Appendix D

Biological Resources
Technical Reports

Eagle Survey Report

Solano Phase 4 Wind Project

Eagle Survey Report
Solano County, California

Prepared for:

Sacramento Municipal Utility District
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May 2017

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Table of Acronyms

AWE	Area West Environmental, Inc.
CDFW	California Department of Fish and Wildlife
CNDDB	California Natural Diversity Database
Eagle Guidance	*Interim Golden Eagle Technical Guidance: Inventory and Monitoring Protocols; and Other Recommendations in Support of Golden Eagle Management and Permit Issuance*
GANDA	Garcia and Associates
Project	Solano Phase 4 Wind Project
SMUD	Sacramento Municipal Utility District
USFWS	U.S. Fish and Wildlife Service

1.0 Introduction

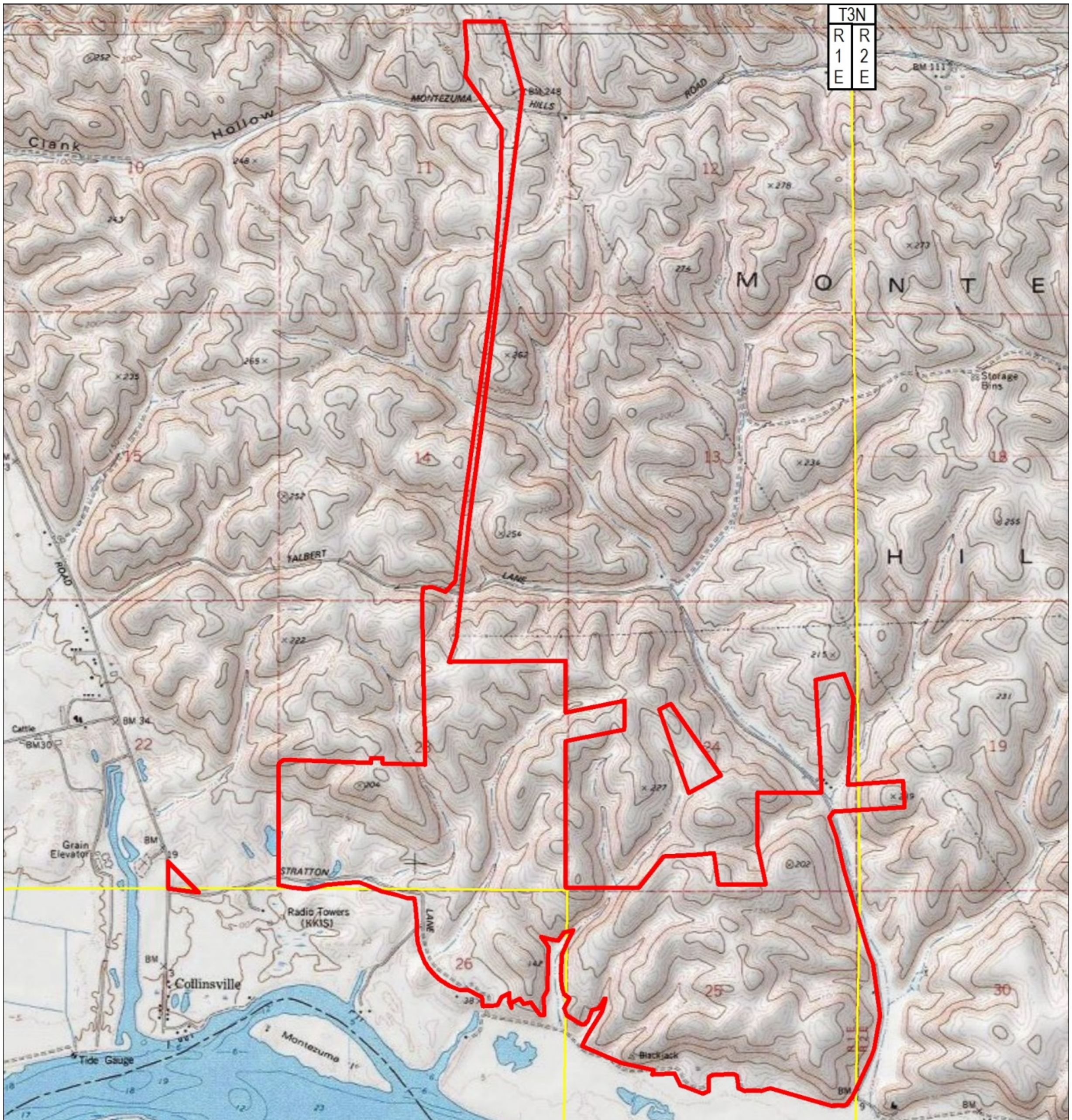
The Sacramento Municipal Utility District (SMUD) is proposing to develop the Solano Phase 4 Wind Project (Project) in the Montezuma Hills in Solano County, California (Figure 1). To determine the use of the Project area by golden eagles (*Aquila chrysaetos*) and bald eagles (*Haliaeetus leucocephalus*), Area West Environmental, Inc. (AWE) conducted nesting surveys to determine bald and golden eagle use of the Project area and vicinity following the U.S. Fish and Wildlife Service's (USFWS) *Interim Golden Eagle Technical Guidance: Inventory and Monitoring Protocols; and Other Recommendations in Support of Golden Eagle Management and Permit Issuance* (Eagle Guidance) (USFWS 2010). The information obtained during the surveys and presented in this report will be used to determine eagle use in the Project area, and will inform Project design to facilitate minimizing or eliminating eagle mortality.

1.1 Project Location and Description

The Project is located immediately east of the community of Collinsville in Solano County, California (Figure 1), specifically in portions of Sections 2, 22, 23, 24, 25, and 26; Township 3 North, and Range 1 East of the Antioch North and Bird's Landing U.S. Geological Survey 7.5-minute quadrangle maps (Figure 2). Consisting of rolling hills characteristic of the Montezuma Hills, the Project area is bordered to the south by Stratton Lane, which is just north of the Sacramento River, and to the north and east by existing SMUD wind energy generating facilities (Solano Wind Phases 1, 2, and 3). Within the 1,172-acre Project area, there are existing rows of wind turbines along the hilltops and ridgelines, which are connected by gravel roads.

The Project area also includes staging areas, which are located within the adjacent SMUD wind facilities, potential access road locations, energy collection systems (transmission lines), and a SMUD substation located just north of Montezuma Hills Road (Figures 1 and 2). SMUD proposes to replace existing wind turbines in the Project area. The Project would also include construction of new access roads, meteorological towers, and a power collection system, including a transmission line to the existing power substation.

