	There is no suitable habitat for this species in the Project site. The only known occurrence north of the Transverse Ranges is more than 10 miles east of the Project site (CNDDB 2016).
Puccinellia simplex California alkali grass	--/--/1B.2	An annual herb found in meadows, seeps, and seasonal wetlands. Valley and foothill grasslands, and chenopod scrub from 2 to 930 meters in elev	Presumed Absent	There is no suitable habitat for this species in the Project site. This species was not observed

Scientific Name/ Common Name	ESA/CESA/CRPR ; Other Status[2]	General Habitat Description	Status in the Project Site[3]	Rationale
		Currently known to occur in Alameda, Butte, Contra Costa, Colusa, Fresno, Glenn, Kings, Kern, Lake, Los Angeles, Madera, Merced, Napa, San Bernardino, Santa Clara, Santa Cruz, San Luis Obispo, Solano, Stanislaus, Tulare, and Yolo Counties. Blooms March to May (CNPS 2019).		on the Project site during botanical surveys conducted during the blooming season.
Sensitive Natural Habitats				
Valley Sink Scrub	--/--/--; G1; S1.1	An open to dense community of low-growing, succulent alkali-tolerant species in the goosefoot family (Chenopodiaceae), especially iodine-bush (*Allenrolfea occidentalis*) and seepweed (*Suaeda* spp.) It occurs in heavy clay soils in lakebeds and playas with shallow groundwater and a salt crust on the surface. Once widespread in the San Joaquin and southern Sacramento Valleys; now essentially extirpated by agriculture and flood control (Holland 1986).	Will not occur	This community is not present in the Project site.

***Note:* Bold font indicates a species that is evaluated in detail in the body of the report.**

[1]Special-status species reported in California Natural Diversity Database, CNPS, or USFWS database queries; identified by USFWS or CDFW to have the potential to occur in the project region in comment letters on the Conditional Use Permit Application; or observed in the site during biological surveys.

[2]Listing is as follows: F = Federal; S = State of California; E = Endangered; T = Threatened; C = Candidate; SSC = State Species of Special Concern; FP = State Fully Protected; WL = State Watch List.

CRPR = California Rare Plant Rank: 1A – presumed extinct; 1B – rare, threatened, or endangered in California and elsewhere; 2A – presumed extirpated in California but more common elsewhere; 2B – rare, threatened, or endangered in California but more common elsewhere; 3 – more information needed; 4 – watch list for species of limited distribution. Extension codes: .1 – seriously endangered; .2 – moderately endangered; .3 – not very endangered.

[3]Status in the Project site is assessed as follows. **Will Not Occur**: Species is either sessile (*i.e.* plants) or so limited to a particular habitat that it cannot disperse on its own and/or habitat suitable for its establishment and survival does not occur on the project site; **Not Expected**: Species moves freely and might disperse through or across the project site, but suitable habitat for residence or breeding does not occur on the project site, potential for an individual of the species to disperse through or forage in the site cannot be excluded with 100% certainty; **Presumed Absent:** Habitat suitable for residence and breeding occurs on the project site; however, focused surveys conducted for the current project were negative; **High**: Habitat suitable for residence and breeding occurs on the project site and the species has been recorded recently on or near the project site, but was not observed during surveys for the current project; **Present**: The species was observed during biological surveys for the current project and is assumed to occupy the project site.

Appendix D

Plant and Wildlife Species Observed in the Project Site

Plants

Family	Species Name	Common Name	Status
Native			
Aizoaceae	*Sesuvium verrucosum*	western sea purslane	--
Amaranthaceae	*Amaranthus blitoides*	prostrate amaranth	--
Apocynaceae	*Asclepias fascicularis*	narrow-leaf milkweed	--
Asteraceae	*Centromadia pungens* ssp. *pungens*	common tarweed	--
	Pseudognaphalium canescens	cudweed	--
	Xanthium strumarium	cocklebur	--
Boraginaceae	*Amsinckia intermedia*	rancher's fiddleneck	--
	Heliotropium curassavicum var. *occulatum*	salt heliotrope	--
Caryophyllaceae	*Spergularia marina*	salt marsh sand spurrey	--
Chenopodiaceae	*Allenrolfea occidentalis*	iodine bush	--
	Atriplex fruticulosa	valley saltbush	--
	Atriplex lentiformis	quailbush	--
	Atriplex serenana var. *serenana*	bractscale	--
	Suaeda nigra	Bush seepweed	--
Convolvulaceae	*Cressa truxillensis*	alkali weed	--
Cyperaceae	*Cyperus eragrostis*	tall flatsedge	--
	Schoenoplectus acutus var. *occidentalis*	tule	--
Frankeniaceae	*Frankenia salina*	alkali-heath	--
Juncaceae	*Juncus balticus* ssp. *ater*	Baltic rush	--
Poaceae	*Distichlis spicata*	saltgrass	--
	Leptochloa fusca ssp. *uninerva*	Mexican sprangletop	--
Salicaceae	*Populus fremontii* ssp. *fremontii*	Fremont cottonwood	--
	Salix gooddingii	Gooding's black willow	--
Typhaceae	*Typha latifolia*	broad-leaved cattail	--
Verbenaceae	*Phyla nodiflora*	common lippia	--
Non-native			
Arecaceae	*Washingtonia robusta*	Mexican fan palm	mod
Asteraceae	*Acroptilon repens*	Russian knapweed	mod; List C
	Anthemis cotula	mayweed	--
	Carthamus tinctorius	safflower	--
	Lactuca serriola	wild lettuce	--
	Pseudognaphalium luteoalbum	everlasting cudweed	--
Brassicaceae	*Brassica nigra*	black mustard	mod
	Capsella bursa-pastoris	shepherd's purse	--
	Hirschfeldia incana	short-pod mustard	mod
	Sisymbrium altissimum	tumble mustard	--
Caryophyllaceae	*Spergularia bocconi*	Boccone's sand spurry	--

Family	Species Name	Common Name	Status
Chenopodiaceae	*Atriplex semibaccata*	Australian saltbush	mod
	Atriplex suberecta	peregrine saltbush	--
	Bassia hyssopifolia	five-hook bassia	lim
	Beta vulgaris	common beet	--
	Chenopodium album	pigweed	--
	Chenopodium murale	nettle-leaf goosefoot	--
	Salsola tragus	Russian thistle	lim; List C
Fabaceae	*Medicago sativa*	alfalfa	--
	Melilotus indicus	Indian sweet clover	--
Malvaceae	*Malvella leprosa*	alkali-mallow	--
Onagraceae	*Ludwigia grandiflora*	large-flowered waterprimrose	--
Poaceae	*Avena fatua*	wild oats	mod
	Bromus diandrus	common ripgut grass	mod
	Bromus madritensis	foxtail chess	--
	Echinochloa crus-galli	common barnyard-grass	--
	Hordeum marinum	Mediterranean barley	mod
	Phalaris minor	Mediterranean canary grass	--
	Polypogon monspeliensis	annual beardgrass	lim
	Triticum aestivum	wheat	--
Polygonaceae	*Polygonum ramosissimum*	bushy knotweed	--
	Rumex crispus	curly dock	lim
Zygophyllaceae	*Tribulus terrestris*	puncture vine	--

[1]Status of native species is federal listing/state listing/California Rare Plant Rank. Status of non-native species is Cal-IPC invasiveness rating (lim=limited, mod=moderate, high); CDFA rating (List C=California noxious weed).

Animals

Order/Family	Species Name	Common Name	Status
Amphibians			
Anura			
Ranidae	*Lithobates catesbianus*	American bullfrog	--
Birds			
Accipitriformes			
Accipitridae	*Buteo jamaicensis*	red-tailed hawk	--
	Buteo swainsoni	Swainson's hawk	ST
	Circus cyaneus	northern harrier	CDFW:SSC
Anseriformes			
Anatidae	*Anas cyanoptera*	cinnamon teal	--
	Anas platyrhynchos	mallard	--
Charadriiformes			
Charadriidae	*Charadrius vociferus*	killdeer	--
Laridae	*Sterna caspia*	caspian tern	--
Recurvirostridae	*Himantopus mexicanus*	black-necked stilt	--
	Recurvirostra americana	American avocet	--
Scolopacidae	*Calidris minutilla*	least sandpiper	--
	Tringa melanoleuca	greater yellowlegs	--
Ciconiiformes			
Ardeidae	*Ardea alba*	great egret	--
	Ardea herodias	great blue heron	--
	Egretta thula	snowy egret	--
Columbiformes			
Columbidae	*Zenaida macroura*	mourning dove	--
Falconiformes			
Falconidae	*Falco sparverius*	American kestrel	--
Gruiformes			
Rallidae	*Fulica americana*	American coot	--
Passeriformes			
Alaudidae	*Eremophila alpestris*	horned lark	CDFW:WL
Corvidae	*Corvus corax*	common raven	--
	Pica nuttallii	yellow-billed magpie	--
Emberizidae	*Passerculus sandwichensis*	savannah sparrow	--
	Zonotrichia leucophrys	white-crowned sparrow	--
Hiruninidae	*Tachycinecta bicolor*	tree swallow	--
Icteridae	*Agelaius phoeniceus*	red-winged blackbird	--
	Euphagus cyanocephalus	Brewer's blackbird	--
	Icterus bullockii	Bullock's oriole	--
	Icterus cucullatus	hooded oriole	--
	Sturnella neglecta	western meadowlark	--

Order/Family	Species Name	Common Name	Status
	Xanthocephalus xanthocephalus	yellow-headed blackbird	CDFW:SSC
Laniidae	*Lanius ludovicianus*	loggerhead shrike	CDFW:SSC
Mimidae	*Mimus polyglottos*	northern mockingbird	--
Tyrannidae	*Sayornis nigricans*	black phoebe	--
	Tyrannus verticalis	western kingbird	--
Podicipediformes			
Podicipedidae	*Podilymbus podiceps*	Pied-billed grebe	
Strigiformes			
Strigidae	*Athene cunicularia*	burrowing owl	CDFW:SSC
	Bubo virginianus	great horned owl	--
Mammals			
Carnivora			
Canidae	*Canis latrans*	coyote	--
Lagomorpha			
Lepidae	*Sylvilagus audubonii*	desert cottontail	--
Rodentia			
Cricetidae	*Peromyscus maniculatus*	deer mouse	--
	Reithrodontomys megalotis	western harvest mouse	--
Heteromyidae	*Dipodomys heermanni*	Heermann's kangaroo rat	--
Muridae	*Mus musculus*	house mouse	--
Sciuridae	*Otospermophilus beecheyi*	California ground squirrel	--

[1]Status is federal/state listing or other sensitivity: ST=State threatened; CDFW=California Department of Fish and Wildlife; SSC=Species of Special Concern; WL=Watch-list.

Appendix E

Representative Site Photographs

Photo 1. Representative view of an active canal on the site (7/08/2018).

Photo 2. View of the southeast corner of the site (7/08/2018).

Photo 3. View of the southwest portion of the site (7/08/2018).

Photo 4. View of the project site south of Murphy Ranch Road, looking west from 23rd Avenue (7/08/2018).

Photo 5. The center of the site north of Kent Avenue, looking east (4/04/2018).

Photo 6. The northern portion of the site looking south from Murphy Ranch Road (4/05/2018).

Appendix F

Swainson's Hawk Regional Study, Protocol Survey Report, and Foraging Study

The Distribution and Abundance of Nesting Swainson's Hawks in the Vicinity of the Proposed RE Mustang Two Solar Generation Facility

February 2017

Prepared for:

RE Mustang Two, LLP

Prepared by:

Estep Environmental Consulting

The Distribution and Abundance of Nesting Swainson's Hawks in the Vicinity of the Proposed RE Mustang Two Solar Generation Facility

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Section 1. Introduction

This report describes the results of breeding season surveys of the state-threatened Swainson's hawk (*Buteo swainsoni*) in the vicinity of the proposed RE Mustang Two Solar Generation Facility (SGF) in Kings County. Using the survey data, this report also assesses the impact of the proposed project, pursuant to the California Environmental Quality Act (CEQA), on the local and regional Swainson's hawk nesting population.

This study of a regional Swainson's hawk nesting population was undertaken in an effort to provide an assessment approach based on a clear biological foundation and that leads to impact determinations that are rationale-based and consistent with CEQA significance criteria. CEQA does not dictate any particular assessment approach but does require that the best scientific information be used to assess biological impacts and reach significance determinations consistent with CEQA guidelines. There may be multiple ways of assessing land use-related impacts on wide-ranging species, such as the Swainson's hawk. This approach was developed using current data on species distribution and abundance and the availability of suitable habitat conditions over a broad landscape.

A similar assessment approach was previously used in the 2011 assessment of the adjacent RE Mustang/RE Orion/RE Kent South SFG, which has since been constructed. This provides an opportunity to review changes in the surrounding land use and species abundance and distribution since 2011 and the extent to which this affects the assessment outcomes of RE Mustang Two.

Purpose of the Study

The purpose of this study is several-fold and includes:

- Determining the distribution and abundance of the Swainson's hawk in the study area.

- Determining nesting and foraging habitat associations of Swainson's hawk in the study area.

- Determining the reproductive performance of Swainson's hawks in the study area.

- Using data on distribution and abundance and available nesting and foraging habitat to assess the effects of the proposed project on the nesting population, and

- Providing baseline information to assist Kings County in the development of regional conservation strategies to protect and sustain the Swainson's hawk nesting population.

Project Background

The SGF is a solar photovoltaic (PV) project proposed by RE Mustang Two LLC. The SGF will have generating capacity of 150 megawatts (MW) and is located generally southwest of the city of Lemoore, California, on approximately 1,800 acres of agricultural land in Kings County (Figure 1). The project footprint would not exceed the 1,800 acres evaluated in this report and in the Initial Study/Mitigated Negative Declaration being prepared for Kings County, the CEQA Lead Agency. The SGF is within the range of the Swainson's hawk, a species that is dependent on agricultural habitats in the Central Valley to meet its foraging needs. Removal of agricultural lands could potentially affect individual nesting pairs and affect the local or regional distribution and abundance of the species.

The SGF is currently undergoing preliminary CEQA review and an Initial Study/ Mitigated Negative Declaration is in progress. Results of this study are intended to be incorporated into the environmental document and are subject to review by Kings County as the CEQA Lead Agency.

Project Location

The SGF site is located approximately 5 miles southwest of the City of Lemoore and approximately 2.5 miles northwest of the community of Stratford. The project site is bounded by Kent Avenue on the north, 25th Avenue on the west, 23rd Avenue on the east, and the Avenal Cutoff Road on the northwest. The site ranges between 0.6 and 1.3 miles west of the Kings River and 2 miles south of State Route 198. The Lemoore Naval Air Station and the on-base community of Lemoore Station are immediately north of State Route 198 (Figure 2). The site is located on flat land, gently sloping eastward toward the Kings River and ranging in elevation from 225 feet to 205 feet above mean sea level from west to east. The site is active agricultural land in the cotton-wheat-tomato rotation typical of the area and surrounding farmlands. The site is surrounded entirely by active agricultural land (Figure 2).

Project Description

The proposed project consists of the construction, operation and maintenance, and eventual decommissioning of the solar PV facility. Project infrastructure includes: solar panels; inverters; transformers; access roads, construction logistics and drill pad areas; underground collection lines; and a 2 to 3 mile-long above-ground 230 kV interconnection generation tie line that would interconnect to the regional electricity grid at Pacific Gas and Electric Company's (PG&E) existing Mustang Switching Station located northwest of the proposed project. The solar array would be installed in parallel rows separated by approximately 10 feet from edge of panel to edge of panel (Figure 3).

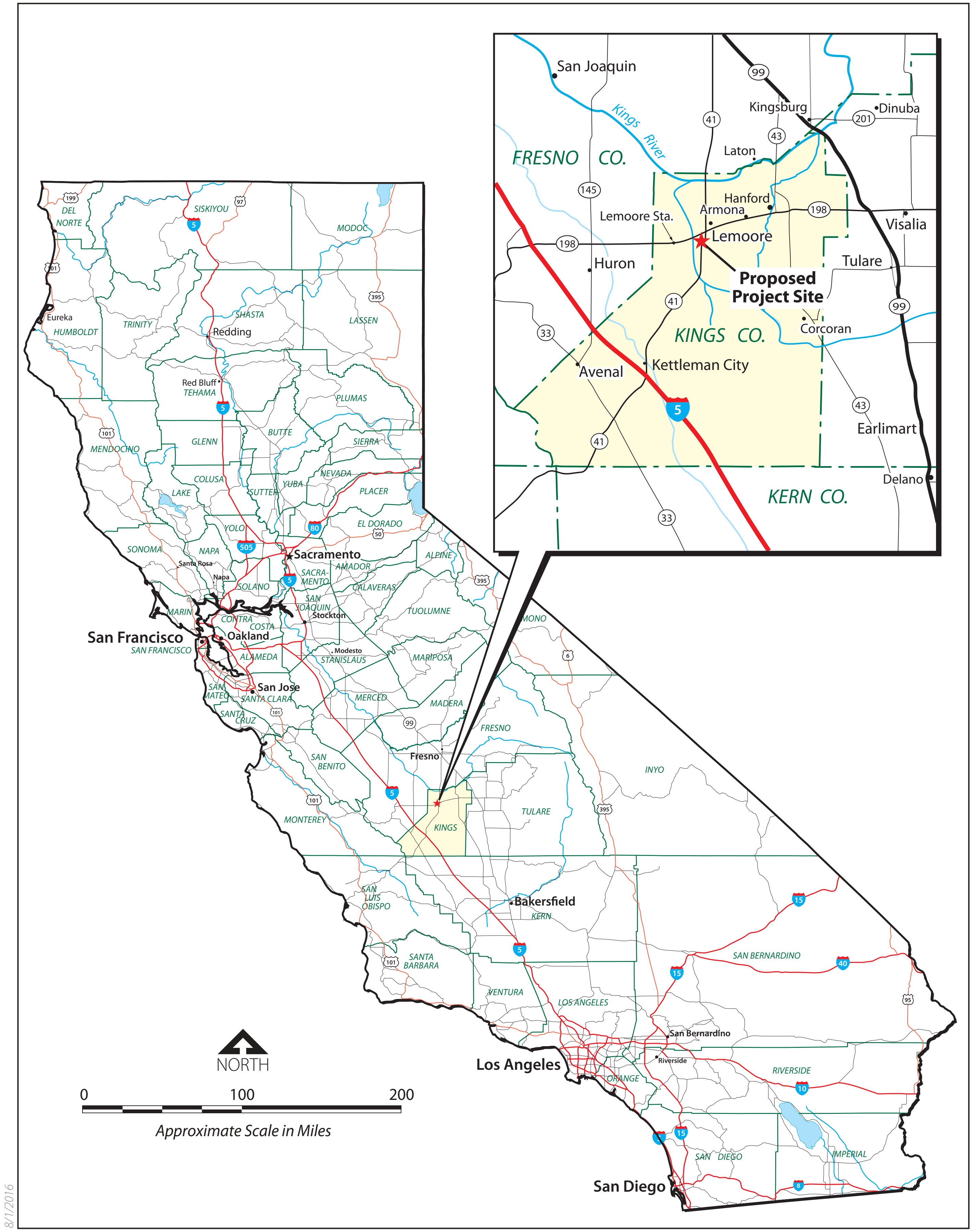
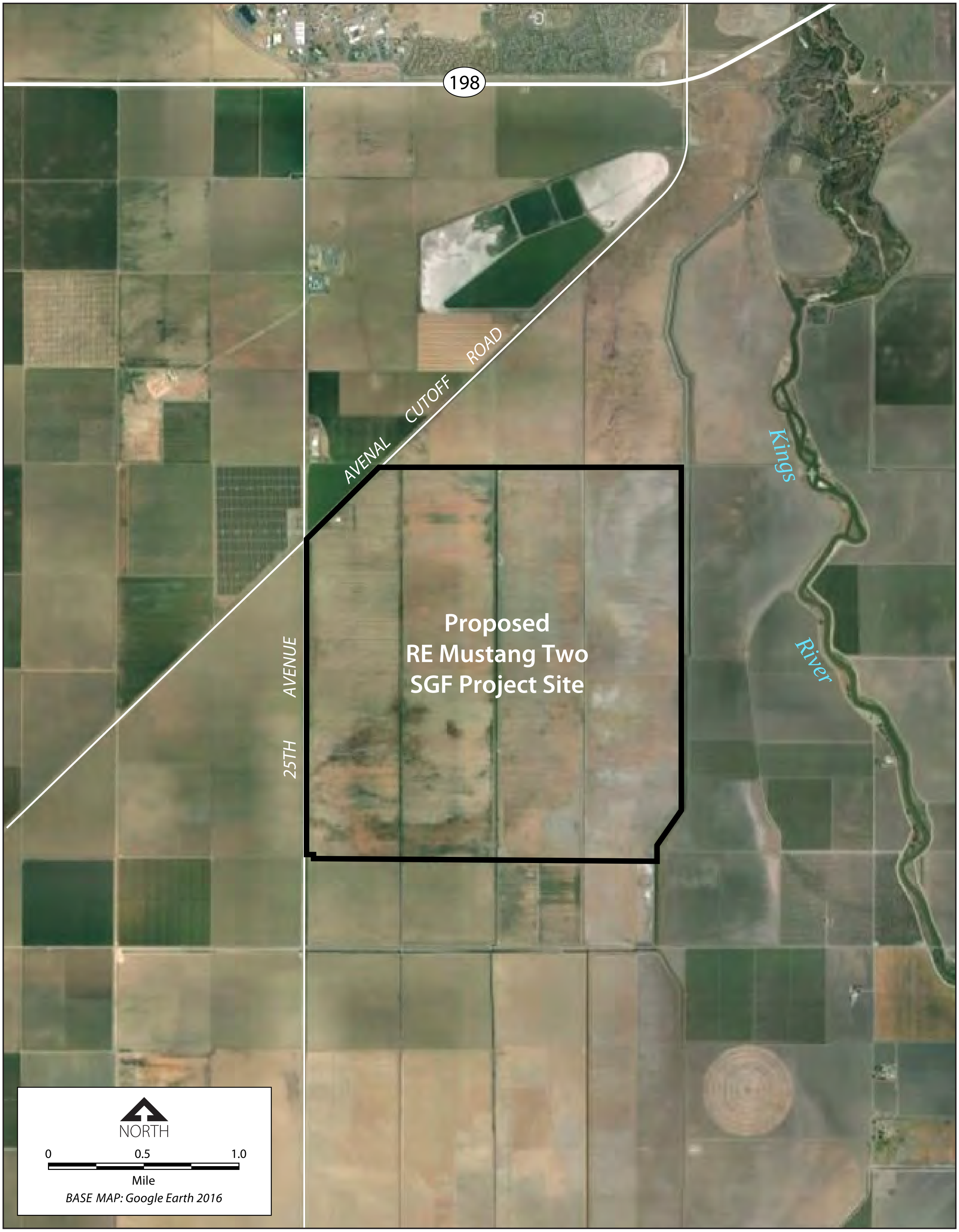


Figure 1
Proposed Mustang Two SGF Project Regional Location



8/1/2016

Figure 2
Proposed Mustang Two SGF Project Site Location

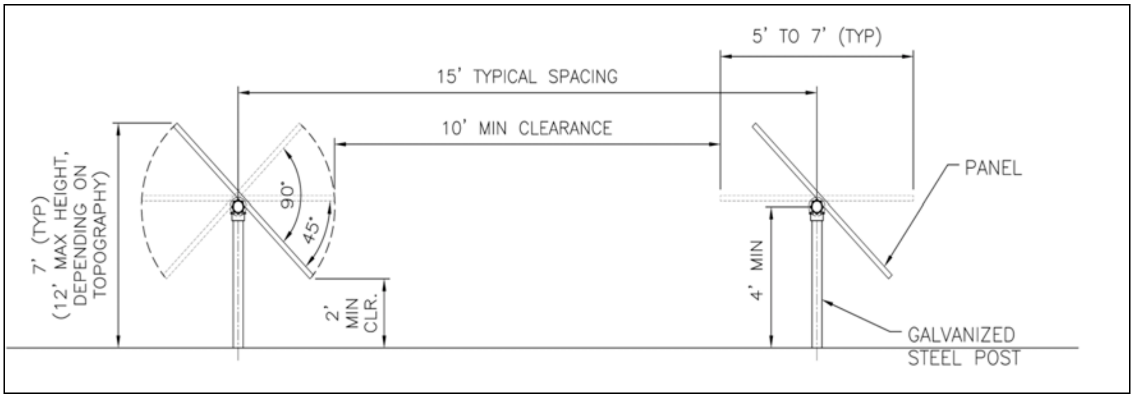


Figure 3. Configuration and layout of solar panel rows.

The internal roadway system would consist of roads approximately 20 feet wide with a permeable surface, a 20-foot right-of-way, and a 20-foot perimeter road around the facility. The SGF site would be secured by an 8-foot-high chain link perimeter fence topped with three-strand barbed wire. This perimeter fence would be “wildlife friendly” such that the bottom of the fence would be an average of 5 inches above the ground along the entire perimeter, as measured from the top of the ground to the highest point of the bottom of the fence.

As part of the maintenance activities that would take place during project operation, the solar panels would be washed several times a year (primarily during summer) to maintain optimal electricity production. Water used for panel washing would be drawn from either an on-site groundwater well or an off-site local well. No chemical cleaners would be used for panel washing.

Once the initial project construction is completed, the project site would be reseeded/re-vegetated with appropriate low-growing species to reduce soil erosion and prevent or control weed growth to reduce fire hazards. Combustible vegetation on and around the project boundary would be actively managed to minimize fire risk, through mowing or sheep grazing on the project site.

Species Background

Swainson’s Hawk Natural History

Description

The Swainson’s hawk is a medium-sized buteo most often characterized by its long, narrow, and tapered wings held in flight in a slight dihedral shape (Plate 1). The body size is somewhat smaller, thinner, and less robust than other buteos, although the wings are at least as long as other buteos. This body and wing shape allow for efficient soaring flight and aerial maneuverability, important for foraging, which Swainson’s hawks do primarily from the wing, and during courtship and inter-specific territorial interactions.

Plate 1. Adult Swainson's hawk showing the long, tapered wings that allow for efficient soaring and flight maneuverability. .

There are three definitive plumage morphs: light, rufous, and dark, with numerous intermediate variations between these plumage morphs. The two most distinguishing plumage characteristics are a dark breast band and the contrasting darker flight feathers and lighter wing linings on the underwings giving most individuals a distinctive bicolored underwing pattern (Plate 2). These characteristics are most pronounced in lighter morph birds and become less so as the plumage darkens, and can be indistinguishable in the definitive dark morph, which is completely melanistic. All three definitive plumage morphs are present in California, with a relatively large proportion of the population categorized as intermediate between the definitive morphs, with varying amounts of streaking or coloration in the belly and wing linings.

Plate 2. Light Morph Adult Swainson's Hawk

Breeding Range

Swainson's hawks inhabit grassland plains, shrublands, and agricultural regions of western North America during the breeding season and inhabit similar habitats from Central Mexico to southern South America during the migration and winter non-breeding seasons (England et al. 1997; Airola et al. *in preparation*). Early accounts described Swainson's hawk as one of the most common raptors in the state, occurring throughout much of lowland California (Sharp 1902). Since the mid-1800s, the native habitats that supported the species have undergone a gradual conversion to agricultural uses, or as in the case of southern California coastal valleys, to urbanization. Today, with the exception of desert scrub communities in the high desert regions of the state, native landscapes that supported nesting and foraging Swainson's hawks are virtually nonexistent. This habitat loss is thought to have caused a substantial reduction in the breeding range and in the size of the breeding population in California (Bloom 1980; England et al. 1997). The current range of the species in California includes the Central Valley, the high desert regions and valleys of northeastern California, the east side of the Sierra Nevada from Owens Valley and extending southwestward into the western Mojave Desert in the vicinity of Antelope Valley (Figure 4).

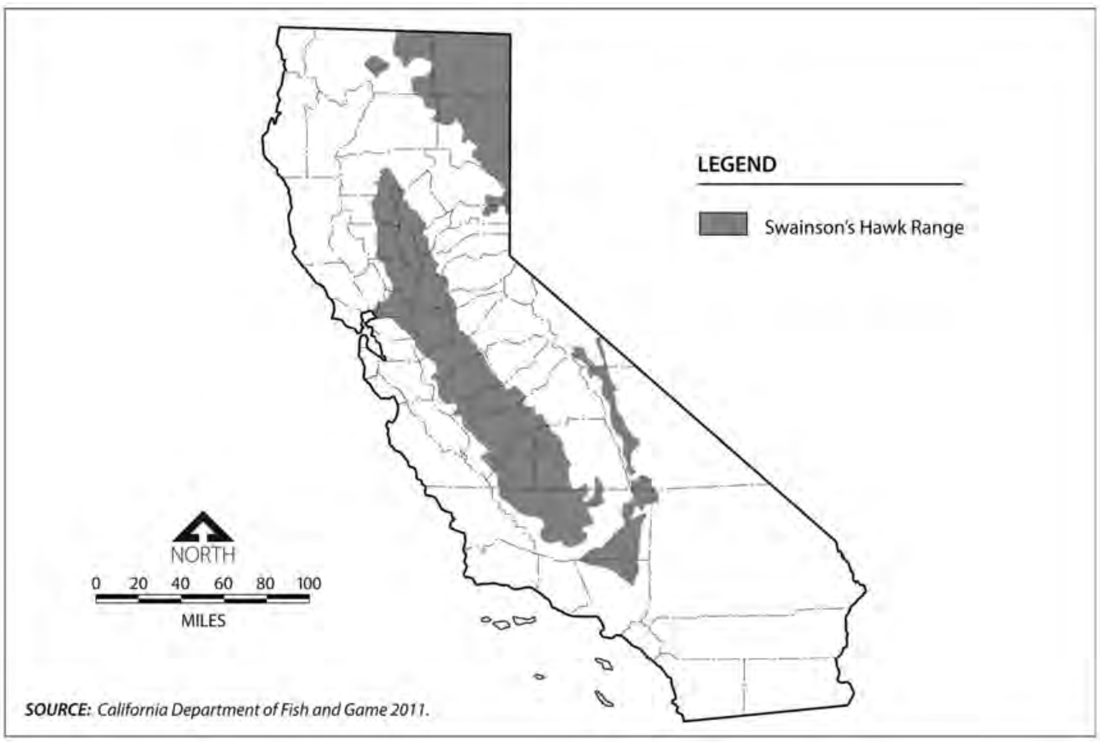


Figure 4. The breeding range of the Swainson's hawk in California.

Despite the loss of native habitats throughout the species' range in California, Swainson's hawks appear to have adapted relatively well to certain types of agricultural patterns in areas where suitable nesting habitat remains. Today, the species is most abundant in landscapes that are entirely under cultivation. The largest segment of the statewide population is in the Central Valley, with the highest nesting densities occurring in Yolo, Sacramento, Solano, and San Joaquin Counties (Bloom 1980, Estep 2007, 2008, LSA 2004, Anderson et al 2007), and where the species is nearly entirely dependent on cultivated foraging habitats. The nesting distribution in the Central Valley follows the distribution of suitable hay, grain, and row crop agriculture compatible with the foraging requirements of the Swainson's hawk and where it occurs in association with suitable nesting habitat (Anderson et al. 2007, Estep and Dinsdale 2012).

The Swainson's hawk has also shifted its distribution throughout the high desert region of northeast California to take advantage of cultivated habitats, where it occurs in greater breeding densities than it does in most native deserts or shrublands (Woodbridge 1991). The same association with cultivated habitats has occurred along the east side of the Sierra Nevada and the Mojave Desert (Estep 2013).

Habitats and Habitat Use

Nesting

Nesting habitat is variable throughout the species range. In the Central Valley, Swainson's hawks nest in large native trees such as valley oak (*Quercus lobata*), cottonwood (*Populus fremontia*), walnut (*Juglans californica*), and willow (*Salix* spp.), and in nonnative trees, such as eucalyptus (*Eucalyptus* spp.) and ornamental pine trees. Prior to agricultural conversion, Central Valley populations nested primarily in riparian woodlands and on the edges of oak woodlands. Today, in addition to riparian and remnant oak woodlands, the species nests in roadside trees, trees along field borders, isolated trees, trees around farm houses and farmyards, and in urban areas that are adjacent to cultivated lands (England et al. 1995, Estep 2007, 2008) (Plate 3).

Use of eucalyptus trees increases southward into the San Joaquin Valley where rows and groves of eucalyptus trees have been planted for wind breaks, visual screens, or ornamental trees. Occurring along field borders, roadsides, and around farm residences, eucalyptus trees have replaced native species in many areas and throughout large areas are the only available nest trees for Swainson's hawks. The majority of native trees throughout much of the San Joaquin Valley are restricted to riparian corridors (Estep and Dinsdale 2012).

In the high desert regions, the most common nesting habitats were juniper (*Juniperus* spp.) trees in northeastern California and Joshua trees (*Yucca brevifolia*) in the Mojave-Colorado desert region. Today, with the expansion of cultivated lands in these high desert areas, nest sites are also found in a variety of non-native trees planted in agricultural areas along field borders, roads, and around farmyards (Bloom 1980, Woodbridge 1991, Estep 2013). .

Nesting pairs are highly traditional in their use of nesting territories. Many monitored nesting territories in the state have been occupied annually since at least the early 1980s and banding studies conducted since 1986 confirm a high degree of territory and mate fidelity (Woodbridge 1991, Briggs 2007, Estep *in progress*).

Plate 3. Typical Swainson's hawk nest in a willow tree (center of photo). Nests are often inconspicuous and difficult to see. The white objects in the nest are downy nestlings.

Foraging

Swainson's hawks are plains or open-country hunters, requiring large open landscapes for foraging. Historically, the species hunted the grasslands of the Central Valley and coastal valleys and the open desert scrub and shrublands in high desert regions. With the cultivation of virtually all of the Central Valley, and a portion of the high desert region, Swainson's hawk foraging has largely shifted onto agricultural lands that provide a dynamic, regularly manipulated landscape that maximizes prey populations and accessibility of rodent prey (Estep 1989, Babcock 1995, Woodbridge 1991).

Foraging habitat use, particularly agricultural foraging habitat, is largely a function of two primary variables: abundance of prey and amount of vegetative cover that affects access to prey (Bechard 1982, Estep 1989, 2009). Suitability is in part a function of changing vegetation structure throughout the growing season, which influences prey accessibility. Agricultural cover types that provide suitable foraging habitat conditions include hay, grain and row crops, fallow fields, and irrigated and dryland pasture. The matrix of these cover types can create a dynamic foraging landscape as temporal changes in vegetation results in changing foraging patterns and foraging ranges (Estep 1989, Babcock 1995). Uncultivated habitats, such as grasslands, shrub-steppe communities in northeastern California, and desert scrub in the Mojave Desert provide more stable, consistent habitat value, but probably do not provide the extent of available prey resources that would support the high breeding densities found in some cultivated habitats.

Within the cultivated landscape, hay crops, particularly alfalfa, provide the highest value because of the low vegetation structure, relatively large prey populations, and because farming operations such as periodic mowing enhance prey accessibility (Plate 4). Foraging studies have demonstrated that use of alfalfa fields is significantly greater than other crop types (Anderson et al. in preparation). Most row and grain crops are planted in winter or spring and have foraging value while the vegetation remains low, but become less suitable as vegetative cover and density increases (Plate 5). During harvest, vegetation cover is eliminated while prey populations are highest, enhancing their suitability during this period. Some crop types, such as orchards, provide little to no value because of reduced accessibility and relatively low prey populations.

Plate 4. Alfalfa fields have consistently low vegetation structure and can support abundant and highly accessible rodent prey.

Plate 5. Prey are less accessible to foraging hawks in mature wheat fields and many other crop types due to tall, dense vegetation until harvest when accessibility is maximized.

Home Ranges

Home ranges are highly variable depending on cover type, and fluctuate seasonally and annually with changes in vegetation structure (e.g., growth, harvest) (Estep 1989, Woodbridge 1991, Babcock 1995). Fleishman et al. 2016 also found that home range size was associated with life stage (e.g., arrival, pre-hatching, nestling, pre-migratory) and nesting status. Studies conducted in the 1980s and 1990s in the Central Valley found that home range size ranged from 830 to 21,543 acres (336 to 8,718 ha) (Estep 1989, Babcock 1995). Fleishman et al 2016 reports larger home ranges from 21,489 acres (8,696 ha) to 45,502 acres (18,414 ha), due in part to including arrival and pre-migratory life stages, periods when home range size was found to be larger and that were not entirely included in earlier studies. Smaller home ranges during the pre-hatching and nestling phases of the breeding cycle may be related to nest provisioning activity. At sites where nests failed, home range expanded (Fleishman et al 2016). Smaller home ranges generally consist of high percentages of alfalfa, fallow fields, and dry pastures (Estep 1989, Woodbridge 1991, Babcock 1995). Larger home ranges were associated with higher proportions of cover types with reduced prey accessibility, such as orchards and vineyards, or reduced prey abundance, such as flooded rice fields. Swainson's hawks regularly forage across a very large landscape compared with most raptor species. Because of their ability to rapidly move long distances, it remains energetically feasible for Swainson's hawks to successfully reproduce when food resources are limited around the nest and large home ranges are required (England et al. 1995) (Plate 6).

Plate 6. Swainson's hawk morphology is ideal for long-distance movements that allow it to expand its home range area in response to changing food resources in agricultural landscapes.

Breeding Season Phenology

Swainson's hawks arrive on their breeding territories from mid-March to early-April. Breeding pairs immediately begin constructing new nests or repairing old ones. Eggs are usually laid in April, and incubation continues until mid-May when young begin to hatch. The brooding period typically continues through early July when young begin to fledge (England et al. 1997) (Plate 7). Studies conducted in the Sacramento Valley indicate that one or two—and occasionally three—young typically fledge from successful nests, with an average of 0.8 to 1.5 young per occupied nest (Estep 2007, 2008, ICF 2012). After fledging, young remain near the nest and are dependent on the adults for about 4 weeks, after which they permanently leave the breeding territory (Anderson et al. *in progress*). By mid-August, breeding territories are no longer defended and Swainson's hawks begin to form communal groups. These groups typically begin their fall migration from late August to mid-September.

Central Valley Swainson's hawks winter from Central Mexico to Central and South America (Airola et al. *in preparation*). This differs from what is known about the migratory pattern and wintering grounds of Swainson's hawk populations outside of the Central Valley, most of which take a different migratory route through Mexico and winter entirely in southern South America, with the largest wintering populations known to occur in northern Argentina (Kochert et al 2011).

Plate 7. Nearly Fledged Swainson's Hawks

Statewide Population Status

Data have been collected on the distribution and abundance of Swainson's hawk in California since the late 1970s. Bloom (1980) conducted the initial statewide survey that estimated a 90% reduction in the historic population and that led to the state-listing of the species in 1983. At that time, the statewide estimate of breeding pairs was 375 (Bloom 1980). Beginning in the early 1980s, long-term monitoring of selected survey sites in the Central Valley was conducted to assess population trends. In 1988, CDFW conducted a second and more intensive statewide survey and using density data from the long-term monitoring sites, recalibrated the statewide estimate to 550 breeding pairs (CDFW 1988). Neither the initial Bloom (1980) nor the CDFW 1988 statewide surveys were conducted using a standardized survey protocol that would lend itself to statistical analysis sufficient to reliably estimate the statewide population. Thus, it was later acknowledged that these early statewide estimates did not necessarily represent an accurate estimate of the statewide population and were cautiously used to describe the status of the species. The survey efforts were, however, important in establishing the current distribution of the species in California.

Since the mid-1980s, several regional and statewide surveys, long-term monitoring efforts, and research studies have been conducted in the Central Valley and in northeastern California, providing additional information on distribution and abundance and life history of the species. As a result of these efforts and the increasing understanding of Swainson's hawk distribution and abundance, but still in the absence of any statistically-based analysis, the Swainson's Hawk Technical Advisory Committee (TAC) – an ad hoc group of researchers that conducts and facilitates research on the Swainson's hawk and advises CDFW and local jurisdictions regarding Swainson's hawk ecology – provided a new estimated population range. In 2001 the TAC conservatively estimated that there were between 700 and 1,000 breeding pairs in the state with approximately 90% of these in the Central Valley.

Finally, in an effort to more conclusively estimate the population size, CDFW, with the assistance of UC Davis and the TAC began a comprehensive, standardized, statistically-based statewide survey effort in 2005 (Anderson et al. 2007). Using a standardized sampling approach across the current range of the species in California, the population is currently estimated at 2,072 breeding pairs (SE = 157.1 at 95% CI), 1,948 (94%) of which are estimated to occur in the Central Valley (Anderson et al. 2007). This is considered the most reliable estimate to date and is thought to more accurately reflect the total number of breeding pairs in the state.

The extent to which this revised statewide estimate reflects simply a more accurate estimation or whether it may represent an increasing population since the early 1980s is unclear. More recent regional census-level surveys conducted in the Central Valley have identified large and more robust breeding populations than had been previously identified including as many as 300 breeding pairs in Yolo County (Estep 2007) and as many as 300 breeding pairs within the Bay-Delta Conservation Plan Area (ICF 2012) centered in the Sacramento-San Joaquin River Delta. Recent anecdotal information also suggests some re-colonization into some areas thought to have been previously extirpated, such as the Napa Valley. However, a long-term population study in Yolo County from 1986 to present indicates that following an initial increase in population in the late-1980s – which could be attributed to refined survey technique and increased survey experience – this population remained relatively stable from the late 1980s to present (Estep *in progress*), suggesting that the current higher statewide estimate may also be due in part to more complete survey and more reliable estimation techniques.

Despite some level of uncertainty regarding the change in population size since the late 1980s, the current statewide estimate still constitutes an estimated 50 to 90 percent reduction in the estimated historic population (Bloom 1980).

Central San Joaquin Valley Status

Compared with the southern Sacramento and northern San Joaquin Valley regions, relatively little work has been conducted in the San Joaquin Valley south of San Joaquin County. Reported nesting occurrence data are primarily from project-specific surveys. In 2011, a comprehensive survey was conducted throughout a large portion of Kings and

Fresno Counties. These census-level surveys were conducted to determine the distribution and abundance of the species in the vicinity of multiple proposed solar energy projects. The survey area encompassed 1,029,785 acres (1,609 square miles) extending from approximately Mendota on the north to Kettleman City on the south and from Coalinga on the west to Hanford on the east. Data from the combined survey area revealed a total of 90 occupied Swainson's hawk breeding territories, or 0.06 per mi^2 (Estep and Dinsdale 2012). Results indicated a low breeding density compared with the southern Sacramento Valley, where density ranged from 0.37 per mi^2 in Sacramento County to 0.38 per mi^2 in Yolo County (Estep 2007, 2008). The nesting distribution was also greatly skewed toward the eastern side of the San Joaquin Valley, along and east of the Fresno Slough/Kings River corridor, where potential nest trees are substantially more abundant and crop patterns more compatible with Swainson's hawk foraging. In this area, the nesting population is fairly robust at approximately 0.18 breeding territories per mi^2. The nesting population west of the Fresno Slough/Kings River corridor is very sparse due primarily to the lack of trees and the increasing extent of orchard-dominated agriculture, which is unsuitable foraging habitat for the Swainson's hawk.

Population Declines and Factors Affecting Distribution

Initial population declines of Swainson's hawk in California were attributed to loss of habitat from urbanization and conversion of native habitats to agriculture. Urbanization, agricultural conversion, channelization of watercourses and other factors have reduced the extent of nesting habitat (e.g., riparian forests, oak woodland, desert woodland) and foraging habitat, primarily native grasslands, shrub-steppe communities, and to a lesser extent desert scrub. However, the species appears well adapted to certain agricultural landscapes and where patterns are compatible with the foraging requirements and behavior of the species, Swainson's hawks can occur in very high breeding densities.

As a result of habitat loss, the species is no longer found in the coastal valleys of southern California and is reported infrequently in central coast valleys. The species has persisted, however, in much of the Central Valley, particularly in the southern Sacramento and northern San Joaquin Valleys. While intensively farmed for over 100 years, much of this area between Stanislaus County on the south and Butte County on the north, retains a relative abundance of nesting habitat – narrow riparian corridors along rivers and streams, remnant oak groves and trees, roadside trees – and an agricultural pattern that is compatible with Swainson's hawk foraging requirements. Thus, the species is relatively common in the central portion of the Central Valley and perhaps on a local basis - even more common than it was historically. Populations in the central and southern San Joaquin Valley are more localized due to the more limited extent of suitable nesting and foraging habitats (Estep and Dinsdale 2012). Today, the distribution and abundance of the Swainson's hawk in the Central Valley is primarily a function of agricultural patterns and nest tree availability. Swainson's hawks are dependent on an agricultural landscape that provides available and accessible food resources and suitable nesting habitat. Where these suitable landscapes are lacking, Swainson's hawks occur in less abundance.

In general, the agricultural landscape of the San Joaquin Valley supports relatively few nesting Swainson's hawks compared with other regions of the Central Valley. South of Stanislaus County, the agricultural landscape becomes increasingly monotypic with large expanses devoted to vineyards and orchards, which are not compatible with Swainson's hawk foraging. But probably most important is the lack of trees throughout much of the San Joaquin Valley, which is likely the main factor limiting the distribution of the Swainson's hawk in that area. Where trees do occur, including riparian habitat along natural drainages, planted eucalyptus tree rows and groves, and remnant oak woodland habitat, Swainson's hawks do occur as long as suitable agricultural foraging habitat is nearby.

Unlike the Sacramento Valley, urbanization in the San Joaquin Valley region has had less influence on the distribution and abundance of nesting Swainson's hawks. Instead, the agricultural matrix and the relative lack of suitable nest trees are the principal factors affecting the distribution and abundance of the species in the San Joaquin Valley region.

Conservation and Management

Today, the Swainson's hawk is reliant on certain types of agricultural land uses, remaining grasslands, and desert scrub communities. With the bulk of the statewide population occurring in association with cultivated lands, changes in agricultural patterns in particular, can have a significant influence on the distribution and abundance of the species. Because of the inherent conflicts between urbanization, the preservation of agricultural and valley grassland habitats, and compliance with state laws and regulations, land use-related impacts that affect the Swainson's hawk continues to be a key issue for land use decision-making.

In 1994, Region 2 of CDFW, which included the Sacramento Valley and the largest proportion of nesting Swainson's hawks in the state, took an initial step in addressing the issue of habitat conservation for Swainson's hawks by issuing guidelines for mitigating development-related impacts (California Department of Fish and Game 1994). The guidelines were developed primarily to address the increasing extent of agricultural habitat loss from urbanization in the Sacramento region. Since then, CDFW's mitigation guidelines have been used by local agencies as a method to mitigate habitat impacts on individual development projects pursuant to the provisions of CEQA. In an effort to standardize mitigation costs for impacts to Swainson's hawk habitat and consolidate conservation efforts, some local agencies established ordinances or similar programs that required payment of mitigation fees. The fees are applied to all development projects that would remove Swainson's hawk habitat and used to compensate for this loss through acquisition and management of offsite lands.

Concurrent with these activities, larger regional habitat conservation plans were also being considered or developed for lands within the range of the Swainson's hawk. Driven by the presence of federally listed species, habitat conservation plans (HCPs) are prepared pursuant to Section 10 of the federal Endangered Species Act under consultation with the U.S. Fish and Wildlife Service. State-listed species can be included as ‘covered’ species in HCPs under agreement and permit authorization of CDFW (Section 2081 or 2080.1 of Fish and Game Code). At the state level, Natural Community Conservation Plans (NCCPs) can also be prepared pursuant to Fish and Game Code (Sections 2800-2835) to provide a means of complying with the California endangered species act (CESA). An NCCP is similar to an HCP in that it is designed to protect and conserve intact natural landscapes and biological communities, biological diversity, and species listed under CESA while allowing appropriate development and economic growth. The HCP and NCCP processes can provide a more regional approach to addressing impacts and mitigation and potentially allowing for consolidation of conservation lands and a greater potential for conservation at a regional population level. Several multispecies HCPs have either been completed (e.g., Natomas Basin, San Joaquin County) or are in preparation (e.g., South Sacramento County) and several others are in progress that combine the HCP and NCCP processes (e.g., Yolo County, Solano County, Butte County) within the range of the Central Valley population of Swainson’s hawk.

State Regulations and Agency Guidance

The Swainson’s hawk was listed as a state-threatened species by the California Fish and Game Commission in 1983 largely as a result of Bloom’s (1980) statewide survey and status assessment conducted in the late 1970s that estimated a population decline of greater than 90 percent. Species that are listed as threatened or endangered receive protection under the provisions of the California Endangered Species Act (CESA) (Section 2050 of the Fish and Game Code), and related Fish and Game Code Sections, including Section 2080 that prohibits the "take" of any threatened or endangered species. Take is defined in Section 86 as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill.”

While not specifically defined in the definition of take, loss of essential habitat can result in the direct or indirect loss of breeding territories and reproductive potential leading to further population declines, and thus can potentially be included in the definition of take. However, most habitat-related impacts on the Swainson’s hawk are addressed through CEQA.

CEQA defines the significance of an impact on a state-listed species based on the following:

- Appendix G of the State CEQA guidelines states that a biological resource impact is considered significant (before considering offsetting mitigation measures) if the lead agency determines that project implementation would result in “substantial adverse effects, either directly or through habitat modifications, on any species identified as being a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by CDFW or USFWS”; and

- CEQA Section 15065 (Mandatory Findings of Significance), a biological resource impact is considered significant if the project has the potential to “substantially reduce the number or restrict the range of an endangered, rare or threatened species".

It has been pursuant to both the CESA and CEQA processes that mitigation and management, including the development of regional strategies, have been developed to address land use issues related to Swainson's hawk conservation.

The 1994 CDFW Region 2 guidelines are often considered at the local jurisdiction level during CEQA review of individual proposed projects, including solar development projects. The guidelines outline methods for conducting nest surveys and avoidance or minimization of impacts to active nest sites from project elements that may result in nest abandonment or otherwise affect the integrity of the breeding territory. The guidelines also recommend acquisition of replacement lands (i.e., compensatory mitigation) for projects that meet criteria that would presumably result in the loss of foraging habitat sufficient to be considered 'significant' pursuant to CEQA definition.

The guidelines then establish that the determining criteria for CEQA significance is removal of any suitable foraging habitat within 10 miles of an active nest, which is defined as a nest active at any time during the previous 5 years. The guidelines provide no further rationale or guidance for determination of a significant impact including the size of the potentially affected population, availability of habitat, the quality or suitability of existing habitat, the long-term sustainability of existing habitat, or the size of the project relative to available habitat. Most importantly, it is unclear how this aspect of the guidelines is consistent with the CEQA significance criteria noted above. The guidelines do, however, allow for independent assessment of impacts and development of a conservation strategy as an alternative to the guidelines. As a result, this study was undertaken to assess the effects of the proposed project by providing information on land use and nesting distribution and abundance and to make a significance determination based on a more robust biological rationale.

Section 2. Description of the Study Area

A minimum 10-mile radius study area was established around the proposed SGF site (See Methods Section) (Figure 5), that encompasses a total of 252,225 acres (394 square miles). The SGF site is located within cultivated farmlands northwest of the small farming community of Stratford. The site is entirely agricultural and consists of periodically cultivated pasturelands and other cultivated lands. There are no trees, shrubs, or other natural vegetation on the site and no topographical or unique biological features on the site.

Most of the immediately surrounding area consists of annually cultivated irrigated cropland, primarily in the cotton-wheat-tomato rotation. However, orchards are also present within 1.5 miles northwest and 0.4 miles east of the project site. A water treatment facility is located 1 mile north of the project site and the community of Lemoore Station is approximately 1.5 miles north of the project site on the north side of State Route 198. The existing RE Mustang, RE Orian, and RE Kent South project site is contiguous with the northwest corner of the project site on the west side of 25th Avenue (Appendix A, Figure A-6)

There are no trees on or within 0.5 miles of the project site, and very few trees occur in the vicinity of the project site (Appendix A). A one-mile-long row of eucalyptus trees extends along the northern edge of State Route 198 extending westward from 25th Avenue and a smaller row of eucalyptus trees occurs along the north side of the water treatment facility 1.3 miles north of the project site. The nearest trees are 0.6 miles east of the project site along the Kings River.

Most of the SGF study area can be similarly characterized; however, there are differences in the agricultural landscape and the abundance of trees east and west of the Kings River, the most prominent natural feature in the study area. The Kings River supports a narrow riparian corridor extending north to south through the eastern half of the study area. The north, south, and Clarks forks of the river extend generally east to west and meet near the north-central portion of the study area. The river then turns southward and extends south of Stratford until it becomes channelized and terminates at the Tulare Basin (Figure 5, Figure A-7).

With the exception of the communities of Lemoore, Stratford, Lemoore Station, developed portions of the Lemoore AFB, several existing solar energy facilities, and several large dairy or other farm complexes, the entire study area is under agricultural production (Appendix A). In general, the study area can be characterized as a matrix of annually rotated irrigated crops, semi-perennial hay crops (e.g., alfalfa and irrigated pasture), and perennial crops (orchards and vineyards). The most common annually rotated crop types in the study area, and throughout Kings County (Kings County 2015) are cotton, wheat, corn, and tomatoes. These, along with alfalfa and orchard/vineyards, make up the majority of the agricultural landscape in the study area.

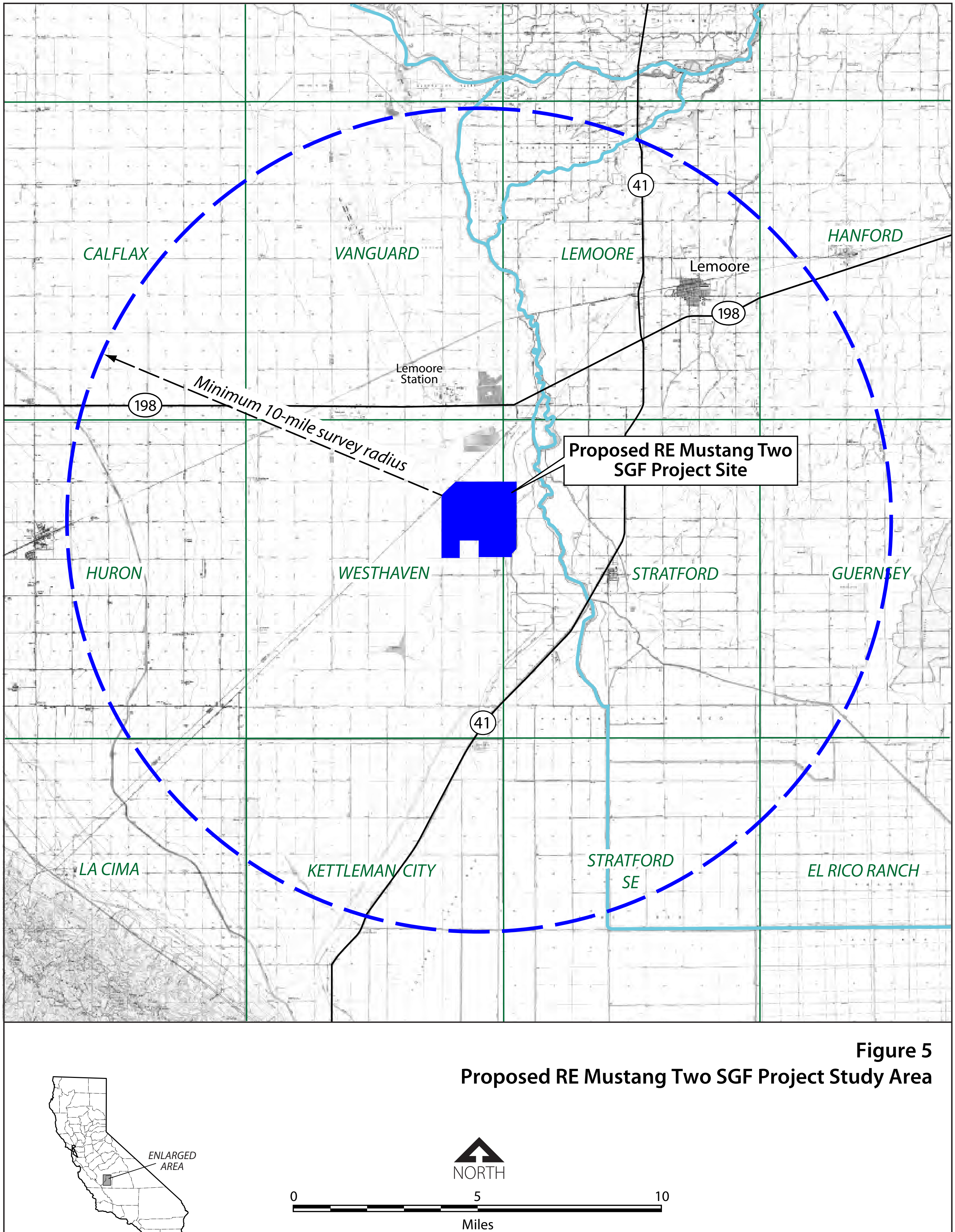


Figure 5
Proposed RE Mustang Two SGF Project Study Area

8/1/2016

However, the portion of the study area east of the Kings River is somewhat more diverse and includes most of the alfalfa and irrigated pasture. These types are typically associated with dairies, which are also primarily located in the eastern portion of the study area. The agricultural landscape west of the Kings River is mostly in the typical cotton-wheat-tomato rotation with an increasing extent of orchards, and is generally characterized by larger, parcel sizes and fewer trees (Appendix A) (Plates 8 and 9).

Plate 8. East of the Kings River, land use is more conducive to Swainson's hawk nesting and foraging with a greater proportion of higher value crop types and more suitable nesting trees, such as this alfalfa field and adjacent tree row.

Plate 9. West of the Kings River, the dominant agricultural patterns and lack of trees is less conducive to Swainson's hawk nesting and foraging

Trees are unevenly distributed throughout the study area (Appendix A). Very few trees occur west of the Kings River corridor and are generally limited to trees associated with farm residences, eucalyptus tree rows, or the occasional isolated tree (Plate 10). East of the Kings River, trees are more abundant. Riparian woodland and forest is limited mainly to the Kings River (Plate 11) and occasional riparian stringers along smaller sloughs or channels. Portions of the South and Clarks forks support relatively dense and continuous oak-cottonwood riparian woodland, while much of the North Fork supports dense to intermittent willow-cottonwood dominated riparian. Eucalyptus tree rows and groves are the most common non-riparian tree type in the study area (Plate 12); however, isolated valley oak and tree rows dominated by valley oak or cottonwood trees also occur east of the Kings River.

Plate 10. Typical isolated tree west of the Kings River.

Plate 11. Riparian habitat along the North Fork Kings River.

Plate 12. Eucalyptus tree row along Highway 198. Eucalyptus is among the most common tree species in the study area occurring as tree rows, groves, and occasionally as isolated trees.

Section 3. Methods

Assessment of Populations

The goal of the nesting survey was to record all active Swainson's hawk nests within the study area. While the survey focused primarily on nesting Swainson's hawks, activity and nesting data were also collected on several other species that compete for nesting and/or foraging habitat resources and may influence the distribution and abundance of Swainson's hawk, including red-tailed hawk (*Buteo jamaicensis*), red-shouldered hawk (*Buteo lineatus*), great-horned owl (*Bubo virginianus*), and common raven (*Corvus corax*). The intent was to generally indicate how these species were distributed across the landscape and to compare the differences in distribution, abundance, and habitat characteristics.

The study area was selected by establishing a minimum 10-mile radius area extending from the edges of the project site boundary. Because the SGF site is irregularly shaped, the study area was expanded outward until a circular-shaped study area was achieved. As a result, the SGF study area is greater than a 10-mile radius and includes a total of 252,225 acres, or 394 square miles.

Surveys were conducted over 26 survey days between April 20 and July 15 to encompass the late incubation/nestling phase through the early fledgling phase of the reproductive cycle. The survey was designed as a complete census. All potential nesting areas within the study areas were surveyed equally according to the protocol described below regardless of past survey effort or existing data on Swainson's hawk nests. Surveys were conducted in two main phases, during the late brooding/early nestling phase from April 20 to May 31, and during the late nestling – to late fledging phase from June 1 to July 15. Conducting an early and later survey ensures that all active nesting territories are documented and that failed nests and nests abandoned later in the breeding season are not missed as they may be if only a June survey were conducted. It also provides a second follow-up opportunity to resurvey all areas in the event any active sites were missed during the first survey, and allows for documentation of reproductive performance.

Surveys were conducted by systematically driving all available roads within the study area. Where roads were not available to drive or where there were no roads to access potential nest trees, the survey was conducted on foot unless access to private property was not granted. In general, access in the study area was very good and I was provided access and gate keys to all levees maintained by the Kings River Conservation District. All potential nest trees were searched for nests and adult Swainson's hawks using binoculars and/or a spotting scope. Photographs were taken of each active nest site and surrounding land use.

All suitable nesting habitats were checked for the presence of adult Swainson's hawks and to note all nesting activity and behavior (e.g., nest construction, courtship flights, defensive behavior). All trees were searched for the presence of active nests. Nest site and habitat data were recorded on a standardized field form. Activity was noted and mapped on field maps; locations of active nests were documented on 7.5 minute USGS quadrangle maps and a hand-held GPS unit was used to record coordinates of each nest. Follow-up surveys were conducted as needed until all potential habitats were inspected. As necessary, each active nest was revisited to determine activity and reproductive status and to record the number of fledged young. Many nesting territories were visited on multiple occasions over the course of the survey in order to collect the necessary data.

Activity data were recorded based on the following definitions:

- *Occupied Nesting Territory:* a nesting area in which a pair of raptors display activity indicating territory establishment. Territories were considered occupied when the following activities and behaviors were observed: regular presence and activity of adults, courtship displays, circling low above the nest tree or nesting stand, defensive behavior, prey exchanges and prey delivery to the nest). The nesting territory location was plotted based on the location of the nest, or if the nest was not located based on the primary area of observed activity within potential nesting habitat.

- A*ctive Nest:* the nest within the occupied nesting territory for which egg laying) was confirmed through direct observation of incubating adults.

- *Occupied Nesting Territory with Unconfirmed Nesting Status:* occupied nesting territories for which reproductive outcome was not confirmed. This includes occupied nesting territories where access was not sufficient to determine nesting activity or where repeat visits were inconclusive in determining the success or failure of the nest.

- *Successful Nest*: an active nest that produced fledged young.

- *Unsuccessful Nesting Attempt*: an active nest that failed to produce fledged young and occupied nesting territories that did not nest.

Each occupied nesting territory was characterized with respect to overall habitat conditions and availability and land use patterns. Each active nest site was characterized with regard to nesting habitat type and condition, tree species, and estimated tree and nest height.

Distribution of Nesting and Foraging Habitats

The distribution and characterization of land uses and habitat types throughout the study area was documented and mapped in the field on twelve 7.5 minute USGS quadrangle maps (Figures A-1 through A-12 in Appendix A). I documented the current 2016 land use or cover type in the field according to the land use/cover type categories listed below.

Using the USGS base maps, field boundaries were recorded, confirmed, or adjusted as needed.

For purposes of this study, foraging habitat associations were assessed in part on the basis of broad agricultural land use categories rather than the specific cover types. The agricultural crop pattern mosaic is dynamic in the study area and throughout the San Joaquin Valley and is subject to change annually and seasonally. Therefore, with the exception of perennial and long-term crop types (e.g., vineyards, orchards, pasturelands), and semi-perennial types (e.g., alfalfa), specific agricultural crop types were grouped into broad categories that represent long-term land use patterns in the study area and that were used to characterize relative habitat suitability at the landscape level (Estep 1989, 2007, 2008, Babcock 1995, Jones & Stokes 2005). As a result, land use/cover type categories in the study area include the following:

- Irrigated cropland (annually cultivated and rotated crops)
- Alfalfa and other hay crops
- Irrigated pastureland
- Orchards/Vineyards
- Natural land (includes all uncultivated grassland and scrub natural communities)
- Developed land (excluding rural residential less than 1 acre)
- Riparian
- Tree row
- Tree grove/savanna
- Isolated trees

Following the initial field mapping of habitat/land use categories, the data were then re-mapped using aerial photos to confirm field boundaries. These maps were then converted to graphic maps using Adobe Illustrator (See Figures A-1 through A-12 in Appendix A).

Habitat/land use cover type acreages were calculated from the graphic maps using a plug-in filter from Telegraphics Inc. While this process provided an accurate representation, and particularly relative abundance of the mapped types across the landscape, it did not exclude roads, rural residences less than 1 acre, uncultivated field borders, and other edge features. As a result, the acreage totals may exceed the actual acreage for most types. However, at the scale of the study area and for purposes of this study where characterizing broader landscapes is most important, this was considered to have a negligible effect on the total calculations or the relative abundance of the various types. The distribution and abundance of Swainson's hawk was analyzed with respect to these broad habitat associations.

The data collected during this survey and assessment were not subjected to statistical analysis for purposes of analyzing habitat use preferences or differences between data sets. The data were used solely to report and describe the current nesting distribution and habitat associations of Swainson's hawk and other raptors within the study area. The data were then used to assess the significance of the removal of habitat as a result of project implementation pursuant to CEQA (See Section 6).

Section 4. Results

Distribution and Abundance

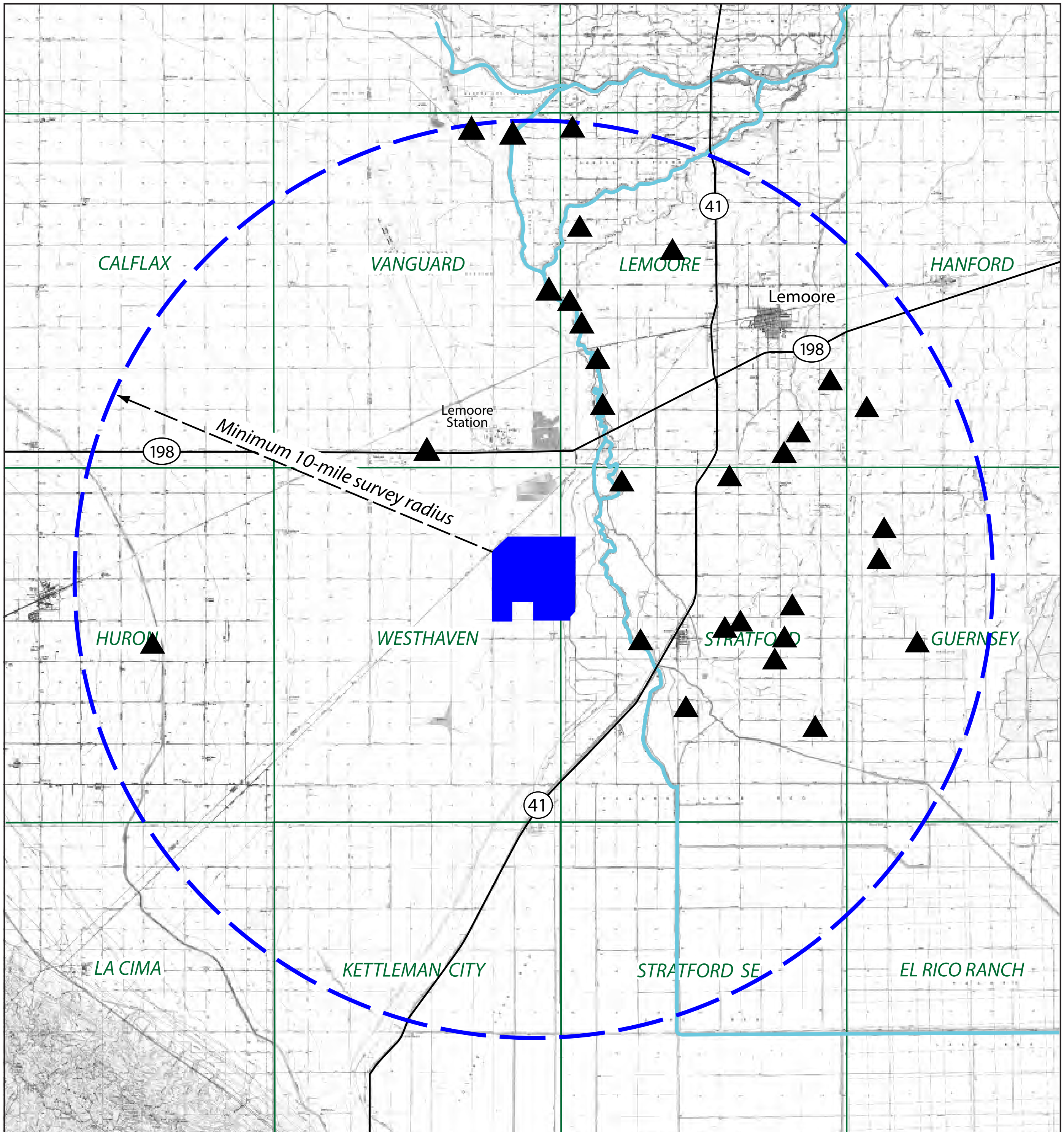
A total of 29 occupied Swainson's hawk nesting territories were documented within the SGF study area. All were confirmed active nests. Figure 6 illustrates the distribution of the nest sites within the study area, Table 1 summarizes the activity and reproductive data and Table 2 provides the location, activity, habitat association, and reproductive data for each nest. Appendix B is a summary description of most of the nest sites and an accompanying photo of the nest tree or nest area.

Confirmed nesting status (i.e., reproductive outcome) was documented at 26 of the 29 occupied nesting territories (89.7%). Of these, 22 successfully reproduced and 4 failed to successfully reproduce. Nesting status was not confirmed at the remaining three occupied nesting territories (10.3%). These include sites with observed breeding activity (e.g., regular presence and activity of the adults, courtship displays, circling low above the nest tree or nesting stand, defensive behavior, prey exchanges and prey delivery to the nest) but lacked direct access to the nesting tree and sites where follow visits did not conclusively determine reproductive performance.

Table 1. Summary of Swainson's hawk nest site data within the SGF Survey Area.

Activity		
	Number	**Percent of Total**
# Active nests – successful	22	75.9
# Active nests – failed	4	13.8
# Active nests with unknown status	3	10.3
Total Active Nests	29	100
Reproduction		
Total # young produced	32	
# young per occupied nest with known status (successful + failed)	1.23	
# young per successful nest	1.45	

Figure 6 indicates that Swainson's hawks were distributed unevenly across the study area with the largest concentrations in the eastern half of the study area. In general, the nesting distribution follows the distribution of suitable nesting habitat, which occurs along a north-south corridor along and east of the Kings River. Twenty-seven of the 29 nesting territories were along or east of the Kings River and most north of the town of Stratford (Figure 6). Relatively few nesting opportunities are available west of the Kings River corridor and south into the Tulare Basin south of Stratford due to the lack of trees and thus, while these areas support suitable foraging habitat, they support few Swainson's hawk or other raptor nest sites.



LEGEND

Proposed SGF Project Site

Study Area (minimum 10-mile radius around project site)

Swainson's Hawk Nest Site

NORTH

0 5

Miles

BASE MAP: USGS 7.5' Quadrangles

Figure 6
Swainson's Hawk Nest Sites within the Proposed Mustang Two SGF Project Study Area

8/1/2016

Table 2. Swainson's hawk nest site locations, status, and nesting habitat type within the RE Mustang Two SGF study area.

Site #	USGS Quad	Location	GPS coordinates	Status	# Yg	Nesting Habitat	Nest Tree
SH1	Lemoore	23rd Avenue 0.25 mi N of Fremont Ave.	36.369555 N 119.870399 W	S	1	Rural residential	Eucalyptus
SH2	Lemoore	Lacey Blvd, 0.5 mi E of 21st Avenue	36.327283 N 119.825777 W	S	2	Tree row – small grove	Valley oak
SH3	Lemoore	Kings River, 0.7 mi N of SPRR crossing	36.300685 N 119.868318 W	S	2	Riparian	Valley oak
SH4	Lemoore	0.5 mi S of Iona Ave, 0.25 mi E of 17th Ave	36.276602 N 119.754187 W	S	1	Tree row	Eucalptus
SH5	Lemoore	0.4 mi S of Idaho Ave, 0.5 mi E of 18th Ave	36.262679 N 119.772545 W	U	U	Tree row	Willow
SH6	Lemoore	500 ft east of 18th Ave, 400 ft N of Jackson	36.255748 N 119.778998 W	S	2	Tree row	Eucalyptus
SH7	Lemoore	Kings River, 2.5 mi N of Hwy 198 at SPRR	36.289842 N 119.863242 W	S	2	Riparian	Cottonwood
SH8	Lemoore	Kings River, 0.6 mi N of SR 198	36.269778 N 119.858618 W	S	1	Riparian	Willow
SH9	Lemoore	0.14 mi S of Geneva Ave, 0.13 mi E of 23rd	36.334615 N 119.866983 W	S	2	Isolated tree	Valley Oak
SH10	Lemoore	Kings River, 0.1 mi N of South Fork	36.307269 N 119.870678 W	S	1	Riparian	Willow
SH11	Huron	CA Aquaduct x Gale Ave	36.188829 N 120.056829 W	S	2	Riparian	Willow
SH12	Vanguard	Boggs Slough, 0.8 mi S of Elgin Ave	36.368838 N 119.916570	S	2	Riparian	Eucalyptus
SH13	Vanguard	North Fork Kings River, 0.6 mi S of Elgin	36.368147 N 119.896425 W	S	2	Isolated tree	Willow
SH14	Vanguard	Kings River, 0.3 mi S of Clarks Fork	36.314635 N 119.881816 W	F	0	Riparian	Willow
SH15	Vanguard	Hwy 198, 0.1 mile E of 27th Ave.	36.255856 N 119.938651 W	S	1	Tree row	Eucalyptus
SH16	Hanford	0.25 mi N of Idaho, 0.1mi E of 16th Ave	36.273179 N 119.742845 W	U	U	Tree row	Eucalyptus
SH17	Guernsey	Jacobs Sl., 700' N of Kent, 0.5 mi W of 15th	36.227580 N 119.731309 W	S	1	Riparian - sparse	Cottonwood
SH18	Guernsey	Jacobs Sl, 0.3 mi S of Kent Ave.	36.221177 N 119.737578 W	S	2	Riparian	Willow
SH19	Guernsey	Laurel Ave and 14 ½ Ave	36.188933 N 119.718020 W	F	0	Isolated tree	Eucalyptus
SH20	Stratford	Kings River, 0.6 mi S of Jackson Ave	36.246082 N 119.851033 W	S	1	Riparian	Willow
SH21	Stratford	0.1 mi W of 19th Ave, 0.4 mi N of Jersey Ave	36.246438 N 119.801194 W	S	2	Tree row	Willow
SH22	Stratford	0.25 mi N of Lansing Ave, 0.2 mi E of 18th	36.200231 N 119.776709 W	S	1	Isolated tree	Willow
SH23	Stratford	Lansing Ave at 19th Ave	36.195589 N 119.798927 W	F	0	Eucalyptus grove	Eucalyptus
SH24	Stratford	0.2 mi S of Lansing, 0.2 mi W of 19th Ave.	36.193827 N 119.802210 W	S	U	Eucalyptus grove	Eucalyptus
SH25	Stratford	18th Ave at Laurel Ave	36.189685 N 119.780091 W	S	2	Isolated roadside tree	Eucalyptus

SH26	Stratford	Laurel Ave, 0.2 mi E of Kings River	36.189318 N 119.842273 W	F	0	Roadside tree row	Eucalyptus
SH27	Stratford	Lincoln Ave, 0.2 mi W of 18th Ave	36.182130 N 119.783396 W	S	1	Isolated tree	Willow
SH28	Stratford	20 ½ Ave, 0.3 mi S of Madison Ave	36.162745 N 119.824013 W	U	U	Small grove	Eucalyptus
SH29	Stratford	Medford Ave, 0.4 mi W of 17th Ave	36.159800 N 119.769164 W	S	1	Tree row	Eucalyptus

S = Successful, F = Failed, U = undetermined

Reproduction

Reproductive performance is calculated on the basis of the number of fledged young. While data are collected on the number of nestlings at various ages, these data are inconsistent due to the inability to observe nests sufficiently to confirm the number of nestlings from all nests at various stages of the breeding cycle. Data on the number of eggs per nest are also not calculated because of the risk of nest abandonment during the sensitive incubation phase of the breeding cycle.

A total of 32 fledged young were recorded. This equates to 1.23 young per nesting attempt and 1.45 young per successful nest, which is generally consistent with other past and ongoing studies of Swainson's hawk in the Central Valley (Estep *in progress*, 2007, 2008, ICF 2015). However, these results, which are consistent with other monitored Central Valley Swainson's hawk populations, are lower than most populations outside of the Central Valley. One speculative explanation for this is the dynamic nature of Central Valley agricultural systems. While the diverse matrix of cover types and the planting and harvesting regimes can produce periodic surpluses of rodent prey, the growth and harvesting of crops also creates an inconsistent surplus forcing birds to hunt further from the nest during some portions of the breeding season and possibly contributing to lower reproductive success per nesting pair.

Nest Density

Nesting density, based on the number of active nest sites per square mile, across the study area was 0.08 active nest sites/mile^2 (0.03/km^2). This is a low nesting density compared with the Sacramento Valley breeding populations (e.g., 0.38 /mile^2 [0.15 km^2] in Yolo County [Estep 2008]), but similar to other portions of the breeding range (Schmutz 1987, Bednarz et al. 1990, Woodbridge et al 1995) and similar to that found in the larger Estep and Dinsdale 2012 study in the Central San Joaquin Valley (0.06/mile^2 , 0.02/ km^2)

Proximity of Nest Sites to the Project Site

Figure 6 and Figures A-1 through A-12 in Appendix A illustrates the geographic relationship of the project site to the 29 Swainson's hawk nest sites in the study area. Of the 29 nest sites, none are within 1 mile of the project site, two are within 1 to 2 miles, seven are within 2 to 5 miles, and 20 are within 5 to10 miles of the project site.

Habitat Associations

Figures A-1 through A-12 in Appendix A illustrate the distribution of land use/cover types across the entire 252,225-acre study area. Table 3 summarizes the acreages and relative abundance of each of the eleven defined cover types in the study area.

Table 3. Land use acreage totals within the SGF Study Area (*suitable foraging land use types are highlighted in green, suitable nesting types are highlighted in orange, unsuitable types are highlighted in blue*).

Land Use Type	Acres	Percent of Total
Irrigated Cropland	189,376	75.1
Orchard/Vineyard	33,836	13.4
Alfalfa Hay	11,409	4.5
Developed Land	7,864	3.1
Irrigated Pasture	2,744	1.1
Solar Energy Facilities	2,454	1.0
Natural Land	1,613	0.6
Riparian	1,450	0.6
Tree Row	616	0.2
Open Water	569	0.2
Grove/Savannah	294	0.1
Total Acreage	252,225	
Total Suitable Foraging	205,142	81.3
Total Suitable Nesting	2,360	0.9
Total Unsuitable	44,723	17.7

Foraging Habitat

Land Use/Cover Types Suitable as Swainson's Hawk Foraging Habitat. Within the study area, lands uses considered suitable for Swainson's hawk foraging included irrigated croplands, alfalfa and other hay fields, irrigated pastures, and natural lands. A total of 205,142 (81.3%) acres of the study area is considered suitable Swainson's hawk foraging habitat (Table 3). The following describes the land use/cover type categories that are considered suitable as Swainson's hawk foraging habitat.

- Irrigated Cropland. This type is defined as areas that are dominated by crop patterns that involve annual or seasonal cultivation and rotation. This is the dominant cover type in the study area comprising approximately 75.1% of the land area (Table 3). While there are smaller acreages of several other crop types within this category, the majority of acreage within this type in the study area and throughout Kings County includes, in order of total acreage, 1) cotton, 2) wheat, 3) Corn, and 4 (tomatoes).

These four crop types comprised approximately 31% of the total agricultural land use acreage in Kings County in 2015, and 53% of all cultivated lands (excluding pasture lands) (Kings County 2015). Annually rotated irrigated cropland has declined in the study area and in overall proportion of harvested acreage in Kings County in recent years. This is presumably due at least in part to the proliferation of orchards.

A typical crop rotation in Kings County includes cotton, wheat, and tomatoes. With milk products as the number one commodity in Kings County, the many dairies support the continuation of a variety of silage and hay crops including corn, wheat, sorghum, and triticale (Kings County 2015). However, during the field surveys it was noted that several dairies, which occur primarily east of the Kings River, have closed and much of the lands formerly supporting silage crops have converted to orchards. Alfalfa is also an important part of this rotation, but as noted below alfalfa hay will remain for several consecutive seasons, and thus is not included in this category.

Annually rotated irrigated crops are generally characterized as having seasonal or fluctuating foraging habitat value depending on the planting and harvesting regime and vegetation structure (Estep 2009). For example, tomatoes are planted in the spring and vegetation height and density increases throughout the breeding season. Rodent populations increase during this period, but prey accessibility (and foraging use) decreases due to increasing vegetation height and density (Bechard 1982, Estep 2009). When tomatoes are harvested in July/August, prey accessibility increases when rodent populations are at their highest and the value and foraging use of tomato fields reaches its peak (Plate 13).

Each crop type within the category undergoes a similar temporal change in value and use; however, the timing is different for each. Some crop types, including cotton and corn have limited value because their vegetation structure precludes foraging relatively early in the breeding season, prey populations are generally lower in these crop types, and harvesting often occurs after Swainson's hawks have begun fall migration.

In general, however, irrigated croplands as a whole are considered to have at least moderate foraging value due to the matrix of different crop types across the agricultural landscape, the seasonal value of certain types such as tomatoes and wheat, and the seasonal or annual rotation practices.

Plate 13. The foraging suitability of most row and field crops, like this tomato field, is seasonally variable as changing vegetation height and density influences prey accessibility.

- *Alfalfa Hay*. Alfalfa is an ungrazed irrigated hay crop used mainly for livestock feed. Alfalfa typically remains uncultivated for 4 to 5 years, and occasionally longer. During this time, it is not rotated to other crop types. Alfalfa is considered to be the cover type with the highest foraging value to Swainson's hawks due to its relatively low vegetation structure and the practice of regular mowing and flood irrigating during the breeding season (Plate 14). During the spring and summer growing season, alfalfa is typically mowed once per month and is frequently irrigated, activities that make rodent prey more accessible and increase foraging use by Swainson's hawk and other raptors. Following several consecutive growing seasons, alfalfa is often converted back to the irrigated cropland rotation described above. The largest proportion of alfalfa in the study area occurred east of the Kings River corridor (Appendix A) and constitutes 4.5% of the land area (Table 3).

Plate 14. Recently mowed alfalfa hay. This crop offers the highest foraging value to Swainson's hawks due to low vegetation height and regular mowing and irrigating.

- *Irrigated Pasture*. Irrigated pastures are irrigated grasses or hays that are grazed by livestock and may be periodically cut for hay. These include large pasturelands such as those found east of Stratford, smaller pastures associated with dairy operations scattered throughout the study area, and small pastures associated with farm residences. Approximately 1.1 % of the study area consists of this cover type (Table 3), all of it east of the Kings River corridor (Appendix A).

- *Natural Land.* Natural land refers to uncultivated portions of the landscape that have retained some natural topography, vegetation characteristics, or other values. These lands are rare in the study area and throughout the valley floor portion of Kings County and are usually associated with remnant patches of grazing land or river bottom land along the edges of the Kings River. Only 0.6% of the study area consists of this cover type (Table 3).

Cover Types with Limited or No Foraging Habitat Value. Of the nine defined land use cover types (excluding nesting habitat types), four (Vineyards/Orchards, Developed Land, Open Water, and Solar Energy facilities) represent distinct land uses or cover types that provide limited to no suitable Swainson's hawk foraging habitat. These types represent 17.6 % of the study area (Table 3). Each is described below.

- *Vineyards and Orchards*. These are perennial crop types that develop a vegetative overstory that precludes access by foraging Swainson's hawks and most other raptors (Plate 15). While potentially converted back to a suitable foraging habitat and thus having potential value for conservation purposes, vineyards and orchards are considered unsuitable habitat areas for at least relatively long periods of time. Approximately 13.4% of the study area consists of these types (Table 3) (Appendix A).

Plate 15. Orchards and vineyards create tall, dense vegetation that Swainson's hawks avoid.

- *Developed Land*. Developed land refers to urban, industrial, and some rural residential areas. These types generally consist of high density developed areas that lack natural or cultivated landscapes and provide no foraging habitat value. Rural Residential is lower density urbanization that fragments natural or cultivated landscapes. Both high density urban areas and lower density rural residential areas are considered unsuitable habitat areas. Approximately 3.1% of the study area consists of these types (Table 3).

- *Solar Energy Facilities*. There are currently four solar energy facilities within the study area comprising a total of 2,454 acres, or 1% of the study area. These facilities are typically considered to have little to no value to foraging Swainson's hawks because the solar array doesn't appear to permit access to prey. Only one pilot study has been conducted to date that provides some data on the use of solar arrays relative to the surrounding landscape (Estep 2013). In this study, Swainson's hawk and other raptors did, in fact, continue to use the solar array field; however, this use may have been limited to the larger open areas between the array cells. Further investigation may determine more conclusively the use of solar array fields that are managed with suitable ground cover to encourage rodent prey populations. In the mean time, these facilities are considered to have limited suitability.

- *Open Water*. Open water habitats in the study area limited to water treatment ponds and other water retention basins. This land use, which comprises 569 acres, or 0.2 % of the study area, is unsuitable for Swainson's hawk foraging.

Nesting Habitat

Swainson's hawk nest sites were found in six defined nesting habitat types (Table 4): Each is described below:

Table 4. Nesting habitat association of active Swainson's hawk nests.

Habitat Association	Number of Active Nests	Percent of Total
Riparian	10	34.5
Tree Row	7	24.1
Isolated Tree	5	17.2
Grove	4	13.8
Isolated Roadside Tree	1	3.4
Roadside Tree Row	1	3.4
Rural Residential	1	3.4
Total	29	100

- *Riparian*. In the study area, riparian vegetation occurs primarily along the Kings River, Boggs Slough, and remnant patches along small sloughs and creeks, where 10 of the nest sites were found (34.5%) (Plate 16) . Riparian is streamside vegetation that is generally characterized by an overstory of cottonwood, willow, and valley oak trees, which are commonly used nest tree species by Swainson's hawks. In the study area, eucalyptus, salt cedar, and other exotic species also occur within riparian zones. In addition to the Kings River (North Fork, South Fork, and Clarks Fork), which supports a relatively continuous corridor of mature riparian forest, there are smaller patches of remnant riparian vegetation in the study area associated with small sloughs, creeks, or other channels (Appendix A). These sites also support suitable habitat for nesting Swainson's hawks and other raptors. Nest tree species used by Swainson's hawks in riparian habitat include willow (5), cottonwood (2), valley oak (2), and eucalyptus (1) (Table 4).

Plate 16. Riparian along the Kings River. Location of SH-20.

- *Tree Row*. Tree row refers to planted rows of trees that are not associated with roadsides. These often occur along field borders or rural driveways and were usually planted as windbreaks or for landscaping purposes. Seven of the 29 nest sites were found in this habitat type (24.1%) (Table 4). Most tree rows in the study area consist entirely of eucalyptus trees, including five of the seven where active nests were found (Plate 17).

Plate 17. Eucalyptus tree row along Elgin Avenue near 27th Avenue and Elgin Avenue.

- *Grove*. Although there are several small patches of valley oak groves in the northern and central portions of the study area east of the Kings River corridor, most are planted eucalyptus groves or small patches of other exotic species.

Eucalyptus groves are relatively common in the study area, planted as windbreaks or as sound and visual barriers. Four of the 29 nest sites were found in this habitat type (13.8%) (Plate 18) (Table 4).

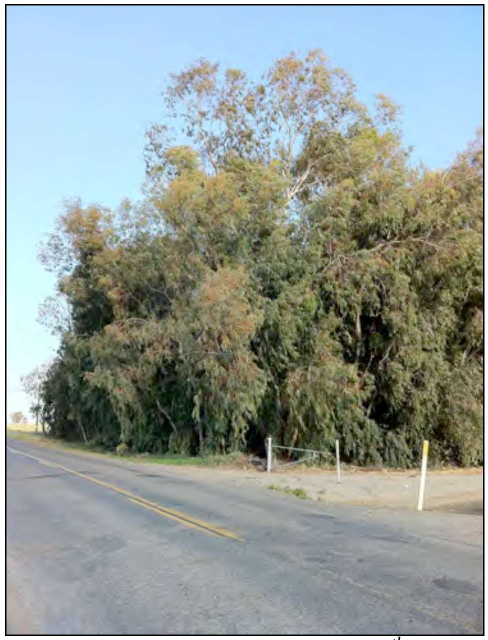


Plate 18. Eucalyptus grove at 18th Avenue and Lansing Avenue. Location of SH-23.

- *Isolated Tree*. Isolated trees are single trees (and sometimes two or three trees) that are not associated with roadsides, residences or other features. Many are large, mature valley oak trees in the middle of agricultural fields that are remnants of pre-agricultural oak woodlands or trees that have grown along field edges. Five of the 29 nest sites were in isolated trees (17.2%), three in willow trees, one in a valley oak tree, and one in a eucalyptus tree (Table 4) (Plate 19).

Plate 19. Isolated willow tree. Location of SH-22.

- *Isolated Roadside Tree*. Isolated roadside trees are distinguished from other isolated trees because they generally receive a substantially greater amount of noise and other human disturbances. This type includes any naturally occurring or planted native or nonnative tree. In the study area, isolated roadside trees include eucalyptus, willow, cottonwood, and valley oak trees. One of the 29 nest sites (3.4%) was found in an isolated valley oak roadside tree (Table 4).

- *Roadside Tree Row*. Like isolated roadside trees, trees rows along roadsides are distinguished from other tree rows only by the level of disturbance due to traffic. One of the 29 nests (3.4%) was found in a roadside tree row (Table 4).

- *Rural Residential*. Rural residential refers to trees that are planted for windbreak cover, shade, or ornamentals around rural farmsteads. These trees are of a variety of species, but in the study area are predominantly eucalyptus. Swainson's hawks can be quite tolerant of human activities and often use trees associated with rural farm residences or farmyards (Estep 2007, 2008). One of the 29 nest sites (3.4%) was classified as rural residential (Table 4); however, several others were in other nesting habitats that were within rural residential areas and close to residences and farm facilities.

Table 5 indicates the tree species used by nesting Swainson's hawks within the study area. Eucalyptus trees were the most commonly used nest tree species, and were used primarily in non-riparian habitats. Willow was the primary tree used in riparian habitats.

Table 5. Nest Tree Species used by Nesting Swainson's Hawks in the SGF Study Area.

Tree Species	Number of Active Nest Sites	Percent of Total
Eucalyptus	13	448
Willow	10	34.5
Valley Oak	4	13.8
Cottonwood	2	6.9
Total	29	100

Relationship Between Distribution and Habitat Associations

Figures A-1 through A-12 in Appendix A illustrate the distribution of Swainson's hawk nesting territories relative to the distribution of land use/cover types in the study area. A review of these maps suggests the relationship between the distribution and habitat associations are based on two primary factors, 1) the distribution of nesting habitat, and 2) the distribution of high value foraging habitat.

As noted above, there are very few nesting opportunities west of the Kings River corridor. This area supports an abundance of moderate value foraging habitat, but the general lack of trees restricts nesting opportunities to relatively few locations. East of the

Kings River corridor from the confluence with Fresno Slough south to approximately Stratford, nesting habitat is relatively abundant and includes fairly continuous riparian woodland along the three forks of the Kings River, and remnant valley oak trees, eucalyptus tree rows, groves, and isolated trees between Stratford and the northern edge of the study area. Riparian vegetation extends only to approximately 1 mile south of Stratford and other available nesting habitat types decline at approximately Medford Avenue, one mile south of Stratford As a result, no Swainson's hawk nests occur south of Medford Avenue (Appendix A).

While nesting habitat distribution is certainly the driving factor affecting the distribution of nesting Swainson's hawks, the more diverse agricultural landscape and the presence of higher value foraging habitat types (particularly alfalfa and other hay crops) east of the Kings River also influences the distribution and abundance of nesting Swainson's hawks and other raptors. Approximately 90 percent of the alfalfa within the study area occurs east of the Kings River corridor. The combination of abundant nesting habitat and a more diverse agricultural matrix with higher value crop types within this area supports a greater abundance of nesting Swainson's hawks and directly affects their distribution on the landscape.

Habitat Use of the Landscape by Foraging Swainson's Hawks

Swainson's hawks forage widely over agricultural landscapes, and foraging has been documented to regularly occur greater than 10 miles from nest sites (Estep 1989, Babcock 1995). However, foraging ranges are highly elastic and change seasonally as crops mature and are harvested and annually as crops rotate into new crop patterns. Swainson's hawks have proven to be very adaptable to this dynamic foraging landscape and have learned to opportunistically exploit suitable foraging conditions as they occur. Using the information on general crop patterns throughout the study area (Appendix A) and data on Swainson's hawk foraging use patterns in the Central Valley (Estep 1989, Babcock 1995), it is possible to qualitatively describe the likely use of the study area by the 29 nesting pairs that reside within it.

Because of the extent of alfalfa and other higher value crop types east of the Kings River, it is reasonable to assume that the majority of foraging activity also occurs east of the Kings River. However, Swainson's hawks readily travel significant distances from their nest sites to forage when opportunities occur. For example, high quality foraging conditions occur during the period of wheat harvest (June), and tomato harvest (July/August). During these periods, these crop types are used extensively by foraging Swainson's hawks. Because these crop types are among the most common in the study area and throughout Kings and Fresno Counties, it is reasonable to suggest that the area west of the Kings River also receives a substantial amount of foraging activity.

Other Nesting Raptors

During the survey all other stick-nest-building raptor and common raven nests were also recorded. Raptor species included red-shouldered hawk, red-tailed hawk, and great-horned owl. A total of 71 nests of other raptor and common raven species were documented in the study area during the survey (Appendix C, Table C-1, Figure 7). Only three active red-shouldered hawk nests, four common raven nests, and seven great-horned owl nests were found. The red-shouldered hawk occurs in relatively low breeding densities in the study area; however, the great-horned owl is likely underrepresented due to its earlier breeding season and reduced detectability during the time of the survey. No white-tailed kite nests were found during the survey. The breeding range of the common raven continues to expand in the Central Valley and will likely continue to increase in the study area. Common raven nests were not recorded during the 2011 surveys of the Mustang SGF. Like raptor species, the common raven can influence the distribution of the Swainson's hawk by establishing and aggressively defending nesting territories prior to Swainson's hawk arrival in the spring.

The most abundant raptor in the study area is the red-tailed hawk with a total of 57 active nests documented (Appendix C). A summary of red-tailed hawk nest site data is provided in Table 6. The more common red-tailed hawk competes with the Swainson's hawk for nesting sites and food resources; however, the species is more of a generalist and can inhabit more fragmented landscapes where the Swainson's hawk is less frequently found. Red-tailed hawks also generally have higher reproductive rates than Swainson's hawks (Table 6). Due primarily to the lack of nesting habitat, the red-tailed hawk – like the Swainson's hawk – was far more common in the portion of the study area east of the Kings River corridor (Figure 7) (Appendix A). Figure 7 clearly demonstrates the difference in available habitat east and west of the Kings River corridor for all stick-nest-building raptors in the region.

Table 6 Summary of red-tailed hawk nest site data within the SGF Survey Area.

Activity		
	Number	**Percent of Total**
# Active nests – successful	53	93.0
# Active nests – failed	2	3.5
# Active nests with unknown status	2	3.5
Total Active Nests	57	100
Reproduction		
Total # young produced	104	
# young per occupied nest with known status (successful + failed)	1.89	
# young per successful nest	1.96	

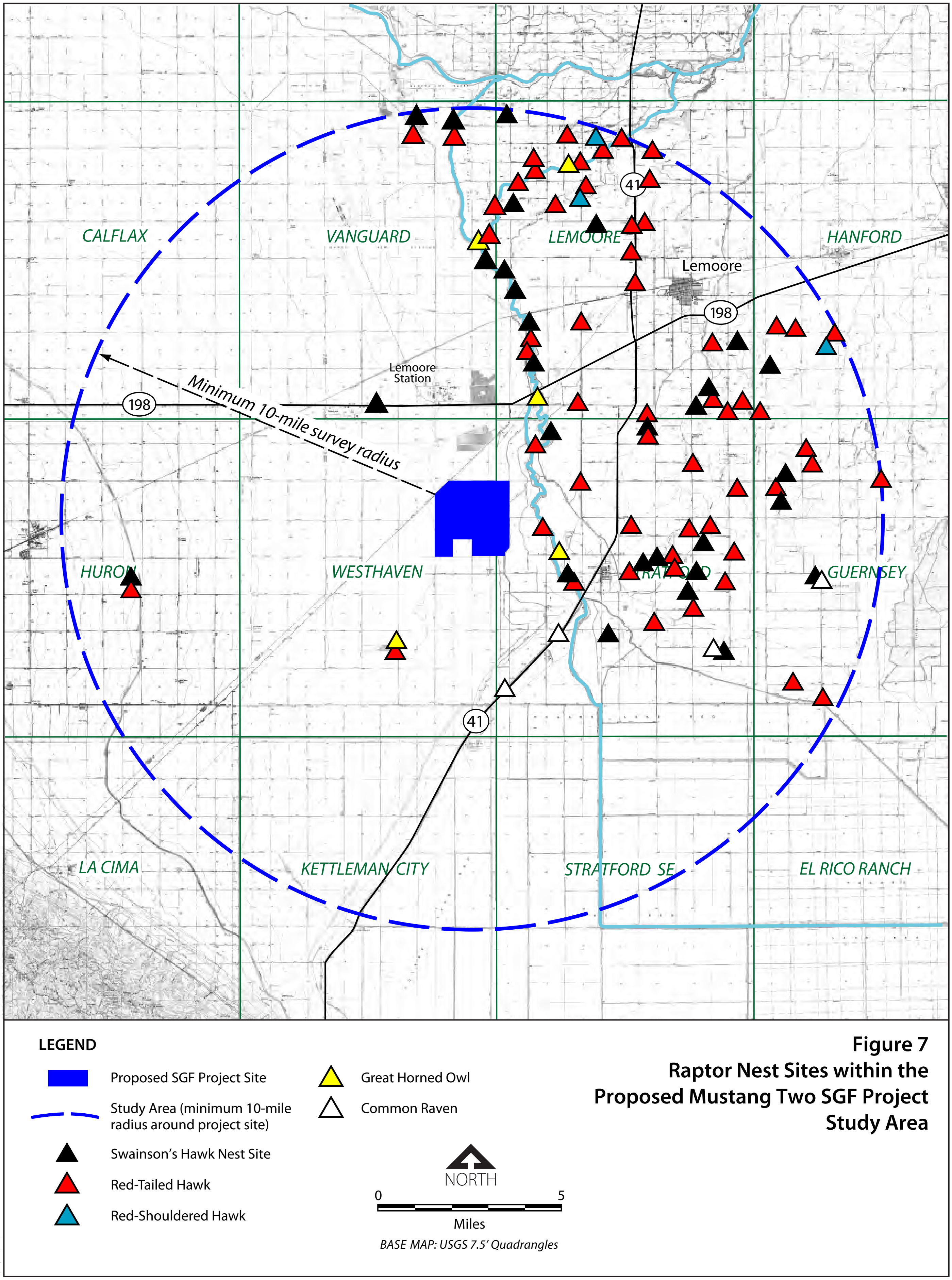


Figure 7
Raptor Nest Sites within the Proposed Mustang Two SGF Project Study Area

8/1/2016

Habitat associations of the red-tailed are similar to those of the Swainson's hawk, particularly within cultivated landscapes. The more generalist red-tailed hawk can exploit smaller patches of foraging habitat, including narrow edges of fields. But like the Swainson's hawk, the red-tailed hawk also generally avoids crop types that reduce or preclude accessibility. Nesting habitats and nest tree species used by the red-tailed hawk are also similar to those used by the Swainson's hawk (Tables 7 and 8).

Table 7. Nesting habitat association of active red-tailed hawk nests.

Habitat Association	Number of Active Nests	Percent of Total
Riparian	20	35.1
Isolated Tree	16	28.0
Grove	8	14.0
Tree Row	7	12.3
Isolated Roadside Tree	2	3.5
Roadside Tree Row	2	3.5
Farmyard	1	1.8
Rural Residential	1	1.8
Total	57	100

Table 8. Nest Tree Species used by nesting red-tailed hawks in the SGF Study Area.

Tree Species	Number of Active Nest Sites	Percent of Total
Eucalyptus	24	42.1
Valley Oak	14	24.5
Willow	10	17.5
Cottonwood	5	8.8
Ornamental Pine	3	5.3
Salt Cedar	1	1.8
Total	57	100

Section 5. CEQA Assessment

As noted in Section 1, CEQA defines the significance of an impact on a state-listed species based on the following:

- Appendix G of the State CEQA guidelines states that a biological resource impact is considered significant (before considering offsetting mitigation measures) if the lead agency determines that project implementation would result in "substantial adverse effects, either directly or through habitat modifications, on any species identified as being a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by CDFG or USFWS"; and

- CEQA Section 15065 (Mandatory Findings of Significance), a biological resource impact is considered significant if the project has the potential to "substantially reduce the number or restrict the range of an endangered, rare or threatened species".

In addition to addressing impacts of the project itself, CEQA requires an assessment of cumulative impacts. "Cumulative impacts refer to two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts" (14 CCR Section 15064[h])[1]) By CEQA definition, a cumulative analysis addresses the "…incremental impact of the project when added to other closely related past, present, and reasonably foreseeable probable future projects (14 CCR Section 15065[a][3]).

To address CEQA guidance pursuant to Appendix G, a threshold of significance is generally established to provide definition and a framework to address the otherwise somewhat vague term "substantial adverse effect". For purposes of this assessment, that threshold is conservatively defined to indicate whether or not the impact would affect the distribution and abundance of the existing breeding population or affect the future expansion of that population. So, if it can be demonstrated that a project or projects that reduce available nesting or foraging habitat for Swainson's hawks would in turn reduce the distribution or abundance of the nesting population or prevent expansion of that population, the impact would be considered significant. If, however, it can be demonstrated that removal or alteration of nesting or foraging habitat would not reduce the distribution or abundance of the existing population or prevent expansion of that population, then the impact would be considered less than significant.

Nesting Habitat and Direct Impacts on Active Nests

There are no trees on the Mustang Two SGF site and therefore the proposed project will not remove or disturb any nesting or potential nesting habitat for Swainson's hawk.

The nearest active nest is approximately 1.75 miles from the SGF site (on the Kings River south of Jackson Avenue). This distance is sufficient to avoid any disturbance-related impacts on nesting Swainson's hawks and therefore the proposed project will not impact active Swainson's hawk nests.

Foraging Habitat

The determination of whether or not the loss of agricultural foraging habitat from the development of the SGF site exceeds the significance threshold is derived from a review of the survey and habitat/land use data to estimate an existing baseline condition expressed as habitat availability, and a review of the requirements of foraging Swainson's hawks in the Central Valley to estimate the extent of suitable agricultural foraging habitat that is required to support the 29 nesting pairs. The assessment is initially conducted using the entire study area to compare availability and species requirements, and if necessary, followed by the same assessment using a smaller assessment subarea that is more representative of the nesting distribution. CEQA also requires that a cumulative assessment be conducted to determine the contribution of the project to a larger regional impact that addresses the cumulative loss of foraging habitat from other similar projects. For purposes of this assessment, the cumulative impact is defined as all existing, planned, and proposed (reasonably foreseeable probable) solar energy projects within the study area. It does not include other types of projects or other land use changes that would remove or modify Swainson's hawk foraging habitat. If necessary, the cumulative assessment is also conducted for the smaller subarea.

In general, throughout its Central Valley range, CEQA-based impacts on the Swainson's hawk are more effectively addressed at the cumulative level. Attempting to determine the effect of an individual project within a vast cultivated landscape and with variable nesting density is problematic with regard to CEQA definitions of significance. CDFW guidelines (CDFW 1994) attempt to address project-specific mitigation using distance from active nests as the primary determinant of significance. However, this approach does not sufficiently satisfy the CEQA definition for a significant impact on this wide-ranging species. In most cases, a significant impact cannot be adequately demonstrated by applying a simple distance variable. Most assessments that rely on this approach to make CEQA determinations do not address the availability of habitat, the density of the nesting population, or the use of the landscape by foraging Swainson's hawks, all of which are essential to appropriately assess land use-related effects on this species and to make reasonable CEQA conclusions using the definitions provided above.

For the Swainson's hawk, using a broader assessment strategy to address the status of the potentially affected population and the quality and use of cultivated landscapes and then emphasizing the cumulative removal of foraging habitat within the assessment area is one way to more accurately and effectively address CEQA-based impacts and to make significance determinations. However, in areas with high nesting density and less available habitat, the project-level assessment can also be revealing. In the following assessment, both approaches, project-specific and cumulative, are used to address the significance of project implementation at the two landscape scales noted above.

Assessment Methods

A simple formula was developed to determine the extent to which the removal of foraging habitat from project implementation would exceed a pre-determined habitat threshold. Significance was determined on the basis of whether or not the threshold was exceeded for any of the assessed project levels. The key variables in the formula are 1) available foraging habitat, and 2) foraging habitat required to support the existing nesting population. Removing foraging habitat below that required to sustain the existing population is considered to meet the CEQA definition for significance as indicated above. Table 9 is the framework for this simple model. Available acres of suitable foraging habitat (Column A) is derived from the habitat calculations (Table 3). The amount of foraging habitat required to sustain the population (Column B in Table 9) was derived using home range data from two radio-telemetry studies conducted in the Central Valley (Estep 1989, Babcock 1995) that examined habitat use and calculated foraging ranges. The average foraging range size from Babcock (1995) was 9,978 acres (N=5) and from Estep (1989) was 6,820 acres (N=12). For purposes of this assessment, the smaller average home range size from Estep (1989) was used While variable in quality and use, nearly all of the land within the calculated home ranges was considered suitable Swainson's hawk foraging habitat, and so this number (6,820) is also used here to represent the average number of acres of suitable foraging habitat required by a nesting pair of Swainson's hawks. Thus, the total amount of foraging habitat required to sustain the existing population is derived by multiplying 6,820 acres by the number of nesting pairs within the study area (29). However, this does not account for overlap among the foraging ranges. In the Estep (1989) study, it was determined that foraging range overlap was approximately 40 percent. But in order to account for less overlap for the more isolated nesting pairs in the study area, this was reduced to 30 percent to result in an adjusted number of acres required to sustain the population (Column C).

The difference (Columns A – C) between the available and required acres represents the estimate of surplus acres available to account for a changing agricultural landscape and population expansion (Column D). The term 'surplus' is used here only to estimate this difference and not to suggest that the area does not actually receive foraging use by Swainson's hawks, which it certainly does.

Table 9. Model framework for determining CEQA significance.

A	B	C	D	E	F	G
Available foraging habitat (ac)	**Unadjusted foraging habitat required to support 32 nesting pairs (ac)**	**Foraging habitat required (adjusted for 30% overlap) (ac)**	**Difference (A-C, representing the estimate of surplus available acres)**	**Impact of the SGF site (ac)**	**Remaining available habitat following impact (A-E (ac/%)**	**Remaining surplus available habitat following impact (D-E) (ac/%)**

Finally, column E represents the acres of impact and columns E and F estimate the remaining acres of available foraging habitat and surplus foraging habitat following implementation of the project.

From Table 9, if A (available foraging habitat) is greater than C (foraging habitat required by the existing population), then this indicates that there is a greater amount of available foraging habitat in the study area than is required to support the existing nesting population. The size of D (surplus acres) and E (impact) will determine the extent of remaining surplus and the significance of the impact. However, recognizing that the landscape is not static and that Swainson's hawk foraging patterns change with changes in crop patterns, to be considered significant, the remaining available surplus acres (Column G) must be reduced below 70% of the pre-impact surplus acres (Column D). So this means that if available foraging habitat acres exceed that required by the population and at least 70% of the remaining surplus suitable acres are retained, then the extent of habitat removal is not expected to affect either the existing population or substantially affect the opportunities for expansion of the population. The impact would thus be considered less than significant. The 70% threshold is arbitrarily set but is considered to represent a reasonable proportion of the surplus landscape.

As indicated above, the assessment is conducted at two landscape scales, the total study area and a sub-area that is more representative of the nesting population and the landscape it uses. However, if results from the total study area assessment reduce available habitat below the established threshold, then the sub-area assessment is unnecessary and therefore would not be presented here. A project-specific and cumulative assessment are conducted at each landscape scale.

Assessment Considerations

There are several issues related to the assessment methods that potentially influence or may confound the results.

1. Size of the Assessment Area. The 10-mile radius assessment area is derived in part on the basis of the maximum distance most Swainson's hawks will travel during foraging bouts (Estep 1989, Babcock 1995). However, this doesn't necessarily represent the total foraging area used by the nesting hawks that that reside within it. The 10-mile radius study area, an area greater than 300 square miles, was selected primarily as a reasonable representation of a regional population area. Changes in the size of the assessment area could potentially influence the results by including additional suitable or unsuitable foraging habitat acres, increasing the number of nesting Swainson's hawks within the study area, or by including additional existing, planned, or proposed projects to be used in the cumulative analysis.

2. Foraging Use Outside of the Study Area Boundary. While the study area is very large and accommodates a large proportion of the landscape that this nesting population uses, because Swainson's hawks are wide-ranging and opportunistic foragers, it is likely that some pairs, particularly those nesting near the study area boundary, will forage outside of

the study area. Because actual movement patterns of individuals are not known, the assessment model instead relies on the an estimate of use based on telemetry data and restricts the assessment to within the confines of the study area. Given the large size of the study area and the relatively few number of nesting pairs that reside within it, this is not an unreasonable approach. An alternative approach would be to extend the assessment area beyond the 10-mile radius boundary in areas where nest sites occur near the boundary or to create an additional assessment area based on the distribution of the nesting population as determined by the initial survey. However, as noted above this would also potentially bring other nesting pairs and additional habitat into the analysis that would then require additional expansion of the study area. Evaluating impacts based on species distribution would be more appropriate than on the location of the impact site, but this requires knowledge of the nesting distribution over a much broader regional area and then determining the habitat needs of that population.

3. Origin of the Telemetry Data. To calculate the extent of foraging habitat required to maintain the population, telemetry data were used from studies conducted in the Sacramento Valley where crop patterns are somewhat different than in the Central San Joaquin Valley. A similar telemetry study in the Central San Joaquin Valley could reveal different foraging range results and result in a different estimated habitat acres. In addition, while the crop matrix is more diverse, the Sacramento Valley has a more uniform landscape in terms of the suitability for the Swainson’s hawk. The nesting population of all raptors in the study area is greatly skewed toward the higher suitability lands east of the Kings River. How this affects movement patterns and foraging range sizes compared with the Sacramento Valley is unclear.

Also, the Estep (1989) home range estimate was used as the average home range size due mainly to the larger sample size compared with the Babcock (1995) study. Alternatively, the larger home range estimate from the Babcock (1995) study could be used, which would influence the results. The more recent study by Fleishman et al (2016) with a still larger average home range estimate could also be used, further influencing the results. However, the Fleishman et al (2016) results were confounded somewhat by including movement data from individuals from failed nests, which appears to have resulted in expanded movements and larger home ranges, but were not likely related to food availability. For these reasons, and to be consistent with the 2011 assessment of the RE Mustang/RE Orion/RE Kent South project and other solar project assessments, the Estep (1989) average home range estimate was used here.

4. Changing Agricultural Landscape. As noted above, this assessment method does not address future changes in the agricultural landscape of the study area. Largely dependent on cultivated landscapes in the Central Valley, changes in crop patterns and practices can affect the distribution and abundance of nesting Swainson’s hawks over time. The most substantial recent change occurring in the study area and throughout much of the San Joaquin Valley that affects the availability of suitable Swainson’s hawk foraging habitat is the extent of conversion from annually rotated irrigated cropland to orchards. Recent and continued conversion to orchards is likely to have a substantially greater effect on

foraging habitat availability throughout the San Joaquin Valley than other land use conversions, including solar development.

While these are reasonable issues to consider for purposes of future refinement of the assessment approach, the method used here is nonetheless considered a reasonable approach to determining the impact of land use changes on Swainson's hawk distribution and abundance and directly addresses the issues of land use and populations to result in a more reasonable and CEQA-compliant method for assessing land use-related impacts on this species in the Central Valley.

Total Study Area – Project-Specific Assessment

Table 10 indicates that there is approximately 30% more available foraging habitat (A) in the total study area than is required by the existing nesting population (C), expressed as 66,696 acres of surplus available habitat (D). Because of the large amount of surplus acres relative to the number of acres removed (E), the remaining surplus acres (G) remains well above the 70 percent threshold and is therefore considered less than significant at this scale.

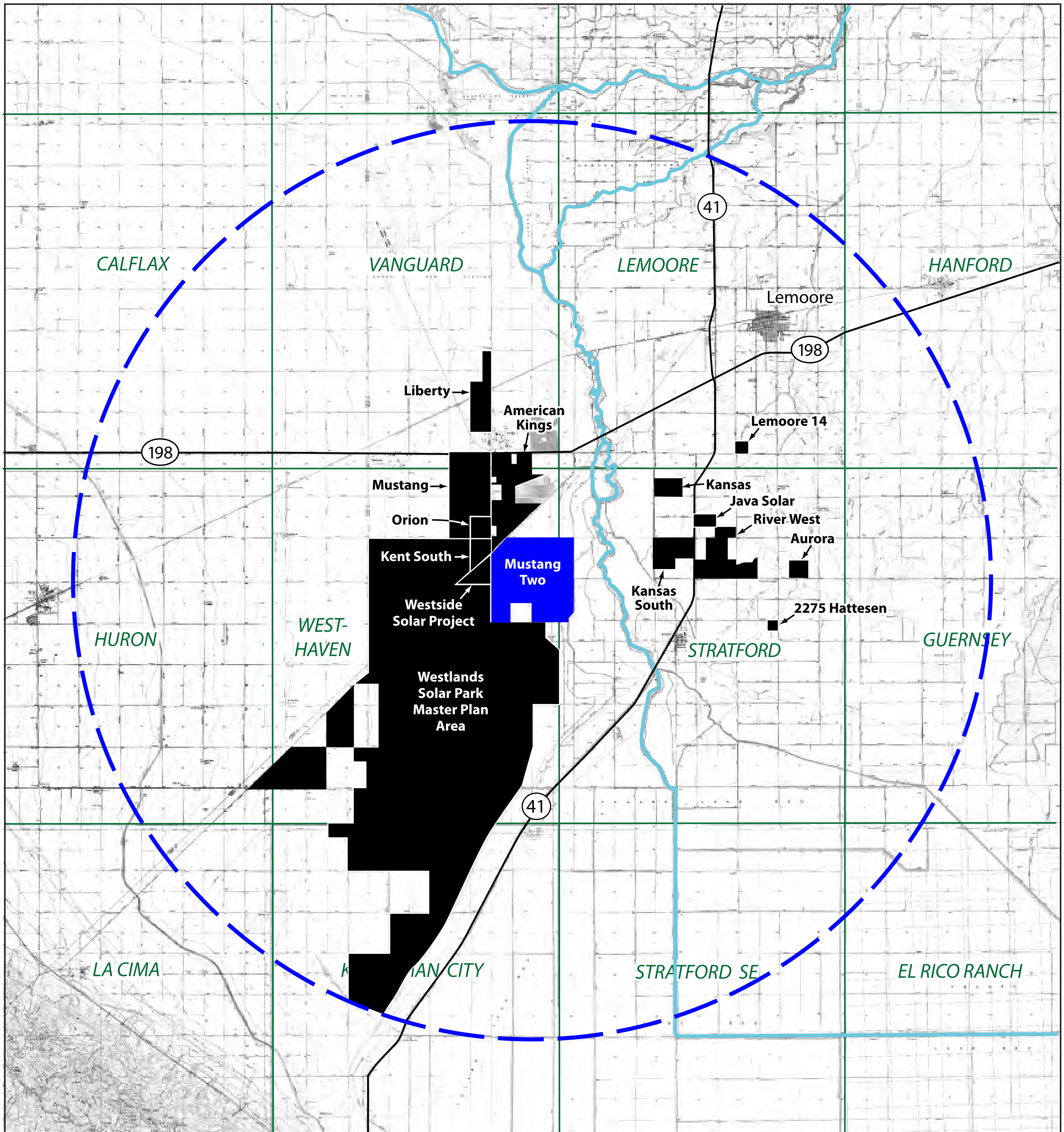
Table 10. Project-specific assessment results for the SGF study area.

A	B	C	D	E	F	G
Available foraging habitat (ac)	**Unadjusted foraging habitat required to support 29 nesting pairs (ac)**	**Foraging habitat required (adjusted for 30% overlap) (ac)**	**Difference (A-C, representing the estimate of surplus available acres)**	**Impact of the SGF site (ac)**	**Remaining available habitat following impact (A-E (ac/%)**	**Remaining surplus available habitat following impact (D-E) (ac/%)**
205,142	197,780	138,446	66,696	1,800	203,342 (99.1%)	64,896 (97.3%)

Total Study Area – Cumulative Assessment

Including the SGF site there are currently 15 existing, planned, or reasonably foreseeable solar energy projects within the study area totaling 27,441 acres or approximately 13.4% of the study area (Figure 8).

Using a similar method as described above, 86.6% of the total available foraging habitat remains following development of all projects (Table 11). However, available surplus habitat drops below the threshold (i.e., Column G is less than 70%) (Table 11). Under this scenario, the project will result in a significant cumulative loss of foraging habitat for the Swainson's hawk.



LEGEND

Proposed Mustang Two SGF Project Site

Study Area (minimum 10-mile radius around project site)

Other Solar Project

Figure 8
Existing, Planned, and Proposed Solar Energy Developments within the Proposed Mustang Two SGF Project Study Area

NORTH

0 5
Miles

BASE MAP: USGS 7.5' Quadrangles

10/7/2016

Table 11. Cumulative assessment results for the SGF study area

A	B	C	D	E	F	G
Available foraging habitat (ac)	**Unadjusted foraging habitat required to support 29 nesting pairs (ac)**	**Foraging habitat required (adjusted for 30% overlap) (ac)**	**Difference (A-C, representing the estimate of surplus available acres)**	**Cumulative impact of fifteen proposed sites (ac)**	**Remaining available habitat following impact (A-E (ac/%)**	**Remaining surplus available habitat following impact (D-E) (ac/%)**
205,142	197,780	138,446	66,696	27,441	177,701 (86.6%)	39,255 (58.9%)

Subarea Assessment

The nesting population within the study area is generally distributed along and east of the north-south Kings River corridor, with a greater proportion (26 of 29) of the nest sites occurring east of this corridor than west due mainly to nest tree availability, but also due to the higher proportion of high value foraging habitat. Because of this skewed distribution, it is possible to establish an assessment area that is more representative of the nesting population and then determine the effect of habitat removal from the project on this smaller, higher value area. However, because available surplus habitat drops below the threshold at the study area scale (Table 11), the smaller subarea assessment would result in a similar outcome and therefore is not necessary for purposes of a significance determination.

Note, however, that while the subarea assessment demonstrates the importance of the available habitat within a smaller assessment area that would be more closely associated with the nesting distribution, it also reveals the importance of the lands outside of the subarea to provide necessary foraging habitat for the population. In other words, nesting Swainson’s hawks within the subarea rely on foraging habitat outside of the subarea, which are also required to bring available foraging habitat above the significance threshold.

Land Use Changes Since 2011

This assessment method was used for several similar solar development projects in Kings County in 2011 including the RE Mustang, RE Orian, and RE Kent South projects, which occur as a single contiguous project area immediately adjacent to the Mustang Two project site (Estep 2011). Because the 2011 project was similarly sized and in a similar location, it is possible to review the land use changes that have occurred since then. Using the same model attributes and formulation, the 2011 assessment did not drop below the threshold for significance. However, at 70.4%, it nearly did for the cumulative subarea assessment. For the Mustang Two Assessment, the threshold is exceeded for the project level cumulative assessment (when the Westlands Solar Park Master Plan area is included, and for both project and cumulative level for the subarea assessment.

To examine the reasons for this change, land use and population data are available from the adjacent 2011 study and can be compared to the 2016 data (Table 12). This exercise reveals the sensitivity of the simple model formulation to the number of active Swainson’s hawk nests and the extent of suitable foraging habitat within the study area. The dimensions and location of the two adjacent study areas are not exact, but they are sufficiently similar to provide a general comparison of major land uses. Table 12 indicates the total number of acres of available foraging habitat has declined by 10.6 percent since 2011. Currently, 82.1 percent of the study area is considered suitable habitat compared with 91.1 in 2011. This is primarily attributable to the 123% percent increase in orchards since 2011. Since that time the agricultural landscape of the central San Joaquin Valley has continued to convert to orchards, resulting in an ongoing decrease in available suitable foraging habitat for the Swainson’s hawk. In addition, while the distribution was similar, the 2016 results include two more nesting pairs than were included in the 2011 results. But even small shifts in the location of the study area can result in differences in the nest abundance. Finally, and perhaps most importantly, is the increase in the existing, planned, and proposed solar energy facilities. The combination of these three factors has changed the outcome of the assessment compared with most projects from the same general area that were assessed in 2011. The result is that, using this assessment approach we now have exceeded the significance threshold and some form of compensatory mitigation would be required to offset the impact.

Table 12. Comparison of land-use acreages between the proposed RE Mustang Two SGF study area and adjacent 2011 RE Mustang, RE Orian, and RE Kent South study area.

Land Use Type	Acres in 2016 (Proposed project)	Percent of Total	Acres in 2011 (Mustang, Orian, Kent South project)	Percent of Total	Percent Change
Irrigated Cropland	189,376	75.8	214,353	85.1	-11.7
Orchard/Vineyard	33,836	13.5	15,159	6.0	+123.0
Alfalfa Hay	11,409	4.6	7,642	3.0	+49.1
Developed Land	7,864	3.1	6,739	2.7	+16.7
Irrigated Pasture	2,744	1.1	4,982	2.0	-44.9
Solar Facility	2,454	1.0	0	0	-
Natural Land	1,613	0.6	2,400	1.0	-32,8
Open Water	569	0.2	507	0.2	+12.2
Seasonal Wetland			38	0.02	-
Total	249,865	100	251,820	100	
Total Suitable Habitat	205,142	82.1	229,415	91.1	-10.6
Total Unsuitable Habitat	44,723	17.9	22,405	8.9	+99.6

Conclusions and Recommendations

Results of the survey indicate a relatively sparse Swainson's hawk nesting population within the 252,225 acres (394 square mile) SGF study area, but with a substantially greater nesting density in the eastern half of the study area. A total of 29 occupied nesting territories were confirmed, nine within five miles of the project site and 20 within five to ten miles of the project site. This represents a nesting density of 0.07 nests per square mile within the study area. This contrasts with the nesting density found in the Sacramento Valley, where over 5 times the nesting density is reported, including 0.38 nests per square mile in Yolo County and 0.37 nests per square mile in South Sacramento County (Estep 2007, 2008).

Within the study area, 205,142 acres (82.1% of the study area) is considered suitable foraging habitat, which includes a substantial amount of low value cover types such as cotton and corn. The highest value habitat, including alfalfa and other hay fields and irrigated pastures is found primarily east of the Kings River. Nesting habitat is also very limited west of the Kings River corridor, but is relatively abundant in the east. Largely as a result of the distribution of high value foraging habitats and suitable nesting habitat, the majority (26 of 29) of the nest sites are found on or east of the Kings River corridor. However, abundant suitable foraging habitat exists throughout the study area and given the foraging behavior of Swainson's hawks, the area west of the Kings River is likely regularly used for foraging by this population.

The proposed RE Mustang Two project will not affect Swainson's hawk nesting habitat or any Swainson's hawk nest site. The nearest active nest is approximately 1.75 miles northeast of the project site. This assessment therefore focused on the loss of agricultural foraging habitat and how the conversion of 1,800 acres would affect the distribution and abundance of the nesting population and the extent to which the reduction would contribute to restricting the range of the population and its ability to expand in the future. Determining the significance of the loss of agricultural foraging habitat within the study area was based on an analysis of the abundance and distribution of available foraging habitat and how nesting Swainson's hawks might respond to this loss. A threshold was established to determine whether or not significance, pursuant to CEQA definition, was reached. The assessment was conducted at the project-specific level and the cumulative level using available information from all existing, planned, or reasonably foreseeable solar projects within the study area.

The conversion of 1,800 acres of agricultural land to a solar array will not affect the distribution or abundance of nesting Swainson's hawks in the total study area. Because it represents only 0.9% of the available foraging habitat within the study area, its conversion is negligible relative to availability, and particularly with regard to the relatively small number of Swainson's hawks that nest in the study area. At the project level, this does not represent a significant loss of foraging habitat for Swainson's hawks within the study area and does not represent a significant CEQA impact.

However, because a substantial amount of solar development is existing, planned, or proposed for the area, the cumulative conversion reduced available foraging habitat by 11.1% below the threshold and thus the project would contribute to a significant cumulative impact.

A subarea assessment was not conducted because significance was determined at the total study area scale, making a subarea assessment unnecessary for CEQA purposes. A subarea assessment would reveal a similar overall deficit of suitable foraging habitat. While most of the nesting Swainson's hawks and other raptors nested east of the Kings River corridor, which would include the majority of the subarea, this demonstrates the value and need for foraging habitat west of the Kings River corridor and other areas in the region that support lower nest density. In other words, while the land along and east of the Kings River corridor supported a more suitable foraging landscape and most of the nesting population, the population likely cannot rely entirely on this area to maintain population levels.

Therefore, in my opinion the proposed RE Mustang Two SGF project-specific impacts would not result in a significant reduction of available Swainson's hawk agricultural foraging habitat in the study area that would reduce population levels or restrict the species' range. However, the extent of cumulative habitat loss represents a contribution to a significant cumulative impact from all projects in the study area, and thus would require mitigation to reduce the impact to a level of less-than-significant.

The approach used here to assess impacts on the Swainson's hawk could be regarded as conservative due mainly to the relatively high significance threshold established. However, while Swainson's hawks can successfully respond to some agricultural land use changes, they occur in a highly modified and largely privately-owned landscape for which there is little certainty regarding the long-term ability of the agricultural lands to support suitable Swainson's hawk foraging habitat. For example, the continuing increase in orchards and vineyards throughout Kings and Fresno Counties reduces available foraging habitat for Swainson's hawks at a rate far greater than other types of land conversion. The extent of uncertainty, particularly regarding the long-term cumulative reduction of suitable agricultural foraging habitat, necessitates a somewhat conservative approach to assessing the effects of habitat loss with regard to its long-term effect on the species range and the potential for range expansion.

Mitigation Approaches

Mitigation for losses of Swainson's hawk foraging habitat can be addressed in several ways from establishing simple mitigation ratios to developing mitigation formulas based on the objective of retaining sufficient habitat to support a defined regional nesting population. Alternative mitigation strategies may also be available that focus on retaining or enhancing value through design and management considerations (see below). The CDFW guidelines (CDFW 1994) use a simple habitat replacement ratio ranging from 0.5:1 to 1:1 based the distance to the nearest active nest. The standard approach used in most Central Valley regional conservation plans is a simple ratio of 1:1 (1 acre of mitigation for each acre converted). However, these approaches generally lack sufficient biological rationale and do not address the habitat needs of the species or the long-term sustainability of the affected population.

If we address the impact as a contribution to a cumulative impact, one simple method is to determine the contribution of the project to the total cumulative impact. For example, consistent with our assessment approach, mitigation can be calculated on the basis of the 70% threshold by determining the contribution of the proposed project to the percent reduction below the 70% threshold. The cumulative reduction of agricultural foraging habitat within the overall assessment area reduces surplus habitat to 58.9% of existing surplus habitat, which is a 7,462-acre reduction below the 70% threshold (i.e., 46,687 acres [70% of the existing surplus] minus 39,225 acres [remaining surplus following the impact] equals 7,462 acres [the number of acres reduced below the 70% threshold]).

Therefore, assuming the objective is to maintain habitat above the 70% threshold, 7,462 acres represents the total cumulative surplus deficit acres to Swainson's hawk foraging habitat. The proposed RE Mustang Two SGF contributes 1,800 acres (or 6.6%) to the total 27,441-acre cumulative impact. Therefore, using this approach, the mitigation contribution for the RE Mustang Two SGF project is calculated as 6.6% of the 7,462-acre surplus deficit, or 492 acres. In the event the project site is changed from the analyzed 1,800-acres, the impact and mitigation calculation should also be adjusted using the approach described above. It may also be possible to adjust the replacement acres (i.e. 492 acres) if it can be demonstrated that habitat value is retained onsite through the design and management practices (see below).

This method, like most of the replacement ratio-based approaches, does not necessarily replace all of the value of the impacted area and thus assumes that all cultivated land is not necessary to support the existing population of Swainson's hawks. This is certainly the case within the study area and throughout most of the Central San Joaquin Valley where the nesting density is low and much of the foraging landscape is in low value crop rotations. In areas of higher nesting density, such as the Sacramento Valley, the replacement proportion could be substantially higher. It does, however, provide some biological rationale for establishing an appropriate mitigation strategy that can be further refined and improved over time as additional study and information become available.