Figure 1. Project Vicinity



SOLANO PHASE 4 WIND PROJECT

The Solano Phase 4 Project Area is located in the southeast portion of the County of Solano. The site encompasses approximately 1,172 acres.

The Project Area is located in the Antioch North and Birds Landing USGS 7.5-minute quadrangle map. The project occurs within Sections 2, 11, 14, 22, 23, 24, 25, and 26, Township 3 North, Range 1 East, and Section 19 and 30, Township 3 North, Range 2 East. A portion of sourthern area of the Project Area is unsectioned.

Center coordinates for the Project Area are:
WGS84 Latitude 38.080932, Longitude -121.827222
UTM Zone 10 South NAD83 Northing 4215443m, Easting 602855m

Data Source:
- Area West Environmental, Inc. 2016
- CH2MHILL, 2016
- ESRI ArcGIS Online, USGS and ©2013 National Geographic Society

Date: 12-6-16

Solano Phase IV Project Area
Township Range Boundary

N
0 1,000 2,000 3,000 feet
1 inch = 3,000 feet

SMUD
AREA WEST ENVIRONMENTAL, INC.

Figure 2. Project Location

2.0 Methods

2.1 Pre-field Analysis

As part of the Eagle Guidance, location data from previous eagle surveys conducted within portions of or adjacent to the Project area were reviewed for known locations of historic eagle nests, and included the following:

- Bald and Golden Eagle Survey Report for Proposed Collinsville Wind Project (Garcia and Associates [GANDA] 2011);
- Avian Use Study (for the) Collinsville Wind Power Project (Curry and Kerlinger, LLC 2011);
- Avian and Bat Protection Plan for the Proposed Collinsville Wind Project (ICF International 2011);
- Bird and Bat Conservation Strategy for the Shiloh 4 Wind Project (ICF International 2012);
- Final Eagle Conservation Plan (for the) Solano Wind Project Phases 1, 2, and 3 (AECOM 2014); and
- California Natural Diversity Database (CNDDB) (California Department of Fish and Wildlife [CDFW] 2017).

Known nest locations and eagle territory location data within 10 miles of the Project area that were obtained from the above sources are presented in Figure 3.

2.2 Field Surveys

According to the Eagle Guidance, two rounds of either aerial or ground-based surveys in a single season are required to determine the status of an occupied nest. The first survey should be conducted during the time of year when golden eagles are establishing nesting territories, which is generally during the winter months (December through early February) in California. During the first survey, all known eagle nests from previous seasons and all potential nesting locations (large trees, utility towers, and cliffs) should be surveyed for the presence of potential eagle mating pairs establishing nest territories. All previously-identified eagle nests should be surveyed for up to 4 hours at a distance (between 300 and 1600 meters) to determine the occupancy status of each site. A second round of surveys (conducted no less than 30 days after the first round and ideally when the young would be more than 51 days old but not yet fledged) would then be conducted to determine the nesting status of each occupied nesting territory from the first round of surveys (unoccupied [or occupied by another raptor species], failure [no young], or success [young surviving to more than 51 days]).

If a nest was determined to be potentially occupied by a bald or golden eagle, the following information would be collected during each round of surveys:

- Date of observation(s);
- Time of observation(s);
- Weather during observation(s);
- Name of observer(s);
- Location of observation(s); and
- Description of observation(s).

For each potential or occupied eagle nest, the following data will be recorded:

- Status (Unknown; Vacant; Occupied-Number of eagles [laying or non-laying]; breeding successful [chick observed to be ≥51 days-fledging]; breeding unsuccessful);
- Location (decimal degree lat/long or Universal Transverse Mercator);
- Elevation
- Age class(es) of eagles observed;
- Estimated nesting chronology (date clutch complete [with incubation behavior observed], hatch date, fledge date, date failure first observed and/or confirmed, and number of young at each visit ≥51 days);
- Photographs (surrounding landscape and nest); and
- Substrate (tree species, cliff, or structure).

Additional observations could also include:

- Presence and description of bands, patagial tags, or telemetry unit;
- Forage location;
- Prey items;
- Height of nest;
- Additional nesting substrate information;
- Aspect; and
- Nearby nesting raptors.