Management and Design Considerations

In some cases, management and design of the solar array may also provide mitigation opportunities. Montag et al (2016) found increased overall ecological value within solar arrays that incorporated vegetation enhancements, such as a grassy understory. In 2012, Estep and Dinsdale (2013) conducted a pilot study in Sacramento County to evaluate the foraging use of solar arrays by Swainson's hawks and other raptor species relative to the surrounding agricultural landscape. In this study, each of the four solar arrays, all from 100 to 200 acres in size, were managed with a grass substrate that was maintained by grazing sheep. Results of the study indicated that the solar array fields were used for foraging similarly to other moderate to high value agricultural cover types and their presence did not appear to affect the overall use of the landscape by Swainson's hawks or other raptors. As one element of an otherwise diverse agricultural matrix, the solar array fields provided a consistent and an apparently reasonably accessible source of prey, particularly for Swainson's hawks and American kestrels.

To encourage raptor foraging use of solar arrays, of key importance is the management of a grassland substrate to promote rodent populations and maintaining this substrate at a height that promotes visibility and access to prey. Unlike most crop types, this condition can be available in solar fields throughout the spring and summer breeding season, and thus provide a consistent and available source of prey. Many crop types, while important in the overall agricultural matrix, may be available for a relatively short period of time during the breeding season due to the planting, growth, and harvesting regime.

It's important to emphasize that the results of the pilot study were based on small solar arrays (100-200 acres) within an otherwise diverse agricultural matrix. How foraging raptors would respond to a larger array, particularly in areas where solar arrays become a dominant land use over a large area rather than incorporated as one element into an existing agricultural matrix, as in the pilot study, is unknown. Still, managing a grass substrate to promote rodent and insect prey would be considered beneficial compared to a non-vegetated substrate and would have additional value beyond that potentially provided to foraging raptors.

The design of the solar array may also be important in promoting continued foraging use by raptors. In the 2012 pilot study, it appeared that foraging use by larger raptors, including Swainson's hawks and red-tailed hawks, may have occurred mainly in the larger open areas between the array cells. Solar designs that maintain a managed grassland substrate and that provide larger open areas within the array may also be beneficial.

The extent to which managing solar arrays to promote continued wildlife use and enhance overall ecological value as a means to offset impacts is unclear. However, it is clear that at least some value is retained with appropriate management. Standard compensatory mitigation options are usually based on land use changes that do not retain habitat value. Because there are opportunities to retain value through land management practices within solar arrays, there may in turn be opportunities to incorporate this practice into compensatory mitigation calculations and potentially reduce the replacement ratio.

Other mitigation approaches may be available and should be explored with the assistance of Kings County, the CDFW, the industry, and other land use organizations to ensure that the impacts are appropriately and consistently mitigated. Additional research on the management and design of solar arrays to promote continued foraging use by Swainson's hawks and other raptors (Estep and Dinsdale 2013) as well as the overall ecological value and potential benefits of managed solar array fields (Montag et al. 2016) is also warranted to determine the actual biological impact of this land use conversion and how management of these sites may reduce the need for compensatory mitigation.

The information contained in this report should be used by Kings County with assistance from the California Department of Fish and Wildlife to develop a comprehensive program for ongoing population and habitat monitoring. These data can be used to begin establishing a framework for the siting of large solar energy developments, for regional conservation planning, and for continued monitoring of impact thresholds for continued CEQA analysis.

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Appendix A. USGS Quadrangle Maps – Distribution of Land Cover Types and Nest Sites

Included as a separate document.

Appendix B. Swainson's Hawk Nest Site Photo Log

Included as a separate document.

Appendix C. Other Raptor Data

Table C-1. Other raptor and common raven nest site locations, status, and nesting habitat type within the SGF study area.

Site #	USGS Quad	Location	GPS coordinates	Status	# Yg	Nesting Habitat	Nest Tree
RS1	Lemoore	South Fork Kings River, W of 21st Ave	36.336446 N 119.835576 W	S	2	Riparian	Valley Oak
RS2	Lemoore	21st and Fargo Ave	36.359871 N 119.831271 W	U	U	Tree Row	Cottonwood
RS3	Hanford	0.2 mi W of 14th Ave, 0.25 mi S of Iona Ave	36.280108 N 119.711969	U	U	Riparian	Cottonwood
CR1	Stratford	Medford Ave, 0.5 mi W of 17th Ave	36.159494 N 119.771516 W	U	U	Grove	Ornamental Pine
CR2	Stratford	State Route 41, S of Madison Ave	36.166495 N 119.845297 W	U	U	Utility Pole	None
CR3	Stratford	State Route 41, 0.5 mi N of Nevada Ave	36.145184 N 119.870416 W	U	U	Utility Pole	None
CR4	Guernsey	14 ½ Ave, 500 feet S of Laurel Ave.	36.188149 N 119.717495	U	U	Utility Pole	None
GH1	Lemoore	Clarks Fork Kings River at 21st ½ Ave	36.349339 N 119.843197 W	S	2	Riparian	Cottonwood
GH2	Lemoore	Kings River, 0.3 mi N of Jackson Ave	36.260312 N 119.855896 W	S	3	Riparian	Valley Oak
GH3	Lemoore	Kings River, 500 feet S of SPRR	36.289974 N 119.865439 W	S	3	Riparian	Valley Oak
GH4	Vanguard	Kings River at Clarks Fork confluence	36.319432 N 119.883592 W	S	3	Riparian	Cottonwood
GH5	Stratford	Kings River, north of Lansing Ave	36.198188 N 119.847416 W	S	2	Riparian	Willow
GH6	Huron	0.6 mi S of SR 198, 0.25 mi W of Aqueduct	36.246650 N 120.084690 W	S	3	Savanna	Valley Oak
GH7	Westhaven	NE of Manteca Ave and 27th Avenue	36. 159089 N 119.927405 W	S	2	Riparian	Cottonwood
RT1	Lemoore	N of Fargo, E of 22nd along Island Canal	36.361024 N 119.843070 W	S	2	Isolated tree	Valley Oak
RT2	Lemoore	Clarks Fork Kings River W of Hwy 43	36.361662 N 119.812367 W	S	2	Riparian	Eucalyptus
RT3	Lemoore	Clarks Fork Kings River W of 21st Ave	36.350599 N 119.836883 W	S	2	Riparian	Valley Oak
RT4	Lemoore	Clarks Fork Kings River E of 21st Ave	36.355342 N 119.826015 W	S	2	Riparian	Valley Oak
RT5	Lemoore	0.3 mi S of Fargo Ave, 0.5 mi E of Hwy 41	36.351847 N 119.798436 W	U	U	Riparian	Cottonwood
RT6	Lemoore	Fairfax Ave, 0.5 mi E of 23rd Ave	36.351717 N 119.860046 W	S	2	Grove	Eucalyptus
RT7	Lemoore	Clarks Fork Kings Ri, 0.4 mi W of 22nd Ave	36.346789 N 119.858312 W	S	1	Riparian	Valley Oak
RT8	Lemoore	Clarks Fork Kings Ri, 0.2 mi E of 23rd Ave.	36.342281 N 119.865146 W	S	2	Riparian	Valley Oak
RT9	Lemoore	So Fork Kings River, 0.2 mi E of 22nd Ave	36.337328 N 119.848537 W	S	2	Riparian	Valley Oak

Site #	USGS Quad	Location	GPS coordinates	Status	# Yg	Nesting Habitat	Nest Tree
RT10	Lemoore	Grangeville at 21st Ave	36.343314 N 119.833896 W	S	2	Roadside isolated tree	Valley Oak
RT11	Lemoore	0.5 mi E of SR41, 0.2 mi N of Grangeville	36.346358 N 119.798974 W	S	2	Isolated tree	Valley Oak
RT12	Lemoore	Lacy Ave, just east of SR 41	36.326824 N 119.805034 W	S	2	Small grove	Eucalyptus
RT13	Lemoore	Lacy Ave, 0.25 mi W of SR 41	36.326895 N 119.811613 W	S	3	Tree Row	Valley Oak
RT14	Lemoore	0.25mi W of Hwy 43, N of Hanford-Armona	36.315285 N 119.813765 W	S	2	Tree row	Eucalyptus
RT15	Lemoore	Kings River, S of SP Railroad	36.287309 N 119.860530 W	S	3	Riparian	Valley Oak
RT16	Lemoore	Kings River, 1.3mi N of Highway 198	36.275130 N 119.860350 W	S	2	Riparian	Valley Oak
RT17	Lemoore	Jackson Avenue W of 21st Avenue	36.255897 N 119.841347 W	F	0	Isolated tree	Eucalyptus
RT18	Lemoore	S of Jackson Avenue, W of 19th Avenue	36.251414 N 119.803575 W	S	2	Riparian	Willow
RT19	Lemoore	N of Jackson Avenue, E of 18th Avenue	36.258007 N 119.772055 W	S	1	Tree row	Willow
RT20	Lemoore	E of 18th Ave, S of Iona along Lemoore Canal	36.282231 N 119.774314 W	S	2	Riparian	Willow
RT21	Lemoore	1.2 mi E of Kings River, S of SP Railroad	36.292061 N 119.835035 W	S	3	Isolated tree	Cottonwood
RT22	Lemoore	W side of Hwy 43, north of Houston Ave	36.302451 N 119.811386 W	U	U	Eucalyptus grove	Eucalyptus
RT23	Lemoore	S of Jackson Ave, W of 17th Ave	36.253873 N 119.765445 W	S	2	Isolated tree	Valley Oak
RT24	Lemoore	N of Jackson, E of 17th Ave	36.260417 N 119.759410 W	S	1	Tree row	Eucalyptus
RT25	Stratford	Kings River, 1.2 mi S of Jackson Avenue	36.241932 N 119.853524 W	S	2	Riparian	Willow
RT26	Stratford	21st Avenue at Kent Avenue	36.223806 N 119.835673 W	F	0	Isolated tree	Eucalyptus
RT27	Stratford	Java Ave at 18th Ave	36. 232034 N 119.781560 W	S	2	Isolated tree	Valley Oak
RT28	Stratford	19th Avenue at Jersey Avenue	36.244570 N 119.801162 W	S	1	Tree row	Eucalyptus
RT20	Stratford	E of 17th Ave, S of Kent Ave	36.224204 N 119.762351 W	S	2	Isolated roadside tree	Eucalyptus
RT30	Stratford	Just E of Hwy 43, south of Kansas Avenue	36.209774 N 119.813168 W	S	1	Isolated tree	Valley oak
RT31	Stratford	N of King Avenue, W of 18th Avenue	36.207764 N 119.782909 W	S	2	Isolated tree	Eucalyptus
RT32	Stratford	N of King Avenue, E of 18th Avenue	36.206422 N 119.775187 W	S	2	Grove	Eucalyptus
RT33	Stratford	N of Lansing Avenue, E of 17th Avenue	36.197205 N 119.758881.W	S	2	Isolated tree	Salt cedar
RT34	Stratford	Lansing Avenue,, 0.5 mi E of 18th Avenue	36.195841 N 119.786539 W	S	2	Isolated tree	Eucalyptus
RT35	Stratford	Laurel Avenue, 0.25 mi E of 20th Avenue	36.189839 N 119.811499 W	S	2	Isolated tree	Eucalyptus

Site #	USGS Quad	Location	GPS coordinates	Status	# Yg	Nesting Habitat	Nest Tree
RT36	Stratford	Laurel Avenue, 0.4 mi E of 19th Avenue	36.189840 N 119.791479 W	S	1	Small grove	Eucalyptus
RT37	Stratford	17th Avenue, 0.25 mi S of Laurel Avenue	36.185549 N 119.763646 W	S	2	Grove	Eucalyptus
RT38	Stratford	19th Avenue, 0.1 mi N of Madison Avenue	36.169336 N 119.798345 W	S	2	Farmyard	Eucalyptus
RT39	Stratford	18th Avenue, 0.1 mi N of Lakeview Avenue	36.176039 N 119.780367 W	S	1	Isolated roadside tree	Ornamental pine
RT40	Stratford	Kings River, 0.8 mi N of Lansing Ave	36.209102 N 119.853883 W	S	2	Isolated tree	Ornamental pine
RT41	Stratford	Kings River, 0.2 mi S of Laurel Avenue	36.186673 N 119.843633 W	S	3	Riparian	Willow
RT42	Vanguard	North Fork Kings River, 1 mi S of Elgin	36.362526 N 119.896782 W	S	2	Riparian	Ornamental pine
RT43	Vanguard	Grangeville Bypass 1.1 mi S of Elgin	36.362898 N 119.916794 W	S	2	Grove	Eucalyptus
RT44	Vanguard	Clarks Fork Kings River 0.4 mi N of Lacy	36.335338 N 119.875534 W	S	3	Riparian	Cottonwood
RT45	Vanguard	Clark Fork Kings River 0.5 mi S of Lacey	36.320777 N 119.882030 W	S	2	Riparian	Willow
RT46	Hanford	0.25 mi E of 16th Ave, 0.25 mi N of Iona Ave.	36.286730 N 119.740436 W	S	2	Tree row	Eucalyptus
RT47	Hanford	0.1mi W of 15th Ave, 0.2mi N of Iona Ave.	36.285236 N 119.728924 W	S	2	Isolated tree	Eucalyptus
RT48	Hanford	14th Ave and Iona Ave	36.283953 N 119.710693 W	S	3	Roadside tree row	Eucalyptus
RT49	Hanford	0.3 mi S of Jackson Ave on 16th Ave	36.250555 N 119.745311 W	S	2	Tree row	Eucalyptus
RT50	Guernsey	Jacobs Slough, 0.2 mi S of Kent Ave	36.222952 N 119.737985 W	S	2	Riparian	Willow
RT51	Guernsey	0.25 mi E of 15th Ave, 0.5 mi N of Kent Ave	36.232510 N 119.722239 W	S	1	Riparian	Cottonwood
RT52	Guernsey	Jersey Ave, 0.2 mi E of 15th Ave	36.239398 N 119.724370 W	S	2	Rural residential	Eucalyptus
RT53	Guernsey	Kent Ave, 0.8 mi W of 12th Ave	36.226072 N 119.686195 W	S	1	Isolated tree	Eucalyptus
RT53	Guernsey	0.5 mi N of Nevada Ave, 0.7 mi E of 16th	36.144902 N 119.730653 W	S	2	Isolated tree	Cottonwood
RT55	Guernsey	14th ½ Ave at Tulare Lake Canal	36.139383 N 119.716946 W	S	3	Riparian	Willow
RT56	Huron	N of Gale Avenue, just W of CA aqueduct	36.183610 N 119.056184 W	S	2	Grove	Willow
RT57	Westhaven	N of Manteca Avenue, E of 27th Avenue	36.159871 N 119.928706 W	S	2	Riparian	Willow

GH = great-horned owl, RS = red-shouldered hawk, RT = red-tailed hawk, CR = common raven, S = Successful, F = Failed, U = Unknown

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June 28, 2018

Ms. Cheryl Bailey
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Recurrent Energy
300 California Street, 7th Floor
San Francisco, CA 94104

RE: Swainson's Hawk Survey Report
RE Slate Solar Energy Project, Kings County, California

On behalf of RE Slate LLC, HELIX Environmental Planning, Inc. (HELIX) conducted surveys for Swainson's hawk (SWHA; *Buteo swainsoni*) on an approximately 2,490-acre project site in western Kings County, near the City of Lemoore, California. The surveys were conducted according to the guidelines prepared by the Swainson's Hawk Technical Advisory Committee (TAC) in the *Recommended Timing and Methodology for Swainson's Hawk Nesting Surveys in California's Central Valley* (TAC 2000). We understand that RE Slate LLC may develop the site as a utility-scale solar photovoltaic generating facility.

INTRODUCTION

The site is in unincorporated Kings County, south of Lemoore Naval Air Station and west of the Kings River. The Kings County Community Development Agency is processing a Conditional Use Permit for the proposed project, which requires analysis of potential environmental impacts, including to species listed as threatened or endangered by the U.S. Fish and Wildlife Service, in accordance with the California Environmental Quality Act (CEQA). The surveys described in this report were undertaken to determine the potential of the proposed project for significant impacts to SWHA.

This report describes the methods used to conduct the SWHA surveys and summarizes the findings. Supplemental information included in this report includes maps and graphics (**Attachment A**) and site photographs (**Attachment B**).

PROJECT LOCATION AND EXISTING CONDITIONS

The project site is located in western Kings County, south of the town of Lemoore Station/ Lemoore Naval Air Station and 0.25 – 2 miles west of the Kings River (**Attachment A – Figure 1**). The site is roughly bounded by Avenal Cutoff Road to the northwest, Jackson Avenue to the north, fallow agricultural land to the west, Laurel Avenue to the South, and fallow and active agricultural land to the east (**Attachment A – Figure 2**).

The site is within the historic limits of Tulare Lake, and terrain in the site is flat and level, draining naturally to the east at a very shallow gradient. There is no natural topographic relief in the site; existing relief is the result of constructed berms associated with irrigation canals, drains, and roads. Elevations in the site range from roughly 195 to 215 feet above mean sea level. The site has been used in the past for agricultural activities including irrigated crops and stock grazing. Current land uses include cattle and sheep grazing in dry pasture, and ground water extraction. Most of the site is inactive agricultural fields that show evidence of past disking and furrowing, but do not appear to have been actively cultivated in recent years. Vegetation in the site is dominated by ruderal upland species and remnant crop species, except in active canals where surface water is present.

There are no trees in the project site. The locations of suitable SWHA nest trees within 0.5-mile of the project site boundary are described in **Table 1** and depicted in **Attachment A – Figure 3**.

Table 1. Suitable SWHA Nest Trees Within 0.5-mile of the Project Site

Stand No.	Location Description	Distance from Site	Notes
1	Kings River for ±1 mile south of Highway 198	0.1 mi. – 0.5 mi.	Scattered groups of large willows in the Kings River floodplain. Active SWHA nest at the north end of this stand, next to Highway 198 (0.5 mi. from the project site). Most of this stand is used by red-tailed hawks.
2	Kings River for ±0.5 mile north of Kent Avenue	0.1 mi. – 0.25 mi.	Individual tamarisk and willow trees scattered along the banks of the Kings River. A pair of SWHA attempted to nest in a small willow tree near the north end of this stand (0.25 mi. from the project site); the nest failed.
3	Farm house north of Laurel Avenue	0.25 mi.	Stand of eucalyptus trees near a farm house surrounded by pomegranate orchards.
4	Farm house south of Laurel Avenue	0.5 mi.	Stand of eucalyptus trees near a farm house surrounded by cotton fields.
5	NAS Lemoore wastewater ponds	0.5 mi.	Row of small eucalyptus trees along the northwest side of the NAS Lemoore wastewater ponds, surrounded by cotton fields.

METHODS

SWHA surveys were conducted in accordance with the guidelines prepared by the TAC in the *Recommended Timing and Methodology for Swainson's Hawk Nesting Surveys in California's Central*

Valley (TAC 2000). The project site was surveyed a total of 12 times during survey periods II, III, IV, and V (**Table 2**) by HELIX biologists with extensive experience at SWHA surveys.

Surveys were at times of day prescribed in the survey protocol (TAC 2000) to allow for maximum probability of detection. The morning surveys started at sunrise when birds become active, and ended by 12 pm. The evening surveys were conducted between roughly two hours before sunset and shortly after sunset. Two active SWHA nesting locations were identified during the initial surveys in Period II; those locations were monitored during each subsequent survey to confirm that the birds identified occupying the nests in the previous surveys were still present. The remainder of each survey was spent observing other suitable nest trees for SWHA activity. Surveys conducted during Period IV were restricted to monitoring the two known active nest locations.

Table 2. Survey Dates and Times (all surveys conducted in 2018)

Date	Personnel	Nest #1 Active	Nest #2 Active
Period II (March 20 – April 5)			
April 3	G. Aldridge, D. Van Essen	✓	
April 4	G. Aldridge, D. Van Essen	✓	
April 5	G. Aldridge, D. Van Essen	✓	
Period III (April 5 – April 20)			
April 6	G. Aldridge, D. Van Essen	✓	
April 17	G. Aldridge, D. Van Essen	✓	✓
April 18	G. Aldridge	✓	✓
Period IV (April 21 – June 10)			
May 10	G. Aldridge	✓	✓
May 11	G. Aldridge	✓	✓
May 21	S. Stringer		
Period V (June 10 – July 30)			
June 21	G. Aldridge	✓	
June 22	G. Aldridge	✓	
June 26	G. Aldridge	✓	

RESULTS

There are no trees in the project site, and therefore no possibility for SWHA to nest in the project site. There are trees suitable for SWHA nesting at five locations within 0.5-mile of the project site. Trees at Location 5 had sparse, easily visible canopies and there were no nests present in those trees. The remaining four locations were monitored during all surveys. SWHA were observed nesting in a tree in the floodplain of the King River where it crosses under Highway 198 (Nest #1; **Attachment A – Figure 3**).

This nest was active throughout the surveys. Another pair of SWHA was observed using a nest in a small tree next to the Kings River north of Kent Avenue (Nest #2; **Attachment A – Figure 3**); however, this nest was unsuccessful, and the hawks were not observed at this location after May 11 and no nestlings were observed. No SWHA were observed in or near other suitable tree stands within 0.5 mile of the project site.

Individual SWHA were observed occasionally flying over the site or perched on power poles in the site; however, red-tailed hawks (RTHA; *Buteo jamaicensis*) and great horned owls (GHOW; *Bubo virginianus*) are common in the project site and may discourage use of the site by SWHA. Two pairs of RTHA were consistently observed perched on power lines in the site and actively hunting in the site, and there were two successful GHOW nests on power poles along the canals at the eastern edge of the site.

SUMMARY/CONCLUSION

Protocol surveys of the RE Slate Project Site were conducted by qualified biologists in accordance with the Swainson's Hawk Technical Advisory Committee's *Recommended Timing and Methodology for Swainson's Hawk Nesting Surveys in California's Central Valley* (TAC 2000). There are no trees in the project site and therefore no possibility for SWHA to nest in the project site. Potentially suitable nesting sites were identified at five locations within 0.5-mile of the project site (**Table 1**), and one successful SWHA nest was identified. A second location had an unsuccessful nesting attempt. The project site was only scantly used by foraging SWHA throughout the survey period.

Feel free to contact me by phone at (916) 365-8700 or by email at StephenS@helixepi.com if you have any questions.

Stephen Stringer

Stephen Stringer, M.S.
Senior Biologist

Attachments:

Attachment A - Figures

- Figure 1. Regional Location Map
- Figure 2. Aerial Map
- Figure 3. Suitable Nest Tree Locations within 0.5 Mile

Attachment B – Site Photographs

References:

Swainson's Hawk Technical Advisory Committee (TAC). 2000. Recommended Timing and Methodology for Swainson's Hawk Nesting Surveys in California's Central Valley. May 31.

Attachment A

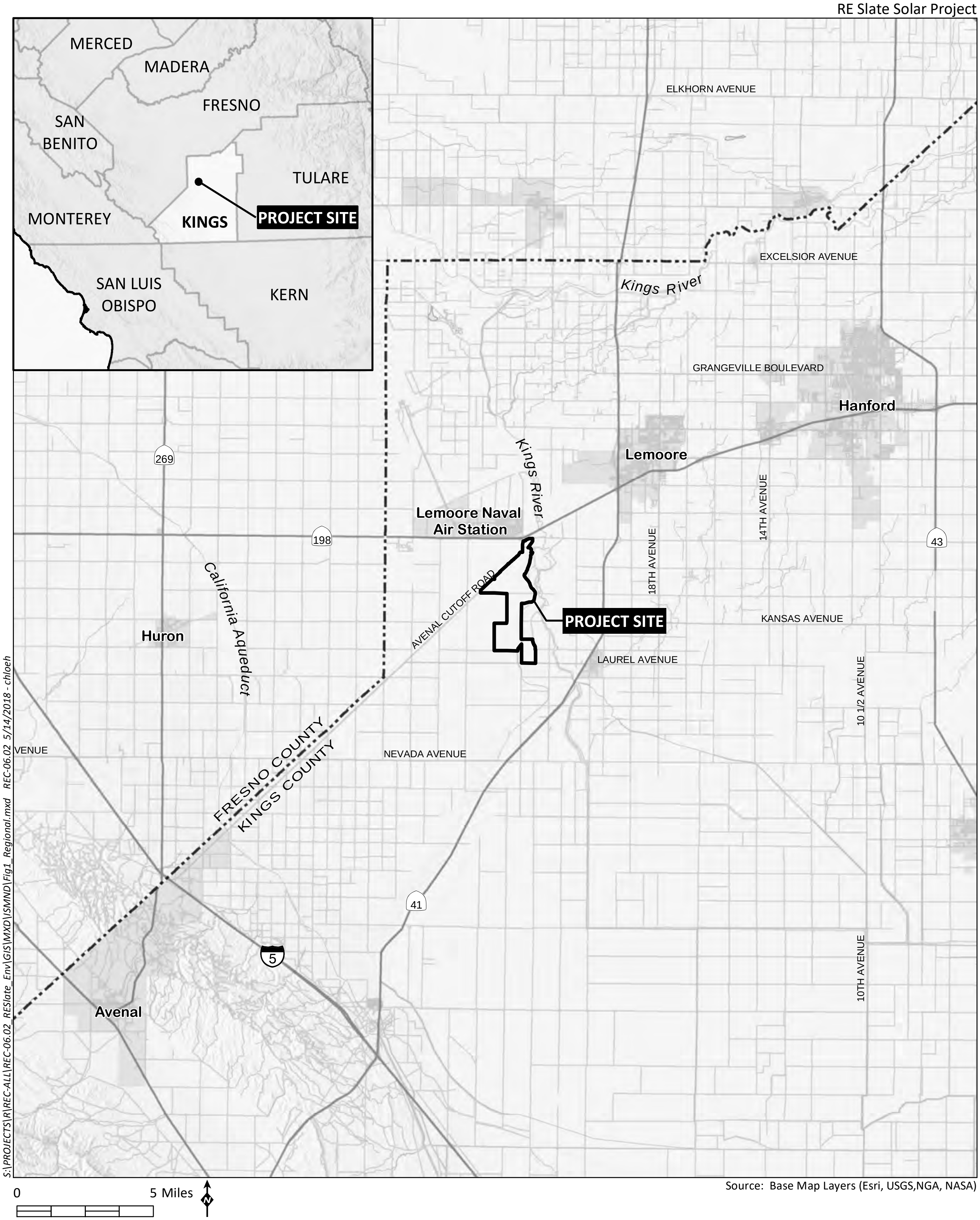
Project Location Map

Aerial Map

Suitable Nest Tree Locations within 0.5 Mile

Attachment B

Site Photographs



Source: Base Map Layers (Esri, USGS,NGA, NASA)

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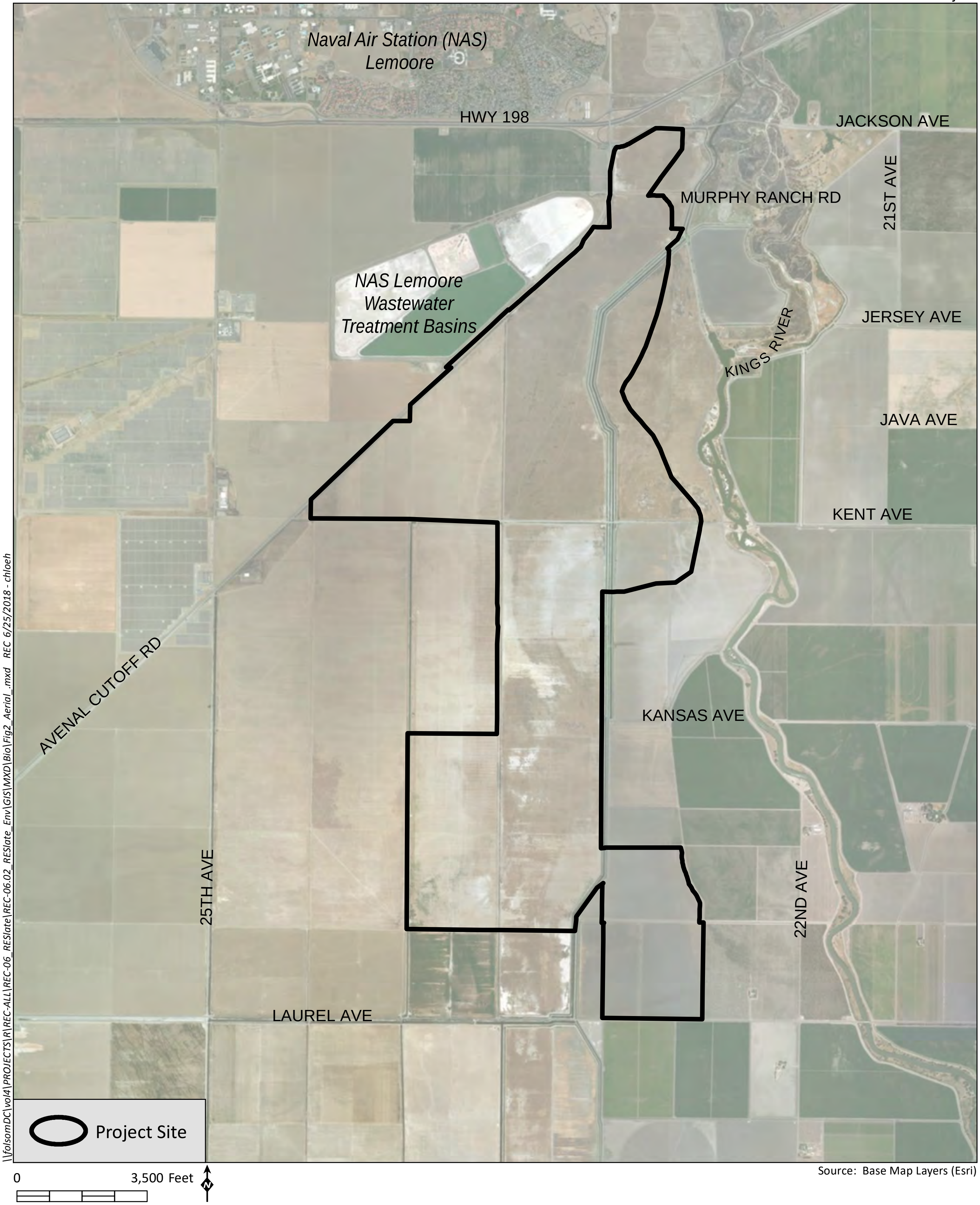
Regional Location

Figure 1



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Source: Base Map Layers (Esri)

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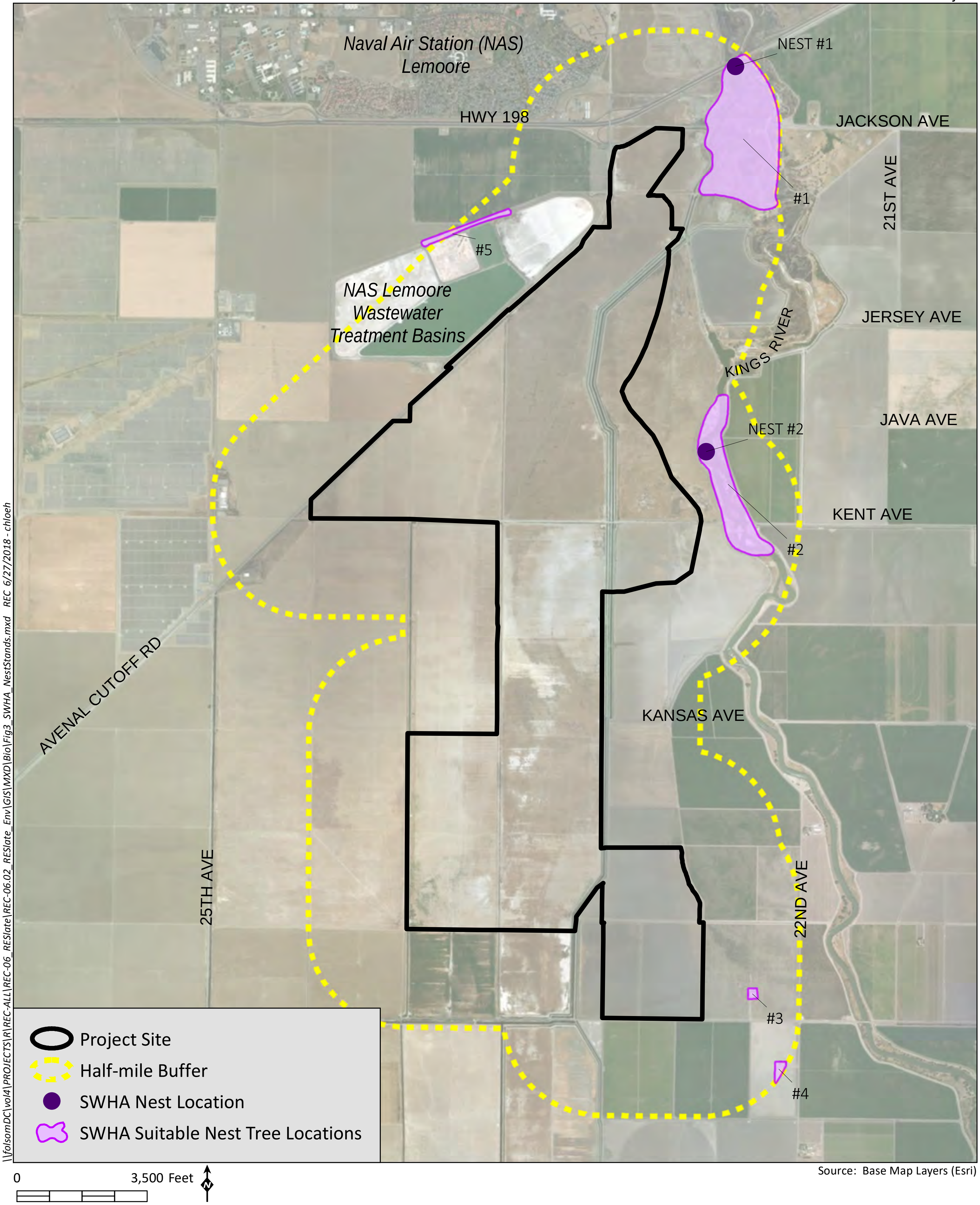
Aerial Map

Figure 2



Source: Base Map Layers (Esri)

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Swainson's Hawk Nest & Suitable Trees Locations Map

Figure 3

Photo 1. Nest tree #1, 0.5 mile north of the project site at Highway 198. This nest was active throughout the survey.

Photo 2. Nest tree #2, 0.25 mile east of the project site at the Kings River. This nest was not successful.

Photo 3. Swainson's hawks perched in a snag near Nest #2. These birds had abandoned nest location #2 by May 21.

Photo 4. Looking across the southeast portion of the project site toward Stand no. 3.

Photo 5. Stand no. 4 viewed from the southeast corner of the project site.

Photo 6. Stand no. 5 viewed from the north, near Highway 198.

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Swainson's Hawk Foraging Use of a Large-scale Solar Generating Facility in an Agricultural Landscape

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February 2018 | REC-04.04

TABLE OF CONTENTS

LIST OF TABLES

ATTACHMENTS

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1.0 INTRODUCTION

Under contract with Recurrent Energy, HELIX Environmental Planning, Inc. (HELIX) conducted a study to evaluate Swainson's hawk foraging use of a large-scale solar generation facility (SGF) in an agricultural landscape. A previous study demonstrated that Swainson's hawk will not only forage in a small-scale SGF but that Swainson's hawk used the small-scale SGF for foraging more frequently than would be predicted based on the proportion of potential foraging habitat available to Swainson's hawk in the landscape (Estep 2013). The purpose of the present study was to see if the results of Estep (2013) would also be true with a large-scale SGF (>1,000 acres) in a different landscape. The study site was chosen because it contains a large-scale SFG that is currently being managed to maintain low herbaceous cover between the solar panels and in undeveloped portions of the facility, resulting in a high percentage of the facility providing potentially suitable foraging for raptors, including Swainson's hawk. Additionally, the existing SGF is adjacent to thousands of acres of agricultural habitat typical of the central San Joaquin Valley and Swainson's hawks are known to be present in the region.

1.1 BACKGROUND

The state-listed as threatened Swainson's hawk (*Buteo swainsoni*) breeds in the Central Valley, where it depends on agricultural habitats for foraging. Foraging is typically considered to occur within roughly 10 miles of the nest (CDFW 1994). Conversion of potential foraging habitat for the Swainson's hawk to unsuitable uses may be considered a significant impact under the California Environmental Quality Act (CEQA), and the California Department of Fish and Wildlife has published guidelines for mitigating impacts to Swainson's hawk in the Central Valley (CDFG 1994). The guidelines call for mitigation of foraging habitat loss through a process of acquisition, preservation, and management of replacement lands. Generally, the entire developed acreage of a site is considered to be permanently converted from suitable Swainson's hawk foraging habitat to unsuitable uses, triggering mitigation requirements at a ratio of 0.5:1 to 1:1 (replaced: impacted) based on factors such as proximity to an active Swainson's hawk nest.

Development of SGFs does not necessarily eliminate all habitat on a site available to hawks for foraging as can other types of development such as residential and commercial development, because solar arrays typically occupy only a small percentage of the total land cover of a site (often less than 30%) as viewed from above. The remaining land cover can often be managed as grassland habitat, which could provide foraging for Swainson's hawk and potentially a prey base for surrounding agricultural areas. Questions regarding whether Swainson's hawk will forage in SGFs center around whether open areas with herbaceous cover between rows of solar panels as well as other undeveloped areas on the site with herbaceous cover would be attractive to Swainson's hawk and would/could be utilized by Swainson's hawk. If Swainson's hawk use open areas within a SGF for foraging, it stands to reason that such use of a site should be taken into account when evaluating potential impacts to this species during the CEQA process.

1.2 SWAINSON'S HAWK NATURAL HISTORY

Swainson's hawks are breeding season residents of California, currently found primarily in the Central Valley but also in the southern desert regions and the northeast portion of the state. Most individuals migrate to South America in the fall, though some small groups may remain in California year-round

(CDFG 1994). Swainson's hawks return to California in March and begin establishing nesting territories. Nest construction continues through April and eggs are usually laid between early April and early May. Incubation lasts 34-35 days, and the young fledge 42-44 days after hatching. The Swainson's Hawk Technical Advisory Committee (TAC) recommended protocol for Swainson's hawk nesting surveys in the Central Valley defines five survey periods based on breeding season phenology (TAC 2000): January – March 20 (Period I); March 20 – April 5 (Period II – courtship/territory establishment); April 5 – April 20 (Period III – nest building); April 21 – June 10 (Period IV – incubating/hatching); June 10 – July 30 (Period V – post-fledging). These dates are based on a typical breeding season for the majority of birds in the Delta region (San Joaquin County to Yolo County) and may shift earlier with decreasing latitude.

Swainson's hawks typically nest in scattered trees or in riparian corridors adjacent to agricultural fields or pastures that are their primary foraging areas (CDFG 1994). Major prey species include California voles, pocket gophers, deer mice, California ground squirrels, mourning doves, ring-necked pheasants, meadowlarks and other passerines, grasshoppers, crickets, and beetles (Estep 1989). Swainson's hawks are active aerial predators that hunt in low circling flights over fields, often following farm equipment. During the breeding season, Swainson's hawks eat mainly vertebrates, shifting to insects during migration (Palmer 1988).

Agricultural lands considered suitable foraging habitat for Swainson's hawk include alfalfa, fallow fields, low-growing row or field crops (*e.g.*, beets, tomatoes), dry-land and irrigated pasture, rice (when not flooded), and cereal crops (CDFG 1994). Suitability for Swainson's hawk foraging is driven largely by the interaction of two factors: prey base supported by the crop type, and accessibility of prey to aerial predators (Estep 1989). Accessibility of prey is determined by vegetation structure; dense cover of vegetation over approximately 12-inches height renders prey largely inaccessible and reduces foraging use (Estep 1989, 2009). Swainson's hawk use of agricultural lands is often associated with mowing or other activity that disturbs prey and reduces vegetative cover (Estep 1989, Swolgaard *et al.* 2008).

1.3 SWAINSON'S HAWK HABITAT PREFERENCES

Comparative studies of foraging habitat use consistently find that Swainson's hawks forage disproportionately in alfalfa and harvested fields (Estep 1989, Babcock 1995, Smallwood 1995, Swolgaard *et al.* 2008, Estep and Dinsdale 2012, Estep 2013, Fleishman *et al.* 2016) because these habitats support large numbers of prey and have low vegetation structure and/or are frequently harvested. Based on such comparative studies, vineyards have often been considered unsuitable foraging habitat because the extent to which Swainson's hawks would attempt to capture prey between rows of tall vegetation is considered negligible (Estep 2013). Similarly, solar generating facilities have often been considered unsuitable foraging habitat because they are usually classified as urban development. However, recent studies indicate that both vineyards and SGFs provide some foraging habitat value for Swainson's hawk.

Swolgaard *et al.* (2008) studied Swainson's hawk use of vineyards in a vineyard-dominated agricultural landscape in northern San Joaquin County, and found that Swainson's hawks foraged in vineyards 0.5 times as frequently as would be expected from the proportion of vineyard acreage to the total study area. In the same study, alfalfa was used 12 times as frequently as would be expected. In a similar study conducted in southern Sacramento County, Estep (2013) found that Swainson's hawks foraged in vineyards 0.66 times as frequently as would be expected and in alfalfa 1.9 times as frequently as would be expected. In the former study, vineyards made up 41 percent of the acreage in the study area and alfalfa 2.2 percent. In the latter study, vineyards were 6.5 percent of the total study area and alfalfa 10.7

percent. Estep (2013) included SGFs in the study area, and found that Swainson's hawks foraged in SGFs 1.8 times as frequently as would be expected from the proportion of SGF acreage to the total study area.

Estep and Dinsdale (2012) surveyed Swainson's hawks in the central San Joaquin Valley, and found that nesting was concentrated along and east of the Kings River/Fresno Slough riparian corridor where nest trees were most abundant. High-value agricultural foraging habitat such as irrigated pasture and alfalfa was also more abundant east of the Kings River, which favored Swainson's hawk nesting in that portion of the study area. West of the Kings River, nest trees were scarce and agriculture was more dominated by wheat, cotton, and row crops, and Swainson's hawk nesting was consequently reduced. Despite the relative lack of high-value agricultural foraging habitat west of the Kings River, Swainson's hawks would fly from east of the Kings River to forage opportunistically in alfalfa, wheat, and row crops such as tomatoes during harvest or other activities that expose prey.

Previous studies of Swainson's hawk foraging use of vineyards (Swolgaard *et al.* 2008) and SGFs (Estep 2013) have focused on comparing foraging use of those habitats to foraging use of a surrounding diverse agricultural landscape that included high-value habitats such as irrigated alfalfa. These studies were conducted in San Joaquin and Sacramento counties, where Swainson's hawk densities are high relative to the central San Joaquin Valley west of the Kings River. Estep (2013) studied small-scale SGFs ranging in size from 105 to 200 acres. This study compares foraging use of a large-scale SGF to surrounding agricultural lands in the central San Joaquin Valley, the site of several proposed large-scale SGFs.

2.0 METHODS

2.1 STUDY AREA

The study was conducted in the central San Joaquin Valley, in western Kings County (***Figure 1-Attachment A***). The study area is 5 to 7 miles southwest of the town of Lemoore, and 0.5 to 3.5 miles west of the Kings River. Except for development associated with Naval Air Station (NAS) Lemoore and several existing solar generating facilities, land uses in the region surrounding the study area are entirely agricultural. The region supports a wide diversity of crops including pistachios, grapes, cotton, tomatoes, melons, onions, wheat, beets, safflower, and alfalfa. The study area included an existing large-scale SGF, and a nearby site consisting of active agricultural lands used as a comparison area for the existing SGF.

2.1.1 Existing Solar Generating Facility

The existing large-scale SGF used in this study is the RE Mustang Solar facility (Mustang SGF), which is an approximately 1,100-acre SGF located south of State Route 198, west of 25th Avenue, and north of Kent Avenue, near NAS Lemoore (***Figure 2a-Attachment A***). Solar panels in the facility are mounted on trackers that tilt the panels east-west to follow the sun throughout the day. The maximum height of the tracker structure is approximately 10 feet at maximum tilt. Trackers are arranged in rows, set 20 feet apart on center, which results in a spacing of 12 feet between rows when the panels are horizontal and 14 feet at maximum tilt. The geometry of the solar trackers results in between 60 and 72 percent of the ground surface within a block of trackers remaining visible from the air through the course of the day. The Mustang SGF includes approximately 720 acres of solar trackers, with the remainder consisting of transformer pads, access roads, transmission line corridors, an electrical substation, road rights-of way, and blocks of undeveloped land. Of the 1,100-acre site, between approximately 200 and 288 acres are covered by solar panels through the course of a day, with the remainder of the ground surface visible from the air. The ground surface in the facility is dirt and supports a cover of grasses and forbs. The facility is regularly grazed by sheep to control weeds and reduce vegetation height. Sheep were actively grazing the facility throughout the study.

The Mustang SGF is bordered on the northwest by pistachio orchards, the southwest and south by wheat fields and the RE Kent South SGF, the east by inactive agricultural land, and the north by State Route 198. Beyond the highway to the north are a line of eucalyptus trees and a large wheat field. Two high-voltage electrical transmission lines run through the southern half of the Mustang SGF including a 500-kV line; a 55-kV line runs along Kent Avenue, and a lower-voltage line runs along the west side of 25th Avenue. These power lines provide perches for a wide variety of birds, as well as nest sites for red-tailed hawks on the largest towers. Security camera and meteorological towers along the perimeter fence of the SGF also provide perches for raptors. Pistachio orchards and the SGF itself provide abundant nest sites for songbirds.

2.1.2 Comparison Area

The area used to compare to the existing Mustang SGF is agricultural land located 0.25 mile southeast of the Mustang SGF, south of Kent Avenue and east of 25th Avenue (***Figure 2b-Attachment A***). Unlike the existing Mustang SGF, the comparison area was not a clearly defined, fenced facility distinct from surrounding land uses and is comprised of very large parcels. For this reason, the comparison area was a substantially larger survey area than the existing SGF. The comparison area included an approximately 2-mile x 2.5-mile rectangle bounded by Kent Avenue on the north, Laurel Avenue on the south, 25th Avenue on the west, and a set of 3 large canals on the east, plus approximately 0.25-mile out from those landmarks in all directions, with the exception of across Avenal Cutoff Road. At the time of the study, the comparison area was inactive agricultural land with a moderately dense cover of non-native forbs and grasses as well as wheat fields that were harvested and/or grazed during the study, disked fields, cotton, and orchards.

A 55-kV transmission line runs along Kent Avenue, and smaller lower-voltage lines run south into the proposed Mustang Two Solar Site along canals to provide power to groundwater wells. Lower-voltage transmission lines run along 25th Avenue, Laurel Avenue, and along the canals at the east edge of the comparison area. These power lines all provide perches for raptors as well as songbirds. The nearest trees to the comparison area are approximately 0.5-mile to the east along the Kings River.

2.2 SURVEYS

Surveys were conducted weekly for 9 weeks between May 24 and July 20, 2017, which corresponds to the late incubation/hatching period through late post-fledging. Each survey was conducted by two biologists to allow the existing SGF and the comparison site to be surveyed simultaneously. Each survey consisted of two 4-hour sessions, one in the afternoon/evening and one the following morning (***Table 1***) for a total of 72 hours of survey effort at each of the two sites. Morning sessions started at 0600; afternoon/evening sessions were adjusted to end between 1930 and 2000 as sunset times changed. The study was terminated after 9 weeks, when Swainson’s hawks were no longer observed in the study area.

Table 1. Summary of Survey Effort

		Start		End		
Week	**Date**	**Time**	**Temp. (F)**	**Time**	**Temp. (F)**	**Surveyors[1]**
1	5/24	1530	96	1930	89	L. Travanti (In)
	5/25	0600	54	1000	66	G. Aldridge (Out)
2	5/31	1530	83	1930	76	S. Stringer (In)
	6/1	0600	61	1000	73	G. Aldridge (Out)
3	6/8	1600	88	2000	77	L. Travanti (In)
	6/9	0600	68	1000	76	G. Aldridge (Out)
4	6/14	1600	90	2000	85	G. Aldridge (In)
	6/15	0600	57	1000	82	L. Travanti (Out)
5	6/21	1600	105	2000	98	B. Rosenbaum (In)
	6/22	0600	76	1000	101	G. Aldridge (Out)
6	6/28	1600	97	2000	92	G. Aldridge (In)
	6/29	0600	58	1000	83	L. Travanti (Out)
7	7/5	1600	103	2000	96	L. Travanti (In)
	7/6	0600	69	1000	91	G. Aldridge (Out)
8	7/12	1600	102	2000	95	G. Aldridge (In)
	7/13	0600	68	1000	83	L. Travanti (Out)
9	7/19	1545	98	1945	93	G. Aldridge (Out)
	7/20	0600	62	1000	80	L. Travanti (In)

[1]In=inside RE Mustang SGF; Out=comparison area

Each 4-hour survey session consisted of eight 30-minute survey periods rotated among established observation points (***Figures 2a and 2b-Attachment A***). Travel time between points was deducted from the survey period for the destination point. To avoid spatiotemporal biases, survey periods were rotated among survey points according to an 8x8 Latin square design modified with a 9th row (*i.e.*, each point was surveyed once in each 30-minute survey period over the course of 8 weeks, with one additional occurrence of one point in each period in Week 9) (**Attachment B**).

Surveyors identified raptors with the aid of binoculars and scored behaviors as: kiting; prey capture attempt (successful, unsuccessful, undetermined); circling below 100-meters; perching; circling above 100-meters consistent with prior Swainson's hawk foraging studies (Estep 2013). Data for the Mustang SGF (In) were recorded only for birds observed inside the perimeter of the SGF; data for the comparison area (Out) were recorded for all birds identifiable from the observation point. Although Swainson's hawks typically take prey from low circling flight, perching was considered foraging behavior because perched hawks were evidently watching the surrounding area for prey.

3.0 RESULTS

3.1 OVERALL BIRD ACTIVITY IN THE STUDY AREA

Raptor activity in the study area appeared to be dominated by resident pairs breeding in the immediate vicinity. Species observed consistently included red-tailed hawk (*Buteo jamaicensis*), northern harrier (*Circus cyaneus*), and American kestrel (*Falco sparverius*). Most of these observations were repeated observations of the same individuals. A pair of red-tailed hawks nested on a 500-kV transmission tower in the southern end of the existing Mustang SGF and successfully fledged two chicks. Another pair of red-tailed hawks was consistently observed in the east and south of the comparison area, although the location of their nest was not identified. A pair of American kestrels nested in a palm tree at the northern end of 25th Avenue, near State Route 198, and was consistently observed in the northern part of the existing Mustang SGF. Other kestrels were observed frequently in the southern portion of the SGF, hunting from perches on the solar panels and fences. A pair of northern harriers was consistently observed foraging in the existing Mustang SGF, and other individuals were seen regularly in the comparison area. The location of suitable norther harrier nesting habitat near the study area is unknown, but habitat may be present in a large artificial pond southwest of the intersection of State Route 198 and Avenal Cutoff Road. Raptors seen only occasionally in the study area include burrowing owl (*Athene cunicularia*) and great horned owl (*Bubo virginianus*), both observed several times in the comparison area but likely not breeding.

Altogether, a total of 120 observations of raptors other than Swainson's hawk were recorded, 58 in the existing Mustang SGF and 62 in the comparison area (***Table 2***). The majority of these observations were red-tailed hawks, most often observed perching on power lines.

Table 2. Other Raptor Observations

Species	Inside SGF	Outside SGF	Total
Red-tailed hawk	31	39	70
Norther harrier	15	10	25
American kestrel	12	2	14
Great horned owl	--	9	9
Burrowing owl	--	2	2
Total	**58**	**62**	**120**

The study area supported an abundance of mourning dove (*Zenaida macroura*), western kingbird (*Tyrranus verticalis*), house finch (*Carpodacus mexicanus*), and loggerhead shrike (*Lanius ludovicianus*). These species were observed in large numbers perched on power lines throughout the study area and on the perimeter fence of the existing Mustang SGF. The SGF and the pistachio orchards to the west supported large colonies of red-winged blackbird (*Agelaius phoeniceus*) that took advantage of nest sites on the solar trackers and in orchard trees, and a pond of irrigation water in the orchard that provided permanent surface water. The blackbirds and kingbirds were extremely aggressive toward any larger bird that flew through the existing Mustang SGF below 30-40 meters. Although they did not nest in the SGF, large groups of American crows (*Corvus brachyrhynchos*) were observed often in the early morning.

3.2 SWAINSON'S HAWK ACTIVITY IN THE STUDY AREA

3.2.1 Inside the RE Mustang SGF

Swainson's hawk activity in the study area was low. A single pair of Swainson's hawks nested in the eucalyptus trees along State Route 198, across the highway from the northwest corner of the Mustang SGF, and was consistently observed attempting to forage within the SGF during the early weeks of the study. These birds were often driven off the SGF either by the resident red-tailed hawks or harassing flocks of blackbirds and kingbirds when they attempted to circle over the SGF. Despite harassment, these Swainson's hawks were observed circling over the SGF, perching on power lines and camera towers around the perimeter of the SGF, and exhibiting hunting behaviors in the SGF (***Table 3***). These birds were also frequently observed circling over a large field north of State Route 198 west of NAS Lemoore; however, these observations were not included in the data as that field was not inside the study area. This pair of Swainson's hawks was observed in the Mustang SGF from Week 1 through Week 6 (May 24 – June 29), for a total of 56 minutes of perching/circling time, 2 kiting behaviors, and 1 prey capture attempt (***Table 3***).

3.2.2 Outside the SGF (Mustang 2 Site and Vicinity)

A pair of Swainson's hawks was observed perching on power poles along 25th Avenue south of Avenal Cutoff Road and circling over a large wheat field west of 25th Avenue early in the study when that field was being harvested. The pair was also observed perching on power poles and circling over fields along Laurel Avenue east of 25th Avenue. Altogether, Swainson's hawks were observed in the comparison area for a total of 60 minutes of perching/circling time and no prey capture attempts (***Table 3***). All but 17 of those minutes were observations in the large wheat field west of 25th Avenue, during and shortly after harvest.

Table 3. Swainson's Hawk Foraging Observations

Week	Location	Session	Period	Perching/Circling (minutes)	Kiting	Prey Capture
1	In	AM	--	--	--	--
		PM	VI	--	2	--
	Out	AM	--	--	--	--
		PM	--	--	--	--
2	In	AM	--	--	--	--
		PM	I, II	3, 4	--	--
	Out	AM	IV	19	--	--
		PM	I, VIII	10, 4	--	--
3	In	AM	--	--	--	--
		PM	VI, VII	2, 5	--	1
	Out	AM	V	5	--	--
		PM	--	--	--	--
4	In	AM	V	2	--	--
		PM	IV	4	--	--
	Out	AM	--	--	--	--
		PM	III	1	--	--

5	In	AM	--	--	--	--
		PM	--	--	--	--
	Out	AM	VI	10	--	--
		PM	--	--	--	--
6	In	AM	I, VI	20, 6	--	--
		PM	--	--	--	--
	Out	AM	--	--	--	--
		PM	--	--	--	--
7	In	AM	--	--	--	--
		PM	--	--	--	--
	Out	AM	--	--	--	--
		PM	--	--	--	--
8	In	AM	--	--	--	--
		PM	--	--	--	--
	Out	AM	I, VIII	10, 1	--	--
		PM	--	--	--	--
9	In	AM	--	--	--	--
		PM	--	--	--	--
	Out	AM	--	--	--	--
		PM	--	--	--	--

3.3 INCIDENTAL OBSERVATIONS OF SWAINSON'S HAWK

Swainson's hawks were routinely incidentally observed in the vicinity of the study area during travel to and from the study area and are known to be actively nesting and foraging in the region. Swainson's hawks were routinely observed perching in eucalyptus trees along SR 198 north and west of the site and pairs of hawks were seen foraging over wheat and alfalfa fields east of the Kings River when those fields were being harvested.

On July 27, Mr. Aldridge returned to the study area to assess conditions following the cessation of surveys. At that time, the large wheat field across SR 198 from the Mustang SGF was being harvested, and at least 30 individual Swainson's hawks were observed circling over the mower. This corroborates anecdotal information received by Mr. Stringer during the survey on May 31 when the site manager of the Mustang SGF informed Mr. Stringer that flocks of foraging hawks were present in the Mustang SGF whenever the site was being mowed.

4.0 DISCUSSION

Our results indicate that Swainson's hawks will forage in a large-scale SGF located in a landscape of agricultural fields. Overall Swainson's hawk activity in the study area was low and roughly equal in the Mustang SGF and the comparison area. Inside the Mustang SGF, Swainson's hawks were observed circling or perching on power poles for a total of 56 minutes between late May and late June, after which time they were no longer seen using the SGF. Outside the SGF in fallow and active agricultural fields, Swainson's hawks were observed circling or perching on power poles for a total of 60 minutes, mostly early in the survey but also twice in mid-July. The only kiting and prey capture attempts observed during the study were inside the existing Mustang SGF. Although the total minutes of use was roughly equal for the two areas, the comparison area was approximately 4.4 times as large as the SGF, which indicates that intensity of use was higher inside the SGF.

The results of the study suggest that Swainson's hawks use the agricultural lands surrounding the Mustang SGF almost exclusively during and shortly after harvest. The large wheat fields along 25th Avenue south of the SGF and others south of Laurel Avenue accounted for almost all of the Swainson's hawk observations outside the SGF, with all foraging activity happening while those fields were being harvested. Swainson's hawks were not observed foraging in the proposed Mustang Two SGF site within the comparison area, which was inactive dry pasture with a dense, tall herbaceous cover throughout the survey. Lands east of the Kings River are likely much higher quality foraging habitat than the study area, due to agricultural practices (*i.e.*, more irrigated alfalfa fields) and proximity to nest trees in the riparian corridor of the Kings River (Estep and Dinsdale 2012). Our results suggest that for Swainson's hawks nesting in the overall lower-quality lands west of the Kings River, the Mustang SGF is not less attractive as foraging habitat than surrounding agricultural lands.

An effect of breeding season phenology was apparent in the contrast between Swainson's hawk activity in the wheat fields that were mowed early in the survey (corresponding to the nestling phase) and activity in the field mowed after mid-July (during the post-fledging phase). Early in the survey, single pairs of Swainson's hawks were observed perching and circling over fields being mowed, while later in the season when breeding territoriality was presumably much weaker, 30 hawks were observed circling over one field.

Estep (2013) found that Swainson's hawks used SGFs at a higher frequency than expected, and 3 times as often as vineyards, which had a roughly equal expected frequency and have the most similar architecture to SGFs (*i.e.*, structural elements arranged in long rows with gaps between the rows). Estep (2013) concluded that Swainson's hawks forage in SGFs, and do so preferentially in excess of what would be expected based on availability. Estep (2013) notes that of key importance is the maintenance of a grassland substrate to promote abundance and accessibility of rodent prey.

In their study of Swainson's hawk use of vineyards, Swolgaard *et al.* (2008) concluded that Swainson's hawks may use sub-optimal foraging habitat such as vineyards opportunistically, based on habitat availability and proximity to nest sites. They recommend that vineyards maintain a short vegetative cover between rows of vines and establish buffer areas of native grasses between blocks of vines in larger tracts of vineyards in order to increase prey accessibility for raptors. Smallwood (1995) recommended that field edges, road verges, and canal banks be managed as strip corridors of grasses and shrubs to provide movement and dispersal habitat for small mammals, and concluded that "even orchards and vineyards, which are generally considered to be poor Swainson's hawk foraging areas, can provide habitat for prey when cover crops are grown." Cover crops provide an alternative food source for rodents other than the commercial crop, and thus reduce the need for rodent control.

Large-scale SGFs such as Mustang Solar typically include extensive contiguous areas of open land around the edges of solar array blocks, along roads, around substations, and in transmission line corridors. These open areas are in addition to the 60 to 72 percent of the ground surface within solar array blocks that is not covered by solar panels. Because an SGF is not an agricultural field, rodents do not pose a threat to commercial crops and therefore do not require suppression; SGFs can be actively managed to promote rodent populations. Finally, mowing, disking, or grazing activities can be performed at any time in an SGF without regard to an agricultural cropping schedule, and so activities that attract Swainson's hawks can be timed to coincide with the needs of Swainson's hawks.

4.1 CONCLUSION

The results of the present study are consistent with previous studies of Swainson's hawk foraging in agricultural landscapes. This study shows that Swainson's hawks will forage in a large-scale SGF located in a landscape dominated by wheat, orchards, row crops, cotton, and idle agricultural land, and generally forage opportunistically in response to agricultural activities such as harvesting or mowing. This study suggests that development of agricultural land as an SGF does not eliminate its value as Swainson's hawk foraging habitat, and that value may be enhanced through management of the SGF to promote rodent prey abundance and accessibility including planting of herbaceous cover and site management to maintain low cover and frequent disturbance. This study also suggests that use of a SGF by Swainson's hawk may depend in part on breeding season phenology and proximity to the nest site. Idle agricultural land with a dense cover of vegetation greater than 12-inches appeared to provide no foraging habitat value for Swainson's hawk.

The results of this study should be considered during CEQA review of large scale SGFs when conducting project specific analysis of potential impacts to Swainson's hawk foraging habitat. Evidence indicates that development of a SGF within suitable Swainson's hawk foraging habitat does not necessarily eliminate all habitat on a site available to hawks for foraging as can other types of development and may in fact enhance foraging habitat if managed properly. Therefore, development of large scale SGFs should not be treated the same as residential or commercial development during the CEQA process when assessing potential impacts to Swainson's hawk foraging habitat and developing a mitigation strategy to reduce impacts to less than significant.

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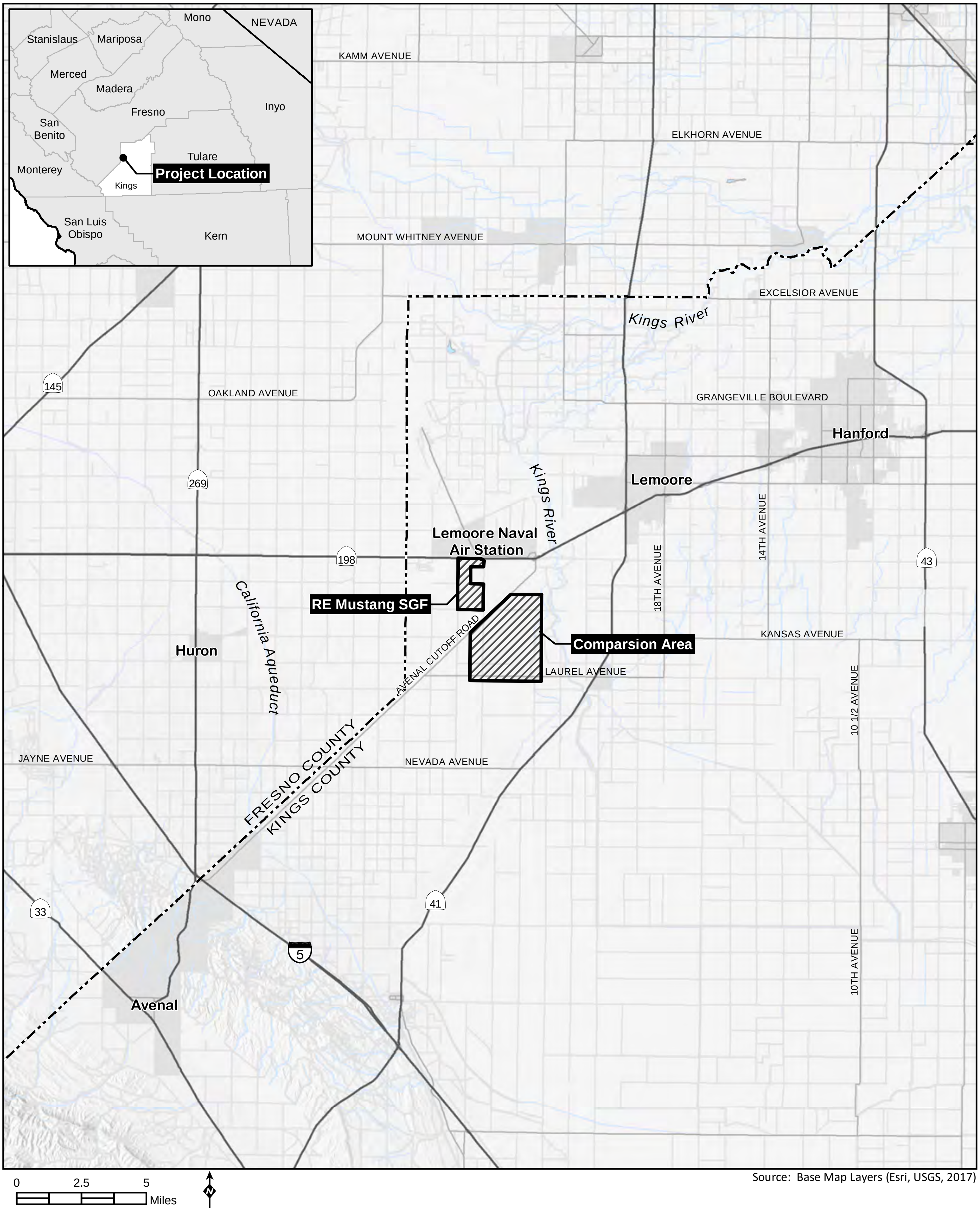
Attachment A-Figures



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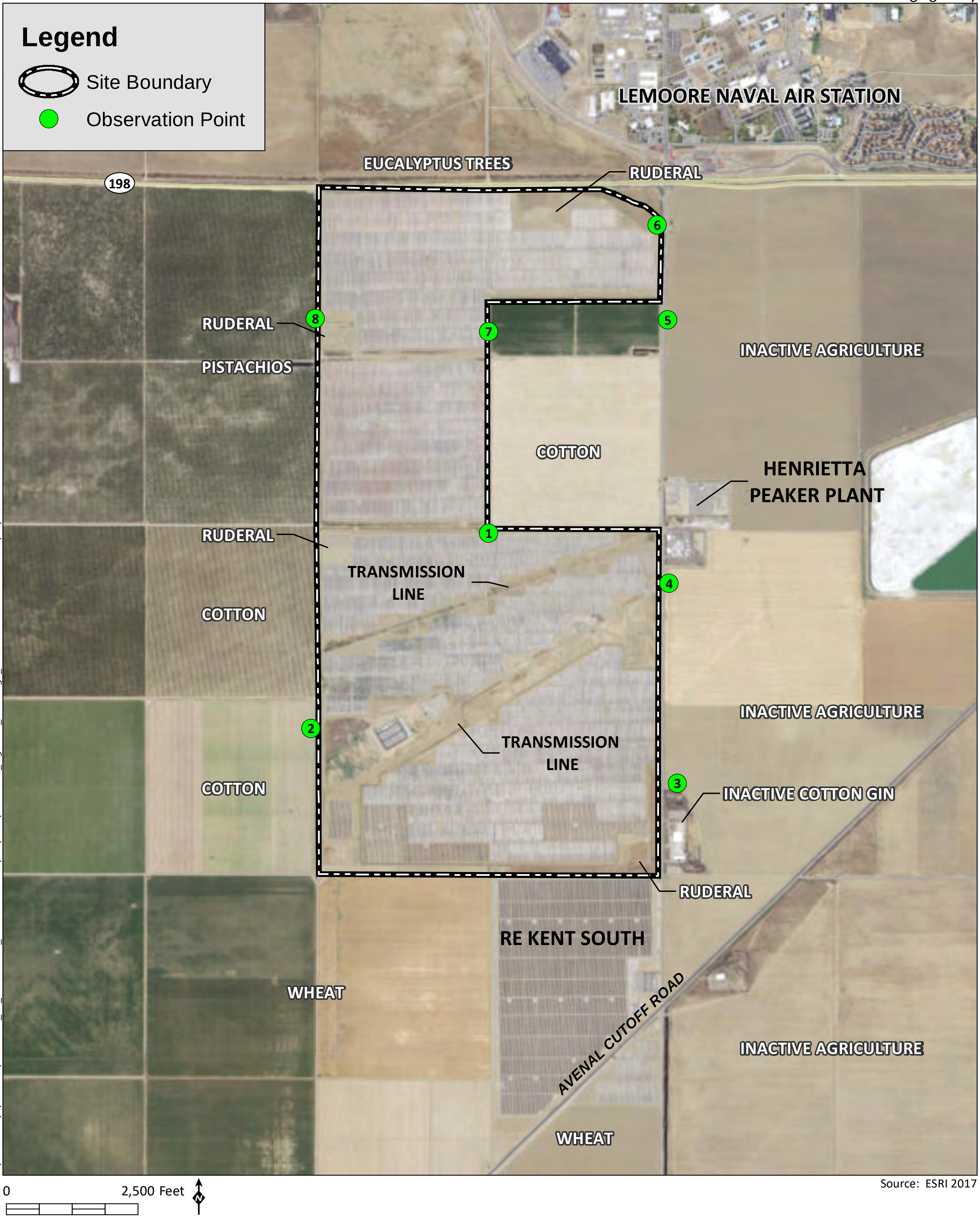
Source: Base Map Layers (Esri, USGS, 2017)

HELIX Environmental Planning

Regional Location and Site Vicinity

Figure 1



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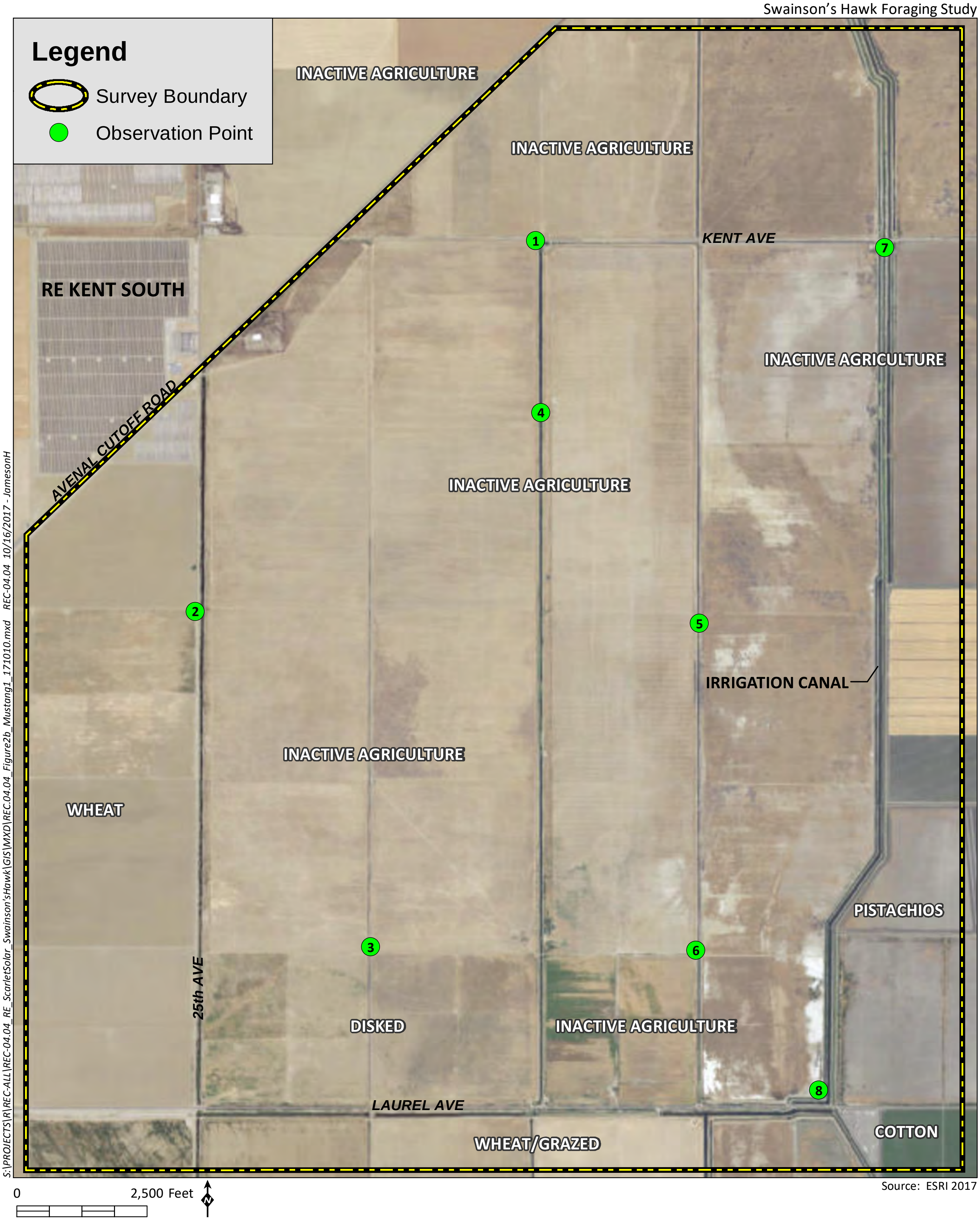
Source: ESRI 2017

HELIX Environmental Planning

Mustang SGF Observation Points and Land Use

Figure 2a



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Source: ESRI 2017

HELIX Environmental Planning

Comparison Area Observation Points and Land Use

Figure 2b

Attachment B-Latin Square Design

Modified Latin Square Observation Rotation for SWHA Foraging Study

RE Mustang SGF Site (Inside)

PM Observations

	I	II	III	IV	V	VI	VII	VIII
5/24	8	1	7	3	2	6	4	5
5/31	1	7	8	4	3	5	6	2
6/8	6	3	4	5	7	2	8	1
6/14	5	4	6	1	8	3	2	7
6/21	7	2	1	6	5	4	3	8
6/28	3	6	2	7	1	8	5	4
7/5	2	5	3	8	4	1	7	6
7/12	4	8	5	2	6	7	1	3
7/19	6	2	5	3	8	4	1	7

AM Observations

	I	II	III	IV	V	VI	VII	VIII
5/25	4	7	8	2	6	5	1	3
6/1	1	3	6	7	4	8	2	5
6/9	6	8	1	4	3	2	5	7
6/15	2	5	7	8	1	3	6	4
6/22	8	6	5	3	2	7	4	1
6/29	5	4	2	6	7	1	3	8
7/6	7	2	3	1	5	4	8	6
7/13	3	1	4	5	8	6	7	2
7/20	7	4	1	5	3	2	6	8

Mustang 2 Comparison Site (Outside)

PM Observations

	I	II	III	IV	V	VI	VII	VIII
5/24	1	5	3	8	7	6	4	2
5/31	2	1	8	6	5	3	7	4
6/8	8	4	1	3	2	7	5	6
6/14	3	6	4	7	1	2	8	5
6/21	5	7	6	2	8	4	3	1
6/28	7	2	5	4	3	1	6	8
7/5	6	8	7	1	4	5	2	3
7/12	4	3	2	5	6	8	1	7
7/19	7	1	4	6	3	5	8	2

AM Observations

	I	II	III	IV	V	VI	VII	VIII
5/25	4	2	8	7	5	3	6	1
6/1	6	3	5	2	7	1	8	4
6/9	8	6	7	3	2	4	1	5
6/15	3	5	2	6	1	7	4	8
6/22	5	7	4	1	8	2	3	6
6/29	7	4	1	8	6	5	2	3
7/6	2	1	6	4	3	8	5	7
7/13	1	1	3	5	4	6	7	2
7/20	5	6	7	4	1	3	2	8

Attachment C-Photos

Photo 1. View of the solar panels in the existing RE Mustang SGF showing spacing between rows and mowed herbaceous cover under and between the rows of panels. The photo was taken looking east from the western boundary of the site.

Photo 2. View of ruderal areas with herbaceous cover within the existing RE Mustang SGF. Solar panels are visible in the background. The photo was taken looking east from the vicinity of Observation Point 8.

Photo 3. View of ruderal areas with herbaceous cover within the existing RE Mustang SGF. A pair of red-tailed hawks nested on the 500-kV transmission tower in the left-hand side of the photo. The photo was taken looking east from the vicinity of Observation Point 2.

Photo 4. View of a dirt road within the existing RE Mustang SGF that bisects the site in an east/west direction. Ruderal herbaceous vegetation lines the road. Observation Point 1 lies along this road.

Photo 5. Representative view of fallow fields within the comparison area looking east from the vicinity of Observation Point 3.

Photo 6. Representative view of a dirt road and adjacent fallow fields within the comparison area looking northeast from near Observation Point 1.

Photo 7. Representative view of fallow fields within the comparison area looking northeast from the vicinity of Observation Point 2.

Photo 8. Representative view of an agricultural ditch and adjacent fallow fields within the comparison area looking north from the vicinity of Observation Point 6.

Appendix G

San Joaquin Kit Fox Habitat Assessment and Protocol Survey Report

HELIX Environmental Planning

RE Slate Solar Project

Early Evaluation Requirements for San Joaquin Kit Fox

June 2018

Prepared for:
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1 INTRODUCTION

HELIX Environmental Planning, Inc. (HELIX) has prepared this San Joaquin kit fox (SJKF) habitat assessment report on behalf of the proposed RE Slate solar project (Project). The purpose of this report is to provide the Project proponent (RE Slate LLC) and the U.S. Fish and Wildlife Service (USFWS) with the information outlined in the Early Evaluation Requirements section of the *U.S. Fish and Wildlife Service San Joaquin Kit Fox Survey Protocol for the Northern Range* (USFWS 1999).

Information in this report comes from site reconnaissance and desktop evaluation. Site reconnaissance was conducted by HELIX biologists Stephen Stringer, Daniel Van Essen, and George Aldridge on April 3-5, 2018. Site reconnaissance consisted of a visual inspection of the entire Project site. The field survey was conducted to obtain 100% visual coverage of the site. The field survey was modified to account for the size and condition of the project site (e.g., most of the site is fallow agricultural fields with easily visible ground surface). Regularly spaced transects were not performed of the entire site; focused surveys were conducted of areas such as canal banks, road berms, and field margins where small mammal burrows were common or where vegetation obscured the ground surface. Surveys were conducted using a combination of pedestrian transects and vehicular surveys from roads and accessible portions of the fields. All surveys were conducted with the aid of binoculars. Data collected in the field included mapping vegetation and land covers, assessing the suitability of the site for SJKF, mapping locations of potential burrows, and identification of general flora and fauna. Desktop evaluation included interpretation of current and historical aerial imagery for the Project site and the surrounding region, sensitive species database queries, and review of existing biological resources reports for nearby lands. Supplemental information provided with this report includes figures (**Attachment A**) and representative site photos (**Attachment B**).

1.1 SAN JOAQUIN KIT FOX

San Joaquin kit fox (SJKF; *Vulpes macrotus mutica*) was listed as “threatened with extinction” on March 11, 1967 under the Endangered Species Preservation Act of October 15, 1966 (16 U.S.C. 668aa(c); 32 FR 4001), and is currently listed as “Endangered” under the Endangered Species Act of 1973 (16 U.S.C. 1531-1544). The following discussion of SJKF ecology is taken from the *Recovery Plan for Upland Species of the San Joaquin Valley, California* (USFWS 1998).

Average size for SJKF is a body length of 19 – 20 inches plus an 11 – 12 inch tail, 12 inches high at the shoulder, and weighing 4.5 – 5 pounds, with females typically smaller than males. The coat is tan in the summer and silver-gray in the winter, with pale undersides and a black-tipped tail. SJKF is distinguishable from sympatric fox species (red fox [*Vulpes vulpes*] and gray fox [*Urocyon cinereoargenteus*]) by having smaller feet, larger ears, and overall smaller bodies. Gray foxes are most similar to SJKF; however, gray foxes are larger and have a distinct longitudinal black stripe on the tail.

The largest extant populations of SJKF are at the western margins of the Central Valley and the eastern Coast Ranges. Population centers occur in western Kern County (Elk Hills and Pixley National Wildlife Refuge), eastern San Luis Obispo County (Carrizo Plain), western Fresno County and eastern San Benito County (Ciervo – Panoche Natural Area), Southern Monterey County (Fort Hunter-Liggett and Camp Roberts), western Merced County, and eastern Contra Costa County. These population centers generally form a metapopulation lying west of Interstate 5 and/or south of Allensworth, with only isolated occurrences of SJKF in the remainder of the valley. By 2006, SJKF was determined to be largely eliminated from the central San Joaquin Valley (USFWS 2010).

In the San Joaquin Valley, SJKF is known to use grasslands, scrublands, agricultural areas where dens are available (e.g., unplowed fields, row crops, vineyards, or orchards), non-irrigated pastures, vernal pool grasslands, playas, and alkali meadows. SJKF dens are typically located on slopes less than 40 degrees, and pupping dens are usually on level ground; den entrances are typically 8 – 10 inches in diameter. SJKF use many dens in a season, and occupied dens often show no signs of use. Common signs of use include a dirt ramp leading to the entrance, flattened grass around the entrance, scat, tracks, and prey remains. Home ranges for SJKF vary from 1 to 12 square miles, depending on prey availability. Kit foxes are nocturnal.

2 PROJECT DESCRIPTION

The RE Slate solar project is a proposed solar photovoltaic generating facility located in unincorporated northern Kings County, California. The nearest towns are Lemoore Station and Lemoore. Interstate 5 is 17 miles to the west and State Route (SR) 99 is 27 miles to the east (**Figure 1**). The Project site lies west of the Kings River, south of SR 198. The Project site is generally bounded by Laurel Avenue on the south, Avenal Cutoff Road on the northwest, and Jackson Avenue on the north (**Figure 2**). The Project site occupies parts of Sections 25, 26, 34, 35, and 36 of Township 19 South, Range 19 East; and parts of Sections 1, 2, 11, 12, and 13 of Township 20 South, Range 19E, Mount Diablo Meridian. The site is depicted on the U.S. Geological Survey “Westhaven, CA”, and “Stratford, CA” 7.5-minute quadrangle map (**Figure 3**).

The Project site comprises approximately 2,730 acres of active and fallow agricultural land, with associated unpaved farm roads and staging areas, as well as numerous canals. There are no residences or other permanent structures in the Project site. There are no paved roads in the site. RE Slate LLC proposes to construct an approximately 300 MW solar photovoltaic generating facility on the site; the proposed photovoltaic arrays would be mounted in rows on steel posts approximately 4 feet above grade with approximately 15 feet between rows. Construction of the proposed project would begin in 2019 and is expected to continue for 12 months.

3 SJKF SIGHTING RECORDS

The California Natural Diversity Database (CNDDB) was queried for SJKF occurrence records within 10 miles of the Project site (CDFW 2019). The query returned a total of 14 SJKF occurrence records within 10 miles of the Project site, of which 11 are more than 5 miles from the site (**Table 1**). The most recent occurrence record for SJKF is dated 2002, and located 2.5 miles north of the Project site, on West Grangeville Avenue. This record is of a single fox sighted in a fallow field. The only other occurrence record dated after 1990 is of a single fox sighted in a walnut orchard 2 miles southwest of Hanford, dated 2000. Most of the remaining occurrence records for SJKF within 10 miles of the Project site date from the early 1970s, and are based on distribution maps published in 1975. The most recent record of a SJKF den is located 5 miles east of the Project site at Kansas Ave and 17th Avenue, and is dated 1988.

CNDDB occurrence records for SJKF generally form 3 clusters: a cluster of records in alkali sink habitat located east of the Project site southwest of Hanford; a cluster of records located in grassland habitat on NAS Lemoore, and; a cluster of records located along the California Aqueduct southeast of Huron. Most of the records in the first 2 clusters date from the 1970s and the records in the 3rd cluster date from 1981.

Table 1. CNDDB SJKF Occurrence Records (within 10-miles) Summary

Occurrence No.	Distance	Information:
191	5-mi SE	6/23/1989: one fox sighted of unknown age.
213	2.5-mi N	1 adult observed during a Caltrans spotlighting route around SR 41. 2002.
454	4.5-mi SE	Kit fox or den observed in May 1988.
455	6-mi SE	Sighting in vicinity sometime from 1972 through July 1975. Kit fox or scat observed in May 1988.
456	7-mi SE	Kit fox or scat observed in May 1988.
916	8.5-mi SE	Sighting sometime from 1972 through July 1975.
917	7-mi E	Sighting, road kill or den prior to 1972. Sighting sometime from 1972 through July 1975.
927	4-mi N	Sighting sometime from 1972 through July 1975.
928	6.5-mi NW	Sighting sometime from 1972 through July 1975.
929	7.5-mi NW	Den observed sometime from 1972 through July 1975.
930	9-mi NW	Den observed sometime from 1972 through July 1975.
1047	9-mi SW	3 dens observed on 17 may 1981.
1048	9.5-mi SW	Inactive den observed in survey sometime between 16 may and 9 June 1981.
1049	9.5-mi SW	Inactive den observed sometime between 16 may and 9 June 1981.

The Sacramento Fish and Wildlife Office was contacted regarding USFWS spatial data potentially not in CNDDB. USFWS personnel indicated that the USFWS does not possess recent SJKF occurrence records for the San Joaquin Valley not reflected in CNDDB (T. Lehman, personal communication March 29, 2016).

4 VEGETATION COMMUNITIES IN THE PROJECT SITE

The Project site contains no natural vegetation communities classified in CNDDB; land cover in the site is fallow agriculture fields with associated canals/ditches and ruderal/disturbed areas (roads, staging areas, field margins) which are periodically grazed by cattle and sheep.

4.1 FALLOW AGRICULTURE

Fallow agriculture includes agricultural fields not under active cultivation at the time of the surveys. Some of these areas were being grazed by cattle and sheep at the time of the surveys. Fallow agriculture areas include former wheat (*Triticum aestivum*), beet (*Beta vulgaris*), and safflower (*Carthamus tinctorius*) fields. Many fallow fields are littered with fragments of plastic irrigation hose torn out of the ground when the field was last disked.

Recently fallow fields still show signs of past cultivation but have become overgrown with early-successional non-native species associated with past disturbance. Vegetation in these areas is overwhelmingly dominated by tumble mustard (*Sisymbrium altissimum*), pigweed (*Chenopodium album*), wild lettuce (*Lactuca serriola*), and remnants of the last crop (i.e., wheat, beets, or safflower). Older fallow fields support tumble mustard and pigweed along with patches of Russian thistle (*Salsola tragus*) that increase in extent with time since last cultivation.

Some areas occur within the fallow agricultural fields where the ground surface is covered by a salt powder or crust as a result of past irrigation practices and the lack of discing in recent years. Vegetation in these areas is very sparse or absent, and consists of a few salt-tolerant species such as salt marsh sand spurrey (*Spergularia marina*), pigweed, Mediterranean barley (*Hordeum marinum*), and beet, usually at the margins.

4.2 CANALS/DITCHES

Active and inactive canals and ditches occur throughout the site to carry water to and from the agricultural fields. Freshwater marsh habitats form along the lower banks and margins of large, active canals and drains, occurring as dense patches of cattail (*Typha latifolia*), tule (*Schoenoplectus acutus*), and tall flatsedge (*Cyperus eragrostis*), with scattered Goodding's black willow (*Salix gooddingii*). These habitats are periodically removed as part of channel maintenance in the canals. Hydrology in the Project site is managed, and canals are filled or dewatered periodically, according to irrigation and drainage needs in surrounding lands.

4.3 SOILS

Soils in the Project site are sandy to clayey loams in 5 soil mapping units (NRCS 2018): Calflax clay loam, saline-sodic, 0 to 2 percent slopes, MLRA 17; Gepford clay, partially drained; Lethent clay loam; Pitco clay, partially drained, and; Tulare variant clay, partially drained. All of these soils are described as alluvium, and are variously derived from igneous, sedimentary, or calcareous rock. Calfax clay loam and Lethent clay loam have depths of greater than 80 inches to the water table; all other soils have depths of 0 inches to the water table. Lethent clay loam is described as having a natric restrictive layer at depths of 4-24 inches; all other soil types have depths of greater than 80 inches to a restrictive layer. All soils are described as slightly to strongly saline.

5 CONTINUITY WITH SURROUNDING AREAS

The Project site is flat and level, sloping less than 0.2 percent between the highest and lowest points. The highest point in the Project site is 218 feet above mean sea level (amsl) in the southwest corner and the lowest point is 198 feet amsl, 2.5 miles to the east. The net elevation change along the north-south axis of the Project site is 7 feet. Local topographic relief in the Project site is artificial, consisting of constructed berms along canals. The Project site is at the historic northern edge of the Tulare Lake Basin.

Surrounding lands are similarly flat and level, and consist of an expanse of agricultural fields in all directions. Agriculture in the 10 miles surrounding the Project site is a mix of irrigated and non-irrigated land. With the exceptions discussed below, there is complete continuity between the habitat in the Project site and similar habitat to a distance of 10 miles in all directions.

Non-agricultural land uses within 10 miles of the Project site include: existing solar photovoltaic generating facilities northwest of Avenal Cutoff Road and along 21st Avenue; the towns of Lemoore, Stratford, Armona, and the outskirts of Hanford to the east, and Lemoore Station to the north; Naval Air Station Lemoore to the north, and; the Kings River, which flows north-south near the eastern edge of the site (**Figure 2**).

Paved roads in the vicinity of the Project site include SR 198, which is a fenced freeway, Avenal Cutoff Road, which is an unfenced 2-lane highway, and Jackson Avenue and Laurel Avenue, which are unfenced 2-lane roads. SR 198 is in a fenced right-of-way and poses a significant barrier to wildlife movement into the site from the north. Avenal Cutoff Road is an unfenced right-of-way, but poses a moderate risk to wildlife movement into the site from the north and west because it carries a high volume of high-speed automobile traffic. Laurel Avenue and Jackson Avenue pose some risk to wildlife movement, as they carry low volumes of high-speed traffic. The Kings River provides a north-south movement corridor near the eastern edge of the Project site.

6 HABITAT SUITABILITY OF THE PROJECT SITE FOR SJKF

The entire Project site provides potentially suitable habitat for SJKF (**Figure 3**). Fallow fields and disturbed areas support small mammal prey such as voles, gophers, and ground squirrels and provide potential foraging habitat for SJKF. Fields and canals provide potential dispersal habitat for SJKF. In addition, burrows of California ground squirrel (*Otospermophilus beecheyi*) are abundant along canal banks and roads in the Project site, and these provide potentially suitable denning habitat for SJKF. However, no burrows with openings of suitable dimensions to be occupied by SJKF and no burrows showing signs of occupancy by SJKF were detected during field surveys. Several burrows suitable for coyote (*Canis latrans*) were observed in the site; however, these were greater than 12 inches diameter. Coyotes were observed in the site during the surveys.

Most of the CNDDB reported occurrences of SJKF within 10 miles of the Project site are over 5 miles from the site and more than 30 years old. The only SJKF records less than 20 years old are of transient individuals. Records of active SJKF dens in the area are more than 35 years old and are located in alkali sink habitat characterized by iodine bush (*Allenrolfea occidentalis*). This habitat does not occur in or adjacent to the Project site. Based on the results of the CNDDB record query, there is only a low potential for SJKF to be present in the Project site and vicinity.

7 POTENTIAL ADVERSE EFFECTS ON SJKF

A discussion of potential adverse effects on SJKF resulting from the proposed project would be purely speculative because the project is still in the early stages of the procurement and preliminary planning process. Project impacts to SJKF would be avoided to the extent feasible and the results of the SJKF evaluation and protocol surveys, if conducted, will be used to inform the project planning and design process. Potential adverse effects on SJKF would likely be limited to modification of potentially suitable foraging and dispersal habitat.

8 RECOMMENDATIONS FOR MITIGATING POTENTIAL ADVERSE EFFECTS ON SJKF

Not applicable at this time.

9 ANALYSIS OF CUMULATIVE EFFECTS

For the purposes of this analysis, cumulative effects are defined as follows (USFWS 1999):

"The cumulative or incremental environmental impact of the effect of the action together with impacts of past, present, and reasonably foreseeable future actions. The action area includes all areas to be affected directly or indirectly by the action, not merely the immediate area involved in the action."

As discussed in **Section 7** above, potential adverse effects on SJKF would likely be limited to modification of potentially suitable foraging and dispersal habitat. The Project site is not located in any areas identified as SJKF "core", "link", or "satellite" recovery areas (USFWS 1998). Thus, the Project would not contribute to a cumulative impact to identified SJKF population centers or important linkage or satellite habitat areas.

10 REFERENCES

California Department of Fish and Wildlife (CDFW). 2016. California Natural Diversity Database. Information expires 12/1/2018. Accessed June 20, 2018.

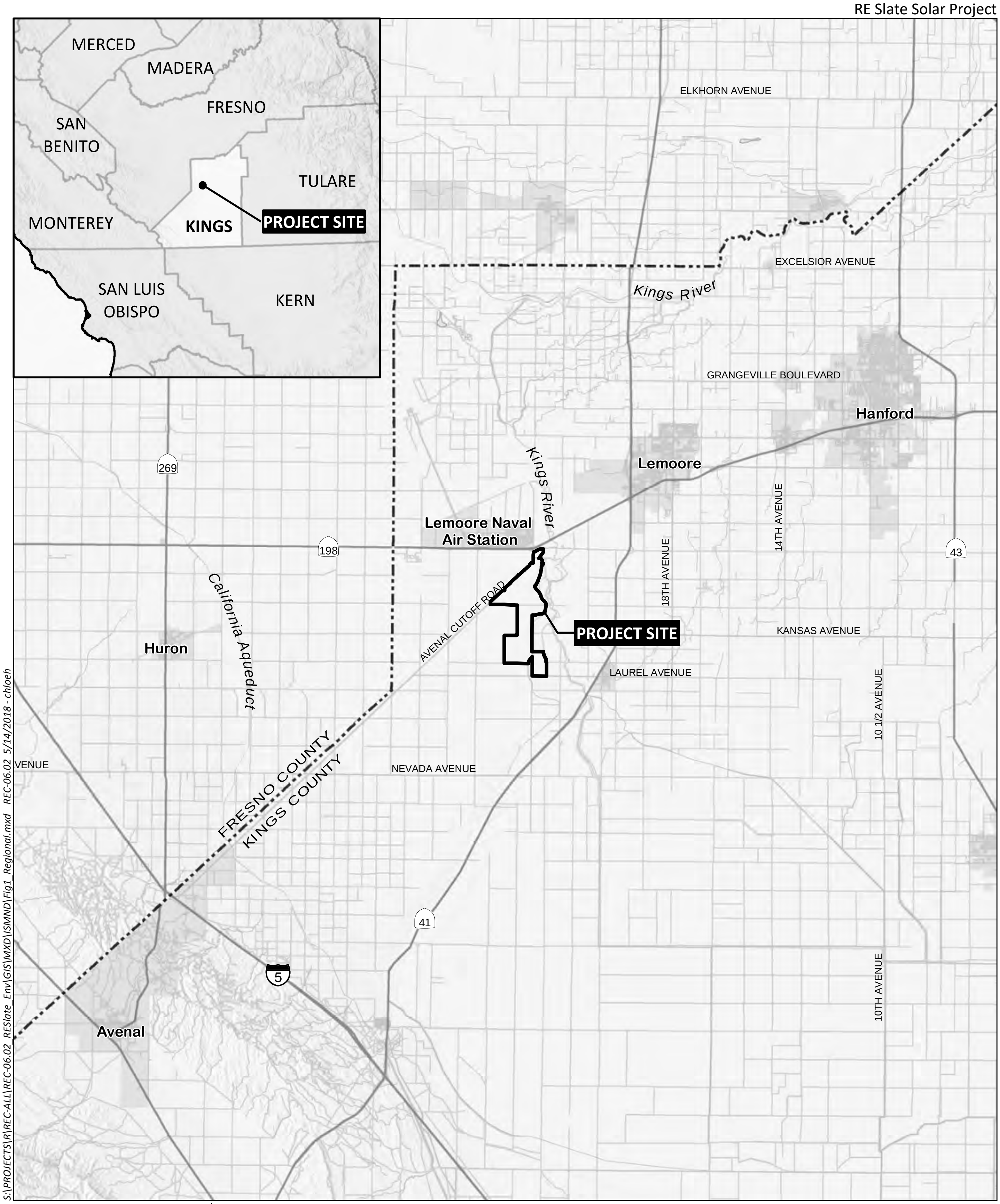
Natural Resource Conservation Service (NRCS). 2018. Web Soil Survey. Available at: <http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx.> Accessed 6/20/2018.

U.S. Fish and Wildlife Service (USFWS). 1998. *Recovery plan for upland species of the San Joaquin Valley, California*. Region 1, Portland, OR. 319 pp.

____. 1999. San Joaquin Kit Fox Survey Protocol for the Northern Range. Prepared by the Sacramento Fish and Wildlife Office. June.

____. 2010. San Joaquin Kit Fox (*Vulpes macrotus mutica*) 5-Year Review: Summary and Evaluation. Prepared by the Sacramento Fish and Wildlife Office.

Attachment A – Figures



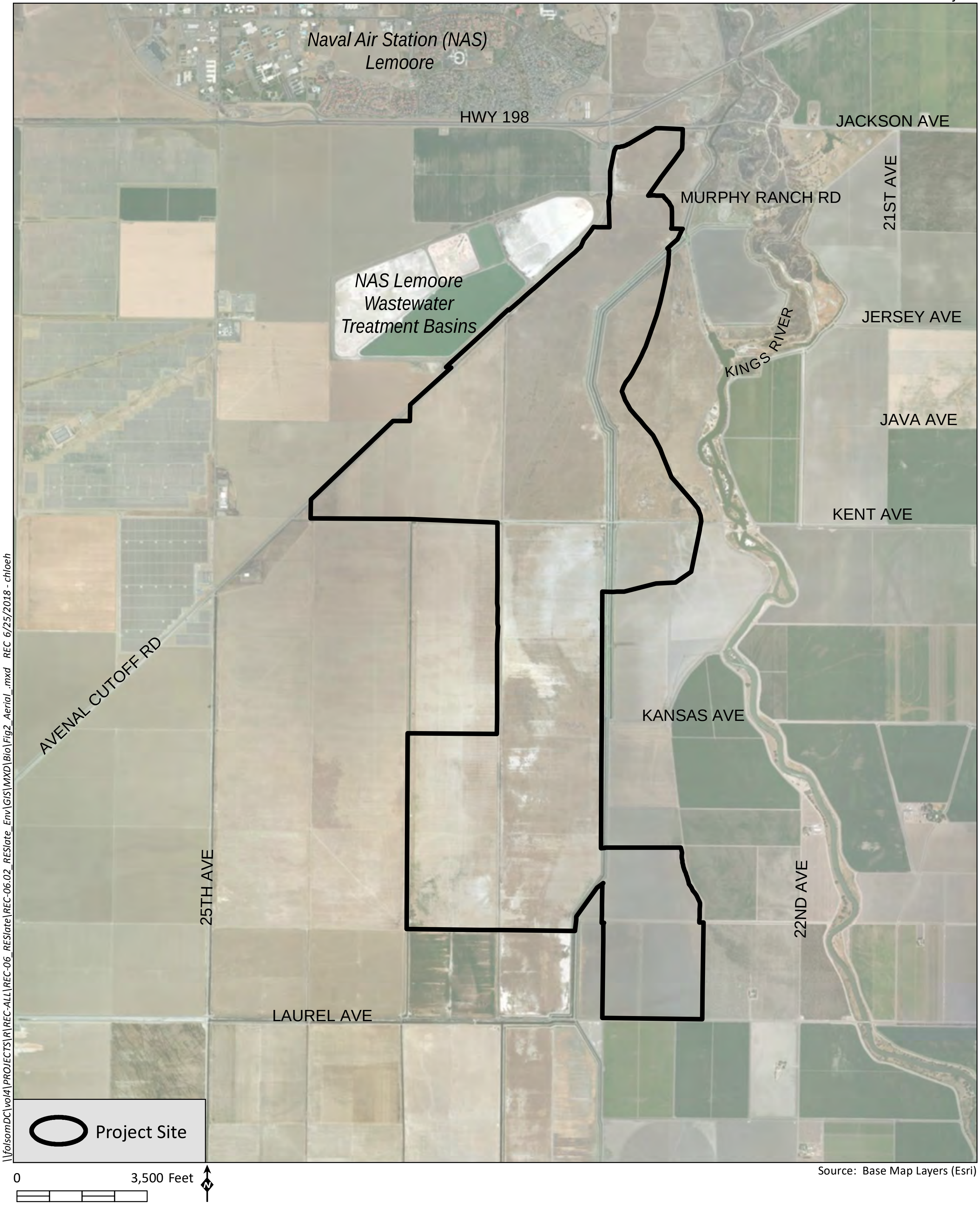
Source: Base Map Layers (Esri, USGS,NGA, NASA)

0 5 Miles

HELIX Environmental Planning

Regional Location

Figure 1



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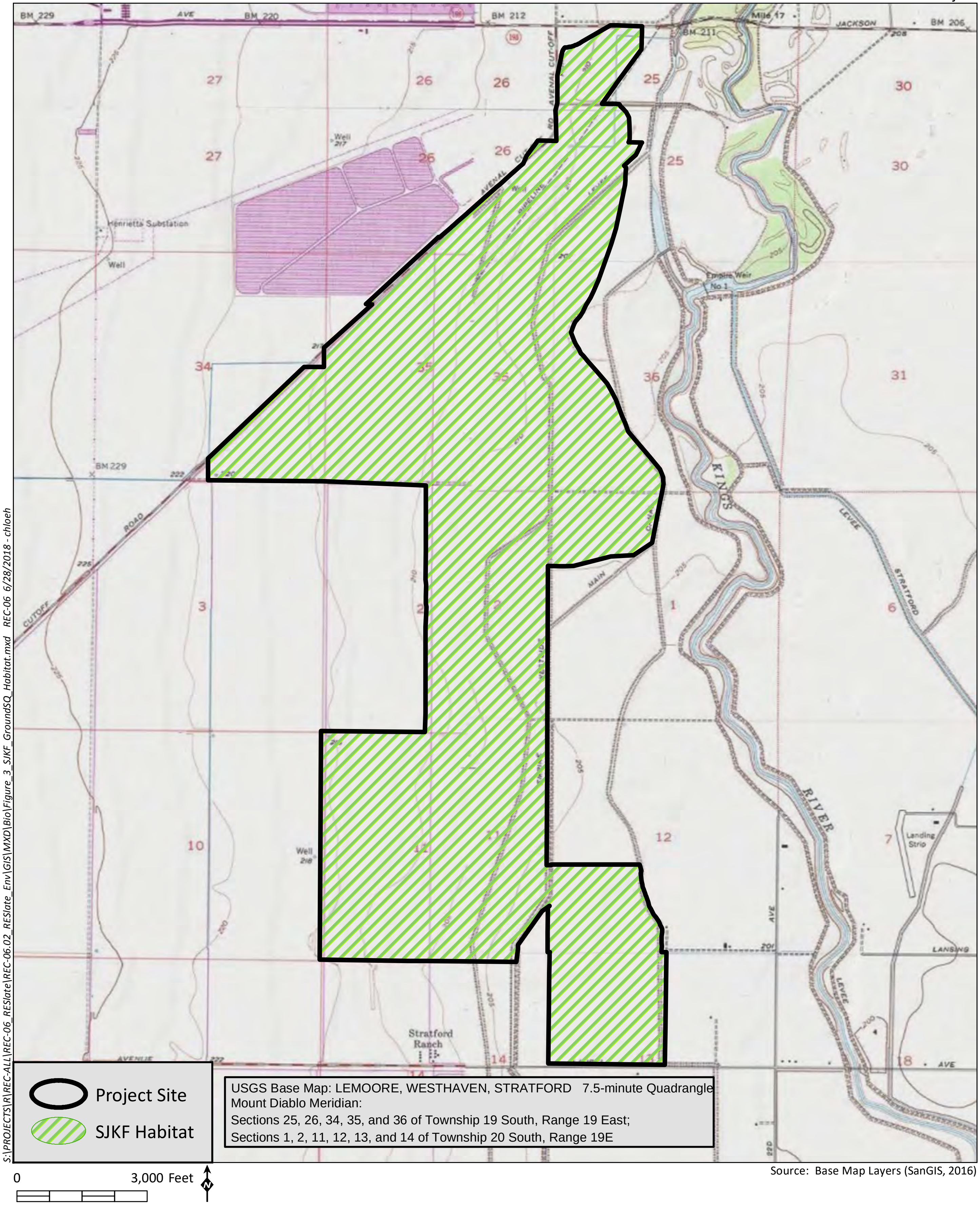
Source: Base Map Layers (Esri)

HELIX Environmental Planning

Aerial Map

Figure 2



Source: Base Map Layers (SanGIS, 2016)

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HELIX
Environmental Planning

Habitat Map

Figure 3

Attachment B – Site Photographs

Fallow wheat field grazed by sheep

Typical canal

Fallow beet field

Canal with ground squirrel burrows on the bank

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RE MUSTANG TWO Property:
San Joaquin Kit Fox Protocol Survey Report


Coyote (Canis latrans)

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AUGUST 2016

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List of Abbreviations and Acronyms

CDFG	California Department of Fish and Game
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CES	Californian Environmental Services
CNDDB	California Natural Diversity Database
GIS	Geographic Information System
GPS	Global Positioning System
SJKF	San Joaquin Kit Fox
US	United States
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

1 – INTRODUCTION

At the request of Helix Environmental Planning Inc., biologists from Californian Environmental Services (CES) conducted protocol surveys for San Joaquin kit fox (*Vulpes macrotis mutica*; SJKF) at the RE Mustang Two Property (Property), following the United States (US) Fish and Wildlife Service(USFWS) *SJKF Survey Protocol for the Northern Range* (USFWS 1999a). The surveys were completed by biologists Jeff Alvarez, Sarah Foster, Maya Khosla, Josh Goodwin, Ryan Witthaus, Jennifer Flohr, and Will Molland-Simms in July and August 2016. This report provides a property description, background research, methods, results and conclusions of the protocol surveys.

The intended use of the Property is for development of a solar photovoltaic generating facility (project). The project would entail installation of solar panels across the Property and fencing the outer perimeter. Previous reports for the Property (Helix Environmental Planning 2016) provided detailed project descriptions, evaluations of requirements for SJKF, and associated mapping.

2 – PROPERTY DESCRIPTION

2.1 LOCATION

The RE Mustang Two Property is approximately 1,800 acres in size and is located in Northern King's County near Lemoore, California. Figure 1 illustrates the Property in relation to its vicinity, which is located within the Westhaven USGS 7.5 Minute Quadrangle Map. The town of Lemoore is located approximately 6 miles to the northeast of the Property, and Interstate 5 is 17 miles to the west. The Property is located south of State Road 198, west of the Kings River, and can be accessed from the interchange of Avenal Cutoff Road and State Road 198. Avenal Cutoff Road is located to the west, Laurel Road to the south and Kent Avenue, a dirt road located immediately north of the Property, leads to the Kings River. Lansing Avenue is a dirt road located immediately south of the Property. East of the Property the Kings River and a network of canals, including the Empire West Main Canal, flow in a generally north-south direction.

2.2 PROPERTY DESCRIPTION

The Property is located in a part of the southern San Joaquin Valley floor that drains the Kings River Watershed. Land within the Property slopes gradually downward from west to east, with the eastern portion of the site located approximately 1 mile to the west of the Kings River corridor. The topography is level and the Property is divided into three long, roughly rectangular agricultural fields, each of which is oriented in a north-south direction, bordered by levees and canal structures to the east and west and electric or barbed wire fencing along most of the boundaries.

The RE Mustang Two Property area has historically been used for agricultural crop production, and there is evidence of recent agricultural activity, including alfalfa (*Medicago sativa*) and the stubble remains of wheat (*Triticum aestivum*) crops. Predominant vegetation on uncultivated portions of the Property is non-native grassland including species such as tumble mustard (*Sisymbrium altissimum*), pigweed (*Chenopodium album*), and wild lettuce (*Lactuca serriola*) (Helix, June 2016). At the time of the SJKF surveys, much of the Property was not in cultivation, though portions of the Property were being actively grazed by herds of cattle and sheep.

Habitats present within the Project area include agricultural, which is the dominant habitat type, non-native annual grassland habitat, and patches of ruderal habitat along the fenced perimeters of the Property (Attachment A). Agricultural flatlands are used for dry-farmed hay and contain a mixture of non-native annual grasslands and hay. Patches of non-native grassland habitat are present. One structure is present at the northwest corner of the Property.

2.3 REGULATORY FRAMEWORK

The California Environmental Quality Act (CEQA) is a California State law created to inform governmental decision-makers and the public about the potential environmental effects of proposed activities and to reduce negative effects. Project proponents are required under CEQA to disclose, consider, and avoid or reduce significant effects to endangered, threatened and rare species. Significant effects are identified in Appendix G of CEQA Guidelines as those that will:

- Substantially affect an endangered or rare animal or plant or its habitat;
- Interfere substantially with the movement of any resident or migratory fish or wildlife species; or
- Substantially diminish habitat for fish, wildlife, or plants.

CEQA Guidelines (California Code of Regulations, Title 14, Division 6, Chapter 3, Sections 15000-15387) are the regulations that explain and interpret CEQA for both the public agencies required to administer CEQA and for the public generally. The Guidelines provide objectives, criteria and procedures for the orderly evaluation of projects and the preparation of environmental impact reports, negative declarations, and mitigated negative declarations by public agencies. As such, they incorporate and interpret both the statutory mandates of CEQA and the principles advanced by judicial decisions. With regard to endangered, rare, or threatened species, Sections 15380(b), (c) and (d) of the CEQA Guidelines state that:

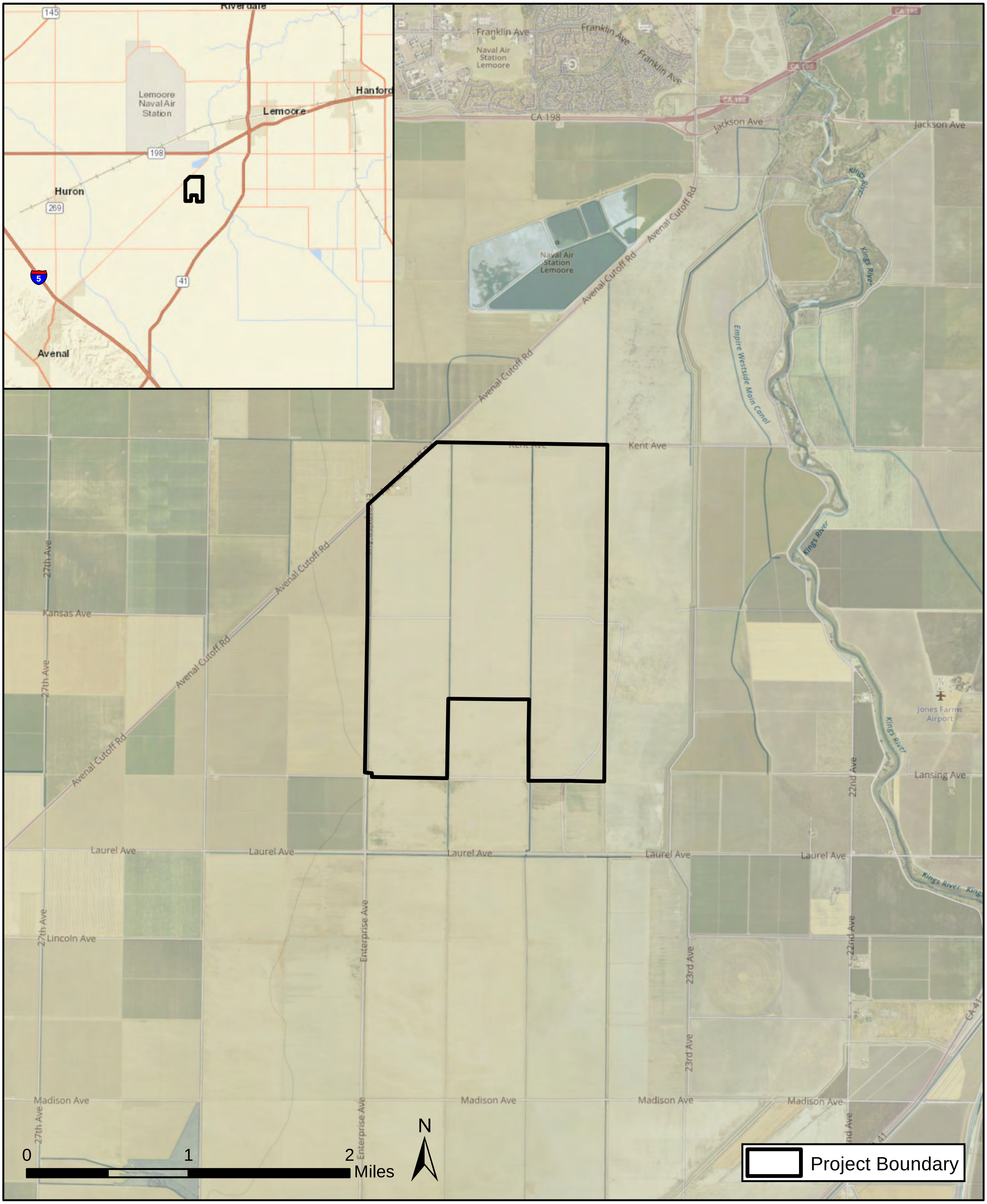
“(b) A species of animal or plant is:

“(1) “Endangered” when its survival and reproduction in the wild are in immediate jeopardy from one or more causes, including loss of habitat, change in habitat, overexploitation, predation, competition, disease, or other factors; or

“(2) “Rare” when either:

“(A) the species exists in such small numbers throughout all or a portion of its range that it may become endangered if its environment worsens;

“(B) The species is likely to become endangered within the foreseeable future throughout all or a significant portion of its range and may be considered “threatened” as that term is used in the Federal Endangered Species Act.



Californian Environmental Services, Inc.

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Figure 1: Project Vicinity and Site Map
San Joaquin Kit Fox Protocol Survey
RE Mustang Two Solar Project

"(c) A species shall be presumed to be endangered, rare or threatened, as it is listed in:

"(1) Sections 670.2 or 670.5, Title 14, California Code of Regulations; or

"(2) Title 50, Code of Federal Regulations §17.11 or 17.12 pursuant to the Federal Endangered Species Act as rare, threatened, or endangered.

"(d) A species not included in any listing identified in subdivision (c) shall nevertheless be considered to be endangered, rare or threatened, if the species can be shown to meet the criteria in subdivision (b)."

3 – SAN JOAQUIN KIT FOX

3.1 CONSERVATION STATUS

On March 11, 1967 SJKF was listed as a Federally endangered species. In 1971, it was listed as a State-threatened species. No critical habitat has been proposed for SJKF. SJKF is therefore afforded full protection under federal law from killing, harming or harassing (all forms of "take"). Federal agencies are required to ensure that activities they authorize, fund, or perform do not jeopardize the continued existence of the species. This document has been prepared to ensure that the Project will not result in any "take" of the SJKF. "Take" means to harass, harm, pursue, shoot, hunt, capture, or collect, or to engage in any such conduct.

3.2 SPECIES BIOLOGY

SJKF is a small, slim-bodied canid with large, conspicuously long and pointed ears, and a long, bushy, tail, with a black tip that is diagnostic in identification. SJKF is distinguished from the related gray fox (*Urocyon cinereoargenteus*) by its black tail tip – as gray fox has a prominent black stripe running along the length of the tail, is slightly larger in size, and lacks the large ears of the SJKF. Another close relative of the SJKF is the red fox (*Vulpes vulpes*), which is significantly larger, and has a pronounced white tip in its tail. All three species use similar habitat types.

SJKF is the smallest canid species in North America. SJKF is the largest of the kit fox subspecies, with adults weighing 2.1 to 2.3 kg (4.6 to 5 pounds). This species lives in annual grassland habitats where friable soils are present. The general habitat requirement for SJKF is annual grasslands or grassy open habitat stages with scattered shrubby vegetation.

SJKF is active year-round and is primarily nocturnal, requiring dens for temperature regulation, shelter from adverse weather, protection from predators, and pupping. Food requirements for SJKF are rodents, insects, and even garbage in urbanized areas. Prey items for SJKF include small mammals such as kangaroo rats (*Dipodomys* spp.), white-footed mice *(Peromyscus leucopus)*, California ground squirrels *(Otospermophilus beecheyi)*, other small mammals including desert cottontails *(Sylvilagus audobonii)* and black-tailed jack rabbits *(Lepus californicus)*, as well as insects (Jensen, 1972, Archon 1992).

Grassland habitats with a large rodent prey base and loose textured soils are thought to provide the best habitat for the SJKF. Historical SJKF habitat consists of open grassland areas at or close to valley bottoms; however, due to the extent of agricultural development in these areas, SJKF are currently known to use foothill habitat. SJKF also exhibit a capacity to utilize habitats that have been altered by humans, such as oil fields, grazed pasturelands, and “wind farms” (Cypher 2000). SJKF do prefer gentle slopes of less than 10 degrees, and the requirement for gentle slopes for reproductive dens may limit population viability in slopes with greater topographic relief; however, topographic heterogeneity has been identified as an important habitat requirement affecting SJKF distribution (Warrick and others 1998). Home range sizes varies from 642 to 7,660 acres (2.6 to 31 square km), which are likely to be affected by stochastic changes in resource abundance.

SJKF are likely to use more than one den, and have not been found to be highly territorial, since home range territory overlap is known to occur. Multiple den use is most prevalent during the dispersal season, and the use of approximately 11.8 dens per SJKF has been documented at the Naval Petroleum Reserve (Coopman and others 1998). Individual animals have been reported to use up to 70 different dens (Hall 1983). Therefore, it is important to designate and protect unused dens as potential SJKF habitat if the species is known to occur within a given area.

SJKF usually breed in December and January, and are primarily monogamous. After a gestation of 48 to 54 days, pups are born during late January-March (Zoellick and others 1987). Several studies have found that mean litter sizes reported for SJKF range from 2 to 3.8. Pups appear above ground at 3 to 4 weeks of age and are weaned when they are 6 to 8 weeks in age. Reproductive rates (the proportion of females bearing young) vary annually with environmental conditions, particularly with food availability. Although some yearling SJKF produce young, most do not reproduce until two years in age (Spencer and others 1992; Spiegel and Tom 1996, Cypher 2000). Some young of both sexes - but particularly females - may delay dispersal, and may assist their parents in raising in the following year’s litter of pups (Spiegel and Tom 1996).

Juvenile SJKF begin dispersing as early as June with a peak dispersal occurring in July. The age at dispersal ranges from 4 to 32 months (Cypher 2000). One study found that among juvenile SJKF surviving to July 1 at the Naval Petroleum Reserve, 49 percent of the males dispersed from natal home ranges while only 24 percent of the females dispersed (Koopman and others 2000). A total of 87 percent of the dispersing SJKF were within a year of age. A total of 65.2 percent of the dispersing juveniles died within the first 10 days of leaving their natal home (Koopman and others 2000). Some SJKF delay dispersal and may inherit their home range. Dispersal distances of up to 123 kilometers (76.3 miles) have been documented for SJKF.

SJKF are subject to competitive exclusion or predation by species such as the non-native red fox, coyote *(Canis latrans)*, domestic dog *(Canis familiaris)*, bobcat *(Felis rufus)*, and large raptors. Although coyote could prey on SJKF, they are not considered mutually exclusive (Cypher and Spencer 1998). One study has showed that larger carnivores can be a significant source of mortality (Briden et al. 1992). SJKF is also negatively impacted by fragmentation and loss of habitat, and an increasing number of roads, which can result in mortalities through vehicle strikes (Bjurlin 2004).

4 – METHODS

4.0 BACKGROUND RESEARCH

Prior to the initiation of field surveys, CES biologists conducted a special-status wildlife species database search and review using the California Natural Diversity Data Base (CNDDB). Documented occurrences of SJKF were accessed by searching the CNDDB database records to include all SJKF occurrences within a 10-mile radius of the Property, as specified in the survey protocol.

4.1 FIELD SURVEYS

All surveys followed the methods and guidelines provided in the USFWS *SJKF Survey Protocol for the Northern Range* (USFWS 1999a).

4.1.0 Walking Transects

Walking transects were conducted to visually survey the entire Property and immediate vicinity. Transects were walked from July 20 through July 22 and from August 2 through August 5, 2016. A team of biologists walked transects in an east-to-west and west-to-east direction across the Property in a manner that achieved 100 percent visual coverage of the Property. As the vegetation height was generally low and there were no visual obstructions within the Property, walking transect widths ranging from 60 to 100 feet were utilized to achieve 100 percent visual coverage of the Property.

Walking transects were conducted across all habitats including:

- Fallow agricultural lands that were recently in use
- Dryland farms
- Ruderal lands associated with the above habitats located along the edges of fallow fields, dry ditches and the edges of levees

The Property can be divided into three long, rectangular fields that are each separated from the next by a system of levees, levee roads, and canals. Each of the three fields was treated as a unit and walked separately for the purpose of thoroughly covering the Property. Walking transect surveys were completed across all areas within the Property, including the three fields and associated canals and borders, to detect any potential SJKF dens in accordance with the USFWS protocol. Walking transects were conducted during the morning and early afternoon hours (generally 0600 – 1400). All potential or appropriate burrows were documented. As specified in the protocol requirements, opportunities and “hot spots” for later spotlighting and camera/scent stations were identified while walking transects.

4.1.1 Camera and Scent Stations

Camera stations were established within the project area at a density of eight per 640 acres (1 square mile). Hand-held Garmins® were used to record the Global Positioning System (GPS) coordinates of all camera and scent stations for later mapping efforts. Scent stations were established at locations where there was evidence of mammal activity (e.g., game trails, levee roads, burrow complexes etc.). Scent stations were installed by using media such as flour, gypsum, or diatomaceous earth, spread out to cover an area approximately 3 feet by 3 feet in size. All burrows were surveyed approximately 24 hours after tracking medium placement, for signs of SJKF activity including tracks, and prey remains.

A total of 36 camera stations and nearby track stations were established within the Property (Figure 3). As specified in the protocols, eight camera stations were placed at appropriate locations within a 640-acre area. If appropriate habitat was present in several closely-spaced areas, the camera stations were placed in those areas to maximize the potential for documenting canids within the Property. Camera and scent stations were maintained for 10 consecutive nights beginning August 5. Camera stations were checked each morning and all photos were tagged by camera identification number and immediately downloaded for later viewing. Scent stations were examined closely each morning to identify all tracks in the media. Bait (canned cat food) was replaced at each scent station on a daily basis, to attract potential canids to each station.

Additional camera stations were established during spotlighting surveys. If an unidentified canid was sighted within an area of the Property, additional camera stations were installed within the area and operated for three nights. The additional cameras were placed within a day of the sighting an unidentified canid.

4.1.2 Spotlighting

Spotlighting within the Property was conducted after completion of 10 days of camera and scent stations. In addition to the Property, all accessible public roads (paved roads and dirt roads) within 2 miles in the vicinity were driven with spotlights for 10 nights. Spotlighting of the Property and vicinity were conducted for 10 nights within a 15-day period from August 13th to 23rd. All levee roads within the Property were driven with spotlights between the hours of 2000 in the evening to approximately 0100 on the following morning. Surveyors shone spotlights in different directions while driving 5 to 10 miles per hour. Spotlights used were 800,000 candlelight.

Additional nights of spotlighting were conducted in of the vicinity areas located over 1 mile away from the Property concurrent with camera station operation from August 5 through 15. Because the Property and areas within a 2-mile radius could not be covered on all nights, spotlighting of surrounding areas started on August 16th continuing through August 24th. As there were nights when coverage of the Property vicinity and the Property itself could not be covered, five additional nights of spotlighting were completely dedicated to the Property vicinity. Prior to conducting each spotlighting survey, the Sheriff's department and the Game Warden's Dispatch office were notified. Surveys were truncated on one night when gunfire was heard in the immediate vicinity.

Spotlighting surveys were conducted along the following roads in the vicinity and within 2 miles of the Property:

- Laurel Road,
- Kent Avenue (separate sections of the dirt road, which are located both west and east of the Kings River),

- Lansing Avenue (separate sections that are located both west and east of the Kings River),
- 21st Avenue and associated levee roads to the east of the Kings River
- 23rd Avenue along the Kings River and an unnamed canal
- Avenal Cutoff Road
- Murphy Ranch Road
- Unnamed roads along the eastern bank and the western bank of the Kings River.

In addition, spotlighting was also conducted along the section of Kent Avenue that runs along the northern boundary of the Property and along all levee roads that bisect the Property in a north-south direction. Spotlighting was conducted to maximize coverage of the project vicinity. Any sightings of canids were noted and documented with GPS. Spotlighting spotlighting along paved and unpaved roads was conducted by driving the car at a speed of approximately 5 miles per hour. All roads in the immediate vicinity of the Property were spotlighted in search of SJKF activity.

5 – RESULTS

5.0 BACKGROUND RESEARCH

Nineteen SJKF occurrences have been documented within 10 miles of the Property (Figure 2). As summarized in the report provided by Helix Environmental Planning, a majority of the sightings were documented between 1972 and 1989 (Helix Environmental Planning 2016) and the nearest occurrence (#191) is reported 7.5 miles from the Property. Recent CNDDB records indicate three recent sightings:

- Occurrence # 1101 was documented northwest of Hanford, east of Kings Road in 2006;
- Occurrence # 213 was documented approximately 1.5 miles west of State Route 41 in 2002.
- Occurrence # 214 was documented in the vicinity of Sand Slough, south of Houston Avenue, in 2000.

5.1 ASSESSMENT OF HABITAT FOR SAN JOAQUIN KIT FOX

Based on the CNDDB results, the Property lies within the known range of SJKF. The Property contains habitat that may be suitable for SJKF, but since it has historically and recently been used as farmland, its current habitat does not represent the most preferred nor optimal habitat available in the region. The Property does support some burrow complexes for ground squirrels and desert cottontails that could serve as a prey base for SJKF. Larger burrow complexes occupied by brush rabbits were observed at the edge of the hill slopes bordering roadways in the vicinity of the Property. The preferred soils in which these mammals burrow are looser, friable types with a sandy component. Soils on the Property are considered potentially suitable for SJKF den sites.

5.2 FIELD SURVEYS

5.2.0 Walking Transects

No dens with sign of SJKF use were documented during the walking transects. All wildlife sightings and potential habitat observations were noted and documented during the walking transect surveys (Table 1). All burrow complexes and potentially suitable canid burrows were recorded with a Garmin® GPS unit. The burrows assisted in focusing locations for the establishment of camera and scent stations. Burrows potentially suitable for SJKF were located at the outer perimeter of each field, along the levees, ditches, and fence lines. A majority of the burrows present on the Property were considered too small to represent potential SJKF dens. An abundance of California ground squirrels were observed utilizing burrow complexes along the southern boundary of the Property. Burrow tailings and other evidence of Botta's pocket gopher were present along the outer margins of the fields.

Table 1: Wildlife Species Observed during Walking Transect Surveys

Common Name	Scientific Name
Birds	
American crow	*Corvus brachyrhynchos*
American kestrel	*Falco sparverius*
American white pelican	*Pelicanus erythrorhynchos*
Anna's humming bird	*Calypte anna*
Barn swallow	*Hirundo rustica*
Black phoebe	*Sayornis nigricans*
Burrowing owl	*Athene cunicularia*
Common nighthawk	*Chordeiles minor*
Great horned owl	*Bubo virginianus*
Greater yellowlegs	*Tringa melanoleuca*
Killdeer	*Charadrius vociferous*
Loggerhead shrike	*Lanius ludovicianus*
Mourning dove	*Zenaida macroura*
Northern rough-winged swallow	*Stelgidopteryx serripennis*
Red-tailed hawk	*Buteo jamaicensis*
Turkey vulture	*Cathartes aura*
Western kingbird	*Tyrannus verticalis*
Western meadowlark	*Sturnella neglecta*
White-faced ibis	*Plegadis chihi*
Mammals	
Blacktail jackrabbit	*Lepus californicus*
Botta's pocket gopher	*Thomomys bottae*
California ground squirrel	*Otospermophilus beecheyi*
Desert cottontail	*Sylvilagus audobonii*
Reptiles	
Side-blotched lizard	*Uta stansburiana*

5.2.1 Camera and Scent Stations

No SJKF were detected in the camera and scent stations. Coyotes and red fox were the only canids detected by camera and scent stations within the Property. The coyotes were utilizing habitats within the southern and eastern parts of the Property. Species documented by the camera stations included burrowing owl, roadrunner (*Geococcyx californianus*), black-tailed jackrabbit, coyote, California ground squirrel, and deer mice (*Peromyscus* spp.) as shown in Attachment B. Tracks of small rodents and coyote were documented at the scent stations.

5.2.2 Spotlighting Surveys

SJKF was not observed during spotlighting surveys. Other canids that were observed and identified during spotlighting surveys included coyote, red fox, and gray fox. Four unidentified canids were observed and additional camera stations were installed at those locations (three cameras at each location) and operated for three days. Two of these were identified as coyotes during later spotlight nights. The two additional unidentified canids were observed within 2 miles of the Property, but were only observed via eye shine and could not be identified, although it is most likely that these were coyote as well.

6 – CONCLUSIONS

No SJKF were observed during any of the surveys and no dens with SJKF sign were detected during walking transects. The Property provides suitable foraging habitat and could serve as a corridor for SJKF movement. Based on relatively recent CNDDB sightings in the vicinity it is possible that SJKF occurs in the vicinity of the Property.

SJKF is negatively affected by human activities such as habitat loss due to urbanization. Habitat fragmentation can be a threat to SJKF as changing habitat conditions can affect connectivity between existing local populations. It is unlikely that development of the Property will be associated with negative impacts to SJKF breeding areas, because appropriate dens were not present and coyotes are active within the Property. Furthermore, habitat within the Property is unlikely to serve as potential SJKF breeding habitat due to the presence of abundant coyotes, which are strong competitors and can also be predators, as well as the sparse distribution of suitable mammal burrows.