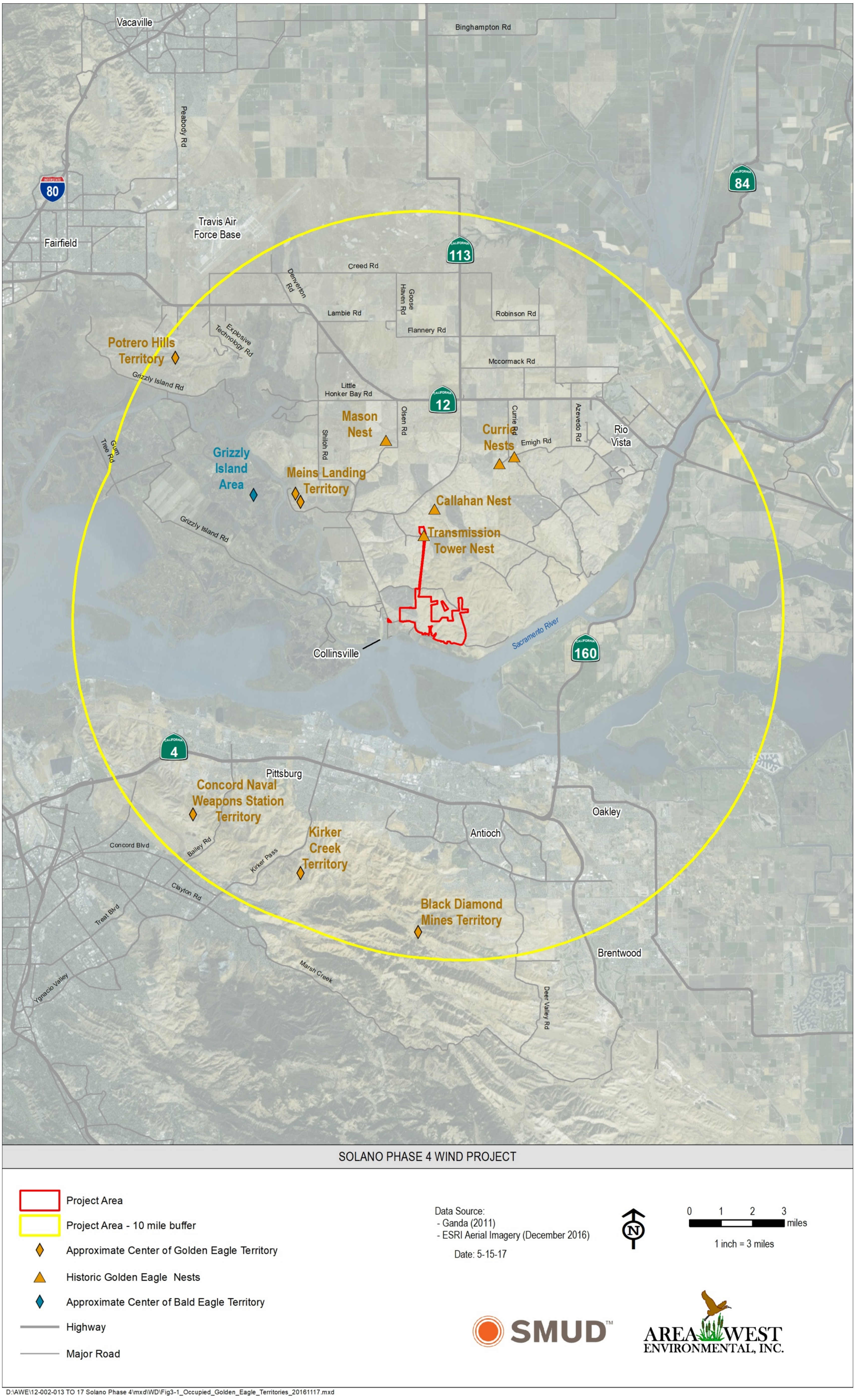


Figure 3. Known Eagle Nests and Territories within 10 Miles of the Project Area

To determine potential eagle occupancy and use of the Project area, a round of ground-based daytime surveys were conducted within the Project area and surrounding 10-mile buffer during the spring by biologist Jeff Alvarez, with assistance by biologist Mark Noyes, on March 30, 2016 and March 31, 2016, and continued by Jeff Alvarez on April 2, 2016 and April 11, 2016. As part of the survey round, all accessible nesting sites within 10 miles of the Project area were visited, with the exception of the portion of Contra Costa County located south of the cities of Antioch and Pittsburg. Although an abundance of potential nesting sites were observed in the area south of the cities of Antioch and Pittsburg, and the three known golden eagle territory locations in this area (Figure 3) were examined, due to the abundance of potential nesting sites in the area, specifically large oaks (*Quercus* sp.), not all potential nesting locations were surveyed. Despite the potential for golden eagle nesting south of the cities of Antioch and Pittsburg, it is unlikely that individuals potentially nesting in these areas would forage within the Project area due to the fact that the land between these potential nesting sites and the Project area is comprised of the cities of Antioch and Pittsburg, and the Sacramento River Delta, and lacks suitable foraging habitat.

During the second monitored breeding season, the first round of winter surveys began on November 29, 2016, though no eagles were observed. An additional survey round began on December 30, 2016, and a followup survey was completed on February 22, 2017, to satisfy the Eagle Guidance protocol.

Eagles were determined to not be utilizing previously-identified nests if either:

- An individual of another raptor species was visually observed siting on the nest,
- A non eagle was observed showing territorial behavior above the nest,
- Calls from a non eagle were heard coming from the general nest location, or
- The nest was damaged to such an extent that it could not be utilized for breeding.

2.3 Agency Coordination and Professional Contacts

Resource agency personnel and professionals from CDFW and USFWS were contacted with regard to special-status species occurrence within the action area.

2.3.1 California Department of Fish and Wildlife

On March 8, 2016, SMUD sent a letter to Craig Weightman, Region 3 Environmental Program Manager at the CDFW Bay Delta Region. The letter included a list of special-status species that have potential to occur within the Project vicinity based on species lists from CNDDB and USFWS. The letter asked if there are any additional special-status species that the CDFW believes has potential to occur within the Project vicinity, or if there are species of local concern. To date, no response has been received.

2.3.2 U.S. Fish and Wildlife Service

A letter was sent to Jan Knight, Deputy Field Supervisor at the USFWS Sacramento Fish & Wildlife Office on March 8, 2016. The letter included a list of special-status species that have potential to occur within the Project vicinity based on species lists from CNDDB and USFWS. The letter asked if there are any additional federally listed species that the USFWS believes has potential to occur within the Project vicinity, or if there are species of local concern. To date no response has been received.

On March 31, 2016, Jose Bodipo-Memba and Ammon Rice of SMUD, Becky Rozumowicz with AWE, and Bridget Canty with CH2M HILL had a conference call with Heather Beeler and Robert Doster of the USFWS to discuss proposed eagle survey methods. During that call Ms. Beeler stated that the USFWS would like early season surveys (December - Feburary) to be included in the methods in order to identify whether there is eagle breeding territory within the Project area.

On April 21, 2016, Becky Rozumowicz with AWE sent a follow up email concerning the March 31 conference call to Ms. Beeler and Mr. Doster with the USFWS. The email included a letter outlining the proposed eagle survey methods for the Project. In addition, the letter requested any additional information the USFWS may have on nesting eagles and territories, and comments on the methods proposed. Resumes of proposed surveyors were also attached for the USFWS's approval. Mr. Doster responded via email on May 3, 2016 with approval of the surveyors. Regarding the request for additional eagle nest data, Mr. Doster stated that the USFWS did not have any further data beyond what was cited in the letter. He also agreed that the proposed survey methods are appropriate. However, given that it was a little late in the nesting season for 2016, Mr. Doster stated that the USFWS recommends considering doing a second round of surveys, appropriately timed during the next nesting season.

3.0 Results

3.1 Pre-field Analysis

Based on a literature review and the CNDDB, five golden eagle nests were previously identified within 10 miles of the Project area (Figure 3). In addition, six golden eagle territories and one bald eagle territory were observed within 10 miles of the Project area (Figure 3) (GANDA 2011).

3.2 Field Surveys

During the 2016 spring eagle surveys, no eagles were detected at any of the previously identified nest locations (Table 1, Figure 4). With the exception of the Transmission Tower Nest, which was located inside the Project area and was too damaged and small to be used, all of the previously identified eagle nests were occupied by other raptor species (Table 1, Figure 4). Although no new eagle nests were observed within 10 miles of the Project area, a golden eagle was observed foraging approximately 0.25 mile northeast of the Project area along Talbert Lane. Juvenile bald eagles were observed on March 31, 2016 by biologists Jeff Alvarez and Mark Noyes foraging with a group of turkey vultures (*Cathartes aura*) and crows (*Corvus brachyrhynchos*) just west of the Project area, and on April 5, 2016 by biologist Patrick Martin just east of the Project area (Figure 4).

Table 1. Status of Previously Identified Eagle Nests

Nest Location	Survey	Species Observed	Notes
Mason Nest	Spring/Winter 2016	Red-tailed hawk (*Buteo jamaicensis*)	Individual red-tailed hawk calling from grove of trees containing nest.
Currie Nest (East)	Spring/Winter 2016	Great-horned owl (*Bubo virginianus*)	Great-horned owl observed flying out of tree containing nest.
Currie Nest (West)	Spring/Winter 2016	Red-tailed hawk (*Buteo jamaicensis*)	Red-tailed hawk observed sitting on nest.
Callahan Nest	Spring/Winter 2016	Swainson's hawk (*Buteo swainsoni*)	Individual Swainson's hawk calling from grove of trees containing nest.
Transmission Tower Nest	Spring/Winter 2016	None	Stick nest was too damaged and small to be utilized by raptors.

No eagles were observed in or around the Project area during the 2016-2017 winter eagle surveys (November 29, 2016, December 30, 2016, and February 22, 2017). More than 100 foraging red-tailed hawks were observed, along with many other species during the November 29, 2016 survey. During the February 22, 2017 survey, a great-horned owl was observed nesting near Latrobe Road (Figure 4). Appendix A lists all bird species observed during the spring and winter surveys.

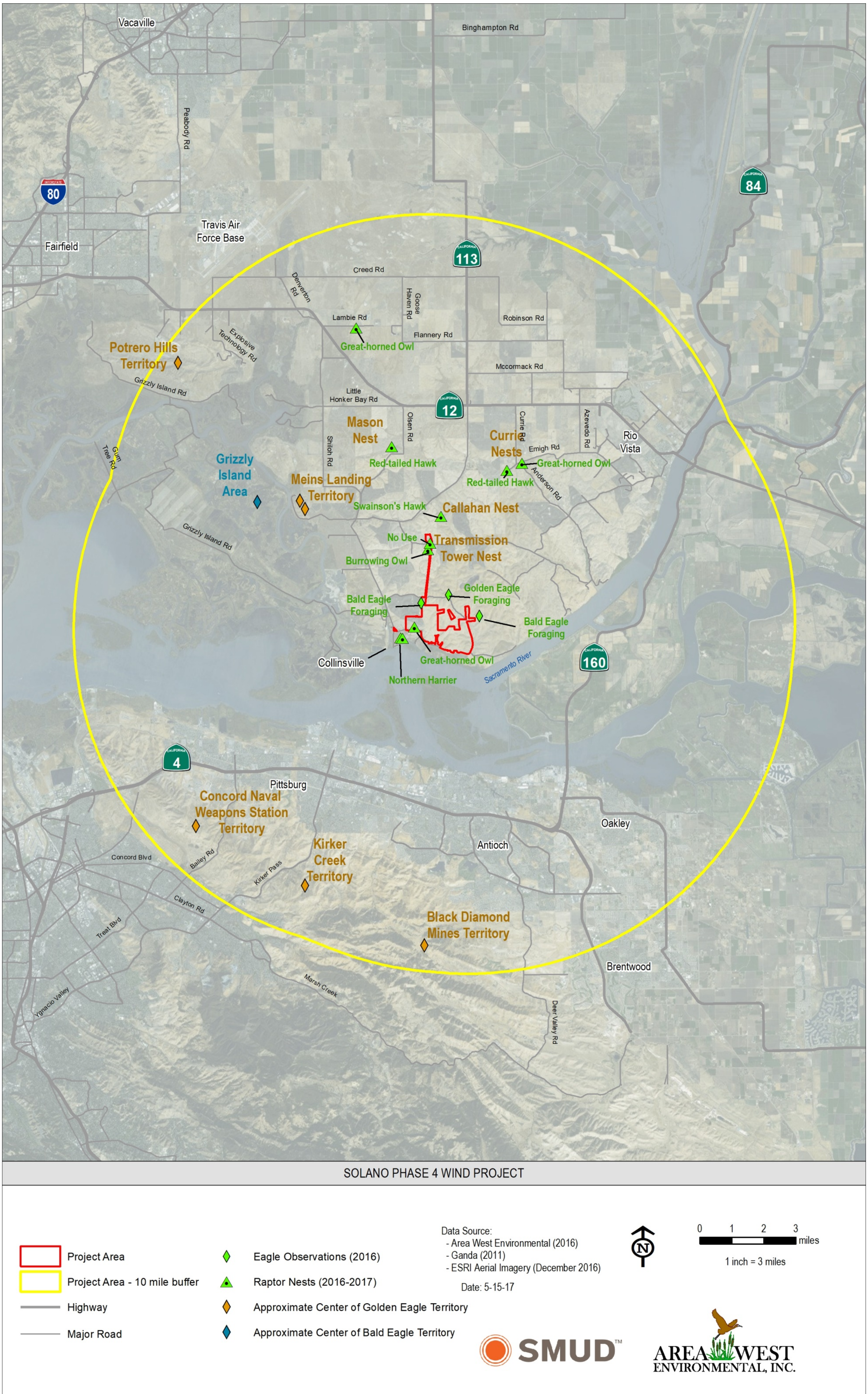


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Figure 4. Nests and Eagle Sightings in the Project Area

4.0 Conclusions

No active eagle nests were observed inside or within 10 miles of the Project area during the 2016 and 2017 surveys. However, foraging eagles were observed near the Project area during other surveys, which suggests that eagles have potential to utilize the Project area for foraging habitat. Although all of the intact previously identified golden eagle nests were occupied by other raptors at the time of the survey in spring 2016, raptor occupancy of stick nests can vary year-to-year, and the nests could become reoccupied by golden eagles in the future. For this reason, a round of winter surveys were recommended to further document the potential for and extent of eagle utilization of the Project area and surrounding region for nesting and foraging habitat. Winter surveys began on November 29, 2016, with a second survey on December 30, 2016, and a final followup survey on February 22, 2017. No eagles were observed during the winter survey, foraging or nesting.

5.0 References

AECOM. 2014. Final Eagle Conservation Plan Solano Wind Project Phases 1, 2, and 3. Prepared for SMUD. August 2014.

California Department of Fish and Wildlife. 2016. California Natural Diversity Database. Available at: https://www.dfg.ca.gov/ biogeodata/cnddb/mapsanddata.asp. Accessed March 1, 2016.