Due to the potential for SJKF to use the Property for a movement corridor or limited foraging, detailed plans for avoidance and preventative measures for the SJKF are recommended prior to development of the Property.

7 – RECOMMENDED AVOIDANCE MEASURES

1. If feasible, restrict construction activities to begin after the peak dispersal season (June to July).
2. Prohibit the use of rodenticides on the Property.
3. Have a qualified biologist survey the Property using walking transects prior to the start of construction to identify whether SJKF have colonized the Property.
4. Install wildlife exclusion fencing around construction areas. Do not use Ertech fencing as it is detrimental to wildlife.

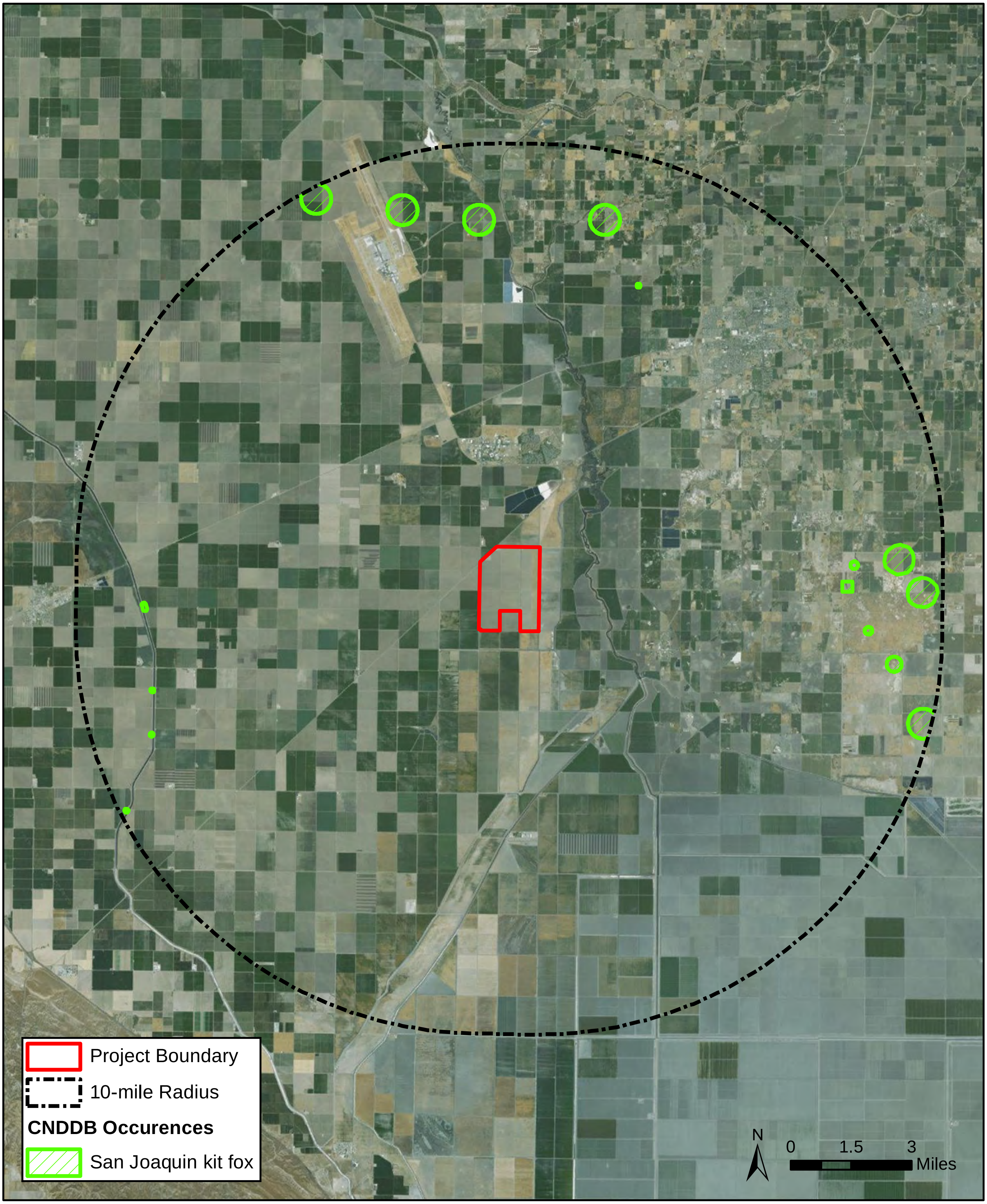

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Figure 2: CNDDB San Joaquin Kit Fox Occurrences
San Joaquin Kit Fox Protocol Survey
RE Mustang Two Solar Project

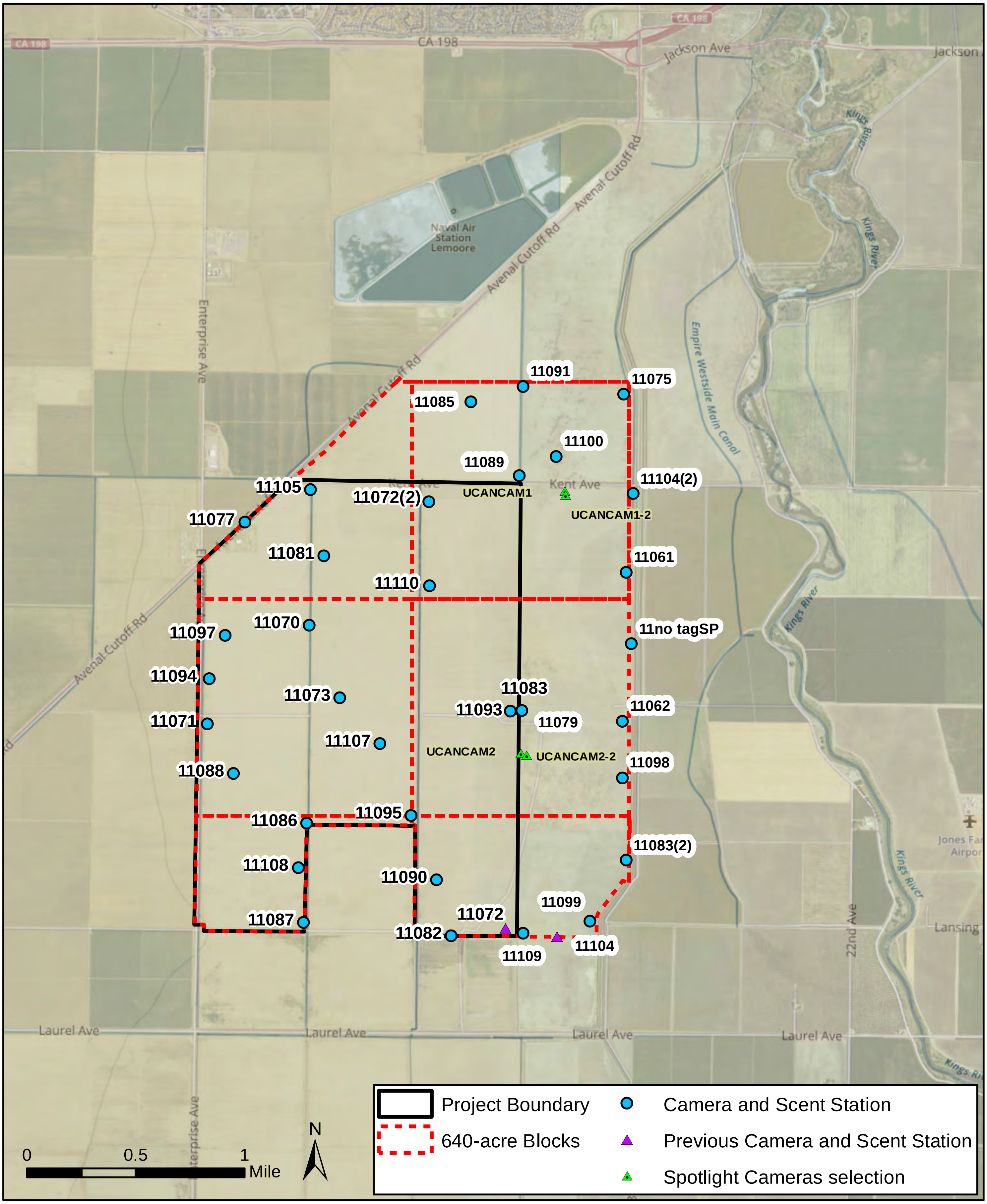

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Figure 3: Camera Stations Locations
San Joaquin Kit Fox Protocol Survey
RE Mustang Two Solar Project

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Attachment A: Representative Site Photographs

Representative Site Photographs

Photograph 1

August 24 2016

Ruderal habitat adjacent to Kent Road looking west.

Photograph 2:

August 24 2016

Canal and ruderal habitat interspersed throughout the Property looking north.

Photographs Continued

	**Photograph 3**: August 24 2016 Alfalfa fields in the northern section of the Property.
	**Photograph 4**: August 24 2016. Kings River to the east looking north.

Attachment B: Representative Camera Station Photographs

Representative Photographs

Photograph 1

August 8, 2016

Coyote at Camera Station 11093.

Photograph 2:

August 7, 2016

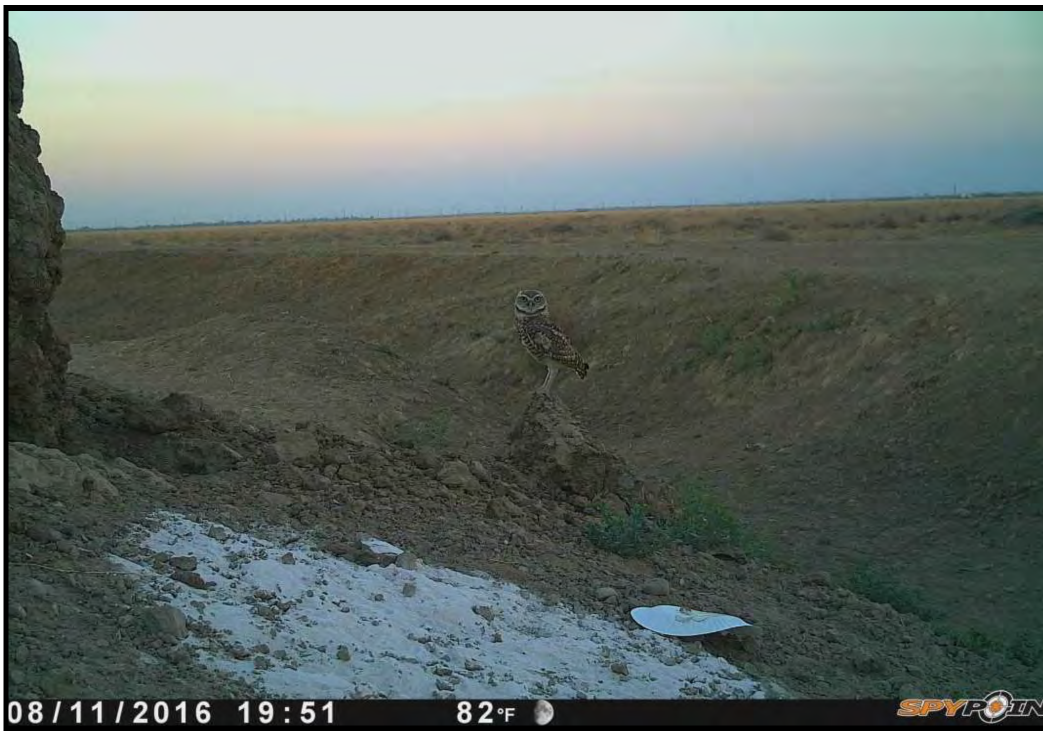
Loggerhead shrike at Camera Station 11071.

Photographs Continued

Photograph 3:

August 10, 2016.

Ground squirrel, camera station 11083.



Photograph 4:

August 11, 2016.

Burrowing Owl, camera station 11086.

Photographs Continued

Photograph 5:

August 12, 2016.

Roadrunner, camera station 11077.

Photograph 6:

August 11, 2016.

Deer mouse, camera station 11108.

Photographs Continued

Photograph 7:

August 8, 2016.

Black-tailed jackrabbit, camera station 11095.

Photograph 8:

August 15, 2016.

Barn Owl, camera station 11105.

Photographs Continued

Photograph 9:

August 19, 2016.

Cottontail, Camera Station UcnCam2.

Photograph 10:

August 20, 2016.

Coyote, Camera Station UcnCam2.

Photographs Continued

Photograph 11:

August 22, 2016.

Coyote, Camera Station UcnCam4.

Photograph 12:

August 22, 2016.

Coyote, Camera Station UcnCam4-2.

Photographs Continued

Photograph 13:

August 6, 2016.

Western kingbird, Camera Station 11094.

Photograph 14:

August 10, 2016.

Red fox, Camera Station 11092.

Appendix H

Blunt-Nosed Leopard Lizard Habitat Assessment

RE Slate Solar Project:
Habitat Assessment for Blunt-Nosed Leopard Lizard

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1 – INTRODUCTION

Californian Environmental Services (CES) biologists conducted a habitat assessment of the RE Slate Solar Project property (Property), located within the southern portion of the Central Valley, less than 2 miles southeast of Lemoore Naval Air Station, Kings County, California. The purpose of this assessment was to characterize habitat types (plant communities) occurring on the Property and to assess habitat suitability for blunt-nose leopard lizard (*Gambelia sila*: BNLL). This report details the characterizations of all habitat types occurring on the Property, and an assessment of the potential for habitats present to support BNLL.

2 – PROPERTY LOCATION AND DESCRIPTION

The RE Slate Property is located in unincorporated northern Kings County, California. The Property occupies parts of Sections 16, 17, 20, and 21 of Township 19 South, Range 20 East; parts of Sections 25, 26, 34, 35, and 36 of Township 19 South, Range 19 East; and parts of Sections 1, 2, 11, 12, 13, and 14 of Township 20 South, Range 19E, Mount Diablo Meridian. The Property is depicted on the U.S. Geological Survey “Lemoore, CA,” “Westhaven, CA,” and “Stratford, CA” 7.5-minute quadrangle map.

The Property consists of two disjunct areas on the west and east sides of the Kings River that are separated by the Kings River and agricultural land. The nearest towns are Lemoore Station and Lemoore, both of which are within 1 mile of the Property to the north and northeast, respectively. Interstate 5 is 17 miles to the west and State Route (SR) 99 is 27 miles to the east (Figure 1). The property is generally bounded by Laurel Avenue on the south, 25th Avenue on the west, Avenal Cutoff Road and SR 198 on the north, and SR 41 on the east. A 226-acre portion of the site lies north of SR-198, west of SR 41 and south of West Hills College (Figure 1).

The Property is comprised of approximately 3,500 acres of active and fallow agricultural land, with associated unpaved farm roads and staging areas, as well as numerous canals. There are no residences or other permanent structures on the Property. The site is bisected by the Kings River.

3 – FOCAL SPECIES

3.0 BLUNT-NOSED LEOPARD LIZARD

Blunt-nosed leopard lizard (BNLL) occurs at elevations of 100 to 2,400 feet throughout the San Joaquin Valley, California, although much of its historic range has been lost due to agriculture. Habitat includes alkali sink scrub, saltbush (*Atriplex* spp.) scrub, thistle (*Ephedra*) scrub, and California annual grasslands in the desert, valley floor and foothill areas of the San Joaquin Valley. BNLL is active during the day, often basking in the morning. The species is highly dependent on the presence of small mammal burrows for refugia during periods of inactivity and for laying eggs. BNLL is active from early April to early November, while spending winter in a state of dormancy called brumation. Diet consists primarily of various insects and some plant matter, but other lizards may occasionally be consumed, including young of its own species.

BNLL has a snout-vent-length of three to five inches and a tail that is longer than the body. Total body length can be up to 13.5 inches. The head is triangular with a blunt snout, which is a key diagnostic feature for distinguishing the species from long-nosed leopard lizard (*Gambelia wislizenii*). The body is grayish, brown, or yellowish with cream-colored banding, and dark spots arranged in rows on each side of the dorsal midline. The limbs are well-developed and scales are granular in texture. The underside is pale with gray to dusky spots on the throat that sometimes merge to form streaks. Juvenile BNLL has red or rust-colored spots on the body and sides, as well as yellow on the thighs and underside of the tail. Males develop a pink to rust coloration during mating season on the throat, chest, and occasionally most of the body. Females also change color during the mating season; developing reddish orange spots on the head, sides, thighs and tail.

BNLL breeds from May to June. Male lizards defend a territory and will mate with any females that occupy the territory. Clutches of one to six eggs are laid in June or July, and hatch in July or August. Females lay a single clutch per year, but additional clutches may be laid if conditions during that year are favorable.

4 – METHODS

4.0 BACKGROUND RESEARCH

Preliminary investigations included a retrospective review of aerial photographs of the Property via Google Earth® and United States (US) Geological Survey (USGS) topographic maps. Prior to visiting the Property, CES biologists also conducted a query of the California Natural Diversity Data Base (CNDDB), maintained by the California Department of Fish and Wildlife (CDFW), for documented occurrences of BNLL within 5 miles of the Property.

The information obtained from these investigations was used to assess habitats *post hoc* for special-status wildlife species not observed during the surveys described in Section 3.1, but that had a potential to occur.

4.1 WALKING TRANSECTS

Walking transects were conducted to visually survey the entire Property and immediate vicinity. Transects were walked from July 20th through July 22nd and from August 2nd through August 5th, 2016. A team of biologists walked transects in an east-to-west and west-to-east direction across the Property in a manner that achieved 100 percent visual coverage of the Property. As the vegetation height was generally low and there were no visual obstructions within the Property, walking transect widths ranging from 60 to 100 feet were utilized to achieve 100 percent visual coverage of the Property.

- Walking transects were conducted across all habitats including:
- Fallow agricultural lands that were recently in use
- Dryland farms
- Ruderal lands associated with the above habitats located along the edges of fallow fields, dry ditches and the edges of levees

Walking transects were conducted during the morning and early afternoon hours (generally 0600 – 1400). All California ground squirrel (*Otospermophilus beecheyi*) burrows were documented.

5 – RESULTS

5.0 BACKGROUND RESEARCH

Blunt-nosed Leopard Lizard (*Gambelia sila*)

There are no documented occurrences of BNLL within 5 miles of the Property (Figure 2). The closest occurrence (Occurrence # 268) of BNLL to the Property is documented 7 miles east of the City of Stratford on the north side of Kansas Avenue and the west side of 14th Avenue. CNDDB documents three additional occurrences (Occurrence #'s 41, 18, and 99) of BNLL in King's County, which are all located more than 15 miles from the Property. Two of the occurrences (#'s 41, and 18) date from 1979 while Occurrence # 99 dates from 1993.

5.1 VEGETATION COMMUNITIES

The Property contains no natural vegetation communities classified in CNDDB; land cover is a mosaic of active and fallow agriculture fields with associated canals/ditches and ruderal/disturbed areas (roads, staging areas, field margins). The Property has historically been used for agricultural crop production, and there is evidence of recent agricultural activity, including alfalfa (*Medicago sativa*) and the stubble remains of wheat (*Triticum aestivum*) crops. Predominant vegetation on uncultivated portions of the Property is non-native grassland including species such as tumble mustard (*Sisymbrium altissimum*), pigweed (*Chenopodium album*), and wild lettuce (*Lactuca serriola*) (Helix, June 2016). At the time of the SJKF surveys, much of the Property was not in cultivation, though portions of the Property were being actively grazed by herds of cattle and sheep.

Habitats present within the Property include agricultural, which is the predominant habitat type, patches of non-native annual grassland habitat, and patches of ruderal habitat along the fenced perimeters of the Property (Attachment A). Agricultural flatlands are used for dry-farmed hay and contain a mixture of non-native annual grasslands and hay.

5.2 HABITAT ASSESSMENT - WALKING TRANSECTS

The majority of the Property is unsuitable habitat for BNLL. There was a distinct paucity of adequate refugia for BNLL due to the lack of shrubs and small mammal burrows. Burrows were located at the outer perimeter of each field, along the levees, ditches, and fence lines. Numerous California ground squirrels were observed utilizing burrow complexes along the southern boundary of the Property. Burrows were only present along the levees and fence lines. No BNLL were observed during six days of walking transects.

6 – CONCLUSIONS

The Property has been heavily cultivated for many years resulting in a homogeneous appearance of soil rows across the Property with little natural topography or soil properties remaining. Given the highly altered and degraded condition of the Property, the marginal quality of the habitat, the distance to the nearest known occurrence of the species, and the isolation of the site from known locations where the species occurs, there is no potential for BNLL to be present on the Property.

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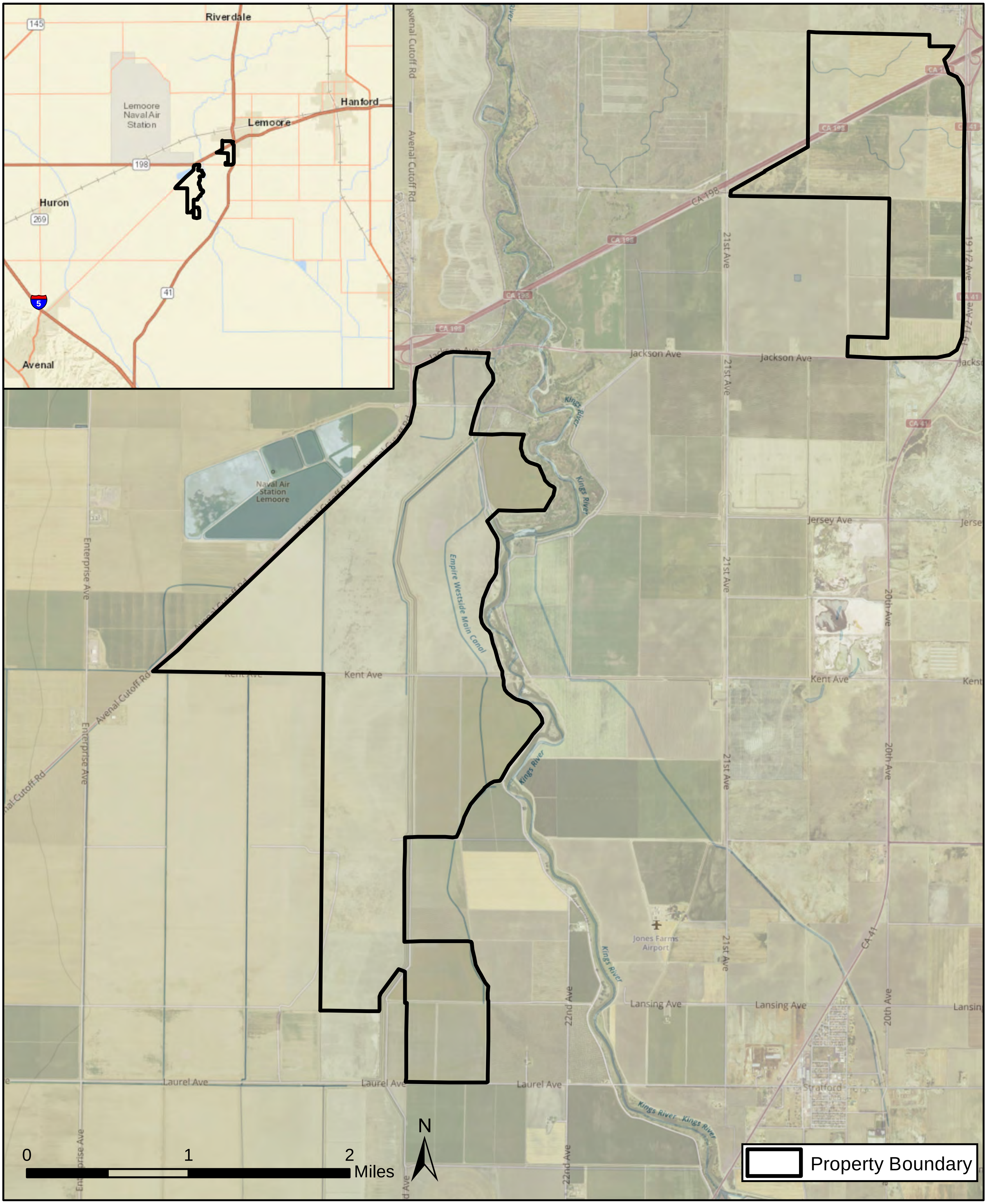

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Figure 1: Vicinity Map
BNLL Habitat Assessment
RE Slate Solar Project

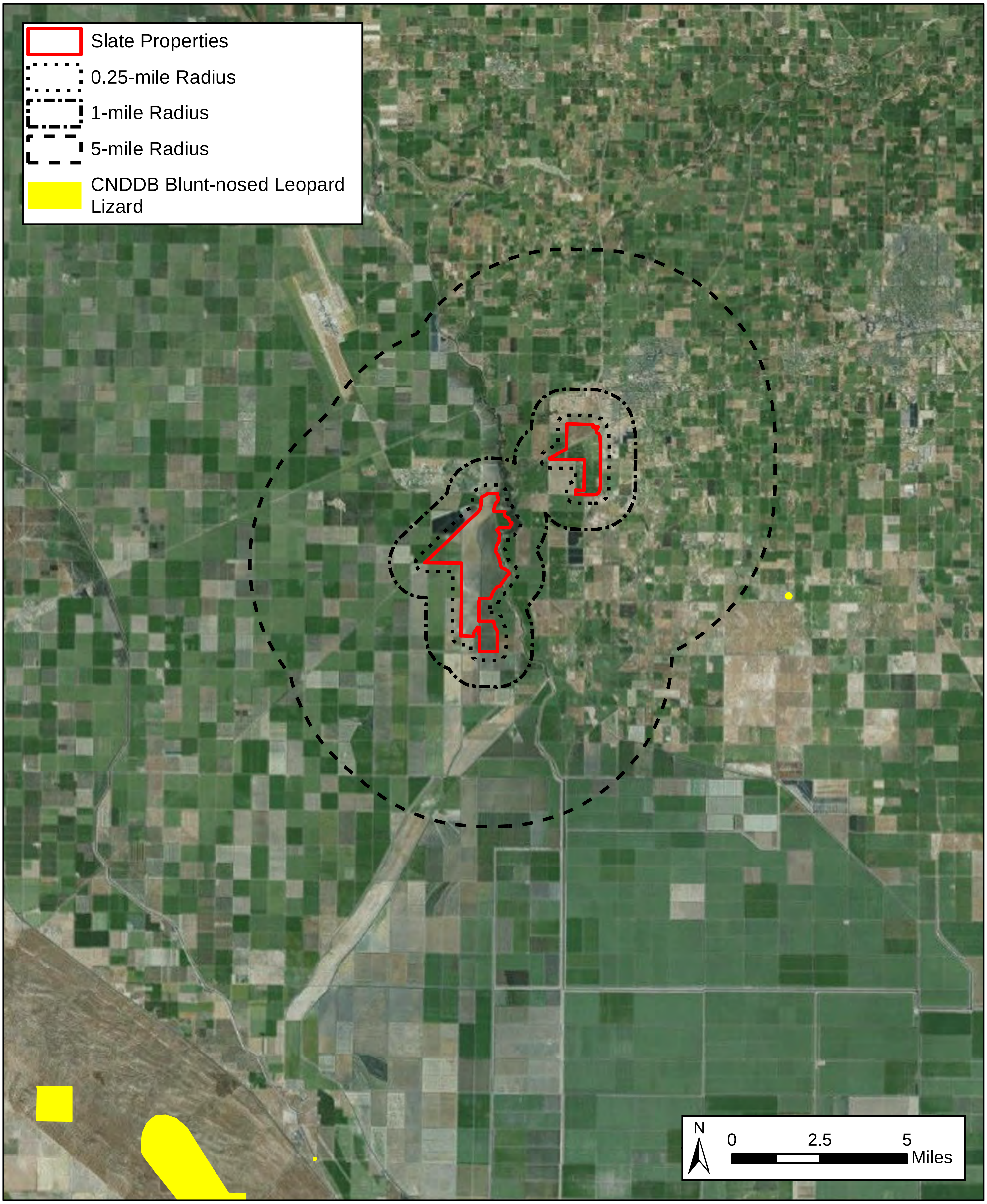

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Figure 2: CNDDB Occurrences of Blunt-nosed Leopard Lizard within 5 Miles of the Project Site

Attachment A: Representative Photographs

Representative Site Photographs

	**Photograph 1:** Representative fallow field and berm along roadway at the Slate Property.
	**Photograph 2**: Representative dry canal and berm with ground squirrel burrows.

Photographs Continued

Photograph 3:

Representative harvested agricultural field.

Photograph 4:

Fallow agricultural field bordering Avenal cutoff road.

Photographs Continued

	**Photograph 5**: Recently plowed and fallow agricultural lands on the property.
	**Photograph 6**: Typical vegetation on abandoned agricultural land on the Property.

Photographs Continued

Photograph 7:

Active agricultural land, in this case cotton, on the property.

Photograph 8:

Active canal systems run throughout the Property.

Appendix I

Special-Status Kangaroo Rat Survey Report

RE Slate Property: Special-status Kangaroo Rat Protocol Survey Report

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OCTOBER 2017

Bay Area Green Business
Environmental Values at Work

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List of Abbreviations and Acronyms

CDFG	California Department of Fish and Game
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CES	Californian Environmental Services
CNDDB	California Natural Diversity Database
GIS	Geographic Information System
GPS	Global Positioning System
US	United States
USFWS	United States Fish and Wildlife Service

All photographs were taken by CES.

1 – INTRODUCTION

At the request of Helix Environmental Planning Inc. (HELIX), biologists from Californian Environmental Services (CES) conducted protocol live-trapping studies for kangaroo rat at the RE Slate Solar Property (Property), located in unincorporated northern Kings County, California less than 2 miles south of Naval Air Station Lemoore. The intended use of the Property is for development of a solar photovoltaic generating facility (project). The project would entail installation of solar panels across the Property and fencing the outer perimeter. Previous reports for the Property (HELIX 2016) provided detailed property descriptions and associated mapping. During survey work for San Joaquin kit fox (*Vulpes macrotis mutica*) in September 2016, CES captured unidentified kangaroo rats (*Dipodomys* spp.) on camera stations and tracking medium. The purpose of this current survey was to identify the species and/or subspecies of kangaroo rat occurring in these areas.

This report presents the results of Protocol surveys conducted in September 2017 to determine if special-status kangaroo rats are present on the Property; specifically, Tipton kangaroo rat (*Dipodomys nitratoides nitratoides*), a federal and state endangered subspecies whose historic range overlaps the Property. Surveys were conducted for five-nights. No Tipton kangaroo rat or other special-status kangaroo rat species were found on the Property. Sixty-nine deer mice (*Peromyscus maniculatus*), one harvest mouse (*Reithrodontomys megalotis*) and one house mouse (*Mus musculus*) were captured during 150 trap-nights of effort. We, therefore, conclude that the Project will not cause negative direct, indirect, or cumulative adverse impacts to Tipton kangaroo rat or other special-status kangaroo rats or their habitat, and that no mitigation is needed or required for Tipton kangaroo rat or other special-status kangaroo rat species.

2 – PROPERTY DESCRIPTION

2.1 LOCATION

The RE Slate Property is located in unincorporated northern Kings County, California. The Property occupies parts of Sections 16, 17, 20, and 21 of Township 19 South, Range 20 East; parts of Sections 25, 26, 34, 35, and 36 of Township 19 South, Range 19 East; and parts of Sections 1, 2, 11, 12, 13, and 14 of Township 20 South, Range 19E, Mount Diablo Meridian. The Property is depicted on the U.S. Geological Survey “Lemoore, CA,” “Westhaven, CA,” and “Stratford, CA” 7.5-minute quadrangle map.

The Property consists of two disjunct areas on the west and east sides of the Kings River that are separated by the Kings River and agricultural land. The nearest towns are Lemoore Station and Lemoore, both of which are within 1 mile of the Property to the north and northeast, respectively. Interstate 5 is 17 miles to the west and State Route (SR) 99 is 27 miles to the east (Figure 1). The property is generally bounded by Laurel Avenue on the south, 25th Avenue on the west, Avenal Cutoff Road and SR 198 on the north, and SR 41 on the east. A 226-acre portion of the site lies north of SR-198, west of SR 41 and south of West Hills College (Figure 1).

The Property is comprised of approximately 3,500 acres of active and fallow agricultural land, with associated unpaved farm roads and staging areas, as well as numerous canals. There are no residences or other permanent structures on the Property. The site is bisected by the Kings River.

2.2 PROPERTY DESCRIPTION

The majority of the Property is unsuitable habitat for *Dipodomys* spp., because it is either under active agriculture or is fallow fields overgrown with dense, primarily non-native grasses. Ongoing and regular disking and other soil disturbance associated with historic and current agricultural activities preclude the establishment of permanent burrows in cultivated fields. Fallow fields provide some potential for establishment of semi-permanent burrows by small mammals; however, fallow fields are subjected to periodic and unpredictable tilling or disking as well.

Habitats present within the Property include active and fallow agricultural fields and patches of ruderal habitat along the perimeters of the Property and road ways. The Property has historically been used for agricultural crop production, and parts are still in active use, primarily in cotton. Predominant vegetation on uncultivated portions of the Property is largely composed of non-native species including, but not limited to, Russian thistle (*Salsola kali*), saltscale (*Atriplex serenana var. serenana*), alkali mallow (*Malvella leprosa*), and wild lettuce (*Lactuca serriola*). At the time of the kangaroo rat surveys, the study areas and majority of the Property were fallow.

2.3 REGULATORY FRAMEWORK

The California Environmental Quality Act (CEQA) is a California State law created to inform governmental decision-makers and the public about the potential environmental effects of proposed activities and to reduce negative impacts. Project proponents are required under CEQA to disclose, consider, and avoid or reduce significant effects to endangered, threatened and rare species. Significant effects are identified in Appendix G of CEQA Guidelines as those that will:

- Substantially affect an endangered or rare animal or plant or its habitat;
- Interfere substantially with the movement of any resident or migratory fish or wildlife species; or
- Substantially diminish habitat for fish, wildlife, or plants.

CEQA Guidelines (California Code of Regulations, Title 14, Division 6, Chapter 3, Sections 15000-15387) are the regulations that explain and interpret CEQA for both the public agencies required to administer CEQA and for the public generally. The Guidelines provide objectives, criteria and procedures for the orderly evaluation of projects and the preparation of environmental impact reports, negative declarations, and mitigated negative declarations by public agencies. As such, they incorporate and interpret both the statutory mandates of CEQA and the principles advanced by judicial decisions. Regarding endangered, rare, or threatened species, Sections 15380(b), (c) and (d) of the CEQA Guidelines state that:

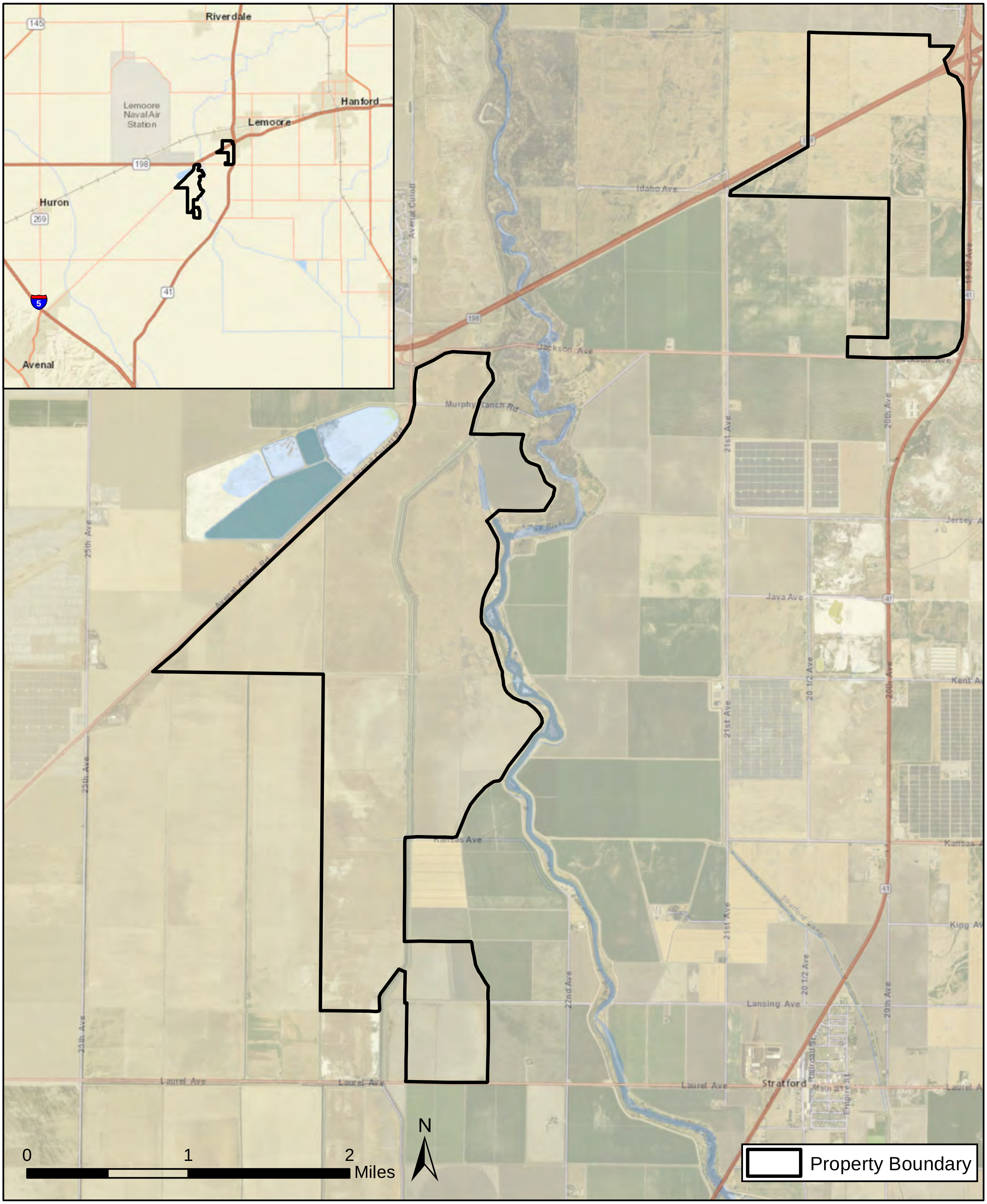

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Figure 1: Vicinity Map
RE Slate Solar Project

(b) A species of animal or plant is:

(1) "Endangered" when its survival and reproduction in the wild are in immediate jeopardy from one or more causes, including loss of habitat, change in habitat, overexploitation, predation, competition, disease, or other factors; or

(2) "Rare" when either:

(A) The species exists in such small numbers throughout all or a portion of its range that it may become endangered if its environment worsens; or

(B) The species is likely to become endangered within the foreseeable future throughout all or a significant portion of its range and may be considered "Threatened" as that term is used in the Federal Endangered Species Act.

(c) A species shall be presumed to be endangered, rare or threatened, as it is listed in:

(1) Sections 670.2 or 670.5, Title 14, California Code of Regulations; or

(2) Title 50, Code of Federal Regulations §17.11 or 17.12 pursuant to the Federal Endangered Species Act as rare, threatened, or endangered.

(d) A species not included in any listing identified in subdivision (c) shall nevertheless be considered to be endangered, rare or threatened, if the species can be shown to meet the criteria in subdivision (b).

3 – TIPTON KANGAROO RAT

3.1 CONSERVATION STATUS

The State of California listed Tipton kangaroo rat as Endangered in 1989 and the species is also federally listed as Endangered as of 1988. It is included in the Recovery Plan for Upland Species of the San Joaquin Valley, California, written in 1998.

3.2 SPECIES BIOLOGY

Tipton kangaroo rat is endemic to the state of California and occurs, or historically occurred, primarily on the San Joaquin Valley floor in the Tulare Basin in Kings, Tulare, and Kern counties. There are also two California Natural Diversity Database (CNDDB) records from the Carrizo Plain in eastern San Luis Obispo County, although most literature does not mention its occurrence in this area. Tipton kangaroo rat is known to occur at elevations mostly between 200 and 400 feet and perhaps locally higher (up to 2,200 feet on the Carrizo Plain). Most of its historical habitat has been lost due to agriculture and urban development, and current populations are limited to scattered or isolated areas within the historical range. It is estimated that approximately 4 percent of the historical acreage within which the species formerly occurred is currently suitable habitat.

Tipton kangaroo rat occurs most commonly in level- to nearly-level terrain saltbush scrub and valley sink scrub, where it occupies alluvial fan and floodplain soils, typically fine-textured and alkaline. It has also occurred in terrace grasslands devoid of woody shrubs; however, sparse cover of such shrubs as spiny (*Atriplex spinifera*), common (*A. polycarpa*), and big (*A. lentiformis*) saltbush, iodine bush (*Allenrolfia occidentalis*), Mormon-tea (*Ephedra californica*), red-sage (*Kochia californica*), sea-blite (*Suaeda* spp.), pale-leaf goldenbush (*Isocoma acradenia*), and honey mesquite (*Prosopis glandulosa* var. *torrevana*), along with grasses and forbs, is associated with populations of high density. The species is nocturnal, active year-round, is solitary outside the mating season, and can be found in burrows when not actively foraging. Tipton kangaroo rat typically locates burrow systems in open areas, although in areas of dense shrub cover, burrows can be located beneath shrubs. Burrows of Tipton kangaroo rat are commonly located in slightly elevated mounds in soft soils, such as fine sands, sandy loams, and powdery soils of finer texture. Higher salinity values are generally associated with greater densities of Tipton kangaroo rat. Terrain not subject to flooding is important for permanent occupancy by Tipton kangaroo rat. Tipton kangaroo rat feeds mainly on seeds, along with small amounts of green herbaceous vegetation and insects, and creates food stores in their burrow systems. Its habit of caching seeds is believed to influence the distribution of many plant species within its range, since it does not always recover all cached seeds.

4 – METHODS

4.0 BACKGROUND RESEARCH

The Property occurs within the historic range of Tipton kangaroo rat in Kings County, California. Prior to the initiation of field surveys, CES biologists conducted a query of the California Natural Diversity Data Base (CNDDB). Documented occurrences of Tipton kangaroo rat were accessed by searching the CNDDB database records to include all Tipton kangaroo rat occurrences within a 10-mile radius of the Property (Figure 2).

4.1 LIVE-TRAPPING SURVEYS

Trapping activities were conducted under David A. Germano’s USFWS Recovery Permit #TE749872-7, and Larry Saslaw’s CDFW Scientific Collecting Permit #SC-02411. Larry Saslaw is on the List of Authorized Individuals for Mr. Germano’s USFWS Recovery Permit for Tipton kangaroo rat. A Request for Permission to Live-trap was submitted to USFWS on September 4, 2017 and was subsequently approved September 7, 2017 (Josh Hull, USFWS); this correspondence is provided in Attachment A.

Live-trapping for Tipton kangaroo rat followed the *Survey Protocol for Determining Presence of San Joaquin Kangaroo Rats* (Protocol; USFWS 2013). Two stations were established at locations where camera traps had previously detected kangaroo rat during SJKF surveys. These locations were labeled Camera Location 11075 and Camera Location 11079 for continuity. Ten traps were set at Camera Location 11075 and 20 traps were set at Camera Location 11079 (Figure 3). The location of each trap was recorded using a Global Positioning System unit (GPS) and the ends of each trap line were marked in the field with a flag. The 30 traps were baited with a bird seed mixture and provided with material for nesting and/or shredding. Traps were set approximately one hour before sunset and checked at sunrise for five nights beginning the evening of September 14, 2017. No suitable habitat was observed at either trapping location.

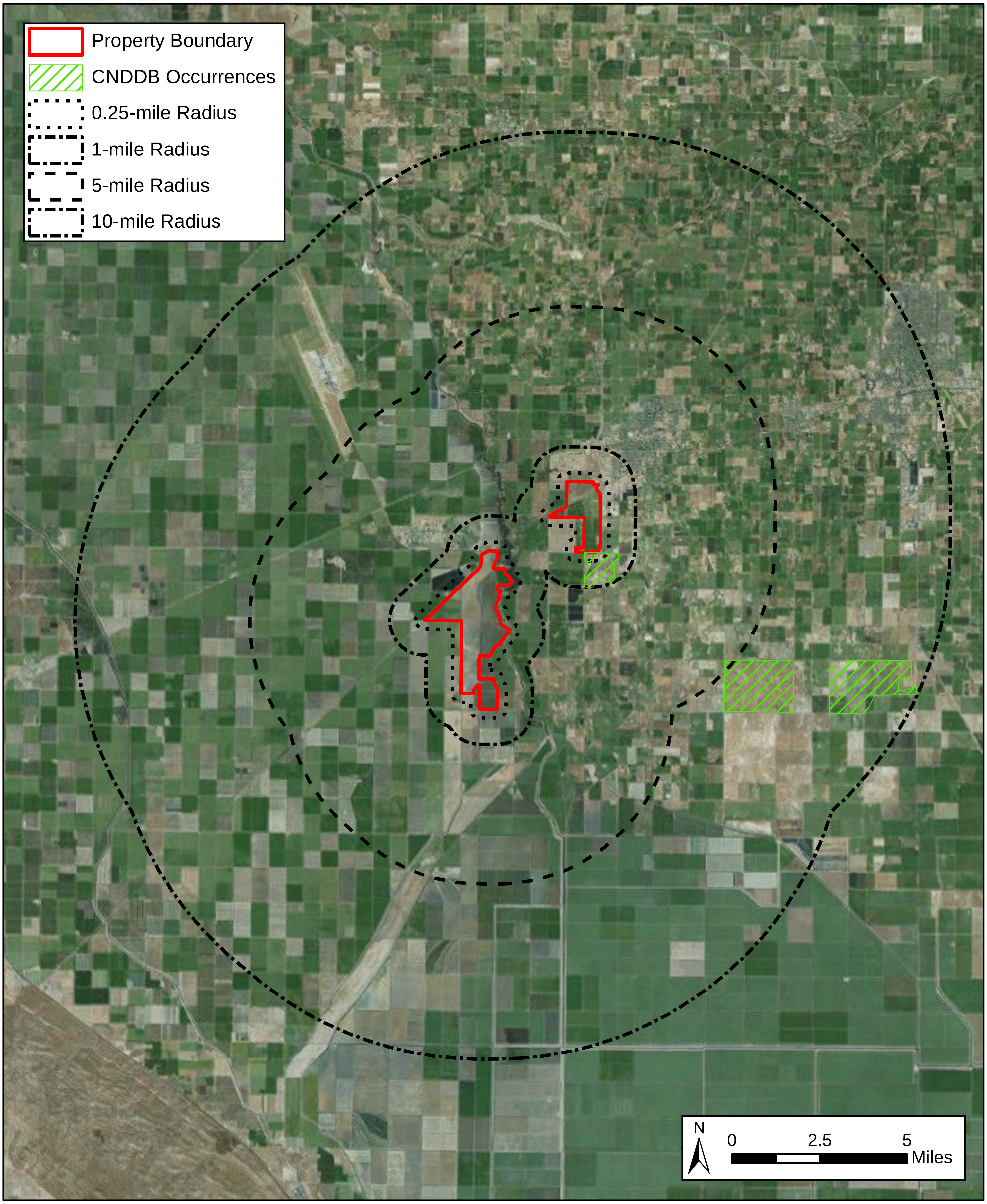

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Figure 2: CNDDB Map of Tipton Kangaroo Rat Occurrences Within 10-miles of Project Site

All animals captured were identified to species and assessed for sex and reproductive status. All data were recorded on field forms which are provided in Attachment B. In addition, the weather forecast was checked daily prior to and during the survey to ensure that weather conditions were suitable for trapping. Daily temperature measurements and weather conditions were also recorded each day on the field data sheets provided in Attachment B. Representative photographs of species captured and trap stations are provided in Attachment C.

5 – RESULTS

5.0 BACKGROUND RESEARCH

Three Tipton kangaroo rat occurrences have been documented by CNDDB between 1985 and 2008 within 10 miles of the Property, all of which are presumed extant (Figure 3). One occurrence from 2008 was adjacent to the disjunct part of the Property on the east side of the Kings river; however, no sign of Tipton kangaroo rat or potentially suitable habitat is present at that part of the Property currently.

5.1 LIVE-TRAPPING SURVEYS

Thirty traps were operated beginning the evening of September 14, 2017 following the *Survey Protocol for Determining Presence of San Joaquin Kangaroo Rats* (USFWS 2013). All traps were re-set each evening and checked at sunrise for a total of 150 trap-nights of survey effort.

No Tipton kangaroo rats or other special-status kangaroo rat species or subspecies were captured during the 150 trap-nights of trapping. No kangaroo rats of any species were captured. A total of 72 small mammals were captured including 69 deer mice, one house mouse, and one harvest mouse. Table 1 provides daily captures and Table 2 provides captures by trap station.

Table 1: Daily Captures During Live-trapping Survey Efforts

Date	# of Traps	Tipton kangaroo rat	Deer Mouse (PEMA)	Harvest Mouse (REME)	House Mouse (MUMU)	Total Captures
9/15/17	30	0	11	0	0	11
9/16/17	30	0	16	0	0	16
9/17/17	30	0	15	1	0	16
9/18/17	30	0	13	0	0	13
9/19/17	[1]30	0	14	0	1	15
TOTAL	**150**	**0**	**69**	**1**	**1**	**71**

Table 2: Daily Captures by Trap Station

Station #	# of Traps per night	9/15/17	9/16/17	9/17/17	9/18/17	9/19/17	TOTAL
11075	10	2PEMA[1]	5PEMA	4PEMA	3PEMA	5PEMA 1MUMU[2]	19PEMA 1MUMU
11079	20	9PEMA	11PEMA	11PEMA 1REME[3]	10PEMA	9PEMA	50PEMA 1REME
TOTAL	**30**	**11PEMA**	**16PEMA**	**15PEMA 1REME**	**13PEMA**	**14PEMA 1MUMU**	**69PEMA 1MUMU 1REME**

1: *Peromyscus maniculatus* (Deer mouse)
2: *Mus musculus* (House mouse)
3: *Reithrodontomys megalotis* (Western harvest mouse)

6 – CONCLUSIONS

The kangaroo rat live-trapping survey was conducted in accordance with the *Survey Protocol for Determining Presence of San Joaquin Kangaroo Rats* (USFWS 2013), and in compliance with the USFWS and CDFW permits. All mammals captured were in good condition and released alive and unharmed. No mortalities or injuries were incurred during the trapping efforts.

No Tipton kangaroo rat or other special-status kangaroo rats were captured; however, deer mouse, house mouse, and harvest mouse are resident within the Property. No suitable habitat for Tipton kangaroo rat was observed on the property. We conclude that Tipton kangaroo rat or other special-status kangaroo rats do not inhabit the Property and that any proposed project will, therefore, not result in negative direct, indirect, or cumulative adverse impacts to Tipton kangaroo rat or special-status kangaroo rats or their habitat. No mitigation is needed or required for the Tipton kangaroo rat or other special-status kangaroo rats.

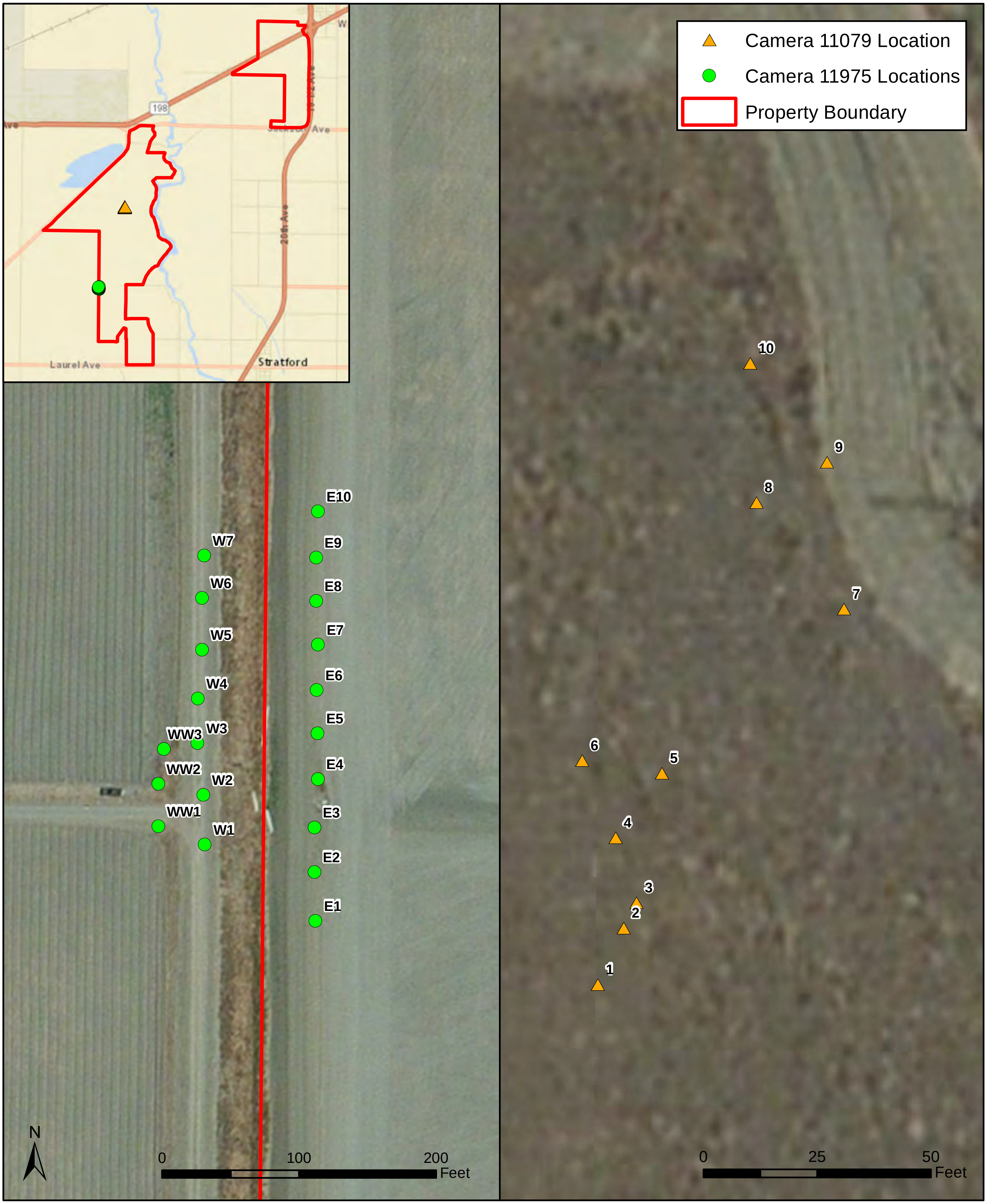

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Figure 3: Property and Trap Locations Map

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Attachment A: Request and Permission to Live-Trap for Special-status Kangaroo Rat Species

Attachment A: USFWS Approval Correspondence

From: "Hull, Josh" <josh_hull@fws.gov>
Date: September 7, 2017 at 4:54:23 PM PDT
To: Larry Saslaw <larry7719@sbcglobal.net>
Subject: Re: Notification to conduct Tipton kangaroo rat trapping, Slate Solar Project, Kings County

Hi Larry,
Thanks for forwarding your request for survey authorization to me. By this email message you are authorized to conduct Tipton kangaroo rat trapping, per the conditions of the recovery permit TE-749872 and as specified in your email request dated September 4, 2017. Please let me know if you have any additional questions.
Thanks,
Josh

****
Josh Hull
Listing and Recovery Division Chief
Sacramento Fish and Wildlife Office
2800 Cottage Way, W-2605
Sacramento, CA 95825

916-414-6742

On Mon, Sep 4, 2017 at 8:10 AM, Larry Saslaw <larry7719@sbcglobal.net> wrote:

Josh: Per Sarah Markegard's Out of Office reply, I am sending you this notification for processing. I had originally sent this with an August 25 start date, but the effort is now proposed to start on September 15. Since Sarah is out of the office until September 11, I am hoping you can help me with the authorization.

Thank you for your consideration in Sarah's absence.

Larry Saslaw
661-706-2673
larry7719@sbcglobal.net

Attachment B: Field Forms

Location: Slate Solar

Date: 9/15/17

Times: 06:55

Capture Crew: Saslaw / Witthaus

Weather: 52° Clear - 0-5

2263177
-1

TRAP	SPECIES	RECAP	EAR TAGS	PIT/Radio	SEX	COND	AGE	MASS	Notes
Camera 11079 - West.									
WW-1	Pema	✓			F				
WW-2	Pema								
WW-3	Pema				M				
W-2	Pema				M				
W-3	Pema				M				
W-4	Pema				F	P			
E-2	Pema				F				
E-4	Pema				F				
E-5	Pema.								
	11075								
4	Pema				M				
9	Pema		–	End 07:25	M				
19:30 - Traps opened + baited									
9/16/17 06:40 - 53°F Clear.									
WW1	Pema				m				
WW2	Pema			Camera 11079	F				
WW3	Pema				m	+-5			
W2	Pema				m				
W3	Pema				F	P			
W4	Pema				m				
E2	Pema				F				
E3	Pema				F				
E4	Pema			Pema? gravid I	F				
E5	Pema				m				
E9	Pema								
2	Pema			Site 11075	m				
5	Pema				m	+-5			
8	Pema				F				
9	Pema				m				
10	Pema			End - 07:24	m				

Location: Slate Solar

Date: 9/17/17

Capture Crew: Saslaw Whithouse

Times: 07:00

Weather: 57° Clear <5

TRAP	SPECIES	RECAP	EAR TAGS	PIT/Radio	SEX	COND	AGE	MASS	Notes
WW1 /	~~Pema~~ Pema			Side Camera 11079	M F				
WW2 WW3	Pema Pema				F F				
W1 W2	Pema Pema				F M				
W3 W4	Pema Pema				M F	P			
E2 E3	Pema Pema				M —				
E4 E6	Peme Pema				F M				
4 8 9	Pema Pema Pema			Camera 11075	M M				
10	Pema			End 08:05	F F				
9/18/17				7:05- 52° Clear					
				Camera 11079					
WW1 WW2	Pema Pema				M —				
WW3 W-1	Pema Pema				F F				
W-2 W-3	Pema Pema				M F				
~~WW~~ E3 E4	Pema Pema		—		— F				
E9 E10	Pema Pema				—				
8	Pema			Camera 11075	— F				
9	Pema				F				
10	Pema				—				
9/19/17		07:10	- 54°	Clear 5-7mph					
WW2 WW3	Pema Pema			Camera 11079	M F				
W1 W2	Pema Pema				F M				
W3 W4	Pema Pema				F M				
E2 E4	Pema Pema				F M				
E5	Pema				—				

5 Pema Camera 11075 M

6 MUMU M

7 Pema F

8 Pema F

9 Pema F

Pema End 8:09 —

Attachment C: Representative Photographs

Representative Photographs

Photograph 1

September 19, 2017.

Location of Traps 1-3 and Camera Location 11075.

Photograph 2:

September 19, 2017.

Traps 4-6 at Camera Location 11075.

Photographs Continued

Photograph 3:

September 19, 2017.

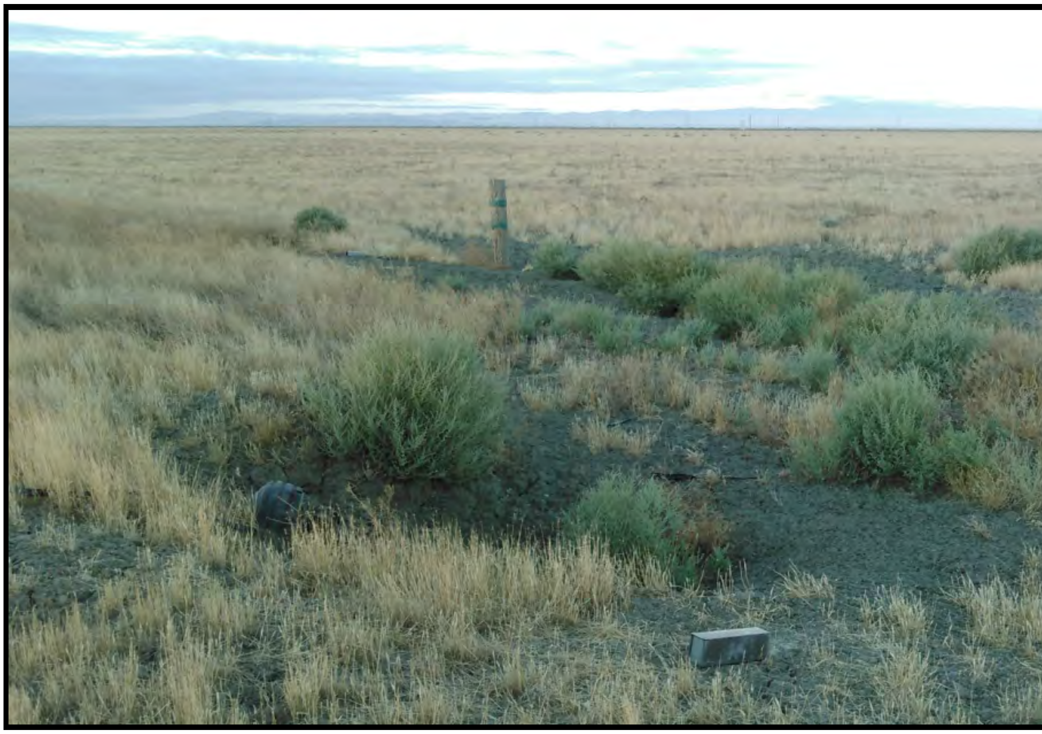
Traps 7-10 at Camera Location 11075.

Photograph 4:

September 19, 2017.

Western trap line at Camera Location 11079.

Photographs Continued



Photograph 5:

September 19, 2017.

Traps WW1-3 at Camera Location 11079.

Photograph 6:

September 19, 2017.

Eastern trap line at Camera Location 11079.

Photographs Continued

Photograph 7:

September 19, 2017.

Deer mouse captured at Location 11075.

Photograph 8:

September 19, 2017.

House mouse captured at Location 11075.

Appendix J

Buena Vista Lake Ornate Shrew Habitat Assessment

HELIX Environmental Planning, Inc.
11 Natoma Street, Suite 155
Folsom, CA 95630
916.365.8700 tel
www.**helixepi**.com

July 3, 2018

Ms. Christy Herron
Recurrent Energy
300 California Street, 7th Floor
San Francisco, CA 94104

RE: Habitat Assessment for Buena Vista Lake Ornate Shrew
RE Slate Solar Project, Kings County, California

On behalf of RE Slate LLC, HELIX Environmental Planning, Inc. (HELIX) conducted a habitat assessment for Buena Vista Lake ornate shrew (*Sorex ornatus relictus*) on the approximately 2,490-acre site of the proposed RE Slate Solar Project in western Kings County, near the City of Lemoore, California. The habitat assessment was conducted in accordance with a request from the U.S. Fish and Wildlife Service to conduct an evaluation of this species (letter to the Kings County Community Development Agency from the Sacramento Fish and Wildlife Office, dated February 8, 2016, reference number 08ESMF00-2016-TA-0423). The site is the location of a proposed 300-Megawatt utility-scale solar photovoltaic generating facility.

INTRODUCTION

The site is in unincorporated Kings County, south of Lemoore Naval Air Station and west of the Kings River. The Kings County Community Development Agency is processing a Conditional Use Permit for the proposed project, which requires analysis of potential environmental impacts, including to species listed as threatened or endangered by the U.S. Fish and Wildlife Service, in accordance with the California Environmental Quality Act (CEQA). The survey described in this report was undertaken to determine the potential for Buena Vista Lake ornate shrew to inhabit the proposed project site. Project impacts to Buena Vista Lake ornate shrew habitat or potential for take of individual animals would trigger consultation with the U.S. Fish and Wildlife Service under Section 7 or 10 of the Endangered Species Act of 1973 (16 U.S.C. § 1531 *et seq*.)

This report describes the methods used to conduct the habitat assessment and summarizes the findings.

BACKGROUND

Information in this section is from U.S. Fish and Wildlife publications (USFWS 1998, 2002, 2012, 2014).

Buena Vista Lake ornate shrew (BVLOS) was listed as "Endangered" on March 6, 2002 under the Endangered Species Act of 1973. Threats to BVLOS include loss of over 95-percent of suitable habitat in its range, and reduction and fragmentation of known populations. Potential threats to BVLOS include selenium poisoning, and genetic swamping through hybridization with sympatric taxa (USFWS 2002).

Shrews are small, insectivorous mammals. BVLOS is one of 9 subspecies of ornate shrew (*Sorex ornatus*), 7 of which are found only in California, and all of which are restricted to California and Baja California. Average size of BVLOS is a total length of 3.8 to 4.1 inches including a 1.4 to 1.5-inch tail, and weight of 0.14 ounces. The coat is black on the back, buffy-brown on the sides, and smoke-gray on the underside. BVLOS is distinguishable from its geographically closest relative (Southern California ornate shrew [*Sorex ornatus ornatus*]) by having a darker coat, smaller body, longer tail, and smaller skull. Four other subspecies of ornate shrew are rare and considered Species of Special Concern by the State of California, but no others are listed under an endangered species act.

The historic range of BVLOS was the Tulare Lake Basin, where it inhabited the swampy margins of lakes fed by rivers that drain the southern Sierra Nevada. The arid uplands that surrounded the historic wetlands in the basin are habitat for the Southern California ornate shrew, from which the Buena Vista Lake ornate shrew is genetically and morphologically distinct. Nearly all of the Tulare Lake basin has been drained and converted to agricultural land, and less than 5-percent of the original wetland habitat remains in small isolated fragments. At the time of listing, BVLOS was known from 4 locations. It is currently known from 8 locations, including 1 west of Lemoore (USFWS 2014).

Habitat for BVLOS is a complex riparian vegetation structure with thick leaf litter or dense mats of low-growing herbaceous species (see **Photos 1 and 2**), moist soil supplied by a high water table or nearby surface water, and abundant insect prey available year-round. BVLOS currently exists in small remnant patches of native vegetation at the margins of the Tulare Lake Basin (USFWS 2012). Because of their small size and high metabolic rates, shrews are active day and night and throughout the year and are not able to tolerate seasonal fluctuations in resource availability. Because shrews typically live only 1 year, a group of shrews or a pregnant female would likely disperse no more than 0.5 mile. While it is possible that an engineered canal could support habitat suitable for BVLOS, it is not likely that BVLOS could become established in a canal except by deliberate introduction (USFWS 1998).

PROJECT LOCATION AND EXISTING CONDITIONS

The project site is located in western Kings County, south of Lemoore Naval Air Station and 0.25 – 2 miles west of the Kings River (**Attachment A – Figure 1**). The site is roughly bounded by Avenal Cutoff Road to the northwest, Jackson Avenue to the north, fallow agricultural land to the east, Laurel Avenue to the South, and fallow agricultural land to the west (**Attachment A – Figure 2**).

The site is within the historic limits of Tulare Lake, and terrain in the site is flat and level, draining naturally to the east at a very shallow gradient. There is no natural topographic relief in the site; existing relief is the result of constructed berms associated with irrigation canals, drains, and roads. Elevations in the site range from roughly 195 to 215 feet above mean sea level. The site has been used in the past for agricultural activities including irrigated crops and stock grazing. Current land uses include sheep and cattle grazing in dry pasture, and ground water extraction. Most of the site is inactive agricultural fields that show evidence of past disking and furrowing, but do not appear to have been actively cultivated in recent years. Vegetation in the site is dominated by ruderal upland species and remnant crop species, except in active canals where surface water is present.

The site is generally bounded by canals. These canals extend offsite to the south and join the regional irrigation network. The wet status of canals on the site changes often, as wells are activated and inactivated, especially in smaller canals. For the purposes of assessing BVLOS habitat, the most significant feature in the project site is a set of 4 large canals that run north-south along the undeveloped right-of-way of 23rd Avenue. Water in these canals supports a narrow band of green vegetation along the lower banks, while the upper banks support sparse, seasonally dry upland vegetation similar to that in the adjacent roads and fields. Patches of dense emergent marsh vegetation establish along the banks and eventually spread outward until they fill the channel. Active canals are periodically dredged to remove dense emergent marsh vegetation, which results in high-intensity disturbance to soil and vegetation along the canal banks.

Although the eastern edge of the site approaches the Kings River in places, the site is always separated from the river at a minimum by an extent of weedy upland and an actively-used dirt road that constitute a barrier to movement of BVLOS, and the portions of the site near the Kings River do not support any habitat suitable for BVLOS. In other places, the site is separated from the Kings River by active agricultural lands including orchards, cotton fields, and wheat fields.

METHODS

HELIX Biologist George Aldridge Ph.D. conducted a focused assessment of habitats within the active canals in and adjacent to the project site on September 13, 2017. The assessment included documentation of vegetation structure and species composition in the active canals in the project site along 23rd Avenue and in the southeast corner, inspection of the project site along the eastern edge nearest the Kings River, and inspection of habitat at the known BVLOS occurrence in the Lemoore Wetland Reserve (USFWS Designated Critical Habitat Unit 7; **Attachment A – Figure 3**). Photos are provided in **Attachment B**.

RESULTS

Active canals in and adjacent to the project site are engineered earthen channels with uniformly steep sides that support a narrow band of green vegetation within a few feet of the water line, or no vegetation at all (see **Photos 3 – 6**). Vegetation above that band is sparse and characterized by upland species adapted to arid, alkaline environments such as five-hook bassia (*Bassia hyssopifolia*), alkali mallow (*Malvella leprosa*), and lamb's quarters (*Chenopodium album*). Vegetation near the water line includes a variety of species associated with wetlands such as tall flatsedge (*Cyperus eragrostis*), false daisy (*Eclipta prostrata*), common barnyard-grass (*Echinochloa crus-galli*), Mexican sprangletop (*Leptochloa fusca*), saltgrass (*Distichlis spicata*), and salt heliotrope (*Heliotropium curassavicum*), as well as upland species such as white sweet clover (*Melilotus albus*).

Dense patches of tall, emergent marsh vegetation rooted in the water occur at intervals along these canals (**Photo 7**) and include cattail (*Typha latifolia*) and bulrush (*Schoenoplectus acutus*); however, in most places, these patches are periodically removed and would not provide stable habitat to sustain a population of BVLOS. One patch of marsh at the southern end of the easternmost of the 4 canals along 23rd Avenue is not apparently subject to periodic removal, as it includes willows (*Salix* spp.) along with well developed marsh vegetation (**Photo 8**). This patch is isolated from any other similar habitat by several miles of unsuitable canal habitat, and also does not have the characteristics of the known BVLOS habitat in the Lemoore Wetland Reserve. Also, this canal does not extend upstream more than 1-mile north of Laurel Avenue, and so has no connection to other aquatic habitat north of the project site or in the Kings River.

Habitat near the water line in the canals is vulnerable to disturbance by fluctuating water levels and periodic dredging and grubbing of dense emergent marsh vegetation, and is susceptible to sudden cessation of flow in the canal resulting from changing water management. The band of habitat near the water line is rarely more than 2 feet wide and is on the steep lower banks of the canal. There is no leaf litter or complex structure to this vegetation, and small animals inhabiting it would be prone to fall into the water.

The Lemoore Wetland Reserve, where BVLOS is known to occur, is a set of percolation basins constructed by the City of Lemoore to detain storm water runoff before it enters the Kings River in years of high storm flows. The site is currently managed for waterfowl and portions are periodically flooded to create a mosaic of wetland communities. The site is flat and supports expanses of shallow surface water, a patchy overstory of mature willows (*Salix* spp.), cottonwoods (*Populus fremontii*), and buttonbush (*Cephalanthus occidentalis*), and a dense herbaceous layer of grasses and forbs. Habitat in the Lemoore

Wetland Reserve is consistent with the remnant patches of native wetland described as the remaining habitat for BVLOS.

SUMMARY/CONCLUSION

Active canals in and adjacent to the project site do not support habitat that meets the requirements of BVLOS. Green vegetation occurs in a narrow band near the water line, on steep canal banks, and lacking leaf litter or complex structure, an overstory, or moist, shaded soil surface. These bands of vegetation are subject to rapid changes in water level and periodic severe disturbance by dredging, are susceptible to sudden cessation of flows in the canals resulting from water management changes, and do not provide any refugia or connectivity to other suitable habitat that would allow small animals to escape such disturbances. Vegetation more than 2-3 feet above the water line in active canals is dry, sparse, and associated with xeric, saline environments. Habitat in active canals does not resemble habitat in the Lemoore Wetland Reserve, where BVLOS is known to occur.

The active canals in the site are isolated from wetland habitat suitable for BVLOS by several miles of arid upland agricultural land that is unsuited for BVLOS and the distance exceeds the predicted 0.5-mile maximum dispersal distance for BVLOS. This fact would prevent colonization of active canals in and near the project site even if those canals supported suitable habitat for BVLOS.

In conclusion, there is no suitable habitat for BVLOS in or adjacent to the RE Slate solar project, and no potential for the shrew to occur in or adjacent to the project site. No impacts to this species would occur as a result of the proposed project. Feel free to contact me by phone at (916) 365-8712 or by email at StephenS@helixepi.com if you have any questions.

Sincerely,

Stephen Stringer

Stephen Stringer, M.S.
Senior Biologist

Attachments:

Attachment A - Figures

- Figure 1. Project Location Map
- Figure 2. Project Vicinity Map
- Figure 3. Critical Habitat and Canals in the Project Site and Vicinity

Attachment B – Site Photographs

References:

U.S. Fish and Wildlife Service (USFWS). 1998. Recovery Plan for the Upland Species of the San Joaquin Valley, California. U.S. Fish and Wildlife Service, Portland, OR.

_____. 2002. Endangered and Threatened Wildlife and Plants; Endangered Status for the Buena Vista Lake Shrew. Federal Register, Vol. 67, No. 44, March 6, 2002.

_____. 2012. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Buena Vista Lake Shrew; Proposed Rule. Federal Register, Vol. 77, No. 132, July 10, 2012.

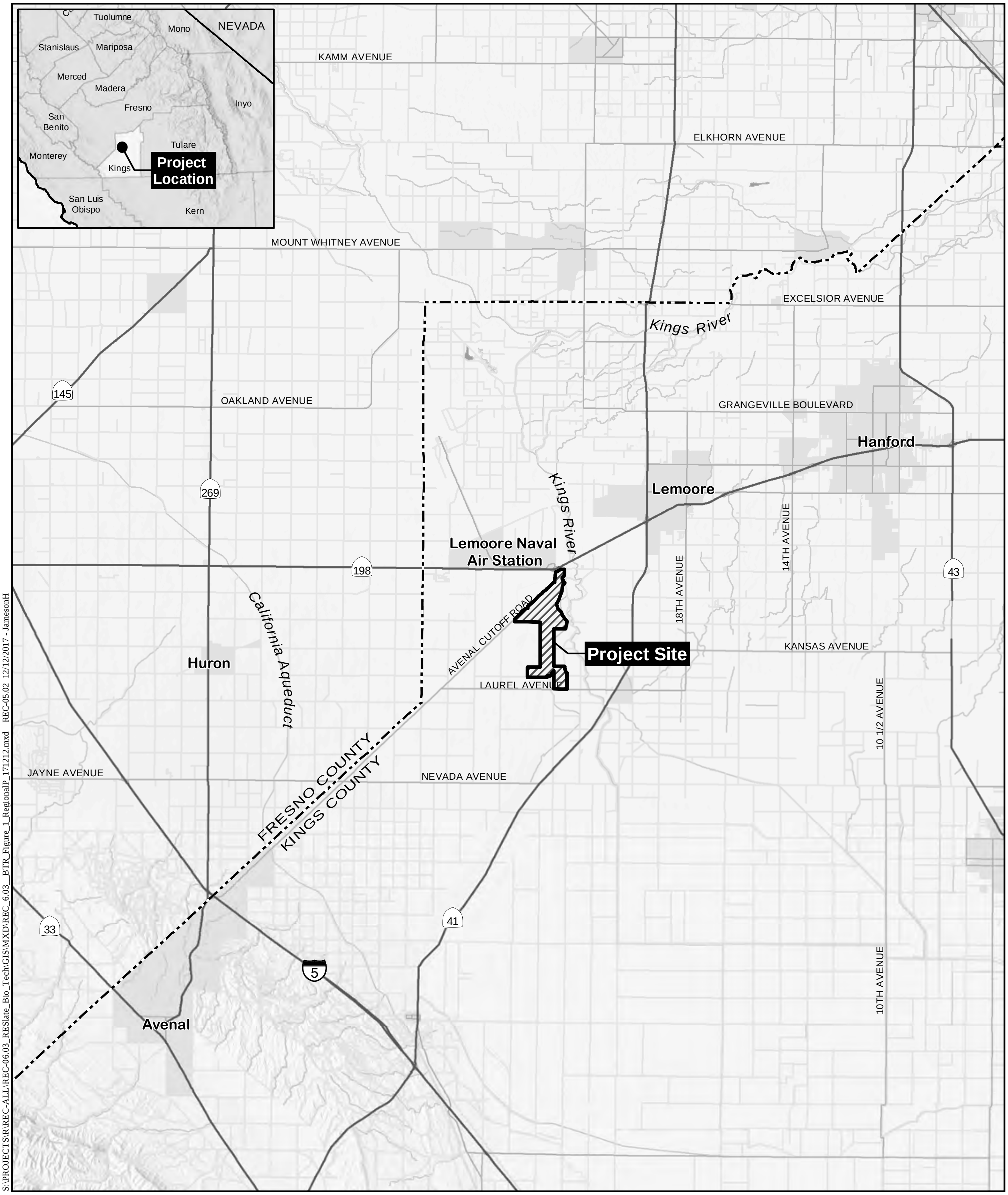
_____. 2014. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Buena Vista Lake Shrew; Final Rule. Federal Register, Vol. 78:39835, July 2, 2014.

Attachment A

Project Location Map

Project Vicinity Map

Critical Habitat and Canals in the Project Site and Vicinity



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Source: ESRI 2016, NHD 2016

Regional Location Map

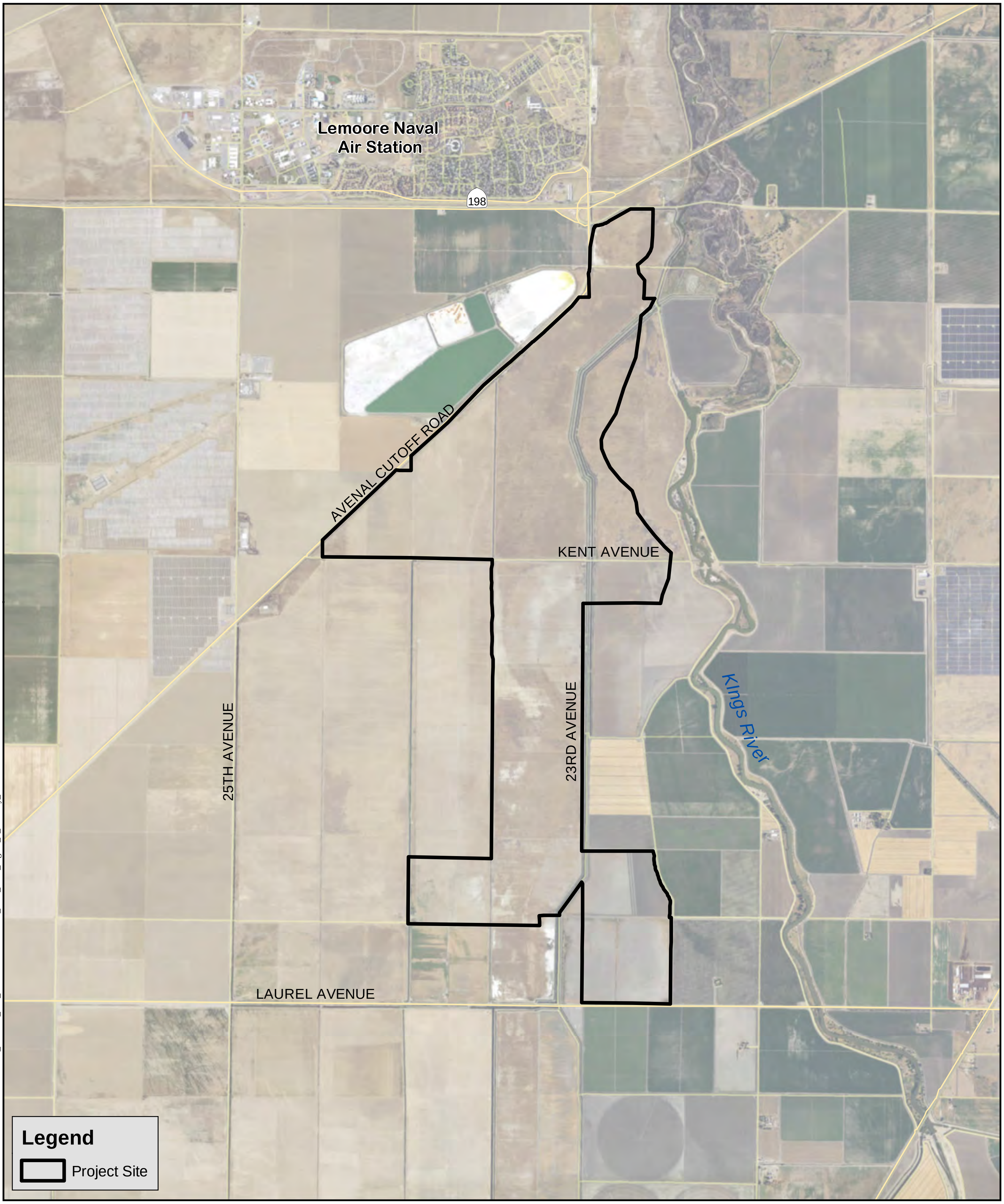
RE SLATE SOLAR PROJECT

KINGS COUNTY, CA

HELIX Environmental Planning

N 0 5 Miles 1 inch = 5 miles

Figure 1



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Source: ESRI 2016

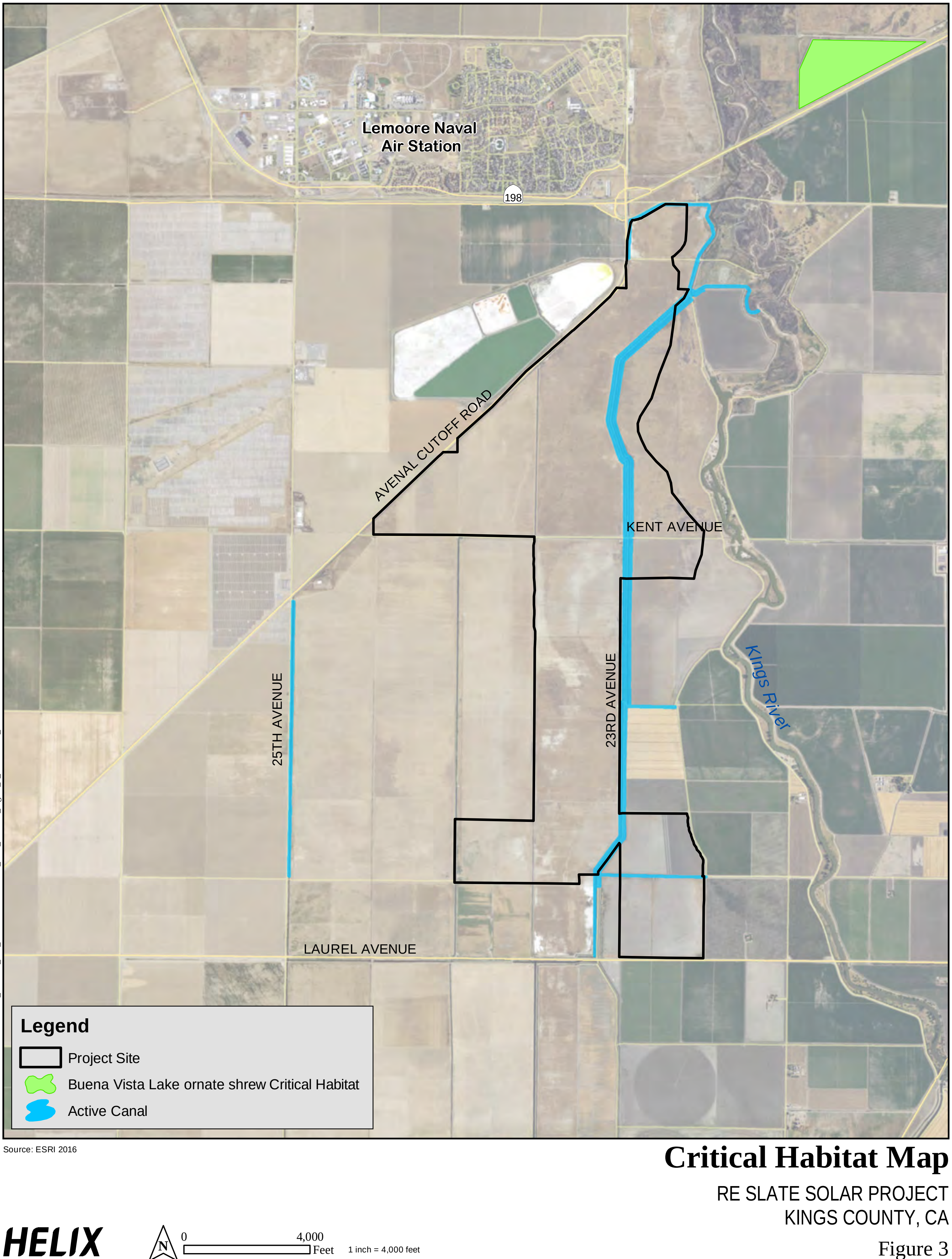
Project Vicinity Map

RE SLATE SOLAR PROJECT
KINGS COUNTY, CA

HELIX Environmental Planning

N 0 4,000 Feet 1 inch = 4,000 feet

Figure 2



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Source: ESRI 2016

Critical Habitat Map

RE SLATE SOLAR PROJECT

KINGS COUNTY, CA

HELIX Environmental Planning

Figure 3

Attachment B

Site Photos

Photo 1: View of known BVLOS habitat at the Lemoore Wetland Reserve.

Photo 2: View of known BVLOS habitat at the Lemoore Wetland Reserve.

Photo 3: Typical view of a canal at Kent Avenue and 23rd Avenue.

Photo 4: View of an active canal in the southeast corner of the project site.

Photo 5: View of the active canal at the north end of the project site.

Photo 6: Typical view of the canal at the east edge of the project site (23rd Avenue).

Photo 7. Dense patch of bulrush in an active canal.

Photo 8. Freshwater marsh in the easternmost canal along 23rd Avenue at Laurel Avenue.

Appendix K

Burrowing Owl Survey Report

HELIX Environmental Planning, Inc.
11 Natoma Street, Suite 155
Folsom, CA 95630
916.365.8700 **tel**
www.**helixepi**.com

July 5, 2018

Ms. Christy Herron
Recurrent Energy
300 California Street, 7th Floor
San Francisco, CA 94104

RE: Burrowing Owl Survey Report
RE Slate Solar Project, Kings County, California

This report documents surveys for burrowing owl (*Athene cunicularia*) conducted by HELIX for the proposed RE Slate Solar Project. HELIX has conducted two full sets of breeding season surveys for burrowing owl at the site according to the guidelines prepared by the California Department of Fish and Wildlife (CDFW) in the *Staff Report on Burrowing Owl Mitigation* (CDFW 2012). HELIX initially conducted burrowing owl surveys during the breeding season in 2016 in anticipation of project commencement in 2017. Due to project delays, HELIX re-conducted the burrowing owl surveys in 2018 to ascertain the current status of burrowing owl at the site.

INTRODUCTION

The RE Slate Solar Project consists of a proposed 300-Megawatt utility-scale solar photovoltaic generating facility. The Kings County Community Development Agency is processing a Conditional Use Permit for the proposed project and requires analysis of potential environmental impacts in accordance with the California Environmental Quality Act (CEQA). The surveys described in this report were undertaken to determine the potential for the proposed project to result in significant impacts to burrowing owl. This report describes the methods used to conduct the burrowing owl surveys and summarizes the findings.

PROJECT LOCATION AND EXISTING CONDITIONS

The approximately 2,490-acre project site is located in western Kings County, southeast of Lemoore Station, and west of the Kings River (**Attachment A - Figure 1**). The site is roughly bounded by Avenal Cutoff Road to the northwest, Jackson Avenue to the north, fallow and active agricultural land to the east, Laurel Avenue to the South, and fallow agricultural land to the west (**Attachment A – Figure 2**). The proposed project is located adjacent to and in the immediate vicinity of numerous existing and approved solar projects. The project would connect into the PG&E Mustang Switching Station northwest of the project site via a gen-tie line constructed as part of the RE Mustang 2 solar facility, which is immediately west of the project site.

The site is within the historic limits of Tulare Lake, which was drained beginning in the late 19th century, and terrain in the site is flat and level, draining naturally to the east and south at a very shallow gradient. There is no natural topographic relief in the site; existing relief is the result of constructed berms associated with irrigation canals, drains, and roads. Elevations in the project site range from roughly 195 to 215 feet above mean sea level.

The project site has been used in the past for agricultural activities including intensive cultivation and stock grazing. Most of the site is currently inactive agricultural land; small parts are used as dry pasture for livestock grazing. There are several groundwater wells in the site, some of which were active at the time of the surveys conducted for this report. Water from these wells flowed offsite to the south in canals and was not used on the site. Site photos are in **Attachment B**.

METHODS

A habitat assessment of the site was initially conducted on April 13, 2016 and the site was determined to provide suitable breeding and foraging habitat for burrowing owl. Breeding season burrowing owl surveys were then conducted according to the guidelines prepared by CDFW in the *Staff Report on Burrowing Owl Mitigation* (CDFW 2012) between April and July 2016. Surveys were re-conducted between April and June 2018 for the reasons stated above. During surveys in 2016 (**Table 1**) and 2018 (**Table 2**), the project site was surveyed a total of four times during the burrowing owl breeding season led by HELIX biologists with extensive experience at burrowing owl surveys. Surveys were led by HELIX senior biologists Stephen Stringer, M.S. and George Aldridge, Ph.D. with assistance by other biologists/environmental scientists on staff with HELIX. Mr. Stringer is familiar with burrowing owl and its local ecology and has participated in and independently conducted dozens of habitat assessments and presence/absence surveys for burrowing owls since 2003. Dr. Aldridge is also familiar with burrowing owl and its local ecology and has conducted numerous burrowing owl surveys and habitat assessments since 2011 throughout California.

During each survey, the entire site was surveyed by driving slowly and stopping every 100 meters or less to scan the surrounding area for burrowing owl presence with binoculars. The majority of the site's acreage is unsuitable for burrowing owl nesting due to periodic tilling or disking for agricultural production in the recent past, resulting in an absence of mammal burrows. Pedestrian transects were performed in areas of suitable nesting habitat such as the margins of agricultural fields, ruderal areas, and canal banks due to the presence of ground squirrel burrows in these locations. For both the 2016 and 2018 surveys, initial habitat assessments of all large fields were performed on foot to obtain 100% visual coverage; however, the cultivated portions of the site are devoid of suitable burrows and perches, and subsequent surveys covered those areas from roads using binoculars or with limited pedestrian surveys. All observed mammal burrows, as well as standpipes and other structures providing perches, were searched for sign of recent use by burrowing owls such as excrement, feathers, and owl pellets during each survey.

Surveys were timed in both years to allow for comprehensive surveys of the site and a high detection probability. The morning surveys started after morning civil twilight to allow ambient temperatures to increase to a level more suitable for burrowing owl detection and ended at 10 am as prescribed in the protocol. The evening surveys were conducted roughly between two hours before sunset and evening civil twilight. **Table 1** documents breeding season surveys conducted in 2016 and **Table 2** documents breeding season surveys conducted in 2018.

Table 1. Survey Dates and Times (Burrowing Owl Breeding Season Surveys 2016)

Date	Start / End Time	Start/End Temp (° F)	Wind Speed (mph)	Weather	Personnel
Survey #1					
April 14	0630-1030	43/50*	2-5	overcast	G. Aldridge, D. Barry
April 15	0630-0915	48/68*	10-15	overcast	G. Aldridge, D. Barry
Survey #2					
May 11	0600-1045	56/78	0-2	clear	G. Aldridge, D. Barry
May 12	0600-1030	55/76	0-2	clear	G. Aldridge, D. Barry
May 13	0600-1030	61/78	0-2	clear	G. Aldridge, D. Barry
Survey #3					
June 16	1800-2045	82/78	0-2	clear	S. Stringer, J. Honeycutt
June 17	0600-1030	56/79	0-2	clear	S. Stringer, J. Honeycutt
Survey #4					
July 13	0530-1000	58/83	0-8	clear	G. Aldridge
July 13	1815-2045	97/84	0-2	clear	G. Aldridge, J. Honeycutt
July 14	0530-1000	64/81	0-5	clear	G. Aldridge, J. Honeycutt

* Although the protocol calls for conducting the survey during warmer temperatures, based on the forecast it didn't seem as though the project site would experience 70+ degree temps during the appropriate survey times prior to April 15th. Owls were observed during these surveys despite the cool temperatures.

Table 2. Survey Dates and Times (Burrowing Owl Breeding Season Surveys 2018)

Date	Start / End Time	Start/End Temp (° F)	Wind Speed (mph)	Weather	Personnel
Survey #1					
April 3	0630-1000	49/62	0-3	clear	G. Aldridge, D. Van Essen
April 3	1730-1945	65/60	5-8	clear	G. Aldridge, D. Van Essen
April 4	0630-1000	50/71	0-5	overcast	G. Aldridge, D. Van Essen
April 4	1700-1930	82/79	3-10	overcast	G. Aldridge, D. Van Essen
April 5	0640-1000	57/59	0-8	clear	G. Aldridge, D. Van Essen
April 5	1730-1930	73/70	3-8	overcast	G. Aldridge, D. Van Essen
April 6	0630-0930	59/61	0-5	overcast	G. Aldridge, D. Van Essen
Survey #2					
April 17	0630-1000	42/50	0-2	overcast	G. Aldridge, D. Van Essen
April 17	1730-1930	55/53	1-5	cloudy	G. Aldridge, D. Van Essen
April 18	0630-0930	40/55	0-2	overcast	G. Aldridge, D. Van Essen
Survey #3					
May 10	0600-1000	55/70	0-5	clear	G. Aldridge
May 10	1730-2000	88/85	3-7	clear	G. Aldridge
May 11	0600-1000	58/72	calm	clear	G. Aldridge
Survey #4					
June 26	0600-1000	65/85	0-1	clear	G. Aldridge
June 26	1800-2100	97/85	5-10	clear	G. Aldridge
June 27	0545-1000	57/84	0	clear	G. Aldridge

RESULTS

Burrowing owls were observed on and adjacent to the site during the breeding season surveys in both 2016 and 2018 as well as incidentally during other biological surveys at the site. Sightings of burrowing owl and sign on the project site are shown on **Attachment A – Figure 3.**

2016 Survey Results

No resident burrowing owls were observed in the project site. A single transient burrowing owl was observed at one location at the southern end of the site near 23rd Avenue. This individual was observed during Survey #2 and was seen only once. There was no sign of an occupied burrow at that location, and no owls were observed at that location again. A breeding pair of burrowing owls was observed at a burrow complex immediately south of the project site. Burrowing owls were observed at this location throughout the duration of the surveys.

Potential predators of burrowing owl observed in the project site and immediate vicinity included red-tailed hawk (*Buteo jamaicensis*) and great horned owl (*Bubo virginianus*). No signs of burrowing owl predation were observed in the project site.

2018 Survey Results

Burrowing owl sign was observed at the entrance to two mammal burrows in the northern half of the project site during the habitat assessment on April 3, 2018. The burrows appeared to have been used over the winter by transient owls. The burrows were re-visited during subsequent surveys and no owls were seen at the location during any subsequent surveys.

A single resident burrowing owl was observed in the project site in the early spring during Surveys 1 and 2. This owl was observed along the southern boundary of the project site during April, usually occupying burrows off-site in an irrigated pasture used for grazing cattle. The owl perched on the fence along the project boundary, foraged in the project site, and occasionally used burrows at the base of fence posts along the project boundary. This individual was observed consistently during surveys 1 and 2 but was not observed again along the southern project boundary after Survey #2. During SWHA surveys on May 21, 2018, a juvenile burrowing owl was incidentally observed along the southern fence line in this same location and flew offsite to the south. The juvenile owl was not seen again.

No burrowing owls were observed during Survey 3. A transient owl was observed at the western edge of the site along Avenal Cutoff Road during Survey #4. This individual was observed once in a dry canal between the project site and the road; it was not seen in subsequent visits to that location during the remainder of Survey #4. The area was examined on foot and no burrows were found with sign of occupancy (pellets, bones, excrement, etc.).

Incidental Burrowing Owl Observations

During biological surveys performed by HELIX biologists between May and July 2017, a transient burrowing owl was observed along a canal at the western edge of the site. During a site visit by HELIX biologists in September 2017, a single transient owl was observed in a canal in the north-center of the site.

Sightings of transient owls since 2016 and owl sign at burrows north of Kent Avenue suggest that the project site is used by transient owls; however, no breeding has been observed in the project site except at the offsite location adjacent to the southern boundary.

SUMMARY/CONCLUSION

Protocol breeding season burrowing owl surveys of the RE Slate Solar Project site were conducted by qualified biologists in accordance with CDFW guidelines (CDFW 2012) in 2016 and again in 2018. Burrowing owls were documented nesting in pastureland adjacent to the southern boundary of the project site during both 2016 and 2018 surveys. No nesting by burrowing owls has been documented on the project site during hundreds of hours of surveys. However, several sightings of transient burrowing owl or burrowing owl sign have been documented throughout the site. Feel free to contact me by phone at (916) 365-8712 or by email at StephenS@helixepi.com if you have any questions.

Stephen Stringer

Stephen Stringer, M.S.
Senior Scientist

Attachments:

Attachment A - Figures

- Figure 1. Project Location Map
- Figure 2. Aerial Map
- Figure 3. Burrowing Owl Sighting Locations

Attachment B – Site Photographs

References:

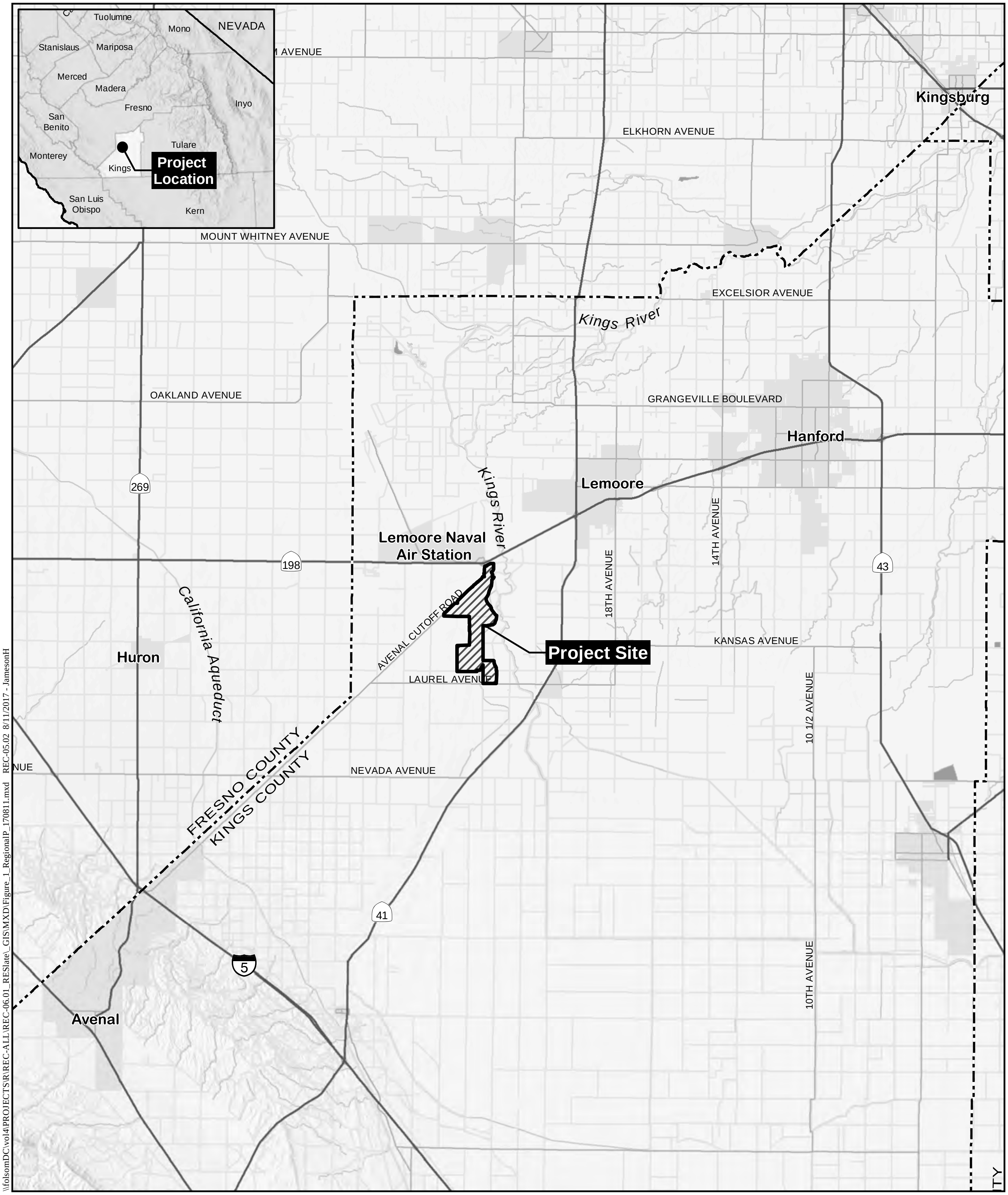
California Department of Fish and Wildlife (CDFW). 2012. Staff Report on Burrowing Owl Mitigation. State of California Natural Resources Agency Department of Fish and Game. March 2012.

Attachment A

Project Location Map

Aerial Map

Burrowing Owl Sightings



\\folsomDC\vol4\PROJECTS\R\REC-ALL\REC-06.01_RESlate_GIS\MXD\Figure_1_RegionalP_170811.mxd REC-05.02 8/11/2017 - JamesonH

Source: ESRI 2016, NHD 2016

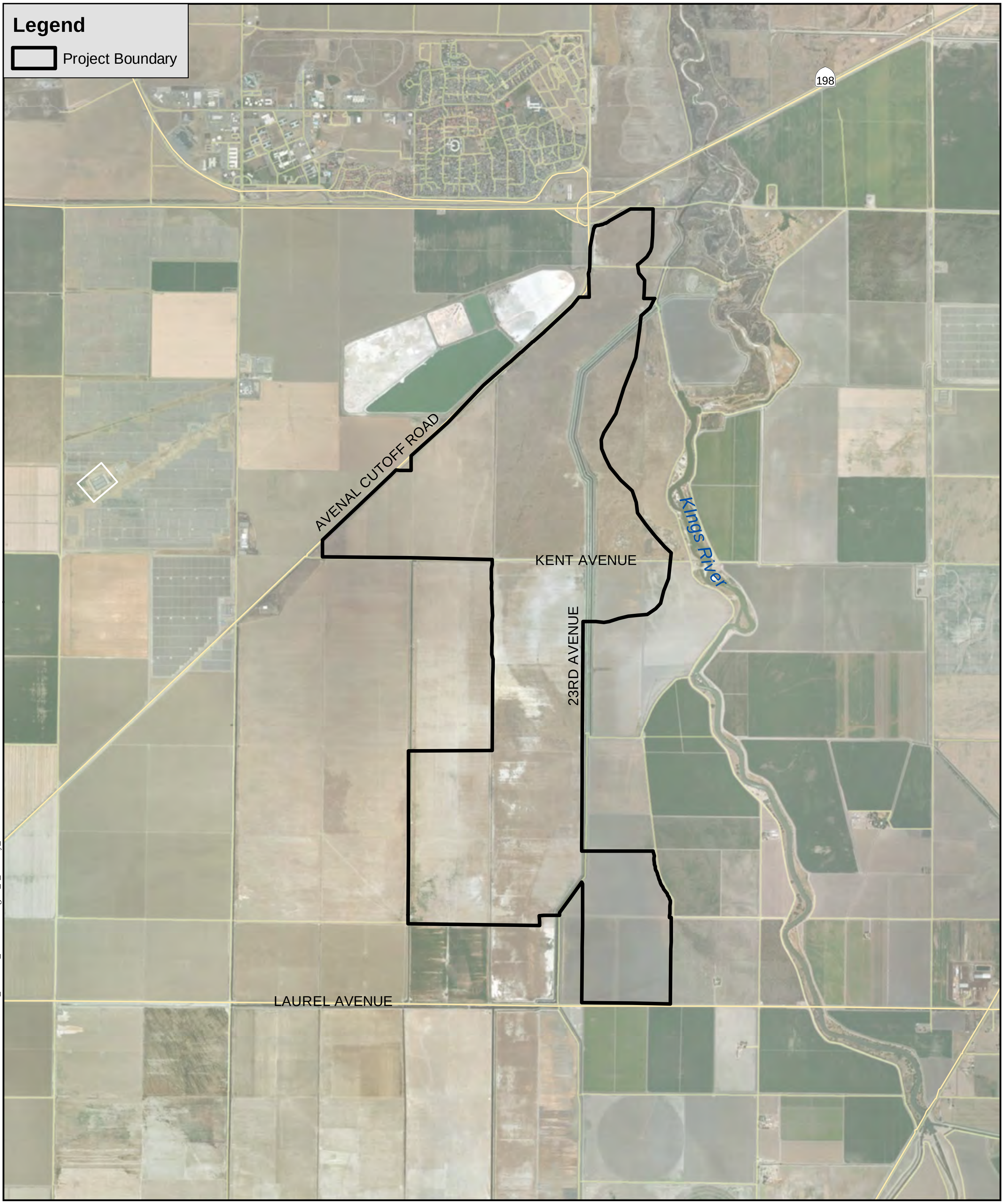
Regional Location Map

RE SLATE SOLAR PROJECT
KINGS COUNTY, CA

HELIX Environmental Planning

0 5 Miles 1 inch = 5 miles

Figure 1



\\folsomDC\vol4\PROJECTS\R\REC-ALL\REC-06.01_RESlate_GIS\MXD\Figure_2_Vicinity_170811.mxd REC-05.02 1/25/2018 - JamesonH

Source: ESRI 2016

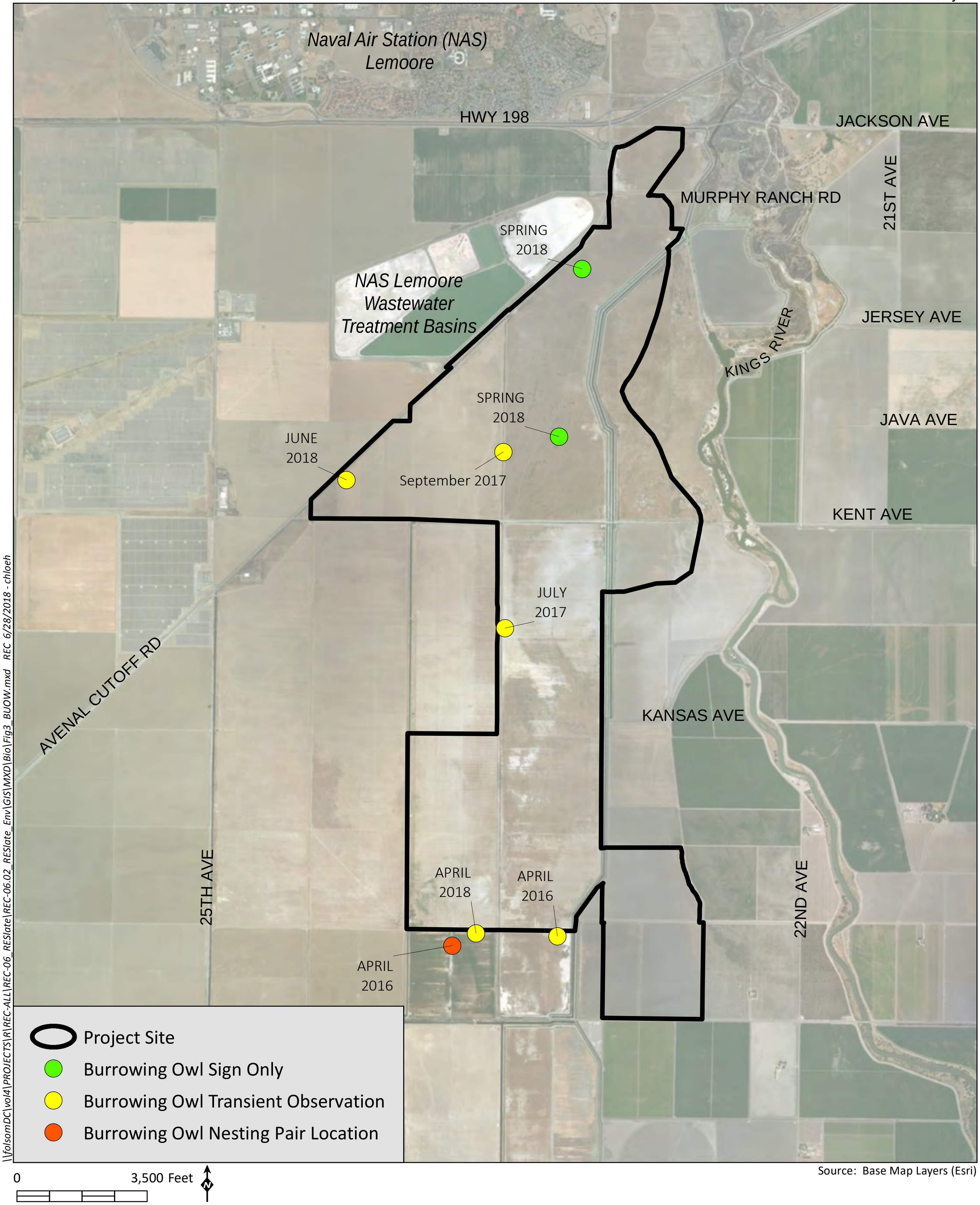
Project Vicinity Map

RE SLATE SOLAR PROJECT
KINGS COUNTY, CA

HELIX
Environmental Planning

N
0 4,000
Feet
1 inch = 4,000 feet

Figure 2



Source: Base Map Layers (Esri)

\\folsomDC\vol4\PROJECTS\R\REC-ALL\REC-06_RESlate\REC-06.02_RESlate_Env\GIS\MXD\Bio\Fig3_BUOW.mxd REC 6/28/2018 - chloeh

HELIX Environmental Planning

Burrowing Owl Locations & Observations

Figure 3

Attachment B

Site Photos

Photo 1. Burrow with owl sign observed in spring 2018.

Photo 2. Typical view of the project site north of Kent Avenue.

Photo 3. The location at the south edge of the project site where a single owl was observed during April 2018.

Photo 4. Transient owl seen in a canal north of Kent Avenue in September 2017.

Mail to:
California Natural Diversity Database
California Dept. of Fish & Wildlife
1416 9th Street, Suite 1266
Sacramento, CA 95814
Fax: (916) 324-0475 email: CNDDB@wildlife.ca.gov

Date of Field Work (mm/dd/yyyy): 04/18/2018

For Office Use Only

Source Code: ______ Quad Code: ______
Elm Code: ______ Occ No.: ______
EO Index: ______ Map Index: ______

Clear Form | Print Form

California Native Species Field Survey Form

Scientific Name: Athene cunicularia

Common Name: Burrowing owl

Species Found? (●) Yes ( ) No ______ If not found, why?

Total No. Individuals: 1 Subsequent Visit? (●) Yes ( ) No

Is this an existing NDDB occurrence? 1991 (Yes, Occ. #) ☐ No ☐ Unk.

Collection? If yes: ______ Number ______ Museum / Herbarium

Reporter: HELIX Environmental Planning, Inc.
Address: 11 Natoma Street, Suite 155
Folsom, CA 95630
E-mail Address: GeorgeA@helixepi.com
Phone: 916-365-8714

Plant Information

Phenology: ______ % vegetative ______ % flowering ______ % fruiting

Animal Information

1 # adults ______ # juveniles ______ # larvae ______ # egg masses ______ # unknown

☐ wintering ☐ breeding ☐ nesting ☐ rookery ☐ burrow site ☐ lek ☒ other

Location Description (please attach map AND/OR fill out your choice of coordinates, below)

Private land 0.5 mile north of Laurel Avenue, 1.25 mile east of 25th Avenue

County: Kings Landowner / Mgr: Private

Quad Name: Westhaven Elevation: 212

T____ R____ Sec____, ____1/4 of ____ 1/4, Meridian: H ( ) M ( ) S ( ) Source of Coordinates (GPS, topo. map & type): ______

T____ R____ Sec____, ____1/4 of ____ 1/4, Meridian: H ( ) M ( ) S ( ) GPS Make & Model: ______

DATUM: NAD27 ( ) NAD83 (●) WGS84 ( ) Horizontal Accuracy: 1 meters/feet

Coordinate System: UTM Zone 10 ( ) UTM Zone 11 ( ) *OR* Geographic (Latitude & Longitude) (●)

Coordinates: 36.19555 N, 119.88354 W

Habitat Description (plants & animals) *plant communities, dominants, associates, substrates/soils, aspects/slope:*
Animal Behavior *(Describe observed behavior, such as territoriality, foraging, singing, calling, copulating, perching, roosting, etc., especially for avifauna):*

Fence line between irrigated pasture and dry pasture; burrows in irrigated pasture and at the base of fence posts. A single adult was observed regularly between early April and mid-May; not seen after mid-May. Apparently not breeding. This same location was used by a breeding pair in 2016.

Please fill out separate form for other rare taxa seen at this site.

Site Information Overall site/occurrence quality/viability (site + population): ( ) Excellent ( ) Good (●) Fair ( ) Poor

Immediate AND surrounding land use: Irrigated and dry pasture

Visible disturbances: Tire tracks; grazing cattle

Threats: Vehicles, mowing, grazing, potential for development

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: Experience identifying species

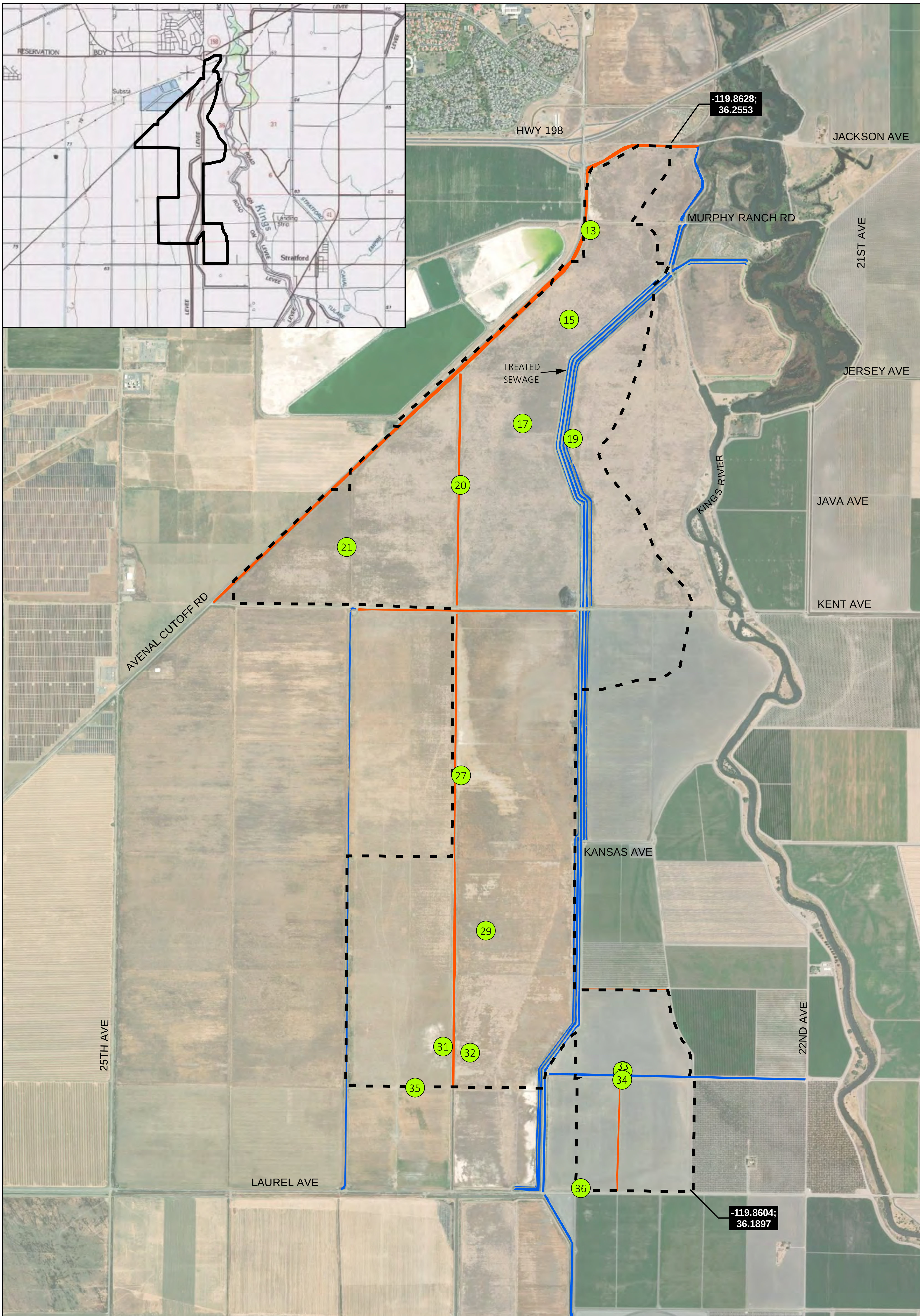
Photographs: *(check one or more)*

	Slide	Print	Digital
Plant / animal	☐	☐	☒
Habitat	☐	☐	☒
Diagnostic feature	☐	☐	☐

May we obtain duplicates at our expense? (●) yes ( ) no

Appendix L

Aquatic Resources Delineation Map and Datasheets



Project Site
Sample Points
Active Canal
Inactive Canal

N

0 1,000 2,000 Feet

1 inch = 2,000 feet

HELIX Environmental Planning

Coordinate System: NAD 1983 StatePlane California IV FIPS 0404 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983

DRAWN BY: C. Hood
DELINEATORS: G. Aldridge, S. Stringer
DATE OF FIELDWORK: October 17, 18, 19, 24, and 26, 2017
DATE OF AERIAL PHOTOGRAPH: June 21, 2016 (NAIP)
CREATED ON: June 25, 2018
REVISED ON:

AQUATIC RESOURCES MAP

RE Slate Solar Project

Kings County, California

July, 12, 2018

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: RE Slate City/County: Kings Sampling Date: 06/03/2016

Applicant/Owner: Recurrent Energy State: CA Sampling Point: SP 13

Investigator(s): S. Stringer, D. Barry, G. Aldridge Section, Township, Range: S25 T19S R19E

Landform (hillslope, terrace, etc.): terrace Local relief (concave, convex, none): none Slope (%): <1

Subregion (LRR): C Lat: 36.24994546 Long: -119.8689898 Datum: NAD-84

Soil Map Unit Name: Lethent clay loam NWI classification: hydric in sloughs

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✔ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✔ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✔	No ____	**Is the Sampled Area within a Wetland?** **Yes** ____ **No** ✔
Hydric Soil Present?	Yes ____	No ✔	
Wetland Hydrology Present?	Yes ____	No ✔	

Remarks:

Sample point is in a saline depression in the corner of a former agricultural field

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: 1m)			
1. Spergularia marina	50	Y	OBL
2. Hordeum marinum	5	N	FAC
3. Chenopodium album	5	N	UPL
4.			
5.			
6.			
7.			
8.			
= Total Cover	60		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum 40 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 1.0 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	____	x 1 = ____
FACW species	____	x 2 = ____
FAC species	____	x 3 = ____
FACU species	____	x 4 = ____
UPL species	____	x 5 = ____
Column Totals:	____ (A)	____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

- ✔ Dominance Test is >50%
- __ Prevalence Index is ≤3.0[1]
- __ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- __ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ✔ **No** ____

Remarks:

SOIL

Sampling Point: SP 13

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-16	2.5Y 3/2	100					Cl	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ______ No ✔

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No ✔ Depth (inches): ______

Water Table Present? Yes ______ No ✔ Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ______ No ✔ Depth (inches): ______

Wetland Hydrology Present? Yes ______ No ✔

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: RE Slate City/County: Kings Sampling Date: 06/03/2016

Applicant/Owner: Recurrent Energy State: CA Sampling Point: SP 15

Investigator(s): S. Stringer, D. Barry, G. Aldridge Section, Township, Range: S26 T19S R19E

Landform (hillslope, terrace, etc.): terrace Local relief (concave, convex, none): none Slope (%): <1

Subregion (LRR): C Lat: 36.24431271 Long: -119.8705799 Datum: NAD-84

Soil Map Unit Name: Gepford clay, partially drained NWI classification: hydric 2

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✔ No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are “Normal Circumstances” present? Yes ✔ No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___	No ✔
Hydric Soil Present?	Yes ___	No ✔
Wetland Hydrology Present?	Yes ___	No ✔

Is the Sampled Area within a Wetland? **Yes** ___ **No** ✔

Remarks:

Sample point is in an agricultural field

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: ___)			
1.			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: ___)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: 1m)			
1. Hordeum murinum	50	Y	UPL
2. Erodium cicutarium	50	Y	UPL
3. Chenopodium album	<1	N	UPL
4. Bassia hyssopifolia	<1	N	UPL
5.			
6.			
7.			
8.			
= Total Cover	100		
Woody Vine Stratum (Plot size: ___)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.0 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = ___

Hydrophytic Vegetation Indicators:

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ___ **No** ✔

Remarks:

SOIL

Sampling Point: SP 15

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-16	2.5Y 3/2	100					Cl L	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ______ No ✔

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No ✔ Depth (inches): ______

Water Table Present? Yes ______ No ✔ Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ______ No ✔ Depth (inches): ______

Wetland Hydrology Present? Yes ______ No ✔

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: RE Slate City/County: Kings Sampling Date: 06/03/2016

Applicant/Owner: Recurrent Energy State: CA Sampling Point: SP 17

Investigator(s): S. Stringer, D. Barry, G. Aldridge Section, Township, Range: S35 T19S R19E

Landform (hillslope, terrace, etc.): terrace Local relief (concave, convex, none): none Slope (%): <1

Subregion (LRR): C Lat: 36.23774983 Long: -119.8741226 Datum: NAD-84

Soil Map Unit Name: Gepford clay, partially drained NWI classification: hydric 2

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✔ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✔ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?		✔
Hydric Soil Present?		✔
Wetland Hydrology Present?		✔

Is the Sampled Area within a Wetland? Yes ____ No ✔

Remarks:

Sample point is in an active agricultural field

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: 1m)			
1. Hordeum murinum	50	Y	UPL
2. Sisymbrium altissimum	50	Y	UPL
3.			
4.			
5.			
6.			
7.			
8.			
= Total Cover	90		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum 10 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.0 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species ____	x 1 = ____
FACW species ____	x 2 = ____
FAC species ____	x 3 = ____
FACU species ____	x 4 = ____
UPL species ____	x 5 = ____
Column Totals: ____ (A)	____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No ✔

Remarks:

SOIL

Sampling Point: SP 17

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 3/2	100					L	
7-12	10YR 3/1	100					Cl L	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5) (**LRR C**)
___ 1 cm Muck (A9) (**LRR D**)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Loamy Mucky Mineral (F1)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

___ 1 cm Muck (A9) (**LRR C**)
___ 2 cm Muck (A10) (**LRR B**)
___ Reduced Vertic (F18)
___ Red Parent Material (TF2)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? Yes ______ **No** ✔

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1) (**Nonriverine**)
___ Sediment Deposits (B2) (**Nonriverine**)
___ Drift Deposits (B3) (**Nonriverine**)
___ Surface Soil Cracks (B6)
___ Inundation Visible on Aerial Imagery (B7)
___ Water-Stained Leaves (B9)
___ Salt Crust (B11)
___ Biotic Crust (B12)
___ Aquatic Invertebrates (B13)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres along Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

___ Water Marks (B1) (**Riverine**)
___ Sediment Deposits (B2) (**Riverine**)
___ Drift Deposits (B3) (**Riverine**)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No ✔ Depth (inches): ______

Water Table Present? Yes ______ No ✔ Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ______ No ✔ Depth (inches): ______

Wetland Hydrology Present? Yes ______ **No** ✔

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: RE Slate City/County: Kings Sampling Date: 05/26/2016

Applicant/Owner: Recurrent Energy State: CA Sampling Point: SP 19

Investigator(s): S. Stringer, D. Barry, G. Aldridge Section, Township, Range: S35 T19S R19E

Landform (hillslope, terrace, etc.): terrace Local relief (concave, convex, none): none Slope (%): <1

Subregion (LRR): C Lat: 36.23683933 Long: -119.8702115 Datum: NAD-84

Soil Map Unit Name: Gepford clay, partially drained NWI classification: hydric 2

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✔ No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes ✔ No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?		✔
Hydric Soil Present?		✔
Wetland Hydrology Present?		✔
Is the Sampled Area within a Wetland?		✔

Remarks:

Sample point is in a relic floodplain now a fallow agricultural field

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ___)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: ___)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: 1m)			
1. Hordeum marinum	60	Y	FAC
2. Beta vulgaris	20	Y	UPL
3. Sisymbrium altissimum	5	N	UPL
4. Chenopodium album	2	N	UPL
5.			
6.			
7.			
8.			
= Total Cover	75		
Woody Vine Stratum (Plot size: ___)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum 25 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.5 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	60	x 3 =	180
FACU species	0	x 4 =	0
UPL species	27	x 5 =	135
Column Totals:	87 (A)		315 (B)

Prevalence Index = B/A = 3.6

Hydrophytic Vegetation Indicators:

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ___ No ✔

Remarks:

Vegetation is borderline hydrophytic

SOIL

Sampling Point: SP 19

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-18	10YR 3/2	100					Cl L	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? Yes ______ No ✔

Remarks:

Relic floodplain soil

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No ✔ Depth (inches): ____________

Water Table Present? Yes ______ No ✔ Depth (inches): ____________

Saturation Present? (includes capillary fringe) Yes ______ No ✔ Depth (inches): ____________

Wetland Hydrology Present? Yes ______ No ✔

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: RE Slate City/County: Kings Sampling Date: 06/03/2016

Applicant/Owner: Recurrent Energy State: CA Sampling Point: SP 20

Investigator(s): S. Stringer, D. Barry, G. Aldridge Section, Township, Range: S35 T19S R19E

Landform (hillslope, terrace, etc.): ditch Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR): C Lat: 36.23386080 Long: -119.8788974 Datum: NAD-84

Soil Map Unit Name: Lethent clay loam NWI classification: hydric in sloughs

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✔ No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes ✔ No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?		✔
Hydric Soil Present?	✔	
Wetland Hydrology Present?		✔

Is the Sampled Area within a Wetland? Yes ___ No ✔

Remarks:

Sample point is in a constructed ditch in an agricultural field. There is no evidence that the ditch has recently conveyed water.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ___)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: ___)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: 1m)			
1. Bromus madritensis	50	Y	UPL
2. Sisymbrium altissimum	40	Y	UPL
3. Amsinckia sp.	10	N	UPL
4. Lactuca serriola	10	N	FACU
5. Bassia hyssopifolia	<1	N	FACU
6. Spergularia marina	<1	N	OBL
7.			
8.			
= Total Cover	90		
Woody Vine Stratum (Plot size: ___)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum 10 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.0 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = ___

Hydrophytic Vegetation Indicators:

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ___ No ✔

Remarks:

SOIL

Sampling Point: SP 20

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-6	2.5Y 4/2	100					Cl L	
7-12	Gley 1 4/10Y	80	5YR 5/8	20	C	PL	Cl	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ✔ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ✔ No ___

Remarks:

Gleyed matrix within upper 12 inches

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✔ Depth (inches): ___

Water Table Present? Yes ___ No ✔ Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No ✔ Depth (inches): ___

Wetland Hydrology Present? Yes ___ No ✔

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: RE Slate City/County: Kings Sampling Date: 06/03/2016

Applicant/Owner: Recurrent Energy State: CA Sampling Point: SP 21

Investigator(s): S. Stringer, D. Barry, G. Aldridge Section, Township, Range: S34 T19S R19E

Landform (hillslope, terrace, etc.): terrace Local relief (concave, convex, none): none Slope (%): <1

Subregion (LRR): C Lat: 36.22486280 Long: -119.8962190 Datum: NAD-84

Soil Map Unit Name: Lethent clay loam NWI classification: hydric in sloughs

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✔ No ___ (If no, explain in Remarks.)

Are Vegetation ✔, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes ✔ No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?		✔
Hydric Soil Present?		✔
Wetland Hydrology Present?		✔

Is the Sampled Area within a Wetland? Yes ___ No ✔

Remarks:

Sample point is in an active agricultural field recently cultivated in wheat and grazed by sheep.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ___)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: ___)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: 1m)			
1. Sisymbrium altissimum	20	Y	UPL
2. Triticum aestivum	20	Y	UPL
3.			
4.			
5.			
6.			
7.			
8.			
= Total Cover	40		
Woody Vine Stratum (Plot size: ___)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum 60 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.0 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = ___

Hydrophytic Vegetation Indicators:

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ___ No ✔

Remarks:

Vegetation has been grazed by sheep.