Curry & Kerlinger, LLC. 2011. Avian Use Study Collinsville Wind Power Project, Solano County, California. Prepared for Pacific Gas & Electric Company. March 2011.

GANDA. 2011. Bald and Golden Eagle Survey Report for Proposed Collinsville Wind Project. Prepared for Pacific Gas & Electric Company. June 2011.

ICF International. 2011. Avian and Bat Protection Plan for the Proposed Collinsville Wind Project. Prepared for Pacific Gas & Electric Company. September 2011.

ICF International. 2012. Bird and Bat Conservation Strategy for the Shiloh 4 Wind Project. Prepared for Shiloh 4 Wind Project LLC. August 2012.

USFWS. 2010. Interim Golden Eagle Technical Guidance: Inventory and Monitoring Protocols; and Other Recommendations in Support of Golden Eagle Management and Permit Issuance. February 2010.

Appendix A. List of Bird Species Observed in Project Area

Table A-1: Bird Species Observed During Eagle Surveys

Scientific Name	Common Name	Family	Status[1] Federal/State
Agelaius phoeniceus	red-winged blackbird	Icteridae	--/--
Anas clypeata	northern shoveler	Anatidae	--/--
Anas platyrhynchos	mallard	Anatidae	--/--
Aphelocoma californica	western scrub-jay	Corvidae	--/--
Ardea alba	great egret	Ardeidae	--/--
Ardea Herodias	great blue heron	Ardeidae	--/--
Aquila chrysaetos	golden eagle (foraging)	Accipitridae	--/FP
Branta canadensis	Canada goose	Anatidae	--/--
Bubo virginianus	great horned owl	Strigidae	--/--
Bucephala albeola	bufflehead	Anatidae	--/--
Buteo jamaicensis	red-tailed hawk	Accipitridae	--/--
Buteo regalis	ferruginous hawk	Accipitridae	--/WL
Buteo swainsoni	Swainson's hawk	Accipitridae	--/ST
Calidris spp.	least or western sandpiper	Scolopacidae	--/--
Cathartes aura	turkey vulture	Cathartidae	--/--
Charadrius vociferus	killdeer	Charadriidae	--/--
Circus cyaneus	northern harrier	Accipitridae	--/SSC
Colaptes auratus	northern flicker	Picidae	--/--
Columba livia	rock dove	Columbidae	--/--
Corvus corax	common raven	Corvidae	--/--
Elanus leucurus	white-tailed kite	Accipitridae	--/FP
Euphagus cyanocephalus	Brewer's blackbird	Icteridae	--/--
Falco columbarius	merlin	Falconidae	--/WL
Falco sparverius	American kestrel	Falconidae	--/--
Fulica americana	American coot	Rallidae	--/--
Haemorhous mexicanus	house finch	Fringillidae	--/--
Haliaeetus leucocephalus	bald eagle (foraging)	Accipitridae	DL/FP, Endangered
Hirundo rustica	barn swallow	Hirundinidae	--/--
Lanius ludovicianus	loggerhead shrike	Laniidae	--/SSC
Larus delawarensis	ring-billed gull	Laridae	--/--
Larus occidentalis	western gull	Laridae	--/--
Megaceryle alcyon	belted kingfisher	Alcedinidae	--/--
Meleagris gallopavo	wild turkey	Phasiandae	--/--
Melospiza melodia	song sparrow	Emberizidae	--/SSC
Melozone crissalis	California towhee	Emberizidae	--/--
Mimus polyglottos	northern mockingbird	Mimidae	--/--
Passerculus sandwichensis	savannah sparrow	Emberizidae	--/--
Phalacrocorax auritus	double-crested cormorant	Phalacrocracidae	--/--
Phasianus colchicus	ring-necked pheasant	Phasiandae	--/--
Sayornis nigricans	black phoebe	Tyrannidae	--/--
Sayornis saya	Say's phoebe	Tyrannidae	--/--
Spinus psaltria	lesser goldfinch	Fringillidae	--/--
Streptopelia decaocto	Eurasian collard dove	Columbidae	--/--
Sturnella neglecta	western meadowlark	Icteridae	--/--
Sturnus vulgaris	European starling	Sturnidae	--/--
Tringa melanoleuca	greater yellowlegs	Scolopacidae	--/--
Tyrannus verticalis	western kingbird	Tyrannidae	--/--
Xanthocephalus xanthocephalus	Yellow-headed blackbird	Icteridae	--/SSC

Table A-1: Bird Species Observed During Eagle Surveys

Scientific Name	Common Name	Family	Status[1] Federal/State
Zenaida macroura	mourning dove	Columbidae	--/--
Zonotrichia atricapilla	golden-crowned sparrow	Emberizidae	--/--
Zonotrichia leucophrys	white-crowned sparrow	Emberizidae	--/--
**Struthio camelus*	*ostrich	*Struthionidae	--/--

*Note: Ostrich was in private property and was not a wild bird.

[1]Status explanations:

-- = no listing.

Federal
FE = listed as endangered under the federal Endangered Species Act.
FT = listed as threatened under the federal Endangered Species Act.
FC = Candidate to be listed under the federal Endangered Species Act.

State
SE = listed as endangered under the California Endangered Species Act.
ST = listed as threatened under the California Endangered Species Act.
FP = designated as a fully protected species under the CFGC.
CT = candidate threatened
SSC = state species of special concern

Preliminary Jurisdictional Determination

SOLANO PHASE 4 WIND PROJECT

PRELIMINARY JURISDICTIONAL DETERMINATION
SOLANO COUNTY, CALIFORNIA

Prepared for:

Sacramento Municipal Utility District
6201 S Street
Sacramento, California, 95817
Contact: Jose Bodipo-Memba
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July 2017

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Tables, Figures, Appendices, and Exhibits

Tables

Figures

Appendices and Exhibits

List of Acronyms

AWE	Area West Environmental, Inc.
CFR	Code of Federal Regulations
CWA	Clean Water Act
FAC	facultative plants
FACU	facultative upland plants
FACW	facultative wetland plants
GIS	Geographic Information System
GPS	Global Positioning System
HUC	Hydrologic Unit Code
NHSL	National Hydric Soil List
NRCS	Natural Resources Conservation Service
NL	not listed
NWI	National Wetland Inventory
NWPL	National Wetlands Plant List
OBL	obligate wetland plants
OHWM	ordinary high water mark
PJD	Preliminary Jurisdictional Determination
Project	Solano Phase IV Wind Project
SMUD	Sacramento Municipal Utility District
TNW	Traditional Navigable Water
UPL	obligate upland plants
Corps	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WRCC	Western Regional Climate Center
WGS84	World Geodetic System 1984 WGS84
WRMS	Western Regional Monitoring Station

1.0 SUMMARY OF FINDINGS

This Preliminary Jurisdictional Determination (PJD) report summarizes the results of a delineation to determine potential waters of the U.S. under the jurisdiction of the U.S. Army Corps of Engineers (Corps) pursuant to Section 404 of the Clean Water Act (CWA) for the Sacramento Municipal Utility District (SMUD) Solano Phase 4 Wind Project (Project). This PJD indicates that waters of the U.S., including wetlands, are present in the Project area (Table 1). The findings of this report are considered preliminary, subject to review by the Corps during the verification process. Implementation of the Project may require the Project proponent to obtain a Section 404 permit.

A total of 14.692 acres of potential waters of the U.S. were identified at the 1,172-acre Project area (Table 1 and Exhibit A), comprised of the 14.481 acres of the following wetland vegetation communities: alkaline pool, brackish marsh, perennial swale, seasonal swale, seasonal wetland, and wetland ditch. A total of 0.211 acre of other waters of the U.S. were identified in the Project area, comprised of open water and ephemeral drainage vegetation communities.

Table 1. Potential Waters of the U.S. Identified in the Project Area

Feature Type	Area (acres)	Length (feet)
Wetlands		
Alkali Pool	0.086	N/A
Brackish Marsh	2.420	N/A
Perennial Swale	0.681	N/A
Seasonal Swale	11.076	N/A
Seasonal Wetland	0.170	N/A
Wetland Ditch	0.048	313.3
Wetlands Subtotal	*14.481*	*313.3*
Other Waters		
Open Water	0.053	N/A
Ephemeral Drainage	0.158	648.2
Other Waters Subtotal	*0.211*	*648.2*
Total Waters	**14.692**	**961.5**

2.0 INTRODUCTION

Area West Environmental, Inc. (AWE) was retained by SMUD to conduct a delineation of waters of the U.S., including wetlands, for the proposed Project area outside the unincorporated community of Collinsville, Solano County, California and prepare a PJD report.

SMUD proposes to replace up to 18 of the existing wind turbines in the Project area. These turbines would be south of, and adjacent to, the previously constructed SMUD Solano Wind Phase 1, 2, and 3 projects within the Montezuma Hills. The Project would include construction of new access roads, meteorological towers, and a power collection system, including a transmission line to the existing power substation.

2.1 Project Location

The Project is located immediately east of the community of Collinsville in Solano County, California (Figure 1). Specifically, the Project is located in portions of Sections 2, 22, 23, 24, 25, and 26; Township 3 North, and Range 1 East of the Antioch North and Bird's Landing U.S. Geological Survey (USGS) 7.5-minute quadrangle maps (Figure 2).

2.2 Site Description

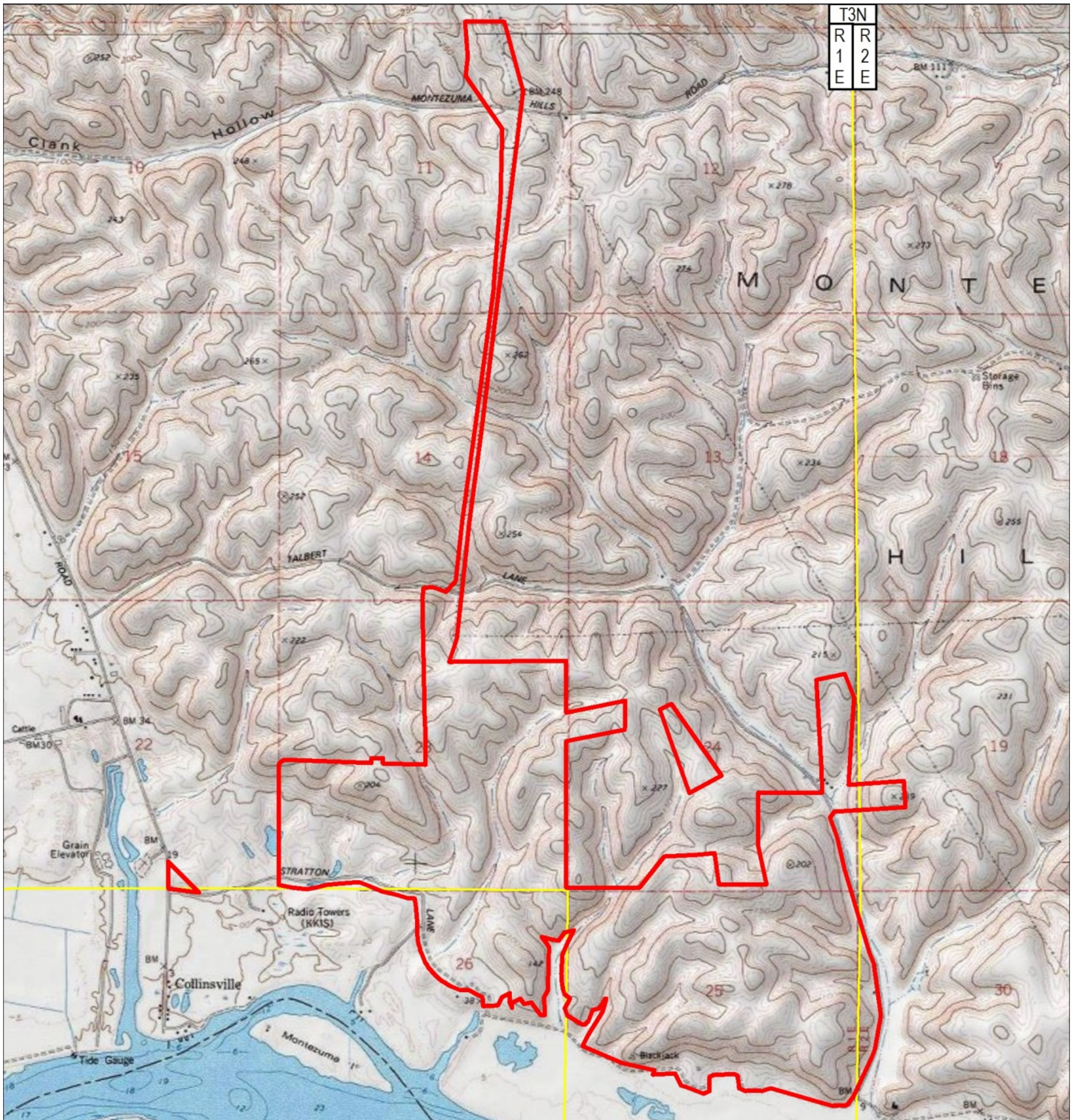
Consisting primarily of rolling hills characteristic of the Montezuma Hills, the 1,172-acre Project area is bordered to the south by Stratton Lane, which is just north of the Sacramento River, and to the north and east by existing SMUD wind energy generating facilities (Solano Wind Phases 1, 2, and 3). Within the Project area, there are existing rows of wind turbines along the hilltops and ridgelines that are connected by gravel roads. The Project area also includes staging areas which are located within the adjacent SMUD wind facilities, potential access road locations, energy collection systems (transmission lines), and a SMUD substation located just north of Montezuma Hills Road (Figures 1 and 2).