SOIL

Sampling Point: SP 21

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-16	2.5Y 4/3	100					Cl L	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ___ No ✔

Remarks:

Soil was disked for wheat cultivation in the previous fall.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✔ Depth (inches): ______

Water Table Present? Yes ___ No ✔ Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ___ No ✔ Depth (inches): ______

Wetland Hydrology Present? Yes ___ No ✔

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: RE Mustang2 City/County: Kings Sampling Date: 05/26/2016

Applicant/Owner: Recurrent Energy State: CA Sampling Point: SP 27

Investigator(s): S. Stringer, D. Barry, G. Aldridge Section, Township, Range: S02 T20S R19E

Landform (hillslope, terrace, etc.): terrace Local relief (concave, convex, none): none Slope (%): <1

Subregion (LRR): C Lat: 36.21560156 Long: -119.8786498 Datum: NAD-84

Soil Map Unit Name: Lethent clay loam NWI classification: hydric in sloughs

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✔ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✔ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✔	No ____
Hydric Soil Present?	Yes ____	No ✔
Wetland Hydrology Present?	Yes ____	No ✔

Is the Sampled Area within a Wetland? **Yes ____** **No ✔**

Remarks:

Sample point is in a depression at the margin of a former agricultural field. Soil is highly saline.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: 1m)			
1. Spergularia marina	15	Y	OBL
2. Chenopodium album	3	N	UPL
3.			
4.			
5.			
6.			
7.			
8.			
= Total Cover	18		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum 82 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 1.0 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

✔ Dominance Test is >50%

__ Prevalence Index is ≤3.0[1]

__ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes ✔** **No ____**

Remarks:

SOIL

Sampling Point: SP 27

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-18	2.5Y 4/3	100					Cl	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ______ No ✔

Remarks:

Salt in the soil is the result of saline groundwater and irrigation, not evaporation of ponded surface water.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No ✔ Depth (inches): ______

Water Table Present? Yes ______ No ✔ Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ______ No ✔ Depth (inches): ______

Wetland Hydrology Present? Yes ______ No ✔

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: RE Mustang2 City/County: Kings Sampling Date: 05/26/2016

Applicant/Owner: Recurrent Energy State: CA Sampling Point: SP 29

Investigator(s): S. Stringer, D. Barry, G. Aldridge Section, Township, Range: S11 T20S R19E

Landform (hillslope, terrace, etc.): terrace Local relief (concave, convex, none): none Slope (%): <1

Subregion (LRR): C Lat: 36.20584283 Long: -119.8766168 Datum: NAD-84

Soil Map Unit Name: Calfax clay loam, saline-sodic, 0 to 2 percent slopes, MLRA 17 NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✔ No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes ✔ No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___	No ✔
Hydric Soil Present?	Yes ___	No ✔
Wetland Hydrology Present?	Yes ___	No ✔

Is the Sampled Area within a Wetland? **Yes** ___ **No** ✔

Remarks:

Sample point is in a former agricultural field overgrown with tumble mustard

VEGETATION – Use scientific names of plants.

Stratum / Species	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: ___)			
1.			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: ___)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: 1m)			
1. Lactuca serriola	3	Y	FACU
2. Triticum aestivum	1	N	UPL
3. Avena fatua	1	N	UPL
4. Phalaris minor	1	N	UPL
5.			
6.			
7.			
8.			
= Total Cover	6		
Woody Vine Stratum (Plot size: ___)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum 94 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.0 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = ___

Hydrophytic Vegetation Indicators:

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ___ **No** ✔

Remarks:

SOIL

Sampling Point: SP 29

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features				Texture	Remarks
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 4/3	100					Cl L	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ____

Depth (inches): ____

Hydric Soil Present? Yes ___ No ✔

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✔ Depth (inches): ____

Water Table Present? Yes ___ No ✔ Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ___ No ✔ Depth (inches): ____

Wetland Hydrology Present? Yes ___ No ✔

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: RE Mustang2 City/County: Kings Sampling Date: 06/02/2016

Applicant/Owner: Recurrent Energy State: CA Sampling Point: SP 31

Investigator(s): S. Stringer, D. Barry, G. Aldridge Section, Township, Range: S11 T20S R19E

Landform (hillslope, terrace, etc.): terrace Local relief (concave, convex, none): none Slope (%): <1

Subregion (LRR): C Lat: 36.19854713 Long: -119.8798592 Datum: NAD-84

Soil Map Unit Name: Calfax clay loam, saline-sodic, 0 to 2 percent slopes, MLRA 17 NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✔ No ____ (If no, explain in Remarks.)

Are Vegetation ✔, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✔ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?		✔
Hydric Soil Present?		✔
Wetland Hydrology Present?		✔
Is the Sampled Area within a Wetland?		✔

Remarks:

Sample point is in a wheat field recently grazed by cattle

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: 1m)			
1. Bassia hyssopifolia	15	Y	FACU
2. Cheopodium album	5	N	UPL
3. Triticum aestivum	5	N	UPL
4. Atriplex serenana	1	N	FAC
5.			
6.			
7.			
8.			
= Total Cover	20		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum 80 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.0 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No ✔

Remarks:

Vegetation has been disturbed by cattle grazing

SOIL

Sampling Point: SP 31

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 3/3	100					Cl L	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5) (**LRR C**)
___ 1 cm Muck (A9) (**LRR D**)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Loamy Mucky Mineral (F1)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

___ 1 cm Muck (A9) (**LRR C**)
___ 2 cm Muck (A10) (**LRR B**)
___ Reduced Vertic (F18)
___ Red Parent Material (TF2)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? Yes ______ No ✔

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1) (**Nonriverine**)
___ Sediment Deposits (B2) (**Nonriverine**)
___ Drift Deposits (B3) (**Nonriverine**)
___ Surface Soil Cracks (B6)
___ Inundation Visible on Aerial Imagery (B7)
___ Water-Stained Leaves (B9)
___ Salt Crust (B11)
___ Biotic Crust (B12)
___ Aquatic Invertebrates (B13)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres along Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

___ Water Marks (B1) (**Riverine**)
___ Sediment Deposits (B2) (**Riverine**)
___ Drift Deposits (B3) (**Riverine**)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No ✔ Depth (inches): ____________
Water Table Present? Yes ______ No ✔ Depth (inches): ____________
Saturation Present? (includes capillary fringe) Yes ______ No ✔ Depth (inches): ____________

Wetland Hydrology Present? Yes ______ No ✔

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: RE Mustang2 City/County: Kings Sampling Date: 05/26/2016

Applicant/Owner: Recurrent Energy State: CA Sampling Point: SP 32

Investigator(s): S. Stringer, D. Barry, G. Aldridge Section, Township, Range: S11 T20S R19E

Landform (hillslope, terrace, etc.): terrace Local relief (concave, convex, none): none Slope (%): <1

Subregion (LRR): C Lat: 36.19817562 Long: -119.8777564 Datum: NAD-84

Soil Map Unit Name: Calfax clay loam, saline-sodic, 0 to 2 percent slopes, MLRA 17 NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✔ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✔ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?	✔	
Hydric Soil Present?		✔
Wetland Hydrology Present?		✔

Is the Sampled Area within a Wetland? Yes ____ No ✔

Remarks:

Sample point is in a barren area in a former agricultural field. The soil is highly saline.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: 1m)			
1. Spergularia marina	40	Y	OBL
2. Sisymbrium altissimum	5	N	UPL
3. Chenopodium album	2	N	UPL
4.			
5.			
6.			
7.			
8.			
= Total Cover	47		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum 53 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 1.0 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

- ✔ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✔ No ____

Remarks:

Vegetation is likely the result of salinity rather than wetland hydrology

SOIL

Sampling Point: SP 32

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-10	2.5Y 3/2	100					Cl	
11-18	2.5Y 3/2	90	2.5Y 5/6	10		M	Cl	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ______ No ✔

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No ✔ Depth (inches): ______

Water Table Present? Yes ______ No ✔ Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ______ No ✔ Depth (inches): ______

Wetland Hydrology Present? Yes ______ No ✔

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Salinity is the result of saline groundwater and irrigation, not of evaporation of ponded water.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: RE Slate City/County: Kings Sampling Date: 06/03/2016

Applicant/Owner: Recurrent Energy State: CA Sampling Point: SP 33

Investigator(s): S. Stringer, D. Barry, G. Aldridge Section, Township, Range: S12 T20S R19E

Landform (hillslope, terrace, etc.): ditch Local relief (concave, convex, none): none Slope (%): <1

Subregion (LRR): C Lat: 36.19711018 Long: -119.8658973 Datum: NAD-84

Soil Map Unit Name: Tulare variant clay, partially drained NWI classification: hydric 2

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✔ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✔ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✔	No ____
Hydric Soil Present?	Yes ✔	No ____
Wetland Hydrology Present?	Yes ✔	No ____

Is the Sampled Area within a Wetland? Yes ✔ No ____

Remarks:

Sample point is in a constructed agricultural ditch holding standing water from a leaking sluice gate

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: 1m)			
1. Polypogon monspeliensis	70	Y	FACW
2. Asclepias fascicularis	10	N	FAC
3. Lactuca serriola	10	N	FACU
4.			
5.			
6.			
7.			
8.			
= Total Cover	80		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum 20 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 1.0 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species ____	x 1 = ____
FACW species ____	x 2 = ____
FAC species ____	x 3 = ____
FACU species ____	x 4 = ____
UPL species ____	x 5 = ____
Column Totals: ____ (A)	____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✔ No ____

Remarks:

SOIL

Sampling Point: SP 33

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? Yes ✔ **No** ______

Remarks:

No soil pit - sample point is located in standing water

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ✔ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ✔ No ______ Depth (inches): 8

Water Table Present? Yes ______ No ✔ Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ______ No ✔ Depth (inches): ______

Wetland Hydrology Present? Yes ✔ **No** ______

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Surface water is 6-8 inches deep and comes from a leaking sluice gate connecting to an active canal.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: RE Slate City/County: Kings Sampling Date: 06/03/2016

Applicant/Owner: Recurrent Energy State: CA Sampling Point: SP 34

Investigator(s): S. Stringer, D. Barry, G. Aldridge Section, Township, Range: S12 T20S R19E

Landform (hillslope, terrace, etc.): ditch Local relief (concave, convex, none): none Slope (%): <1

Subregion (LRR): C Lat: 36.19655194 Long: -119.8659414 Datum: NAD-84

Soil Map Unit Name: Tulare variant clay, partially drained NWI classification: hydric 2

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✔ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✔ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No ✔
Hydric Soil Present?	Yes ____	No ✔
Wetland Hydrology Present?	Yes ____	No ✔

Is the Sampled Area within a Wetland? **Yes** ____ **No** ✔

Remarks:

Sample point is in a dry portion of a constructed agricultural ditch

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: 1m)			
1. Melilotus indicus	70	Y	FACU
2. Lactuca serriola	50	N	FACU
3. Phalaris minor	5	N	UPL
4.			
5.			
6.			
7.			
8.			
= Total Cover	100		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.0 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ____ **No** ✔

Remarks:

SOIL

Sampling Point: SP 34

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-9	2.5Y 4/2	100					Cl L	
9-16	2.5Y 3/2	90	2.5Y 5/6	10	C	M	Cl L	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5) (**LRR C**)
___ 1 cm Muck (A9) (**LRR D**)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Loamy Mucky Mineral (F1)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

___ 1 cm Muck (A9) (**LRR C**)
___ 2 cm Muck (A10) (**LRR B**)
___ Reduced Vertic (F18)
___ Red Parent Material (TF2)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ______ No ✔

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1) (**Nonriverine**)
___ Sediment Deposits (B2) (**Nonriverine**)
___ Drift Deposits (B3) (**Nonriverine**)
___ Surface Soil Cracks (B6)
___ Inundation Visible on Aerial Imagery (B7)
___ Water-Stained Leaves (B9)
___ Salt Crust (B11)
___ Biotic Crust (B12)
___ Aquatic Invertebrates (B13)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres along Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

___ Water Marks (B1) (**Riverine**)
___ Sediment Deposits (B2) (**Riverine**)
___ Drift Deposits (B3) (**Riverine**)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No ✔ Depth (inches): ______
Water Table Present? Yes ______ No ✔ Depth (inches): ______
Saturation Present? (includes capillary fringe) Yes ______ No ✔ Depth (inches): ______

Wetland Hydrology Present? Yes ______ No ✔

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Sample point is in a constructed ditch, but there is no evidence of recent use.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: RE Mustang2 City/County: Kings Sampling Date: 05/26/2016

Applicant/Owner: Recurrent Energy State: CA Sampling Point: SP 35

Investigator(s): S. Stringer, D. Barry, G. Aldridge Section, Township, Range: S11 T20S R19E

Landform (hillslope, terrace, etc.): terrace Local relief (concave, convex, none): none Slope (%): <1

Subregion (LRR): C Lat: 36.19593396 Long: -119.8819958 Datum: NAD-84

Soil Map Unit Name: Calfax clay loam, saline-sodic, 0 to 2 percent slopes, MLRA 17 NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✔ No ___ (If no, explain in Remarks.)

Are Vegetation ✔, Soil ✔, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes ✔ No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?		✔
Hydric Soil Present?		✔
Wetland Hydrology Present?	✔	

Is the Sampled Area within a Wetland? Yes ___ No ✔

Remarks:

Sample point is in a barren area at the edge of an agricultural field. The area has been heavily trampled by cattle and used for stock tanks which have created muddy conditions.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ___)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: ___)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: 1m)			
1. Bassia hyssopifolia	10	Y	UPL
2. Chenopodium album	2	N	UPL
3. Spergularia marina	3	N	OBL
4. Malva parviflora	1	N	UPL
5.			
6.			
7.			
8.			
= Total Cover	16		
Woody Vine Stratum (Plot size: ___)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum 84 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.0 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = ___

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ___ No ✔

Remarks:

Vegetation has been largely removed by cattle trampling

SOIL

Sampling Point: SP 35

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-16	2.5Y 4/2	100					Cl	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? Yes ______ No ✔

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ✔ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No ✔ Depth (inches): ______

Water Table Present? Yes ______ No ✔ Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ______ No ✔ Depth (inches): ______

Wetland Hydrology Present? Yes ✔ No ______

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Area is heavily disturbed by cattle hoof prints in mud. Mud is the result of temporary stock tanks.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: RE Slate City/County: Kings Sampling Date: 05/26/2016

Applicant/Owner: Recurrent Energy State: CA Sampling Point: SP 36

Investigator(s): S. Stringer, D. Barry, G. Aldridge Section, Township, Range: S13 T20S R19E

Landform (hillslope, terrace, etc.): terrace Local relief (concave, convex, none): none Slope (%): <1

Subregion (LRR): C Lat: 36.18972656 Long: -119.8690645 Datum: NAD-84

Soil Map Unit Name: Calfax clay loam, saline-sodic, 0 to 2 percent slopes, MLRA 17 NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✔ No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes ✔ No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?	✔	
Hydric Soil Present?	✔	
Wetland Hydrology Present?		✔

Is the Sampled Area within a Wetland? **Yes** ___ **No** ✔

Remarks:

Sample point is at the margin of an agricultural field

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: ___)			
1.			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: ___)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: 1m)			
1. Atriplex serenana	20	Y	FAC
2. Chenopodium album	5	N	UPL
3. Malvella leprosa	5	N	FACU
4.			
5.			
6.			
7.			
8.			
= Total Cover	30		
Woody Vine Stratum (Plot size: ___)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum 70 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 1.0 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = ___

Hydrophytic Vegetation Indicators:

- ✔ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ✔ **No** ___

Remarks:

SOIL

Sampling Point: SP 36

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-16	2.5Y 3/1	100					Cl	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ✔ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ✔ **No** ______

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No ✔ Depth (inches): ______

Water Table Present? Yes ______ No ✔ Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ______ No ✔ Depth (inches): ______

Wetland Hydrology Present? Yes ______ **No** ✔

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Appendix M

Swainson's Hawk Impact Analysis

Memorandum

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Date: 9/14/2018

To: Chuck Kinney, Kings County

Cc: Recurrent Energy: Christy Herron and Scott Dawson

From: Stephen Stringer

Subject: RE Slate Solar Generation Project, Kings County – Analysis of Impacts to Swainson's Hawk Foraging Habitat

HELIX Proj. No.: REC-06.02

Attachments:

Attachment A – Figures
Attachment B – Land Use Crosswalk

Message:

INTRODUCTION

HELIX Environmental Planning, Inc. (HELIX) has prepared this memorandum on behalf of Recurrent Energy (Recurrent) to present an analysis of the potential impacts of the proposed RE Slate Solar Project on Swainson's hawk (SWHA; *Buteo swainsoni*), which is listed as threatened under the California Endangered Species Act (CESA), and to provide the Lead Agency, responsible agencies, and the public with information necessary to make findings pursuant to the requirements of the California Environmental Quality Act (CEQA). The proposed project is in unincorporated western Kings County, and Recurrent is seeking a Conditional Use Permit from Kings County (County).

The analysis provided in this memorandum identifies potential project impacts to SWHA using methods employed in other studies of regional Swainson's hawk populations, refined to provide additional analytical rigor in response to methodological issues identified in those studies (Estep 2011, 2015, 2017). The refined approach combines field observations, public and proprietary data, and desktop spatial analysis to estimate the acreage of suitable foraging habitat required to sustain the regional population of Swainson's hawk. Impacts are assessed at the project- and cumulative levels.

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Project Site

The project site is an approximately 2,490-acre site in unincorporated Kings County, southeast of the State Route 198 (SR-198) interchange with Avenal Cutoff Road. The site is west of the Kings River and southeast of NAS Lemoore. The site is roughly bisected east-west by the Kent Avenue right-of-way between Avenal Cutoff Road and the Kings River and also includes rights-of-way for underground and overhead utility lines, and several canals.

The site consists entirely of inactive agricultural crop land. Since 2014, most of the project site has been uncultivated and used as pastureland or fallowed. As of 2018, the entire project site is fallow agricultural land, with grazing occurring in portions of the site. There are no trees or structures in the project site, and the only topographic relief is constructed berms along canals through the site. The project site is in an area of active and inactive agricultural lands, and existing and planned solar photovoltaic (PV) generating projects.

Summary of the Proposed Project

Overview

The proposed project would be composed of a solar PV facility, an energy storage system, and an approximately 500-foot-long gen-tie line connecting to a shared gen-tie line located off of the project site that will be constructed as part of the RE Mustang Two Solar Generation Project.

Solar PV generating facilities consist of individual solar panels (modules) which are arranged in rows to form solar arrays. The arrays are combined to form larger units called solar blocks or array blocks. For large-scale utility applications, hundreds of array blocks are interconnected as part of the solar power generation facility. Each array block is served by an electrical inverter, which can be located centrally within the array block or distributed within the array footprint. The inverters convert the direct current (DC) output from the array to alternating current (AC) which is then conveyed to the substation and switchyard which steps up the voltage to match the collection system.

Solar arrays are linear (approximately 300 feet long) rows of solar PV modules mounted on round shafts (torque tubes) that rotate to orient the modules east-west through the course of the day. The long axis of a tracker is oriented north-south. The torque tubes are supported approximately 4 feet above grade on steel posts, leaving a soil substrate underneath the trackers. At maximum tilt, the top edge of the modules on a tracker is approximately 10 feet above grade. Within an array block, trackers are spaced approximately 20 feet on center to reduce shading by neighboring modules at maximum tilt in the morning and evening when sun angle is low. When trackers are horizontal, the spacing between the edges of adjacent rows of modules is approximately 12 feet; this increases to slightly more than 14 feet at maximum tilt. This geometry results in a maximum of 40 percent of the area within a typical array block consisting of solar PV panel surface when viewed from above, and the other 60 percent remaining visible ground surface.

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The solar facility of the proposed project would consist of solar PV modules and support structures; the energy collection system which would include electrical inverters and intermediate voltage transformers to step up the voltage to 34.5 kV to match the internal collection system voltage; and an energy storage system which would include electrical enclosures, electrical wiring, transformers, and associated equipment. The proposed project includes one or two electrical substations, which would receive electricity from consolidated intermediate voltage cables from the energy collection system and would step the voltage up to 230 kilovolts (kV) via high voltage transformers located in the individual PV substation or shared facilities. Each substation area would include an electrical control building and would connect with a shared switching station. Either the switching station or the project substation(s) would tie into PG&E's high-voltage 230 kV Mustang Switching Station via infrastructure for the planned RE Mustang Two Solar Generation Project.

Other necessary infrastructure would include one permanent operations and maintenance (O&M) building, a Supervisory Control and Data Acquisition system, a meteorological data system, telecommunications infrastructure, access driveways, a gen-tie line, and security fencing. The project site is transected by existing easements, canals, and Kent Avenue. The solar facility layout would be contained within discrete areas delineated by the various existing infrastructure and easements. Each discrete area of the solar facility would be enclosed by perimeter fencing, with the existing infrastructure and easements fully accessible outside of the facility fencing.

Impact Area

Buildings, internal driveways, equipment pads, and footings would total approximately 31 acres of impervious surfaces (approximately 1.2 percent of the site). The PV modules would cover approximately 847 acres (34 percent) from an aerial perspective when fully horizontal (parallel to the ground); however, it is noteworthy that the ground under the 847 acres of solar module surface would be undeveloped soil substrate that would support vegetation and wildlife. Therefore, approximately 878 acres of the project site would be composed of impervious surfaces and solar modules; the precise acreage of unvegetated surfaces and solar modules will depend on final project design.

Outside of array blocks, driveways, pads, and buildings, the project site would be contiguous areas of undeveloped land. Such areas would include spaces where the irregular project site boundary does not accommodate trackers, as well as rights-of-way for public roads, overhead transmission lines, underground utilities (*i.e.*, a natural gas pipeline runs diagonally across the site from the northeast), and canals owned by the Westlands Water District and Empire West Side Irrigation District. The 878 acres of "developed" area would be unsuitable for SWHA foraging. The potential for the remaining 1,612 acres to provide suitable for habitat for SWHA foraging is considered in the **Discussion** section of this report.

Swainson's Hawk Use of the Project Site

HELIX biologists have observed SWHAs occasionally perched on power poles near the project site or flying over the site; however, red-tailed hawks are very common in the site and may discourage use by SWHAs. SWHAs have frequently been seen foraging in active wheat and alfalfa fields east of the Kings

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River and are typically present in wheat fields near the project site during harvest. The lack of regular agricultural activities in the project site likely reduces its attractiveness to SWHAs.

Protocol nesting surveys for SWHA were conducted by HELIX in and within 0.5 miles of the project site between April and June 2018. During those surveys, one active nest was documented along the Kings River at a point approximately 0.5-mile northeast of the project site. A regional study conducted by Estep (2017) in 2016 on behalf of Recurrent Energy also documented an active SWHA nest at this location. A second pair of SWHAs was observed exhibiting nesting behavior (e.g., nest building, courtship) in an old willow snag along the Kings River approximately 0.25 mile east of the project site early in the breeding season but was not successful, and the location was abandoned by late May (this location was not documented by Estep (2017), which suggests that this location is not an established nesting territory). The nest at this location was only 10-12 feet above the surrounding grade and was exposed with no canopy cover, which is not typical of SWHA nests. During the survey on May 21, 2018 the willow tree appeared to have lost a large branch, which may have led to the nest abandonment.

METHODS

Regulatory Guidance

The California Department of Fish and Wildlife (CDFW) has developed regional strategies to address land use issues related to SWHA conservation pursuant to both CESA and the CEQA process. The CDFW Region 2 guidelines (CDFW 1994) are often used during CEQA review of proposed projects in the Central Valley. The guidelines outline methods for conducting nest surveys and avoiding or minimizing impacts to active nests that may result in nest abandonment or otherwise cause injury or mortality to individual SWHA (*i.e.*, "take"), which would be regulated under CESA. To avoid impacts to nesting SWHA, the guidelines recommend that no intensive new disturbances or other project related activities that may cause nest abandonment or forced fledging should be initiated within 0.25-mile of an active nest between March 1 and September 15. The exclusion period may be reduced to March 1 to August 15 if a Management Authorization or Biological Opinion is obtained for the project. The exclusion buffer is extended to 0.5-mile in nesting areas away from urban development, where intensive disturbance is not a normal occurrence during nesting season. Examples of intensive disturbance cited in the guidelines include heavy equipment associated with construction, use of cranes and draglines, and rock crushing activities (CDFW 1994).

The guidelines also recommend acquisition of replacement lands as mitigation for project impacts to SWHA foraging habitat deemed sufficient to be considered a significant impact to the SWHA population under CEQA. The guidelines state that the determining criteria for CEQA significance is removal of any suitable foraging habitat within 10 miles of an active SWHA nest, which is defined as a nest active at any time in the previous 5 years. Compensatory mitigation is recommended at ratios ranging from 1:1 for projects within 1-mile of an active nest, 0.75:1 for projects 1-5 miles from an active nest, to 0.5:1 for projects 5-10 miles from an active nest (CDFW 1994). The guidelines do not consider the size of the potentially affected SWHA population, the amount and quality of existing foraging habitat in the region,

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or the size of the project relative to the amount of available foraging habitat. However, the guidelines allow for independent assessment of impacts and development of a conservation strategy as an alternative to the guidelines. In order to more accurately assess the potential impacts of the project to SWHA, this study was undertaken to quantify the effects of the proposed project on the regional population of SWHA by analyzing data on land use, nest distribution and abundance, and to inform a CEQA significance determination based on a more robust biological rationale.

Methodology

Impacts to SWHA Nests

The potential for the RE Slate project to result in disturbance to SWHA nests is restricted to potential indirect impacts to active nests outside of the project site, as there are no trees inside the project site boundary. Project construction activities could create disturbances to nesting SWHA through noise, vibration, night lighting, or human presence leading to nest abandonment and mortality of chicks. The study included an analysis of the potential for project-related activities to meet the standard of intensive disturbance provided in the guidelines, and an assessment of the appropriate exclusion buffer distance.

Impacts to SWHA Foraging

The analysis of potential impacts of the RE Slate project on foraging habitat for the regional population of SWHA builds upon methods that have been used for the analysis of impacts to SWHA foraging habitat on several other approved utility-scale solar projects in the region (reviewed in Estep 2017). This method more effectively addresses CEQA-based impacts to SWHA than the simpler approach employed in the CDFW guidelines. In order to provide a more robust assessment of CEQA impacts, it is necessary to extend the analysis beyond the scale of the project site and the nearest active SWHA nest, which is the scale of analysis employed in the CDFW guidelines. The larger-scale analysis should consider the size and distribution of the regional population of SWHA, availability of suitable foraging habitat for the regional population, and the effect of project implementation on the availability of resources to the regional population.

Regional Population and Study Area

For purposes of this analysis, the regional population of SWHA was defined as the number of nesting territories documented within 10 miles of the project site. The 10-mile radius standard was chosen based on telemetry studies that indicate SWHA will fly up to 10 miles from the nest to forage (Babcock 1995, Estep 1989). Consequently, the regional population for the study is equivalent to the SWHA that may potentially forage in the project site and thus be adversely affected by the project through loss of foraging habitat. The minimum 10-mile radius around the project site boundary, smoothed to account for the irregular shape of the project site, also defines the study area for the analysis.

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Foraging Habitat Availability

The amount, distribution, and quality of foraging habitat available to the regional population is a function of surrounding land use patterns. Historically, SWHA hunted in the grasslands of the Central Valley and coastal valleys, and the desert scrub and shrub lands of high desert regions. With the conversion of the Central Valley to agriculture, SWHA foraging has shifted to managed cultivated lands and the availability of foraging habitat is now largely dependent on agricultural practices (Babcock 1995, Woodbridge 1991, Estep 1989). The suitability of individual land cover types is largely a function of two factors: 1) prey abundance; and 2) prey accessibility, which is influenced by vegetation structure (Estep 2009, Bechard 1982). Land uses considered suitable for SWHA foraging include: alfalfa hay; irrigated cropland typically cultivated in a rotation of cotton, wheat, and tomatoes, but also including silage crops such as triticale, sorghum, and corn; irrigated pasture; and uncultivated land that has retained some natural soil and vegetation (Estep 2017). Land uses that have been considered unsuitable for SWHA foraging include: developed land; orchards and vineyards; solar facilities; and open water (Estep 2017).

Suitable foraging habitat varies in quality also based on agricultural management. Crop types that support large numbers of rodent prey and consistently have a low, open vegetation structure provide the highest quality habitat, while crop types that support low numbers of prey or are characterized by tall and dense vegetation provide the lowest quality foraging habitat. Foraging studies indicate that SWHA preferentially forage in alfalfa, tomato, wheat, oat, and other annually rotated crops that maintain a relatively low vegetation profile and that are harvested during the breeding season. Alfalfa has been shown to provide particularly high value habitat due to its consistently low vegetation height and high frequency of mowing and is used by SWHA at a significantly high rate relative to its availability in the landscape (Estep 2013, 2009, 1989; Swolgaard *et al.* 2008; Babcock 1995; Bechard 1982). Other grain crops (e.g., wheat, barley, sorghum), along with row crops (e.g., tomatoes, sugar beets) and irrigated pasture provide moderate value habitat, as they are harvested during the breeding season. Crops such as corn, cotton, safflower, melons, and vegetables provide low value habitat (Estep 2015).

Based on the factors discussed above, it is possible to categorize landscape-scale data on land use as suitable/unsuitable for SWHA foraging, and as High/Moderate/Low quality foraging habitat.

Foraging Habitat Requirements

Although SWHA do not defend a territory beyond the immediate vicinity of the nest, SWHA forage widely over a large area (Estep 2015). Data from two telemetry studies conducted in the Sacramento Valley indicate that SWHA home ranges vary from 830 acres to 21,543 acres (Estep 1989, Babcock 1995). The average home range size from Babcock (1995) was 9,978 acres (N=5) and from Estep (1989) was 6,820 acres (N=12). Smaller home ranges generally consist of high percentages of alfalfa, fallow fields, and dry pastures (Babcock 1995, Woodbridge 1991, Estep 1989). Where nests are located in the immediate vicinity of high value foraging habitat, home range sizes are as low as 830 acres (Estep 2015). This study used the average home range size of 6,820 acres from Estep (1989).

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It is important to note that home range and foraging territory are not synonymous. The 6,820-acre home range is the average area that an individual hawk will occupy during the course of the breeding season; however, within this area, foraging occurs opportunistically where conditions provide accessible prey (Estep 2015). Furthermore, this area is not defended and SWHA often forage communally (Estep 1989, personal observation by the author[1]). Although average home range size may not be an accurate indicator of realized foraging habitat acreage, it is not feasible to precisely quantify the foraging area used by individuals of wide-ranging, opportunistic species such as SWHA; therefore, the average home range size is a useful baseline that can be adjusted to account for factors that affect the amount of the home range that provides the essential resource base for the SWHA nesting territory and thus determines the amount of habitat required to sustain a nesting pair (Estep 2015).

Factor One – Home range overlap. Home ranges within a population overlap, as SWHA forage opportunistically over a shared landscape and often gather in large numbers to forage during agricultural activities that expose prey such as harvest, disking, burning, or flooding. Estep (1989) found that average overlap among home ranges within a population was 40 percent. Adjusting the average home range size downward by the average amount of overlap partially accounts for the extent to which SWHA in a population share the available foraging habitat in the region.

Factor Two – Habitat suitability. While SWHA utilize a large home range, actual foraging takes place in a subset of the total home range, and most prey capture attempts are in moderate- or high-quality habitat areas (Estep 2105). Most SWHA home ranges are likely to contain some unsuitable and low-quality suitable land uses that do not contribute appreciably to the resource base available in the home range. In order to account for this, the average home range can be adjusted downward to reflect only the proportion of the suitable foraging habitat in the study area that is of Moderate or High quality (Estep 2015).

Factor Three – Foraging outside the study area. Because SWHA utilize land up to 10 miles from the nest for foraging, some portion of the potential foraging habitat available to a nesting pair in the regional population will be outside the study area, unless the nest is inside the project site boundary. Since there are no trees in the project site, no nest in the regional population will have a potential foraging area entirely inside the study area. Comparing only the habitat available inside the study area to the total habitat requirements of the regional population would substantially underestimate the amount of habitat available to the regional population.

The amount of overlap between the study area and the potential foraging territory of a nest will decrease with distance from the project site. This relationship can be represented in a simplified manner with Equation 1, which is a trigonometric formula for the overlap (A) between two circles of unit radius (radius=1):

[1] Author observed 30 SWHA foraging in a wheat field immediately north of SR-198, two miles west of the project site during harvest in July 2017.

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$$A = 2\,cos^{-1}\left(\frac{d}{2}\right) - \frac{d}{2}\sqrt{4 - d^2}\ ,$$

where d=distance between the centers of the circles expressed as a proportion of the radius, and r=1. Although the study area is not a perfect circle, this is a suitable approximation of the amount of a given nest's potential foraging area as a function of its distance from the project site, as the study area is approximately a circle of radius 10 miles centered on the project site, and the potential foraging area available to a nesting pair of SWHA is a circle of radius 10 miles centered on the nest. After applying this equation to each nest location in the regional population and calculating the weighted average overlap of all nests, the total amount of foraging habitat required by the regional population can be adjusted to reflect the average proportion of all home ranges that is outside the study area. For this analysis, nest distances from the project site were binned in increments of 1 mile, and the value of d for each bin was the mid-point of the distance increment (e.g., the quantity A for all nests between 2 and 3 miles from the project site boundary was calculated using a value for d of 0.25).

Using all of the information discussed above, the acreage of suitable foraging habitat required in the study area to support the regional population of SWHA (Y) can be calculated using Equation 2:

$$Y = n \cdot 6{,}820 \cdot p \cdot q \cdot r\ ,$$

where n is the number of SWHA nesting pairs in the regional population; 6,820 is the baseline average home range size; p is the adjustment for average home range overlap (1-average overlap); q is the proportion of the suitable habitat in the study area that is moderate- or high-quality habitat; and r is the weighted average overlap between the study area and the potential foraging area available to the regional population. The quantity Y can be subtracted from the total existing acreage of suitable foraging habitat in the study area; a positive result would indicate that there is a surplus of foraging habitat available to SWHA in the study area; a negative result would indicate that there is a deficit of foraging habitat in the study area.

Thresholds of Significance

CEQA defines the significance of an impact on a state-listed species based on the following:

- Appendix G of the State CEQA guidelines states that a biological resource impact is considered significant (before considering offsetting mitigation measures) if the lead agency determines that project implementation would result in "substantial adverse effects, either directly or through habitat modifications, on any species identified as being a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by CDFW or USFWS"; and

- CEQA Section 15065 (Mandatory Findings of Significance), a biological resource impact is considered significant if the project has the potential to "substantially reduce the number or restrict the range of an endangered, rare or threatened species".

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<u>Impacts to SWHA Nests</u>

Any impact from project activities that results in abandonment or forced fledging of an active nest, or otherwise results in take of individual SWHA would be considered a significant impact under CEQA.

<u>Impacts to SWHA Foraging</u>

Based on the above-referenced definitions, the proposed project could be considered to have potential for a significant impact to SWHA if it resulted in a reduction of available foraging habitat below the amount required to sustain the regional population. If the proposed project would not result in a deficit of suitable foraging habitat in the study area, the project's impact could be considered less than significant under CEQA.

Because SWHA home ranges are different each year due to seasonal and annual changes in the crop matrix, it is difficult to predict or model the extent of the area likely to be used by a given pair of SWHA over a period of years (Estep 2015). In addition, although the method used to estimate the acreage of available and required foraging habitat in the study area represents a robust and scientifically defensible analysis, it is necessarily dependent on a number of generalizations and assumptions. Therefore, the estimates in the study are only best approximations. In order to account for variation in the estimates due to interannual variation in the regional population caused by mortality and recruitment, allow for resilience in the regional population to environmental factors outside the scope of this analysis, and to account for other potential sources of error, the CEQA significance threshold should be set substantially higher than the minimum amount of foraging habitat required in the study area to sustain the regional population. For this analysis, the CEQA significance threshold was set at 70 percent of the existing surplus habitat. If the project would result in the surplus of suitable foraging habitat in the study area being reduced to less than 70 percent of the existing surplus, the project would be considered to have a significant impact on the regional population of SWHA under CEQA.

Data Acquisition and Processing

Data used in the analysis came from publicly-available datasets as well as proprietary data obtained during surveys performed by consultants under contract with Recurrent. All public data sets were the most recent available as of August 2018.

Land Use Data

Land use data were taken from the 2014 California Department of Water Resources (DWR) Land Use Surveys layer, which is available at: https://water.ca.gov/Programs/Water-Use-And-Efficiency/Land-And-Water-Use/Land-Use-Surveys. The data are based on the 2014 Statewide Agricultural Survey conducted by DWR, and were downloaded on September 5, 2018. The data set provides agricultural land cover data collected by DWR field surveyors based on aerial imagery and ground surveys.

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The data were clipped to the study area boundary, and land cover types were characterized as suitable or unsuitable for SWHA foraging, and as High, Moderate, Low, or Unsuitable quality foraging habitat, according to a crosswalk derived from previous studies (Estep 2017, 2015). The crosswalk is provided in **Appendix B**.

Foraging habitat quality data were overlaid on 2017 aerial imagery and visually reviewed by HELIX biologists for recent conversions to unsuitable land uses or changes in foraging quality. Conspicuous contiguous areas of land that were unclassified in the DWR data layer (*i.e.*, land that was not in an agricultural use at the time of the DWR survey) were reviewed against aerial imagery and classified as Low-, Moderate-, or High-quality foraging habitat as appropriate to the apparent land use, or left unclassified. The majority of these areas were considered 'natural land' as defined in previous studies (Estep 2017) and classified as Moderate quality foraging habitat. Small or non-contiguous areas of unclassified land (e.g., undeveloped lots and yards in otherwise urban or developed settings, undeveloped median strips and shoulders of highways, apparent wastelands, land associated with industrial or agricultural processing uses) were left unclassified. After visual review was complete, all remaining unclassified land was classified as unsuitable. This conservative approach certainly resulted in exclusion of many small areas of undeveloped land from the total acreage of suitable habitat, as well as likely classification of a small amount of Low-quality land as Moderate quality.

Swainson's Hawk Nest Data

Data on SWHA nest locations in the study area were obtained from three sources: California Natural Diversity Database (CNDDB) records; a ground survey performed in 2016 in the study area for the adjacent RE Mustang 2 solar project (Estep 2017) which, given the relative size and shape of the two projects, is almost entirely included in the study area for this analysis (**Figure 1**); and data from a survey of SWHA nests in the central San Joaquin Valley (Estep and Dinsdale 2012). Duplicate records for the same locations among these three data sets were combined into a single record for analysis. Because SWHA exhibit a high degree of nest site fidelity, it is unlikely that this method resulted in a significant underestimate of the current number of active nest territories in the study area; however, any potential underestimate of the regional population would be accommodated by the elevated CEQA significance threshold discussed previously.

Cumulative Projects

Data on other existing, planned, and reasonably foreseeable solar projects (cumulative projects) in the study area were obtained from Kings County and Fresno County. Cumulative projects were classified as Constructed/Not Constructed for purposes of analysis.

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RESULTS

Regional Population and Habitat Requirements

The regional population of SWHA that would potentially be affected by the RE Slate project is 38 nesting pairs in a 276,048-acre study area. The nest locations are concentrated to the east and north of the study area (**Figure 1**). A total of 194,719 acres of suitable foraging habitat were identified in the study area; the remaining 81,329 acres were unsuitable land uses (**Figure 2**). Orchards and vineyards made up 45.3 percent of the unsuitable land uses. Of the suitable foraging habitat in the study area, 17,112 acres are High quality (alfalfa), 125,678 acres are Moderate quality, and 51,390 acres are Low quality (**Figure 3**). Overall, 73.3 percent of the suitable foraging habitat is Moderate- or High-quality habitat. Land uses in the study area are summarized in **Table 1**.

Table 1. SWHA Foraging Habitat in the Study Area

Habitat Type	Area (ac)	% of Total
Grand Total	**276,048**	**100.0**
Suitable Habitat	194,719	70.4
High Quality (alfalfa)	17,112	8.8
Moderate Quality	125,678	64.5
Low Quality	51,930	26.7
Unsuitable Habitat	81,329	29.6
Orchards/Vineyards	36,868	45.3
Urban/Developed/Other	44,462	54.7

Most nests (87 percent) were more than 3 miles from the project site boundary (**Figure 4**), and the largest number (8 nests) were 9-10 miles from the project site. The approximate overlap of the potential foraging area and the study area was calculated for each nest using Equation 1. The weighted average overlap of all nests with the study area was 0.63 (**Table 2**).

Table 2. Proportion of Potential Foraging Area Inside the Study Area

Distance Increment (mi)	Number of Nests	Overlap
0-1	1	0.968
1-2	2	0.905
2-3	2	0.841
3-4	6	0.778
4-5	5	0.716
5-6	4	0.654
6-7	3	0.594
7-8	4	0.534

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8-9	3	0.476
9-10	8	0.419
	Weighted Average	**0.632**

Using the results discussed above, the total acreage of foraging habitat required in the study area to sustain the regional population of SWHA was calculated using Equation 2:

$$Y = 38 \cdot 6{,}820 \cdot 0.6 \cdot 0.73 \cdot 0.63 = 71{,}513,$$

where 38 is the size of the regional population (n); 6,820 is the baseline average home range size; 0.6 is the correction for 40 percent overlap among home ranges (p); 0.73 is the proportion of the suitable foraging habitat in the study area that is Moderate- or High-quality (q); and 0.63 is the weighted average proportion of potential foraging area for all nest territories in the regional population that is inside the study area (r).

According to Equation 2, the total amount of foraging habitat in the study area required by the regional SWHA population is 71,513 acres. The total amount of suitable foraging habitat in the study area is 194,719 acres; therefore, there is a surplus of 123,206 acres of suitable foraging habitat in the study area. The CEQA significance threshold is 70 percent of the existing surplus, or 86,244 acres (**Table 3**).

Project Impacts and Mitigation

Nesting

Impacts

Because there are no trees in the project site, the project would not remove Swainson’s hawk nesting habitat. Project construction/decommissioning activities within 0.25-mile of suitable trees could potentially disturb nesting Swainson’s hawks using those trees. There was one documented active Swainson’s hawk nest within 0.5-mile of the project site in 2018: in a tree 0.35-mile north of the project site along the Kings River.

CDFW management protocols for Swainson’s hawk (CDFW 1994) stipulate a 0.25-mile buffer for “intensive new disturbances” around active nests, extended to 0.5-mile outside urban areas where disturbance is not a normal occurrence during the nesting season. CDFW (1994) cites heavy equipment operation, use of cranes or draglines, and rock crushing as examples of “intensive disturbance”. Normal agricultural operations in the vicinity of the project site include disking and plowing of fields by large (6-8 wheel) tractors and combine harvesters, and periodic presence of scores of agricultural laborers during planting and harvest. Equipment used for construction of the proposed project would include road graders (bladers), small self-contained drill rigs for boring support post holes, front loaders and fork lifts, and semi-trucks. These vehicles and activities would not cause noise, dust emissions, or vibration greater than that typical of large agricultural equipment used in the region, nor would the impacts from

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such equipment and activities rise to the level of disturbance caused by heavy equipment, cranes or draglines, or rock crushing. Consequently, an extended (0.5-mile) buffer would not be warranted for the project, and a 0.25-mile buffer would be sufficient to protect active Swainson's hawk nests from disturbance.

Mitigation

Implementation of Mitigation Measure BIO-2a would reduce project impacts to nesting SWHA to less than significant.

Mitigation Measure BIO-2: Swainson's Hawk Nest Avoidance. Prior to initiation of construction/decommissioning activities during the Swainson's hawk breeding season (March 1 – September 15), the applicant shall determine the presence of active Swainson's hawk nests within 0.25-mile of the project site using the most recent published survey protocols (*i.e.*, 3 surveys by a qualified biologist in each of the two periods preceding the construction start date; SHTAC 2000). If an active Swainson's hawk nest is discovered within a 0.25-mile radius of the project site, the applicant shall initiate consultation with CDFW prior to starting any construction-related activities within 0.25-mile of the nest(s). Construction-related activities may commence in parts of the project site greater than 0.25-mile from the nest(s). If no active nests are discovered, no further action is required.

Foraging

Project-Level Impacts

The proposed project would result in conversion of 2,490 acres of undeveloped land in the study area into a solar PV generating facility. Although properly managed solar facilities have been demonstrated to be used by SWHA for foraging (see **Discussion**), the entire acreage of solar facilities are considered a land use unsuitable for SWHA foraging for purposes of this analysis. Removal of 2,490 acres of habitat would reduce the surplus SWHA foraging habitat in the study area to 120,716 acres, which is 97.9 percent of the existing surplus, and well above the 70-percent CEQA significance threshold (**Table 3**). The project impact to the regional population of SWHA through foraging habitat loss would be less than significant, and no compensatory mitigation would be required.

Cumulative Impacts

Including the proposed RE Slate project, there are a total of 16 existing, planned, or reasonably foreseeable solar projects in the study area (**Figure 5**). The total area of these cumulative projects is 28,006 acres, of which over 20,000 acres are in the Westlands Solar Park Master Plan area. The proposed project contributes 8.9 percent of the cumulative impact. Development of the cumulative projects would reduce the surplus SWHA foraging habitat in the study area to 95,200 acres, which is 77.3 percent of the existing surplus and above the 70-percent CEQA significance threshold (**Table 3**).

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Some of the cumulative impact is existing solar projects that were classified as unsuitable in the analysis, and some is already in unsuitable land uses. Of the 28,006 acres of cumulative projects, 2,946 acres are existing solar facilities, and 1,565 acres are currently unbuilt and unsuitable for SWHA foraging. The remaining 23,495 acres of unbuilt cumulative projects, including the 2,490-acre project site, are suitable SWHA foraging habitat (**Figure 6**). Considering only future impacts to suitable foraging habitat, the cumulative impact would be 23,495 acres and the surplus remaining after development would be 99,711 acres, which is 80.9 percent of the existing surplus (**Table 3**).

The project would contribute to a less than significant cumulative impact to the regional population of SWHA through foraging habitat loss, and no compensatory mitigation would be required.

Table 3. Project Impacts and CEQA Significance Threshold

		Remaining After Impact					
	Existing	Project 2,490	% of Existing	Cumm. 28,006	% of Existing	Cumm. 23,495	% of Existing
Foraging Habitat Required	71,513	--	--	--	--	--	--
Suitable Foraging Habitat	194,719	192,229	98.7	166,713	85.6	171,224	87.9
Surplus	123,206	120,716	97.9	95,200	77.3	99,711	80.9
CEQA Significance Threshold	86,244	--	--	--	--	--	--
Less than Significant Impact[1]	36,962	34,472	93.3	8,956	24.2	13,467	36.4

[1]Impact acreage that would be below the CEQA threshold of significance, or 123,206·(0.3) = 123,206-86,244 = 36,962

DISCUSSION

Conclusions

The proposed RE Slate solar project would potentially result in significant impacts to nesting SWHA if an active nest were to be established within 0.25-mile of the project site prior to initiation of construction activities. This potential impact would be less than significant after implementation of Mitigation Measure BIO-2: *Swainson's Hawk Nest Avoidance*.

The proposed RE Slate solar project would not result in a significant impact to the regional population of SWHA through loss of suitable foraging habitat, nor would it contribute to a significant cumulative impact in concert with other existing, planned, or reasonably foreseeable projects. After project development, the amount of surplus suitable foraging habitat in the study area would remain greater than 70 percent of the existing surplus and therefore provide sufficient surplus foraging habitat to allow for population growth and resiliency to disturbance, as well as to changes to the foraging landscape through changes in agricultural land uses.

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The analysis performed for this study represents a robust, scientifically defensible rationale for assessing potential project impacts to a wide-ranging, opportunistic forager such as SWHA. The method is based on previously accepted methods (Estep 2011, 2015, and 2017) and makes use of the best available data. The analysis considers impacts to SWHA at a more biologically realistic scale than the method employed in the 1994 CDFW guidelines while remaining logistically feasible as well as generalizable to a wide range of projects and locations. The most limiting factor in the analysis is the need for a suitably current and accurate census of active SWHA nest territories in the study area. The CDFW guidelines define an active SWHA nest location as one that has been active in any of the previous 5 years; therefore, primary nest data for the study area should come from a ground survey performed within the previous 5 years. In this case, the survey data from Estep (2017) were the primary source of nest locations, as that survey covered nearly the entire study area (**Figure 1**). Data from CNDDB and Estep and Dinsdale (2012) were used to supplement the primary data from 2016 (Estep 2017).

Swainson's Hawk Use of Solar Facilities

It has been previously thought that lands supporting linear rows lined with tall vegetation (e.g., vineyards) are considered unsuitable foraging habitat because the extent to which SWHAs would attempt to capture prey between rows of tall vegetation is considered negligible (Estep 2013). Similarly, solar generation facilities – which are generally similar to vineyards in overall structure – are typically considered unsuitable foraging habitat. This assumption was applied to the analysis presented in this study; however, recent studies indicate that both vineyards and solar generation facilities provide some foraging habitat value for SWHAs (Estep 2013; Swolgaard *et al.* 2008).

Because much of the typical solar generation facility is composed of open areas, there is potential for use of solar projects by SWHA and other raptors for foraging, particularly if the facility is managed to optimize habitat for prey and the area between the panels is managed as perennial grassland vegetation of a suitable height. As previously mentioned, other land uses with a similar structure, such as vineyards, have also been demonstrated to be used by foraging SWHA, so this concept is not completely new. To test the hypothesis that solar arrays provide foraging habitat for SWHA, Estep (2013) conducted a pilot study in Sacramento County in 2012 to evaluate the foraging use of solar arrays by SWHAs and other raptor species relative to the surrounding agricultural landscape.

In that study, three PV solar generation facilities in Sacramento County, ranging from 105 to 200 acres in size, were evaluated for foraging use by SWHAs and other raptors. All three of the solar generation facility evaluated in the foraging study are located within a diverse agricultural landscape of similarly sized parcels to the solar facilities. The study was conducted after the three facilities had been constructed, operation had commenced, and grass cover had been established. The three facilities were being managed to allow establishment of grasses beneath and between the solar panels. The grass cover at these sites is maintained between 4 and 12 inches in height through a sheep grazing program. The grass ground cover is managed to promote the establishment of rodent populations to provide foraging habitat for raptors as well as refugia for rodents to assist with re-establishment of rodent populations on adjacent farmlands following cultivation.

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Results of the study indicated that the solar array fields were used for foraging by SWHA similar to other moderate to high value agricultural cover types and the presence of the solar facilities did not appear to affect the overall use of the landscape by SWHAs or other raptors. As one element of an otherwise diverse agricultural matrix, the solar array fields provided a consistent and an apparently reasonably accessible source of prey, particularly for SWHAs and American kestrels. Surprisingly, the study also indicated that the solar arrays were used at a higher rate than would be expected based on their availability in the landscape, meaning that SWHAs appeared to be selectively foraging within solar arrays over other crop types. The key to this was the fact that the solar sites were managed to provide a continual source of prey that was accessible to the hawks consistently throughout the spring and summer breeding season versus the seasonal availability of prey in agricultural crops due to the planting, growth, and harvesting regime.

Although this was a relatively simple short-term study (*i.e.*, a 5-month study) designed to determine foraging use by SWHAs in 100-200-acre solar arrays within a diverse agricultural matrix, it demonstrated that solar arrays do provide available foraging habitat for SWHAs and are used by this species for foraging. The study also suggests that conversion of otherwise suitable foraging habitat to solar arrays does not necessarily constitute a complete loss of foraging habitat for SWHA and that properly managed solar arrays could provide important foraging habitat for SWHA during periods when surrounding agricultural crops are not suitable.

In 2017, HELIX biologists conducted a study of SWHA foraging at the operational RE Mustang Solar Generation Facility, which is west of the project site across Avenal Cutoff Road (HELIX 2018). The study expands on the Estep study and shows that SWHAs will forage in a large-scale solar generation facility (>1,000 acres). The study compared SWHA foraging use of the 1,100-acre solar facility to an approximately 4,800-acre off-site area that included the project site and surrounding active agricultural lands. HELIX found that SWHAs foraged in the operational RE Mustang Solar Generation Facility at a higher intensity (determined by the minutes of forage per unit area) than in surrounding lands and observed no foraging behavior near or within the fallow proposed project site. This result is consistent with the findings of Estep (2013), suggesting that solar generation facilities managed to promote SWHA foraging may provide higher-value foraging habitat than active and idle agricultural lands.

The results of these studies indicate that solar generation facilities are used for foraging by SWHA similar to other moderate to high value agricultural cover types. As one element of an otherwise diverse agricultural matrix, the solar generation facilities provided a consistent and an attractive source of prey. The key to this was the fact that the solar generation facilities were managed to provide a continual source of prey that was accessible to the hawks consistently throughout the spring and summer breeding season versus the seasonal availability of prey in agricultural crops due to the planting, growth, and harvesting regime (Estep 2013).

Standard compensatory mitigation ratios for loss of SWHA foraging habitat (CDFW 1994) are based on land use changes that do not retain habitat value. In the case of standard SWHA mitigation, complete loss of foraging value is assumed. However, because there are opportunities to retain value through land management practices within solar facilities and the solar facilities are temporary (typical lifespan

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of approximately 40 years), solar projects should not be analyzed using the same impact assumptions as other forms of development that eliminate foraging habitat on a permanent scale (e.g., residential or commercial development).

Estep (2013) notes that to encourage raptor foraging use of solar arrays, the management of a grassland substrate to promote rodent populations, including maintaining vegetation at a height that promotes visibility and access to prey, is of key importance. Most crop types are available for a short period of time during the breeding season due to the planting, growing and harvesting regime, whereas a managed grassland can provide a consistent and available source of prey throughout the spring and summer breeding season.

Potential for On-Site Enhancement of Foraging Value

The analysis conducted for this study assumed that development of the project would result in a complete (100%) loss of foraging value at the site for SWHA. However, as discussed above, there is evidence that conversion of otherwise suitable foraging habitat to solar facilities does not constitute a complete loss of foraging habitat for SWHA. As indicated by Estep (2013) and Helix (2018), it is clear that typical management of solar arrays promotes continued wildlife use and at least maintains, and may enhance, overall ecological value.

The project site currently consists of fallow agricultural land with grazing occurring in portions of the site. The proposed project would include constructing approximately 31 acres of structures and paved surfaces (e.g., internal driveways, buildings, equipment pads) on the 2,490-acre project site (approximately 1.2 percent would be covered by these structures and paved surfaces). In addition, the aerial coverage of the solar panels when horizontal would be approximately 847 acres (approximately 34 percent of the project site). During operation of the project, the applicant plans to maintain the project site as dryland pasture and seasonally graze livestock (sheep) between and under the solar panels for the duration of operation of the solar facility, pursuant to an Agricultural Management Plan. Because sheep can graze under and between the panels, approximately 2,241 acres of the site (90 percent) would be available for dryland pasture land uses. The remaining 8.8 percent of the site acreage is canal and other rights-of-way that would be outside the facility’s perimeter fence and would not be grazed.

The mixture of grassland and forbs managed by targeted sheep grazing is expected to provide high value and consistently available habitat conditions for SWHA’s preferred small mammal prey species (voles, pocket gophers, deer mice and house mice). The dryland pasture could also be managed to facilitate SWHA use of the site for hunting during the spring and summer. The Agricultural Management Plan would include vegetation management methods to ensure that the vegetation composition and structure provides a combination of areas with lower vegetation heights and density to provide accessibility to the hawk, and areas with denser, taller vegetation to attract and maintain prey on the site, thus enhancing the site for SWHA foraging use.

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Management conditions would include ensuring that the vegetation cover is not reduced to the extent that vegetation would not naturally regenerate; there are openings in the vegetation to allow foraging access for SWHA; and there are areas where the vegetation would be allowed to grow taller. In general, vegetation heights below the panels should be allowed to be higher to provide cover for prey species, and the vegetation heights between the panels should be maintained at a suitable height to provide foraging accessibility. Suitable grass height to promote foraging for SWHA is generally less than 12 inches, and optimally 4 – 8 inches.

The managed pasture of the project site would provide excellent refugia and foraging habitat for a variety of species of prey and the site fencing would further benefit the prey species in the project site by providing some protection from terrestrial predators. As such, the project site would serve as a source of recolonization by rodents of neighboring lands following cultivation. The result would be a biological enhancement of the project site and adjacent areas that would benefit SWHAs foraging both on the project site, and in areas adjacent to the project site. In summary, while the proposed project would result in a reduction of foraging habitat for SWHA for the operational life of the facility, land management activities during operation would maintain foraging opportunities for the hawk over most (65 percent) of the site area, as well as have the potential to provide ecological benefits to the site and adjacent areas. As such, conversion of otherwise suitable foraging habitat to solar arrays does not constitute a complete loss of foraging habitat for SWHA.

Based on preliminary design, approximately 35 percent of the project site (878 acres) would be directly impacted by structures, paved surfaces, and solar array modules, and therefore be considered inaccessible to foraging SHWA. The remaining approximately 65 percent of the project site (1,612 acres) would remain accessible to foraging SWHAs as dryland pasture between solar arrays and in open space areas on the site during project operation. Given that the approximately 1,612 acres of the site that would remain in dryland pasture would provide an equivalent (or greater) foraging value to SWHA when compared to baseline conditions, the true project impact to SWHA foraging habitat could be as little as 878 acres.

Opportunities for Further Study

The effectiveness of the proposed management of the project for SWHA foraging should be assessed by conducting a SWHA foraging study post-construction. Following construction of the project and implementation of site management measures such as revegetation and grazing and allowing sufficient time for rodent populations to re-establish in the site, a SWHA foraging study should be conducted to evaluate use of the site by SWHA for foraging. The SWHA foraging study should cover at least one SWHA breeding season. The study should compare SWHA foraging in the project site to the pre-construction baseline in the project site or to a suitable control site that represents the pre-construction condition of the project site. This could take the form of an observational study of the relative foraging use by SWHA that quantifies the foraging behavior by SWHAs in each site/scenario. Foraging behaviors include (see Estep 2013):

- Circling below 100 meters

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- Soaring below 200 meters
- Flying through the survey area below 200 meters
- Kiting/Hovering
- Perching (adjacent poles/trees/fences)
- Standing on ground
- Prey capture attempt
- Prey capture successful
- Prey capture unsuccessful
- Aerial foraging.

Distribution of SWHA Nests and Habitat in the Study Area

The distribution of SWHA nest territories in the study area is markedly concentrated in the northeastern portion of the study area. Of the 38 nests in the study area, 36 are east of the Kings River/Fresno Slough and north of Nevada Avenue (approximately 3 miles south of Stratford). This same area includes nearly all of the High-quality foraging habitat (alfalfa) in the study area, and by far the highest concentration of unsuitable land covers (**Figure 7**). Although a statistical analysis was not performed, a pronounced spatial correlation between SWHA nest locations and alfalfa land use is apparent from visual inspection (**Figure 7)**. The spatial data depicted in **Figure 7** strongly suggest that the presence of even a high density of unsuitable land uses does not affect the suitability of the landscape for SWHA so long as High-quality (alfalfa) foraging habitat is also present even at low density. The data further suggest that the regional population of SWHA is primarily sustained by approximately 17,000 acres of alfalfa probably supplemented by other crops available at harvest, and not by the 71,513 acres of suitable habitat estimated as required by the analytical method employed in this and other studies.

Implications for SWHA Conservation

The correlations among the spatial distributions of SWHA nest locations, unsuitable land uses, and High-quality foraging habitat discussed above suggest that availability of High-quality (alfalfa) foraging habitat is important to SWHA conservation independent of broader landscape-level patterns of land use. Almost 50 percent of unsuitable land uses in the study area are orchards and vineyards (but see the previous discussion of potential for SWHA foraging in vineyards), and conversion of agricultural land to orchards and vineyards is not subject to any planning process. Therefore, our results indicate that preservation or establishment of High-quality (alfalfa) foraging habitat land uses in the study area is likely more important to conserving the regional population of SWHA than is avoiding conversion of lower-quality habitat.

Recurrent has expressed willingness to include preservation of 50-80 acres of agricultural land off-site as a component of the project in order to promote conservation of the regional SWHA population. Based on the results of this study, such preservation would be most effective in the form of a conservation easement to ensure cultivation of alfalfa, preferably on land east of the Kings River. Where nests are located in the immediate vicinity of high value foraging habitat, home range sizes are as low as 830 acres

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(Estep 2015); therefore, conservation of 80 acres of alfalfa near a suitable nest site would provide approximately 10 percent of the expected home range of a pair nesting at that site and likely a far larger proportion of that pair's realized foraging habitat acreage.

Distribution of Habitat and Impacts in the Study Area

Given the highly concentrated distribution of SWHA nests north and east of the project site, it is evident that a large proportion of the study area is far from any SWHA nest and may be of limited value to those hawks (**Figure 7**). This pattern has been noted in other studies of this type and addressed through a "sub-area analysis" (Estep 2017, 2011). The sub-area analysis typically removes a large portion of the study area and repeats the analysis of required and available foraging habitat with a greatly reduced acreage of available habitat compared to the regional population. The project site is always retained in the sub-area (Estep 2017, 2011). It is evident from inspection of **Figure 7** that a sub-area analysis for the RE Slate project would logically divide the study area almost exactly in half along a diagonal starting at the north end of the runway on NAS Lemoore. It is also evident from inspection that the portion of the study area that would be removed from the sub-area would include approximately half of the project site and nearly all of the cumulative projects, but only 2 of the 38 nests in the regional population.

While this approach would almost certainly result in a deficit of suitable foraging habitat available in the truncated study area, it is also clear that the logic of the sub-area analysis is inconsistent with the rationale for the analytical method of which it is a part. Excluding half of the study area because it is likely not used by the regional population implies that the regional population does not rely on that habitat currently and would not be affected by its conversion to unsuitable land uses. Given that in this case the excluded area would encompass half of the project site and almost all of the cumulative impact, it is clear that the proposed project is in a portion of the study area that is most likely not currently relied upon by SWHA and is not necessary to the maintenance of the regional population. Adjusting the sub-area to include the project site would be arbitrary and obviously not warranted by the patterns of SWHA nest and habitat distribution evident by inspection of **Figure 7**. Therefore, under the logic of the subarea analysis, development of the proposed RE Slate project and the cumulative projects would not affect the regional population. For this reason, a sub-area analysis was not performed as part of this study.