In addition to an existing wind farm in the Project area, land uses also include wheat cultivation and livestock grazing. Farming within the Project area is conducted in phases, with different portions of the Project area planted on a three-year cycle. Most of the Project area, with the exception of the flat, alkaline areas located just north of the Sacramento River/San Joaquin River Delta, is regularly disked on a semi-annual basis (Figure 3).

2.3 Driving Directions

Heading west on Interstate 80 from Sacramento: Take the exit for Pedrick Road (Exit 67) in Dixon. Head south on Pedrick Road for 9.6 miles before turning west onto Binghamton Road. Continue on Binghamton Road for 1 mile and turn south onto Highway 113. Stay on Highway 113 for 13.2 miles and turn east onto Highway 12. After 1.5 miles on Highway 12, turn south onto Currie Road. Continue on Currie Road for 1.8 miles before turning east on Emigh Road. After 0.2 mile on Emigh Road, turn south onto Anderson Road. Continue on Anderson Road for 2.3 miles before turning south on Montezuma Hills Road. After 1.8 miles, when Montezuma Hills Road makes a 90 degree turn west, turn east onto Toland Lane to arrive at the SMUD office.

Figure 1. Project Vicinity



SOLANO PHASE 4 WIND PROJECT

The Solano Phase 4 Project Area is located in the southeast portion of the County of Solano. The site encompasses approximately 1,172 acres.

The Project Area is located in the Antioch North and Birds Landing USGS 7.5-minute quadrangle map. The project occurs within Sections 2, 11, 14, 22, 23, 24, 25, and 26, Township 3 North, Range 1 East, and Section 19 and 30, Township 3 North, Range 2 East. A portion of sourthern area of the Project Area is unsectioned.

Center coordinates for the Project Area are:
WGS84 Latitude 38.080932, Longitude -121.827222
UTM Zone 10 South NAD83 Northing 4215443m, Easting 602855m

Data Source:
- Area West Environmental, Inc. 2016
- CH2MHILL, 2016
- ESRI ArcGIS Online, USGS and ©2013 National Geographic Society

Date: 12-6-16

Solano Phase IV Project Area
Township Range Boundary

0 1,000 2,000 3,000 feet

1 inch = 3,000 feet

SMUD™ AREA WEST ENVIRONMENTAL, INC.