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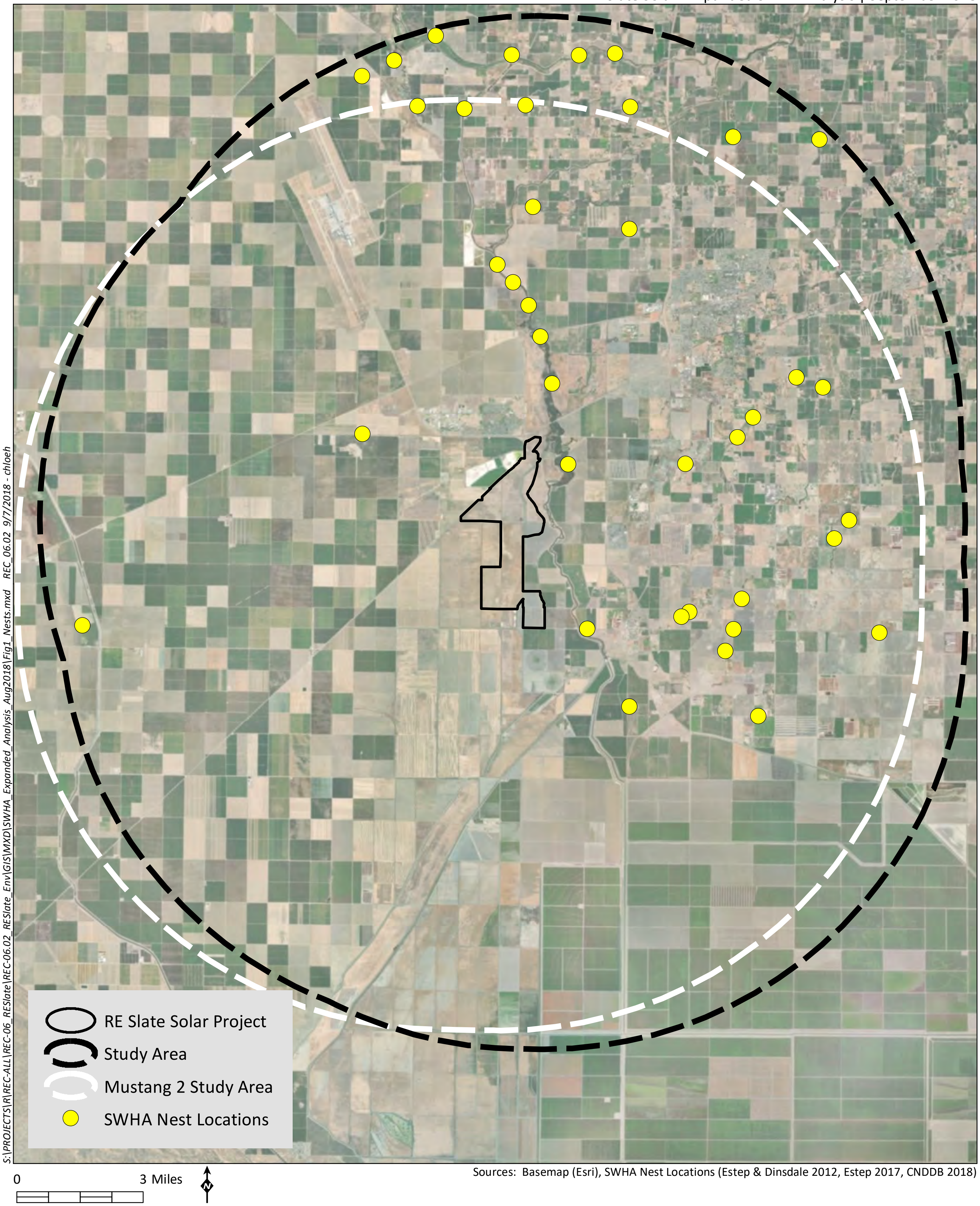

Sources: Basemap (Esri), SWHA Nest Locations (Estep & Dinsdale 2012, Estep 2017, CNDDB 2018)

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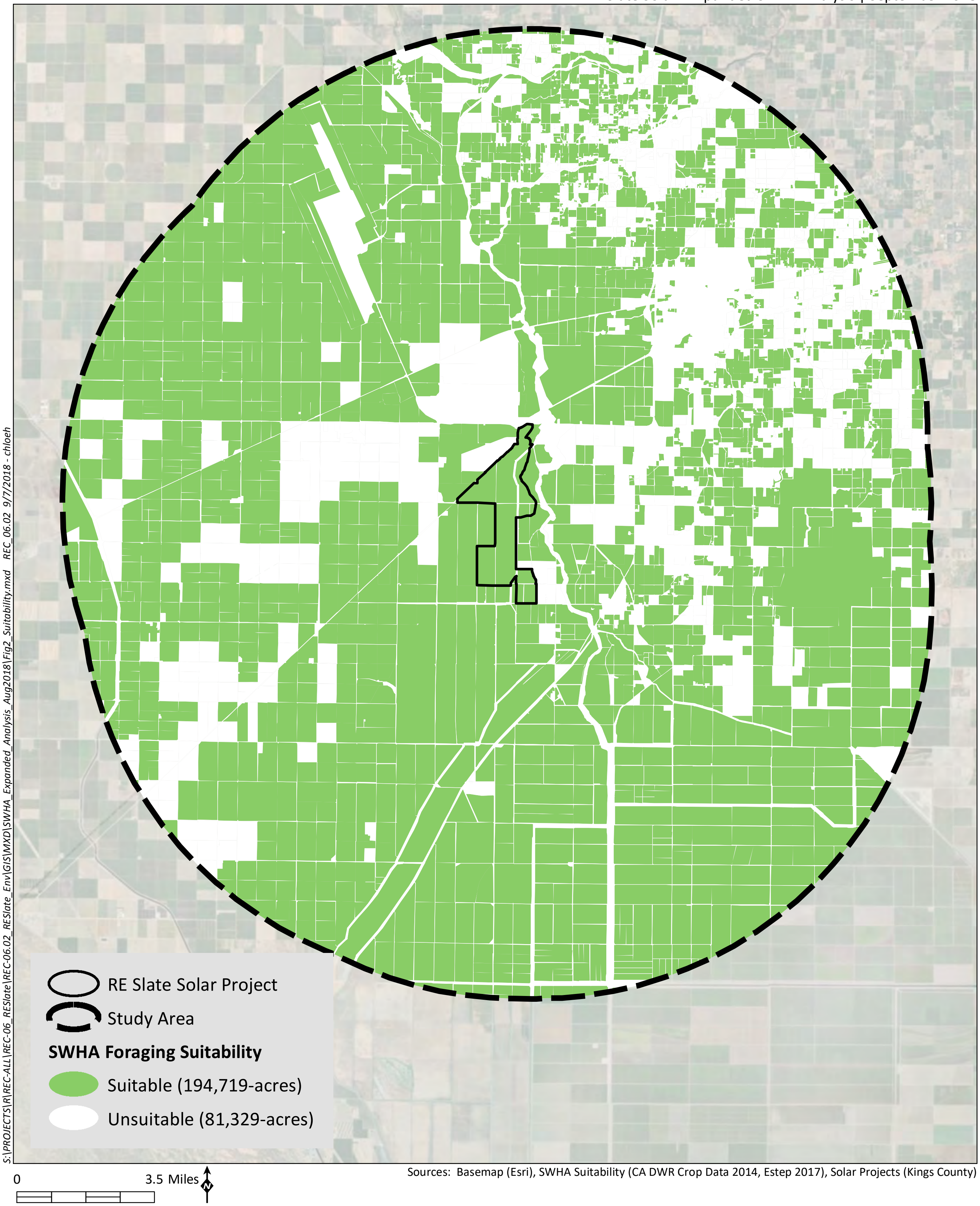
Swainson's Hawk Nest Locations

Figure 1



Sources: Basemap (Esri), SWHA Suitability (CA DWR Crop Data 2014, Estep 2017), Solar Projects (Kings County)

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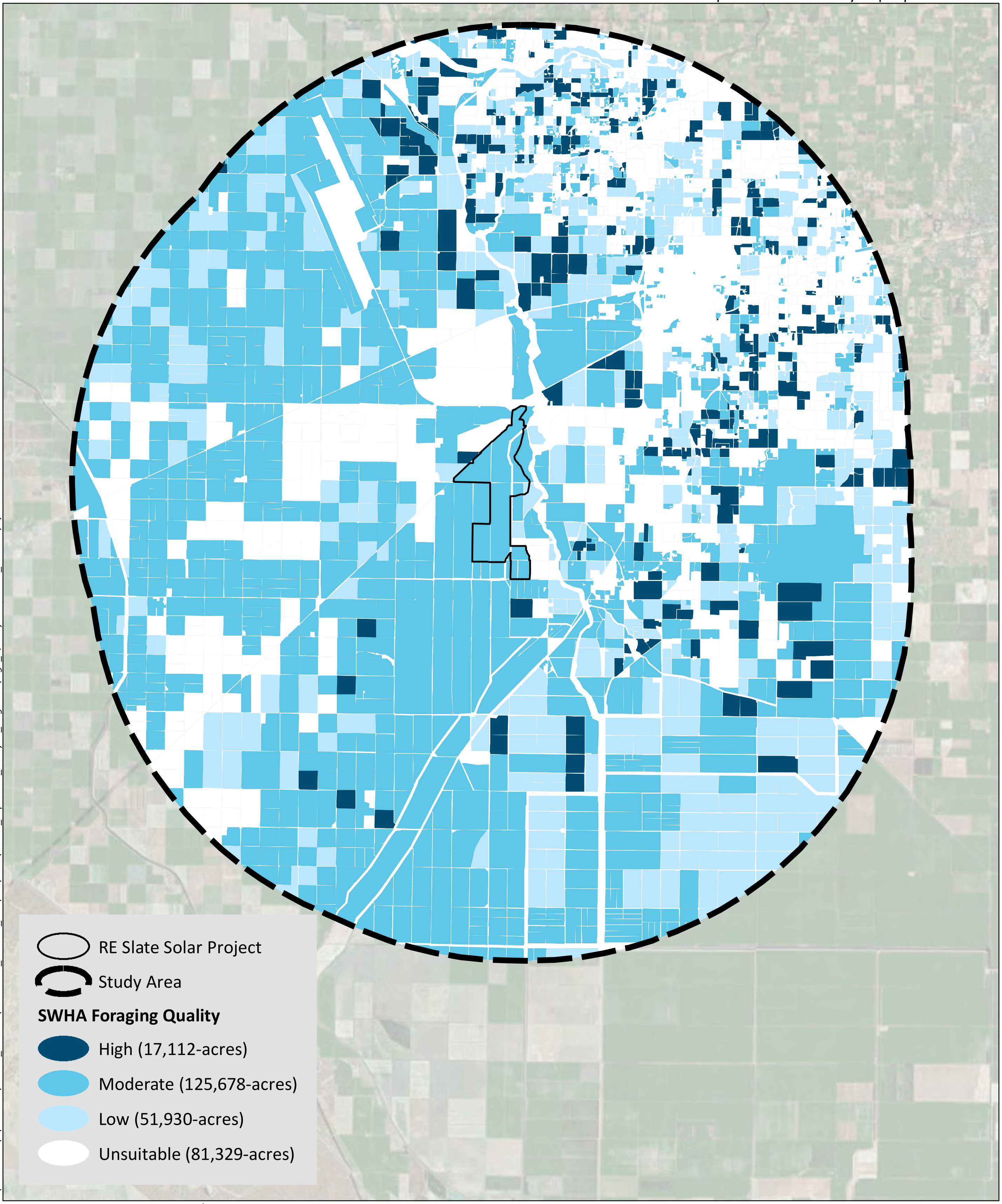
Swainson's Hawk Suitable Foraging Habitat

Figure 2



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Sources: Basemap (Esri), SWHA Suitability (CA DWR Crop Data 2014, Estep 2017), Solar Projects (Kings County)

0 3.5 Miles

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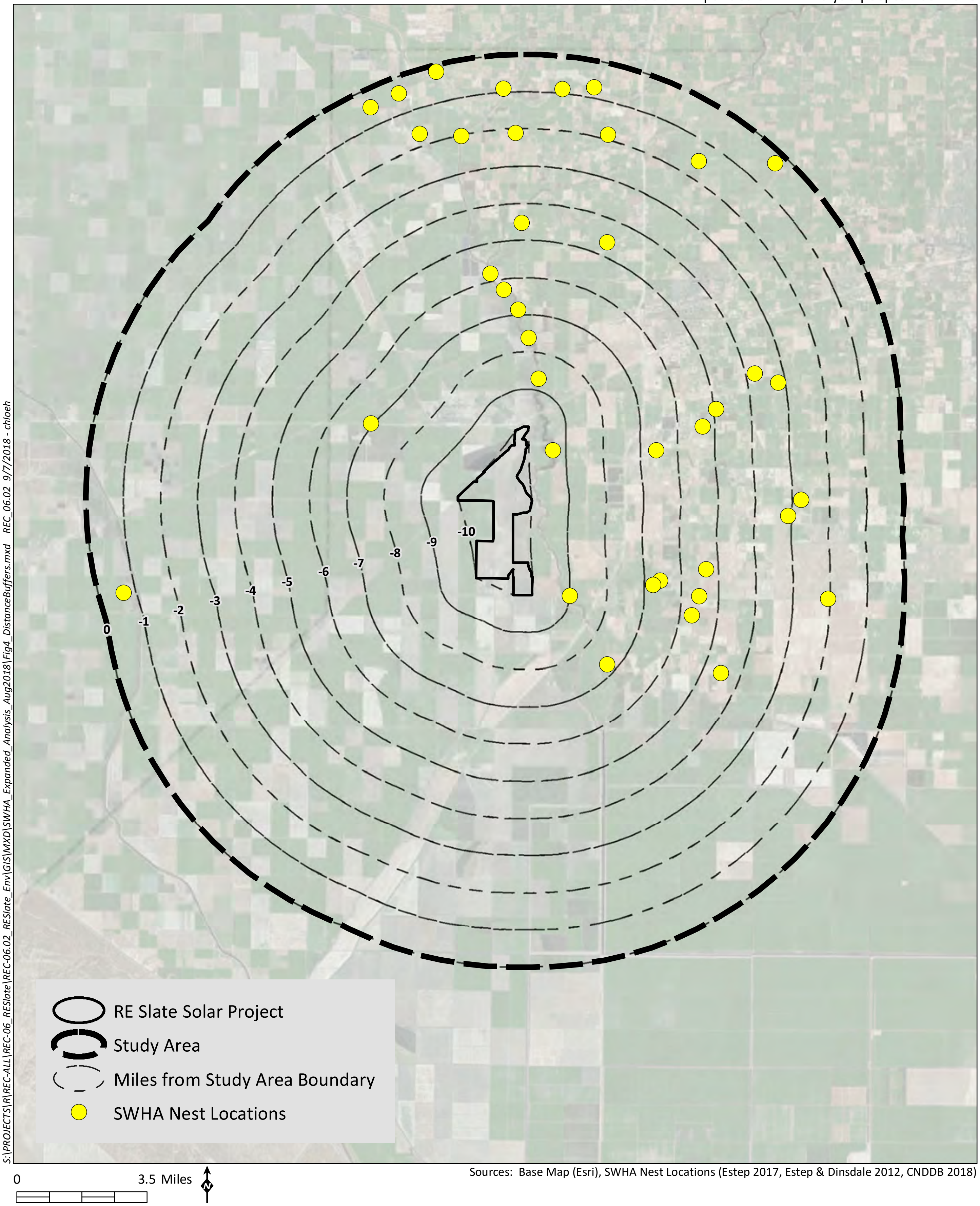
HELIX
Environmental Planning

Swainson's Hawk Foraging Habitat Quality

Figure 3

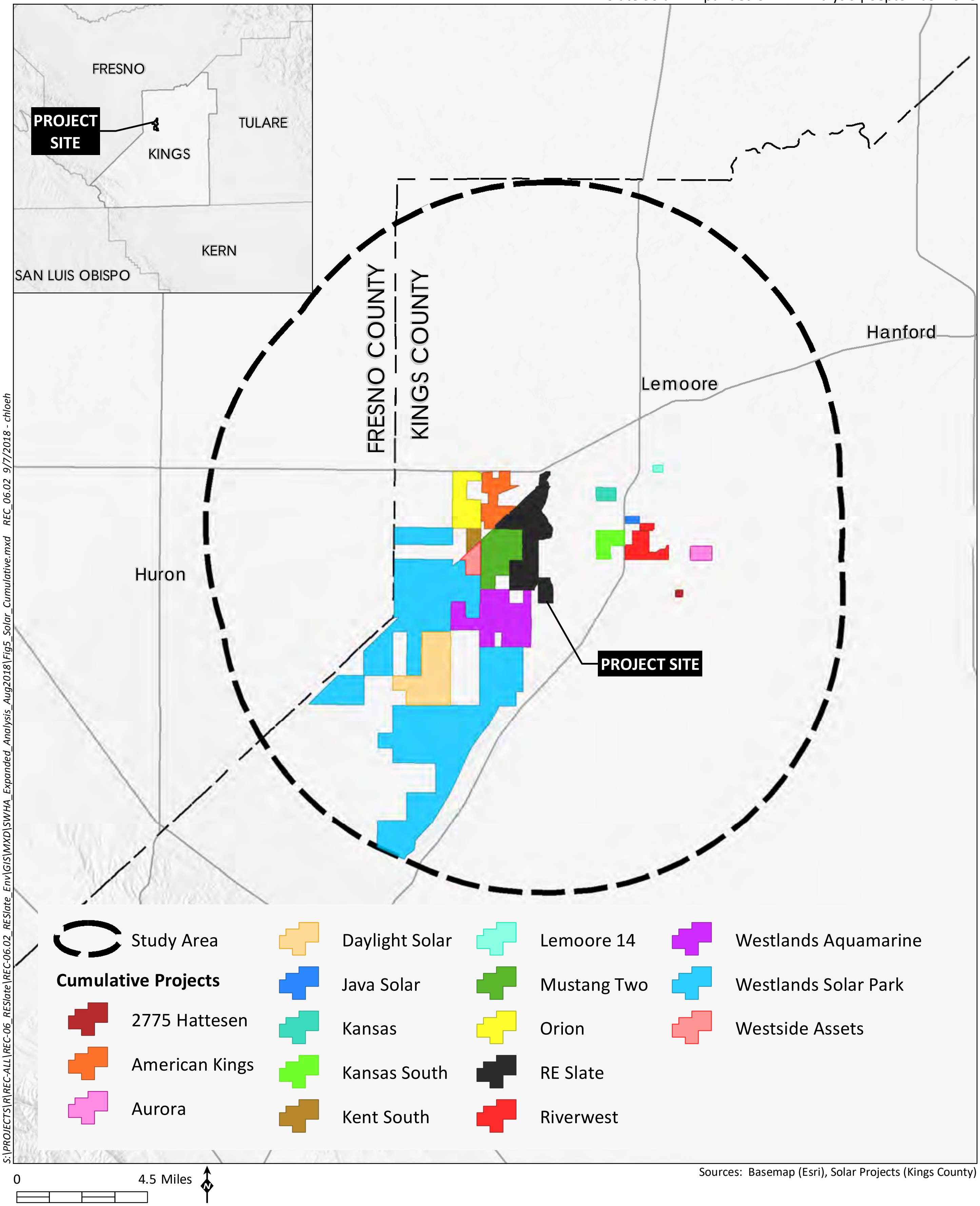


Sources: Base Map (Esri), SWHA Nest Locations (Estep 2017, Estep & Dinsdale 2012, CNDDB 2018)

HELIX Environmental Planning

Swainson's Hawk Nest Distances from Study Area

Figure 4

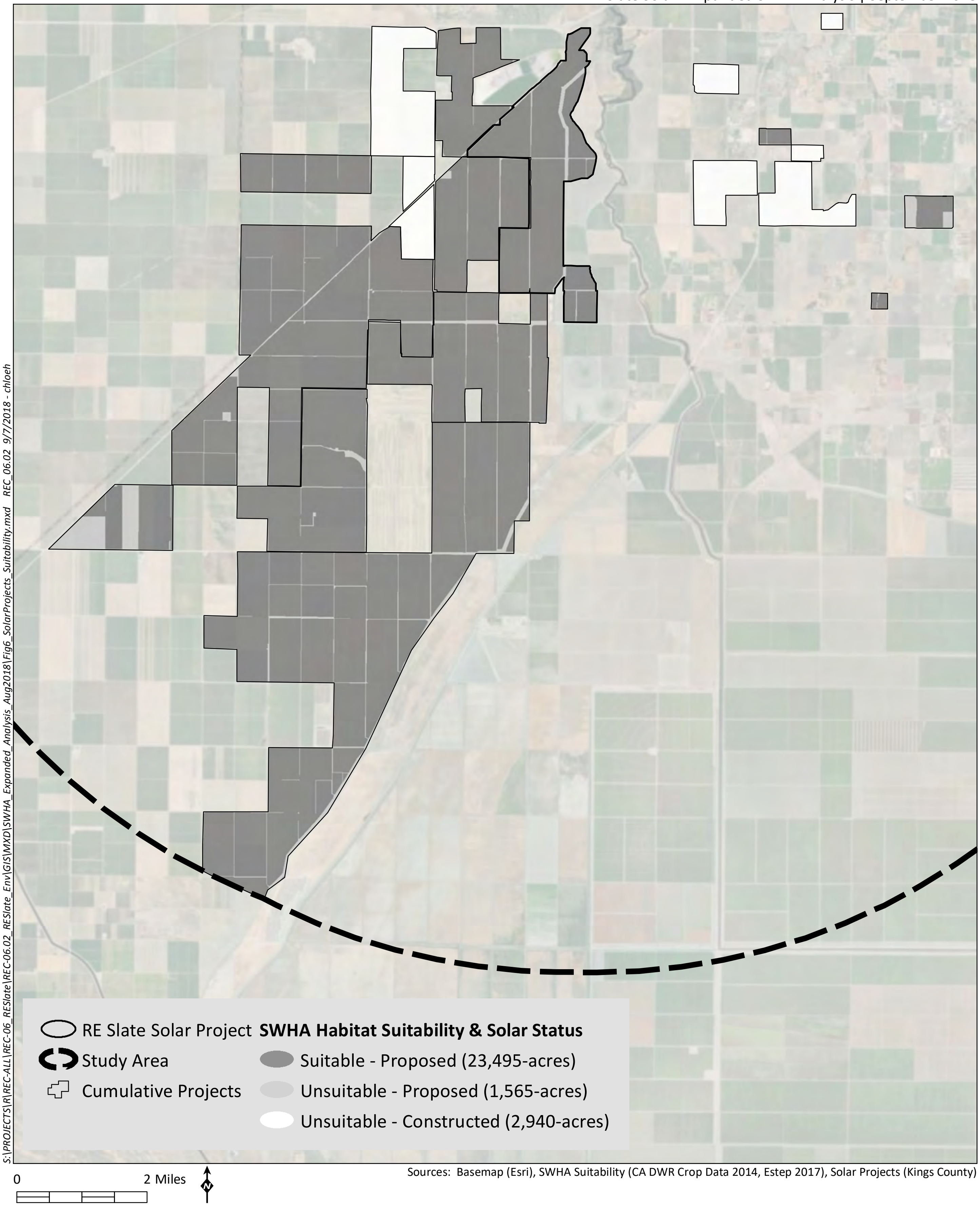


Sources: Basemap (Esri), Solar Projects (Kings County)

HELIX
Environmental Planning

Cumulative Projects

Figure 5

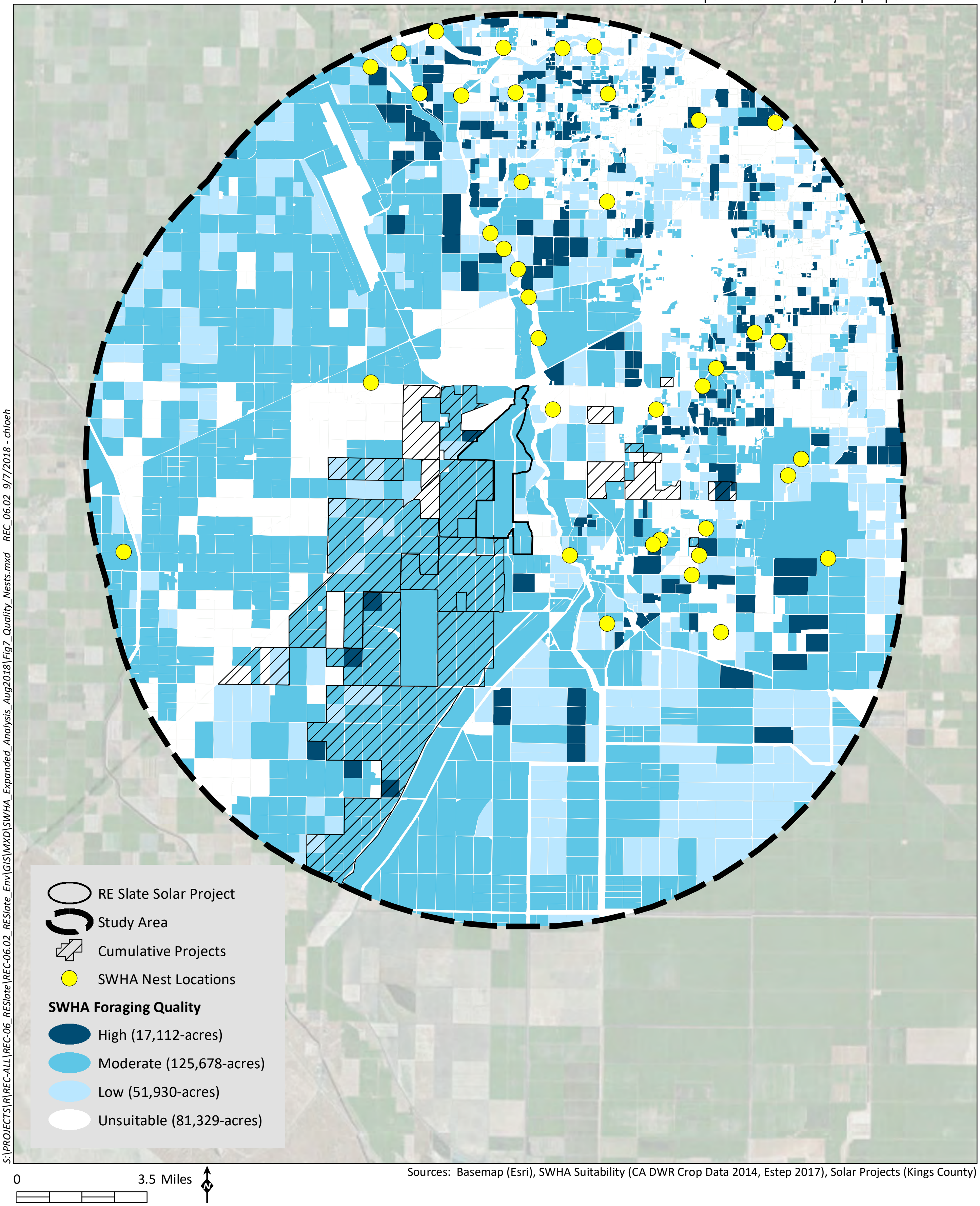


Sources: Basemap (Esri), SWHA Suitability (CA DWR Crop Data 2014, Estep 2017), Solar Projects (Kings County)

HELIX
Environmental Planning

Cumulative Projects & Foraging Suitability

Figure 6



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Sources: Basemap (Esri), SWHA Suitability (CA DWR Crop Data 2014, Estep 2017), Solar Projects (Kings County)

HELIX Environmental Planning

Swainson's Hawk Foraging Habitat Quality

Figure 7

Crop2014	DWRLegend	LandType	Suitable	Quality
Alfalfa and Alfalfa Mixtures	P | PASTURE	Alfalfa / Hay Crop	1	3
Almonds	D | DECIDUOUS FRUITS AND NUTS	Orchard / Vineyard	0	0
Apples	D | DECIDUOUS FRUITS AND NUTS	Orchard / Vineyard	0	0
Beans (Dry)	F | FIELD CROPS	Irrigated Cropland	1	1
Bush Berries	T | TRUCK NURSERY AND BERRY CROPS	Orchard / Vineyard	0	0
Cherries	D | DECIDUOUS FRUITS AND NUTS	Orchard / Vineyard	0	0
Citrus	C | CITRUS AND SUBTROPICAL	Orchard / Vineyard	0	0
Cole Crops	T | TRUCK NURSERY AND BERRY CROPS	Irrigated Cropland	1	1
Corn, Sorghum and Sudan	F | FIELD CROPS	Irrigated Cropland	1	1
Cotton	F | FIELD CROPS	Irrigated Cropland	1	1
Flowers, Nursery and Christmas Tree Farms	T | TRUCK NURSERY AND BERRY CROPS	Orchard / Vineyard	0	0
Grapes	V | VINEYARD	Orchard / Vineyard	0	0
Idle	I | IDLE	Irrigated Cropland	1	2
Lettuce/Leafy Greens	T | TRUCK NURSERY AND BERRY CROPS	Irrigated Cropland	1	2
Melons, Squash and Cucumbers	T | TRUCK NURSERY AND BERRY CROPS	Irrigated Cropland	1	1
Miscellaneous Deciduous	D | DECIDUOUS FRUITS AND NUTS	Orchard / Vineyard	0	0
Miscellaneous Field Crops	F | FIELD CROPS	Irrigated Cropland	1	1
Miscellaneous Grain and Hay	G | GRAIN AND HAY CROPS	Alfalfa / Hay Crop	1	2
Miscellaneous Grasses	P | PASTURE	Irrigated Pasture	1	2
Miscellaneous Truck Crops	T | TRUCK NURSERY AND BERRY CROPS	Orchard / Vineyard	1	1
Mixed Pasture	P | PASTURE	Irrigated Pasture	1	2
Olives	C | CITRUS AND SUBTROPICAL	Orchard / Vineyard	0	0
Onions and Garlic	T | TRUCK NURSERY AND BERRY CROPS	Irrigated Cropland	1	2
Peaches/Nectarines	D | DECIDUOUS FRUITS AND NUTS	Orchard / Vineyard	0	0
Pistachios	D | DECIDUOUS FRUITS AND NUTS	Orchard / Vineyard	0	0
Plums, Prunes and Apricots	D | DECIDUOUS FRUITS AND NUTS	Orchard / Vineyard	0	0
Pomegranates	D | DECIDUOUS FRUITS AND NUTS	Orchard / Vineyard	0	0
Safflower	F | FIELD CROPS	Irrigated Cropland	1	1
Tomatoes	T | TRUCK NURSERY AND BERRY CROPS	Irrigated Cropland	1	2
Walnuts	D | DECIDUOUS FRUITS AND NUTS	Orchard / Vineyard	0	0
Wheat	G | GRAIN AND HAY CROPS	Irrigated Cropland	1	2
Young Perennials	Y | YOUNG PERENNIAL	Orchard / Vineyard	0	0

Appendix N

Burrowing Owl Exclusion Plan

HELIX Environmental Planning, Inc.
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July 24, 2018

Ms. Christy Herron
Recurrent Energy
300 California Street, 7th Floor
San Francisco, CA 94104

RE: Burrowing Owl Exclusion and Mitigation Plan
RE Slate Solar Project, Kings County, California.

HELIX Environmental Planning, Inc. (HELIX) prepared this Burrowing Owl Exclusion and Mitigation Plan for the proposed RE Slate Solar Project (project). This plan describes the methods that will be used to conduct pre-construction surveys for burrowing owl (*Athene cunicularia*) and provides methods for excluding and passively relocating burrowing owls if any are documented during pre-construction surveys. This plan also describes the mitigation that would be implemented to offset the project's impacts to burrowing owls and their habitat, if any nesting burrowing owls are passively relocated as a result of the project. HELIX prepared this plan based on current guidelines outlined in the California Department of Fish and Wildlife's (CDFW) *Staff Report on Burrowing Owl Mitigation* (CDFW 2012).

PROJECT LOCATION

The project is located on approximately 2,490 acres of agricultural/grazing land in unincorporated Kings County, 0.2 mile southeast of Naval Air Station Lemoore (NAS Lemoore), 3.2 miles southwest of the City of Lemoore, and 10.5 miles west-southwest of the City of Hanford (**Attachment A – Figure 1**). The project site is generally bounded by Avenal Cutoff Road to the northwest, Jackson Avenue to the north, the Kings River floodplain to the east which trends north-south between 22nd Avenue and 23rd Avenue, and Laurel Avenue to the south. The western site boundary generally follows Avenal Cutoff Road and canals (**Attachment A - Figure 2**). The project site occupies parts of Sections 25, 26, 34, 35, and 36 of Township 19 South, Range 19 East and Sections 1, 2, 11, 12, and 13 of Township 20 South, Range 19 East, Mount Diablo Base and Meridian. The majority of the project site is located within the "Westhaven, CA" and "Stratford, CA" USGS 7.5-minute quadrangles, with a portion of the northernmost parcels located within the "Lemoore, CA" 7.5-minute quadrangle.

The site is surrounded by existing agricultural uses including intensive rotating cultivation of row crops such as cotton and tomatoes, orchards of pomegranate and pistachio, and dry-farming of wheat. Other surrounding land uses include existing solar photovoltaic generating facilities.

Current land uses in the site include cattle grazing and active groundwater wells. There are no residences in or adjacent to the project site; one overhead electrical transmission line bisects the site along Kent Avenue, and an underground gas pipeline runs diagonally through the northwestern portion of the site from northeast to southwest.

PROJECT DESCRIPTION

The proposed project would involve the construction, operation, and decommissioning of a 300 megawatt photovoltaic generating facility. The facility will include the following components: solar arrays, substations, inverters, energy storage units, a generation tie-line to an existing transmission line, an operation and maintenance building, and an internal road system. The generation tie-line will connect to the generation tie-line constructed to connect the RE Mustang Two solar generating facility to the existing Pacific Gas and Electric (PG&E) Mustang switching station, which is located approximately 2 miles northwest of the project.

The project will be constructed in a single phase, beginning with site preparation, proceeding through panel installation, and ending with installation of inverters, transformers, and the electrical collection system. Project construction is expected to require approximately 14 months. Site preparation is expected to require minimal grading, as the site has been disked and plowed regularly for decades as part of regular agricultural operations. The operational life of the project will be 35 – 50 years, after which the project will be decommissioned and all components removed from the site. Decommissioning is expected to require 36 months.

The project is estimated to require installation of between 1 and 4 million PV panels, depending on the type of panel installed. The structures supporting the PV module arrays (trackers) at the facility will consist of steel piles (e.g., cylindrical pipes, H-beams) driven into the soil using a pneumatic pile driver similar to a hydraulic rock hammer attachment on the boom of a rubber-tired backhoe excavator. The typical spacing between piles would be 10 feet. Panels will be mounted on trackers in sets of 40 (4 x 10 panels making a table) and the long axes of tables will be oriented either north-south for single-axis trackers, or east-west for fixed-tilt trackers. The maximum height of PV panels will be 12 feet above grade.

Access to the project site will be from multiple points along Kent Avenue. The on-site roadway system will include a perimeter road, access roads, and internal roads. The perimeter road and access roads will be a minimum of 20 feet wide. Internal roads will have permeable surfaces and be approximately 12 to 20 feet in width. Trafficked roads will be treated to create a durable, dustless surface (e.g., lime-treated) for use during construction and operation. Temporary driveway aprons to points of ingress/egress during construction may be up to 80 feet wide to accommodate construction traffic; however, permanent driveway aprons will be built according to Kings County Standards.

BURROWING OWL AND OTHER BIOLOGICAL SURVEYS

Numerous biological surveys have been conducted for the project including biological reconnaissance surveys, protocol surveys for special-status species [i.e., Swainson's hawk (*Buteo swainsoni*), burrowing owl, and San Joaquin kit fox *(Vulpes macrotus mutica*)], and special-status species habitat assessments [i.e., Tipton's kangaroo rat (*Dipodomys nitratoides nitratoides*), blunt-nosed leopard lizard (*Gambelia sila*), and Buena Vista Lake ornate shrew (*Sorex ornatus relictus*)]. Focused surveys were conducted according to most recent published protocols, including the 2012 Staff Report for burrowing owl (CDFW 2012).

A habitat assessment of the site was initially conducted on April 13, 2016 and the site was determined to provide suitable breeding and foraging habitat for burrowing owl. Breeding season burrowing owl surveys were then conducted between April and July 2016. Surveys were re-conducted between April and June 2018 due to project delays. During surveys in 2016 and 2018, the project site was surveyed a total of four times during the burrowing owl breeding season. Surveys covered the entire site and surrounding lands to a minimum distance of 200 meters on each occasion. Survey times were restricted to morning or evening hours when the probability of owl detection is highest, as specified in the 2012 protocol (CDFW 2012). Burrows suitable for use by burrowing owl were also noted and inspected for signs of occupancy opportunistically, whenever discovered during the other surveys listed above.

RESULTS

Project Site Conditions and Habitats

The project site is roughly divided into 8 sections by canals and roads. Each section is a large, flat, level agricultural field. Portions of the site are grazed by cattle and sheep. The soil surface throughout the site is still furrowed from past cultivation. Fossorial mammals such as gophers and ground squirrels are common in levees and canal access roads, but scarce in fields.

Vegetation on the site is overwhelmingly dominated by tumble mustard (*Sisymbrium altissimum*), wheat (*Triticum aestivum*), Mediterranean canary grass (*Phalaris minor*), and lamb's quarters (*Chenopodium album*). After grazing, vegetation is reduced to stubble. Canal berms constitute the only topographic relief in the project site, and provide extensive habitat of dry, friable soil with low-growing, open vegetation that supports California ground squirrel (*Otospermophilus beecheyi*).

Wildlife observed during site surveys include coyote (*Canis latrans*), red-tailed hawk (*Buteo jamaicensis*), Swainson's hawk (*Buteo swainsoni*), gray fox (*Urocyon cinereoargenteus*), great horned owl (*Bubo virginianus*), black-tailed jackrabbit (*Lepus californicus californicus*), desert cottontail (*Sylvilagus audubonii*), Botta's pocket gopher (*Thomomys bottae*), and California ground squirrel. Hawks, owls, coyotes, and foxes are potential predators of burrowing owl, while ground squirrels, cottontails, and gophers are suitable prey for burrowing owl.

Burrowing Owls

Burrowing owls were observed on and adjacent to the site during the breeding season surveys in both 2016 and 2018 as well as incidentally during other biological surveys at the site. Sightings of burrowing owl and sign on the project site are shown on **Attachment A – Figure 3**.

2016 Survey Results

No resident burrowing owls were observed in the project site. A single transient burrowing owl was observed at one location at the southern end of the site near 23rd Avenue. This individual was observed during Survey #2 and was seen only once. There was no sign of an occupied burrow at that location, and no owls were observed at that location again. A breeding pair of burrowing owls was observed at a burrow complex immediately south of the project site. Burrowing owls were observed at this location throughout the duration of the surveys.

Potential predators of burrowing owl observed in the project site and immediate vicinity included red-tailed hawk (*Buteo jamaicensis*) and great horned owl (*Bubo virginianus*). No signs of burrowing owl predation were observed in the project site.

2018 Survey Results

Burrowing owl sign was observed at the entrance to two mammal burrows in the northern half of the project site during the habitat assessment on April 3, 2018. The burrows appeared to have been used over the winter by transient owls. The burrows were re-visited during subsequent surveys and no owls were seen at the location during any subsequent surveys.

A single resident burrowing owl was observed in the project site in the early spring during Surveys 1 and 2. This owl was observed along the southern boundary of the project site during April, usually occupying burrows off-site in an irrigated pasture used for grazing cattle. The owl perched on the fence along the project boundary, foraged in the project site, and occasionally used burrows at the base of fence posts along the project boundary. This individual was observed consistently during surveys 1 and 2 but was not observed again along the southern project boundary after Survey #2. During SWHA surveys on May 21, 2018, a juvenile burrowing owl was incidentally observed along the southern fence line in this same location and flew offsite to the south. The juvenile owl was not seen again.

No burrowing owls were observed during Survey 3. A transient owl was observed at the western edge of the site along Avenal Cutoff Road during Survey #4. This individual was observed once in a dry canal between the project site and the road; it was not seen in subsequent visits to that location during the remainder of Survey #4. The area was examined on foot and no burrows were found with sign of occupancy (pellets, bones, excrement, etc.).

Incidental Burrowing Owl Observations

During biological surveys performed by HELIX biologists between May and July 2017, a transient burrowing owl was observed along a canal at the western edge of the site. During a site visit by HELIX biologists in September 2017, a single transient owl was observed in a canal in the north-center of the site.

Sightings of transient owls since 2016 and owl sign at burrows north of Kent Avenue suggest that the project site is used by transient owls; however, no breeding has been observed in the project site except at the offsite location adjacent to the southern boundary.

BURROWING OWL EXCLUSION AND MITIGATION PLAN

Pre-construction Surveys

To prevent the take of burrowing owls that may establish burrows in the project site prior to the start of construction, pre-construction surveys will be conducted. The survey methods will be consistent with the *Staff Report on Burrowing Owl Mitigation* (CDFW 2012) and shall consist of walking parallel transects spaced adequately to obtain 100% visual coverage of the site no more than 14 days prior to ground disturbing activities.

The first pre-construction survey will be conducted no more than 14 days ahead of the start of construction, and will cover all areas within 150 meters of the portion of the site in which construction is scheduled to start. Surveys will be phased based on the construction schedule such that the surveys are conducted no more than 14 days ahead of the start of ground disturbance in new areas. The construction contractor will ensure that the site is kept active and remains inhospitable for burrowing owls during construction of the project to discourage owls from entering the site. If construction activities in portions of the site cease for a period of 14 days, those portions of the site will be resurveyed for burrowing owls prior to the resumption of construction. If no occupied breeding or wintering owl burrows are identified, no further mitigation will be required.

Based on the results of intensive site surveys for suitable burrows, it is expected that if burrowing owls establish in the site, they will most likely be located on a canal bank or along the site perimeter where there will be no direct impact to the burrow. It is unlikely that burrowing owls will establish in places that will be directly disturbed by construction.

Avoidance and Buffers

If burrowing owls are found within the project site during the pre-construction surveys, avoidance of the active burrows will be the first priority. If possible, the timing and location of construction activities will be adjusted to avoid the occupied burrow by the appropriate distance (see below), where possible. Due to the size of the project, it is anticipated that the construction schedule and location can be modified to avoid all potential impacts to occupied burrows during the breeding season.

Buffer zones for occupied burrows will be established at 200 meters during the breeding season (February 1 to August 31) and at 50 meters for the non-breeding season. These buffers may be adjusted in consultation with the CDFW and monitored at the discretion of a qualified biologist. No ground-disturbing activities, such as vegetation removal, road construction, or installation of solar arrays or ancillary facilities will occur within the buffer zone, unless passive relocation is implemented. The buffer zone will be clearly marked with flagging and/or construction fencing.

Passive Relocation (Exclusion)

If it is determined that an occupied burrow cannot be avoided and the burrowing owls must be moved away from the disturbance area, HELIX will implement passive relocation techniques where feasible. Passive relocation (exclusion) is defined as encouraging owls to move from occupied burrows to alternate natural or artificial burrows that are beyond 50 meters from the construction area, and that are within or contiguous to a minimum of 6.5 acres of foraging habitat for each pair of relocated owls. The CDFW (2012) guidance indicates that passive relocation be conducted between October 1 and February 1. HELIX will provide CDFW with at least 48 hours' notice prior to proceeding with the passive relocation techniques described in this plan. The notice will be provided by email and will include the location and status of the burrow, numbers and dates that burrowing owls were observed at the burrow, and relocation area.

Occupied burrows will not be disturbed during the nesting season unless a qualified biologist verifies through non-invasive methods that either: (1) the birds have not begun egg-laying and incubation or (2) juveniles from the occupied burrows are foraging independently and are capable of independent survival.

HELIX will work with the construction contractor to avoid relocating burrowing owls between February 1 and September 30. All possible effort will be taken to avoid relocation of burrowing owls until near the end of the project or at a point in which the remainder of the project impact area has been made inhospitable to burrowing owls (i.e., grading and commencement of construction activities immediately following burrowing owl exclusion). If feasible, the location of the occupied burrow will be avoided until the remainder of the project impacts have occurred, resulting in the project site being inhospitable to burrowing owls and increasing the likelihood of the owl passively relocating to an area outside of the project footprint.

If a burrowing owl on the RE Slate site is relocated between February 1 and September 30, HELIX will first document that the excluded burrow is an inactive nest. HELIX will use passive observation to first determine the status of the burrow. Passive observation will consist of a minimum of 2 hours per day for 3 consecutive days of burrow observation at sunrise or sunset. Observer will remain at a distance that will not cause the owls to flush but will allow for clear observation of the burrow and surrounding land. Observation will be conducted with the aid of binoculars and/or a spotting scope. Signs of an active nest include but are not limited to the presence of non-foraging juveniles, adults returning to burrow with food, and repeated visits inside the burrow. If at any time a sign that the burrow is an active nest is observed, the observation will be discontinued for at least a week. Based on the activity observed, the biologist conducting the observation will determine when the passive observation will begin again. The biologist will scope the nest following 3 consecutive days of observation with no sign that the burrow is an active nest. The burrow will only be approached if no predators (such as hawks or coyotes) are observed. The biologist will determine via close inspection and scoping if the burrow is no longer active. Once the burrow is determined to no longer be an active nest, burrowing owl sign (white wash, pellets, and tracks) will be removed from the burrow entrance and a one-way door will be placed over the burrow for a minimum of 48 hours. HELIX will check the burrow at least twice daily for signs that owls may be trapped inside, which include white wash or pellets deposited inside the door.

After the doors have been in place for 48 hours and the burrow has been observed to be empty, HELIX will use a scope to ensure no eggs or animals are present in the burrow. Once HELIX determines the burrow to be empty via scoping, the burrow will be excavated. A section of corrugated plastic pipe will be placed in the burrow entrance to allow any animals that may be present in the burrow an avenue of escape once excavation has begun. The excavation will be accomplished by, or under the direct supervision, of a HELIX biologist and will be accomplished using hand tools.

The relocated burrowing owls will be passively monitored for approximately 2 weeks. If the location is not known, HELIX will survey the habitat within 200 meters of the active construction area in an attempt to locate the burrowing owls. As part of the monitoring, HELIX will document the location of relocated burrowing owls and whether owls are using natural or artificial burrows. HELIX will provide a letter summarizing the relocation effort to CDFW after the 2 weeks of passive monitoring following relocation. HELIX will take photographs of the relocation process, including location of the initial burrow, one-way door, excavation process, removal of owl habitat, and relocation area. HELIX will monitor the passively relocated owls for the duration of construction, focusing on the location of the owls and documenting potential breeding.

Passive relocation (if required) is summarized as follows:

1. Removal of other potential burrows or refugia within the impact area.
2. Confirmation by passive observation that the burrow is not an active nesting site.
3. Installation of one-way door to remain in place for a minimum of 48 hours.
4. Confirmation by scope that no eggs or animals are present inside the burrow.
5. Hand excavation of burrow.
6. Photograph the excavation and closure of burrows.
7. Monitor excavated burrow and new location of burrowing owls.

Artificial Burrows

The design of the artificial burrows is based on the methods adapted from Barclay (2008) and Kidd (2013; **Attachment B**). The nest chamber will be a PVC irrigation control box with the burrow tunnel constructed of 4 inch corrugated, perforated pipe. The pipe will be approximately 7 to 10 feet long and be anchored at the surface with concrete block or rocks or prevent collapse. The pipe will be installed with a 90 bend to prevent light from directly entering the chamber. Each chamber will be installed with a wire mesh bottom to prevent fossorial mammals from entering chamber. The chamber will include two burrow entrances (pipes).

Rock piles will be made on the surface near the burrow to allow for a perching location. The burrows will be installed away from tall perches or utility towers (poles). If available, the burrows will be installed in the vicinity of natural burrows and low fence lines.

On Site Easement

For the case in which an on-site easement is created, the land shall remain the property of RE Slate LLC. Any transfer of title for the easement will require the approval of CDFW. No construction will occur within the limits of the easement. The easement shall be monitored for the presence of burrowing owl annually for 3 years. The annual monitoring will consist of a single visit during the breeding season to check for presence/absence of burrowing owls. If owls are observed, the biologist will document the number of adults and juveniles, along with any behavior observed. At the end of the 3-year period, a brief letter will be submitted to the CDFW with a summary of the status of the burrowing owls on the easement.

Additional Mitigation

The project would include preservation of between 250 and 807 acres of land under a restrictive covenant as compensatory mitigation for impacts to Swainson's hawk (*Buteo swainsoni*) foraging habitat. This land will be available for potential use as compensatory mitigation for burrowing owl and/or additional special-status species, if needed.

Under the terms of the restrictive covenant, off-site mitigation land would be managed for cultivation as annual crops in order to function as high-quality foraging habitat for Swainson’s hawk and the restrictive covenant would include measures for protection of burrowing owl habitat and/or habitat for additional species, if needed. The restrictive covenant would prohibit the conversion of the land to orchards or vineyards or another use that would be unsuitable for Swainson’s hawk and would also prohibit conversion of suitable burrowing owl habitat to unsuitable uses, and would remain in place for the lifetime of the project. The restrictive covenant would expire upon the completion of project decommissioning.

If nesting burrowing owl pairs are passively excluded/relocated, compensatory mitigation for lost wintering/breeding habitat shall be provided either through dedication of 6.5 acres of suitable habitat in the project site or on the off-site mitigation land (protected through a restrictive covenant), or through purchase of credits at a CDFW-approved mitigation bank in the region. The service area of the Kern Water Bank Authority Mitigation Bank includes the project site in Kings County, and burrowing owl mitigation credits are available. No compensatory mitigation is required for passive relocation or eviction of transient, unpaired owls.

If land dedication is required, the 6.5 acres of land set aside for each pair of burrowing owls will include the construction of a minimum of two artificial burrows per burrowing owl pair passively excluded/relocated (see Artificial Burrows and Conservation Easement section). If off-site mitigation lands are used for compensatory mitigation the land will be preserved through a restrictive covenant disallowing land uses incompatible with burrowing owl habitat functions and values, in the amount of 6.5 acres for each pair of owls passively relocated. A Mitigation Management Plan for off-site mitigation lands will be prepared in accordance with Appendix F of the 2012 Staff Report (CDFW 2012).

Active Relocation (Translocation)

In the case in which a pair of burrowing owls occurs in a location near the center of the project site or in another location that makes passive relocation and avoidance non-viable options, translocation shall be employed. This option will entail the creation of a burrowing owl relocation plan to be approved by the CDFW. The active relocation will only occur as a last resort and would be conducted by a biologist approved for capture and relocation of burrowing owl by the CDFW.

We appreciate the opportunity to support your team during implementation of the pre-construction and construction tasks. Please contact us at (916) 365-8700 if you have any questions regarding this letter.

Sincerely,

Stephen Stringer, M.S.
Senior Scientist

Attachments:

Attachment A - Figures

- Figure 1. Project Location Map
- Figure 2. Project Vicinity Map
- Figure 3. Burrowing Owl Sightings

Attachment B – Artificial Burrow Design

REFERENCES

Barclay, J.H. 2008. A Simple Artificial Burrow Design for Burrowing Owls. J. Raptor Res. 42 (1): 53-57.

California Department of Fish and [Wildlife] (CDFW). 2012. Staff Report on Burrowing Owl Mitigation. State of California Natural Resource Agency. March 7.

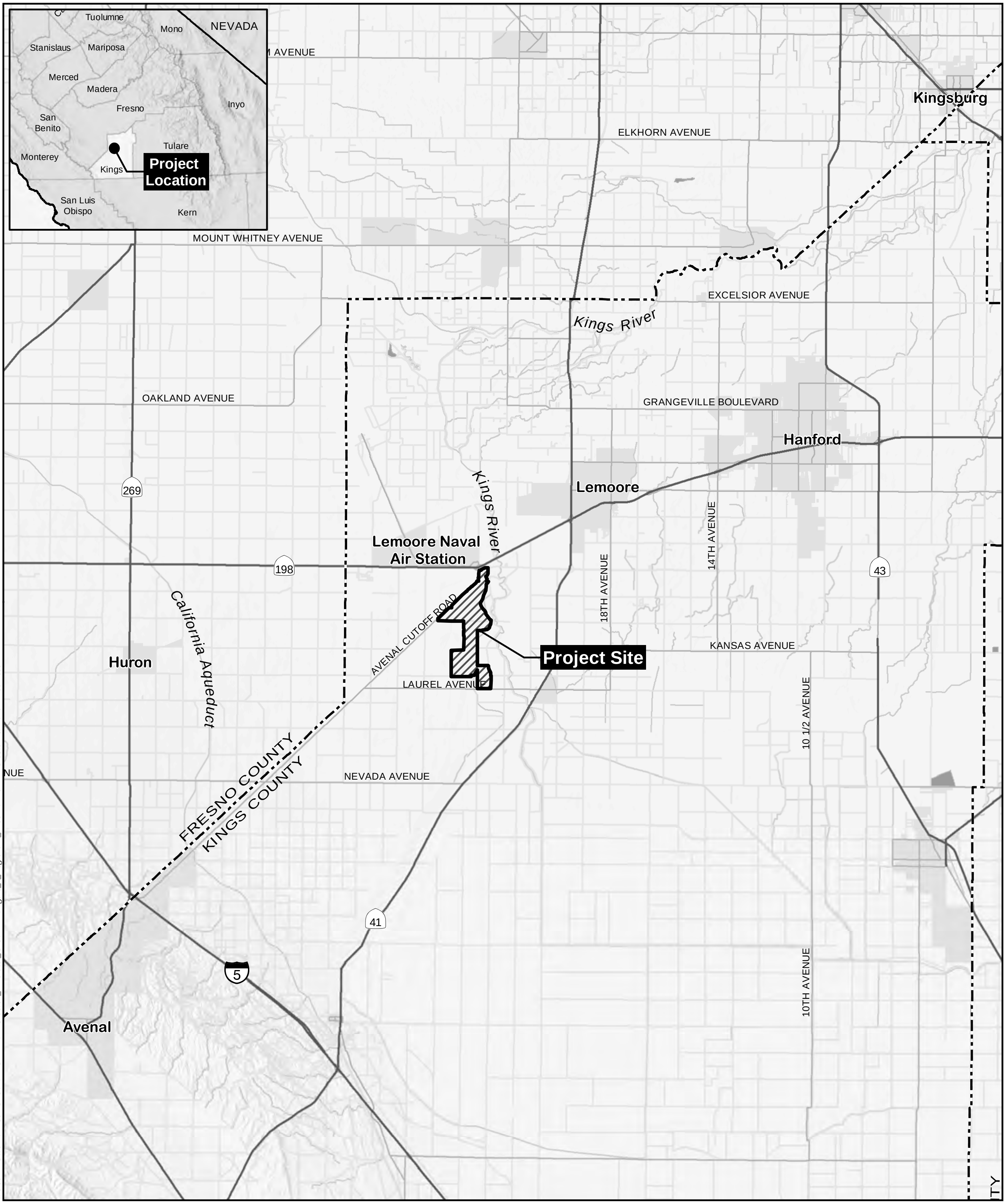
Kidd Biological, Inc. 2013. Burrowing Owl Relocation Plan prepared for Industrial Development International. January 23.

Attachment A

Project Location Map

Project Vicinity Map

Burrowing Owl Sightings



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Source: ESRI 2016, NHD 2016

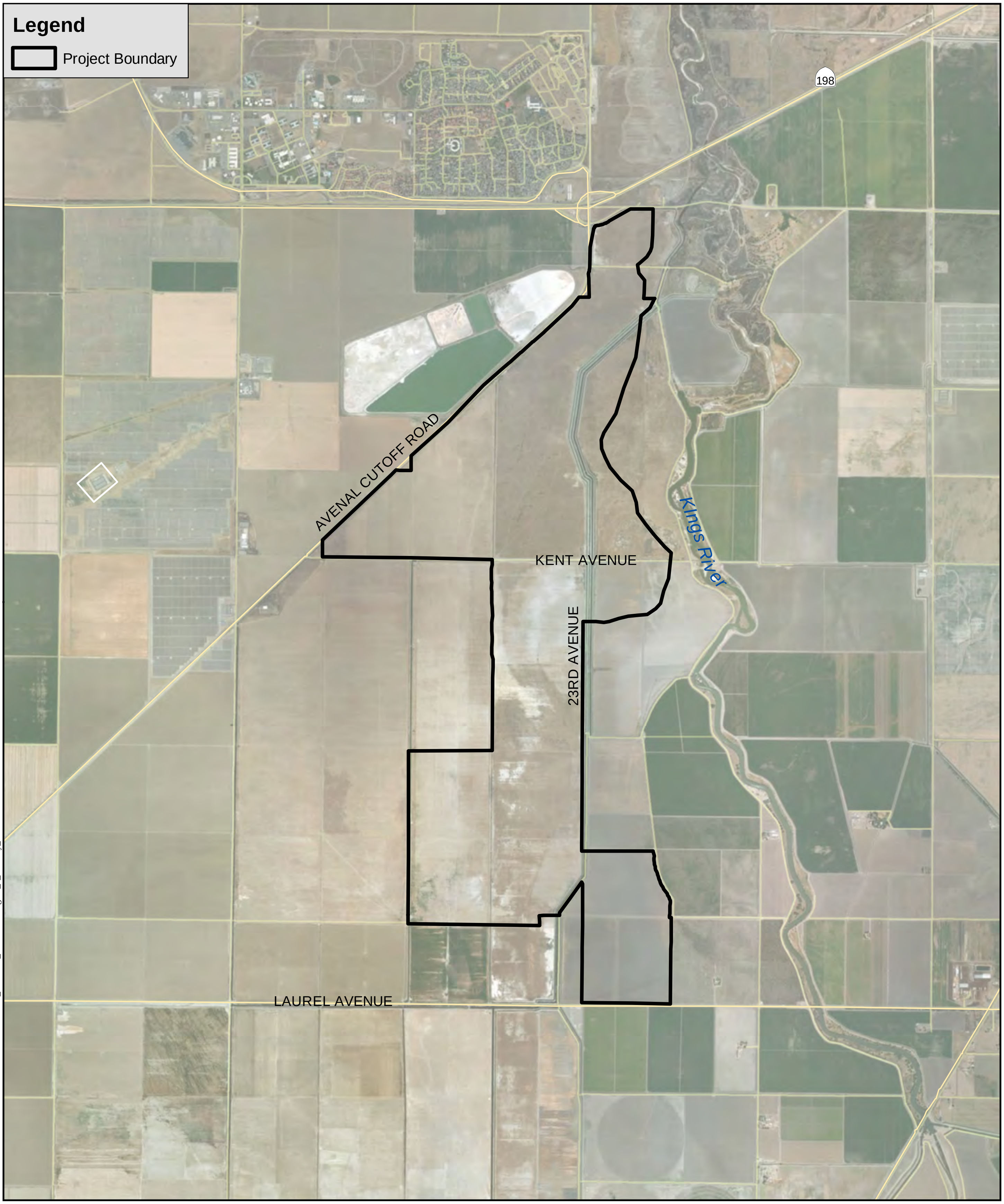
Regional Location Map

RE SLATE SOLAR PROJECT
KINGS COUNTY, CA

HELIX Environmental Planning

N 0 5 Miles 1 inch = 5 miles

Figure 1



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Source: ESRI 2016

Project Vicinity Map

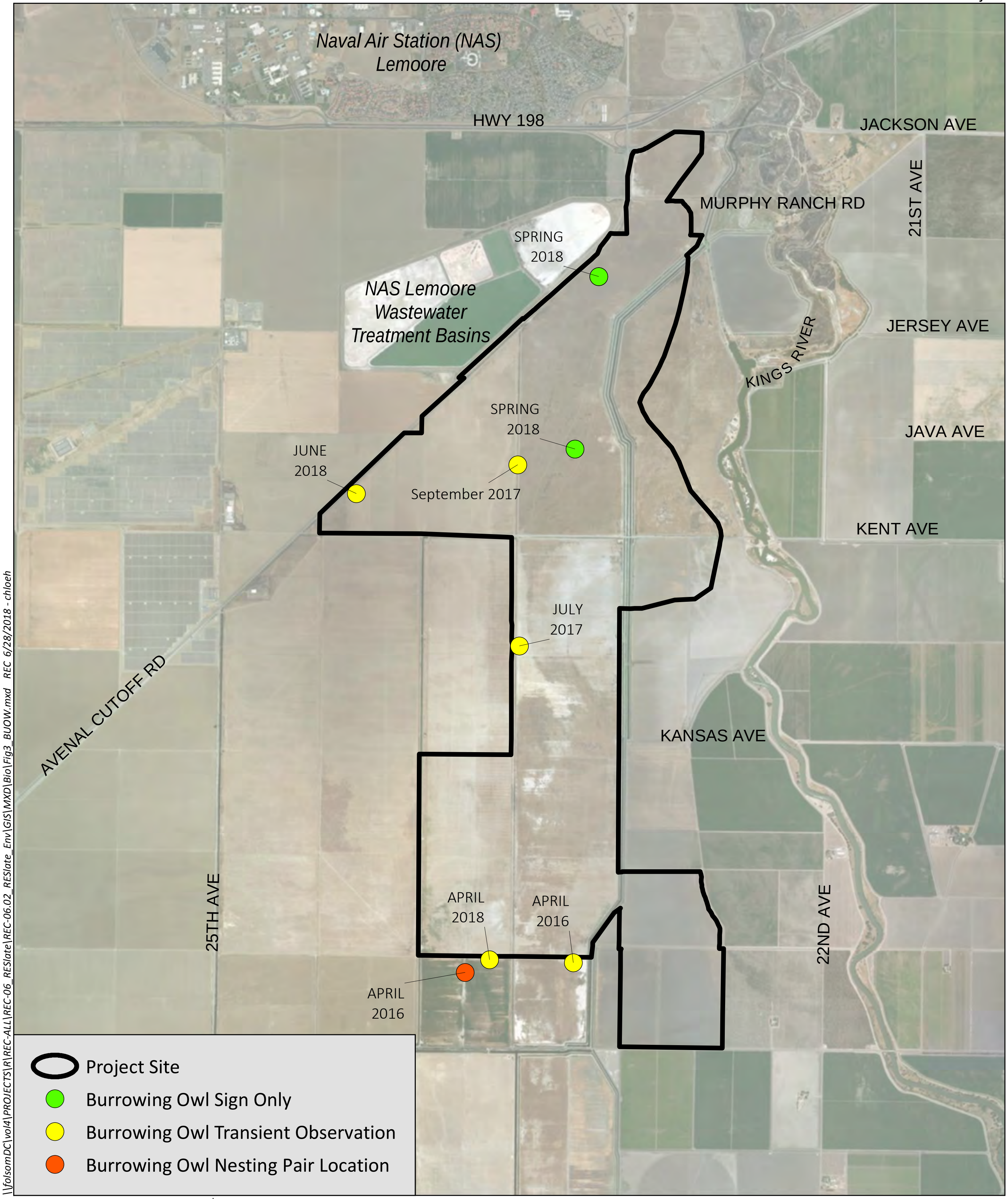
RE SLATE SOLAR PROJECT

KINGS COUNTY, CA

HELIX Environmental Planning

N 0 4,000 Feet 1 inch = 4,000 feet

Figure 2



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Source: Base Map Layers (Esri)

0 3,500 Feet

HELIX
Environmental Planning

Burrowing Owl Locations & Observations

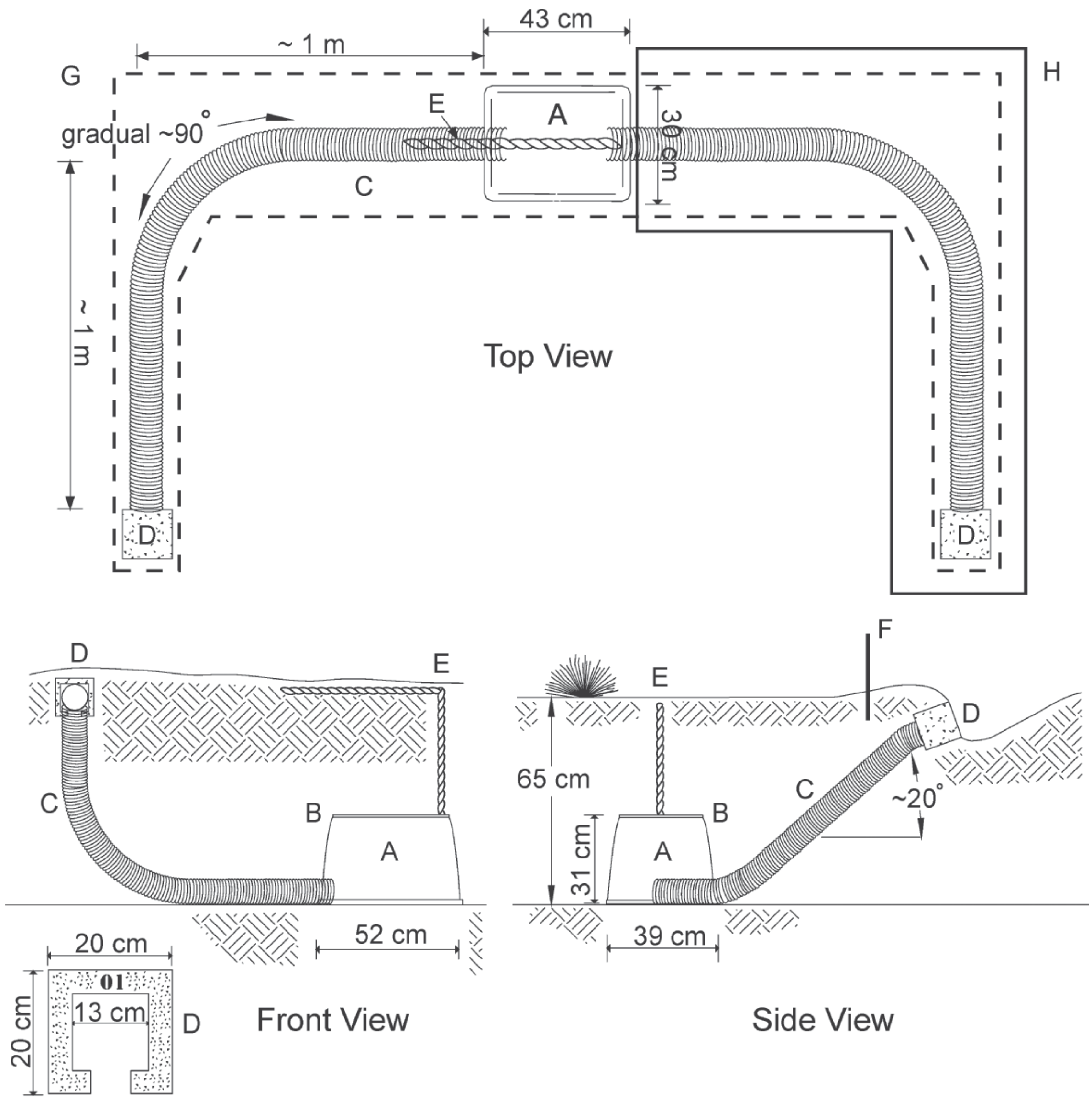
Figure 3

Attachment B

Artificial Burrow Design

APPENDIX A

Figure 1. A Simple Artificial Burrow Design For Burrowing Owls (Barclay 2008).



A - Plastic irrigation valve box, 48 cm long x 35 cm wide x 27 cm high (inside dimensions)
B - Removable lid
C - Ca. 2 m of 10-cm diameter perforated flexible plastic pipe
D - 20 x 20 x 15 cm hollow concrete block
E - Plastic rope or chain marking location of nest chamber on ground surface
F - 0.5 m perch post (optional)
G - Excavation footprint for installation – – –
H - Optional second entrance