Figure 2. Project Location

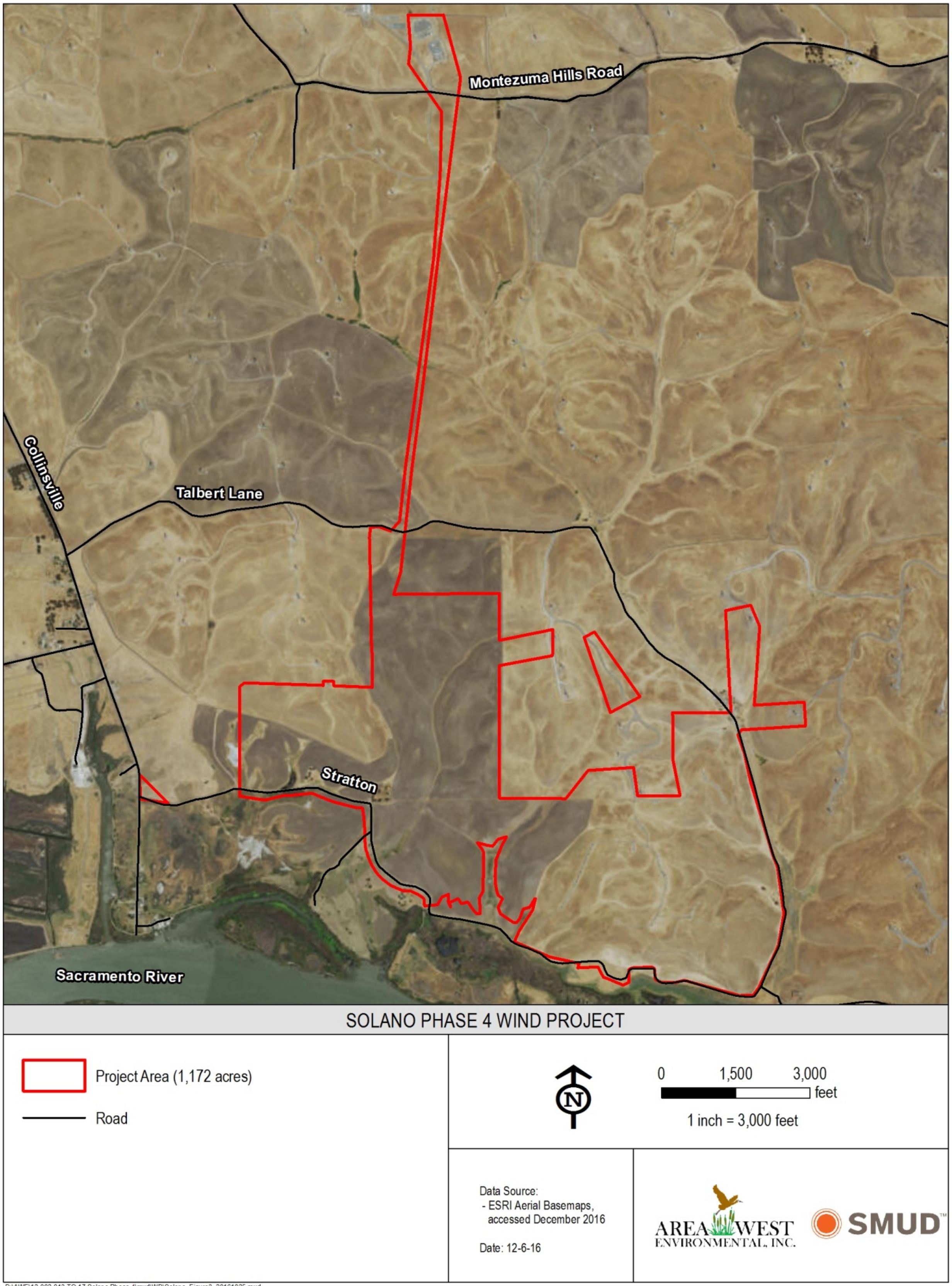


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Figure 3. Project Overview

From the office, drive back to Montezuma Hills Road and continue west for 4.8 miles before turning west onto Bird's Landing Road. After 1.4 miles, turn south onto Collinsville Road. Continue on Collinsville Road for 3.8 miles before turning east onto Stratton Lane. A small portion of the Project area is located at the northeast corner of the intersection of Collinsville Road and Stratton Lane. The remainder of the Project site begins approximately 1-quarter mile further east Stratton Lane on the north side of the road.

3.0 DEFINITIONS

Certain terms used throughout this report have specific meanings that relate to the wetland delineation process, as specified by the *Corps of Engineers Wetland Delineation Manual* (Environmental Laboratory 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)* (Corps 2008a). These terms are described briefly below.

"Waters of the U.S." is the encompassing term for areas that qualify for federal regulation under Section 404 of the CWA. Waters of the U.S. include "wetlands" and "other waters of the U.S." For regulatory purposes, wetlands are defined as:

> Areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (Code of Federal Regulations [CFR] 328.3, 230.3).

Wetlands under Corps jurisdiction must have the following field indicators:

1. A prevalence of hydrophytic vegetation (i.e., "water loving" species with "obligate," "facultative wetland," or "facultative" wetland indicator status [Lichvar et al. 2016]);

   Plant wetland indicator statuses from *The National Wetland Plant List: 2016 Update of Wetland Ratings* (NWPL) (Lichvar, et al. 2016) are abbreviated as follows:

   - OBL = Obligate wetland plants. Almost always occur in wetlands.
   - FACW = Facultative wetland plants. Usually occur in wetlands, but may occur in non-wetlands.
   - FAC = Facultative plants. Occur in wetlands and non-wetlands.
   - FACU = Facultative upland plants. Usually occur in non-wetlands, but may occur in wetlands.
   - UPL = Obligate upland plants. Almost never occur in wetlands.
   - For species not listed in the NWPL, "NL" is used to indicate their absence in the list. These species can be assumed to be upland species.
   - An asterisk (*) denotes a wetland rating that has been assigned to a plant based on biologist local knowledge of the species' wetland occurrence frequency.

2. Hydric soils (i.e., hydric soils listed by the U.S. Department of Agriculture Natural Resources Conservation Service [NRCS] and unclassified soils that are formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part) (NRCS 2010); and

3. Wetland hydrology (evidence that episodes of inundation or soil saturation lasting more than a few days during the growing season have occurred repeatedly over a period of years and that the timing, duration, and frequency of wet conditions have

been sufficient to produce a characteristic wetland plant community and hydric soil morphology).

In the Arid West Region, growing season dates are determined through onsite observations of the following indicators of biological activity in a given year: (1) above-ground growth and development of vascular plants, and/or (2) soil temperatures. Season dates may be approximated by using WETS tables available from NRCS National Water and Climate Center to determine the median dates of 28 degree F (-2.2 degree C) air temperatures in spring and fall based on long-term records gathered at the nearest appropriate National Weather Service meteorological station (Corps 2008a).

For this report, **other waters of the U.S.** refer to waterways and other water bodies with a defined bed and bank, such as drainages, ditches, creeks, rivers, and lakes. This translates to the bank-to-bank portion of water bodies, up to the “ordinary high-water mark” (OHWM). Other waters of the U.S. may lack hydrophytic vegetation and/or evidence of hydric soils.

In 33 CFR Part 329.1, the OHWM for non-tidal rivers is defined as the line on the shore established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank; shelving; changes in the character of the soil; destruction of terrestrial vegetation; and the presence of litter and debris. The OHWM for a stream is usually determined through an examination of the recent physical evidence of surface flow in the stream channel. In dry land fluvial systems typical of the desert areas, the most common physical characteristics indicating the OHWM for a channel usually include, but are not limited to, a clear, natural scour line impressed on the bank; recent bank erosion; destruction of native terrestrial vegetation; and the presence of litter and debris (Corps 2008b, 2010).

4.0 METHODS

Wetlands were delineated using the *Corps of Engineers Wetland Delineation Manual* (Environmental Laboratory 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)* (Corps 2008a). An area must meet criteria for hydrophytic vegetation, hydric soils, and wetland hydrology to be identified as a potential wetland under Corps jurisdiction.

Water bodies that did not meet the wetland criteria were reviewed to determine if they met the definition of other waters of the U.S. (i.e., had evidence of an OHWM) (Corps 2008b, 2010).

Specific details of the delineation methods are described below.

4.1 Preliminary Review

Before field surveys were conducted, the following information was reviewed:

- General topography from the *Antioch North* and *Birds Landing*, California USGS 7.5-minute topographic quadrangle maps (Figure 2);
- Soils information from the NRCS Web Soil Survey 2016 (Figure 4, Appendix A);
- Site hydrology from visual interpretations of aerial photographs and topography at a scale of 1 inch = 200 feet (Exhibit A);
- National Wetland Inventory (NWI) maps (Figure 5) (U.S. Fish and Wildlife Service [USFWS] 2016);
- Regional hydrology data from visual observations and aerial photographic evidence of hydrologic connections to Traditional Navigable Waters (TNW) (Figure 6); and
- USGS Hydrologic Unit Code (HUC) data for California watershed boundaries (Figure 7).

4.2 Field Survey Dates and Methods

Wetland delineation fieldwork was conducted by AWE biologists Mark Noyes and Callen Keller on June 23, 2016 and by Mark Noyes on July 1, 2016; July 26, 2016; and July 27, 2016. The purpose of the fieldwork was to gather data on the vegetation, soils, and hydrology of the Project area to determine what areas; if any, met the Corps three mandatory criteria for wetlands (i.e., exhibited positive indicators of wetland vegetation, soils, and hydrology).

4.2.1 Vegetation

Vegetation within potential waters of the U.S. was recorded on Wetland Determination Data Forms (Arid West Region, Version 2) which are provided in Appendix B. Plant species not readily identifiable in the field were determined based on the *Jepson Manual: Vascular Plants of*

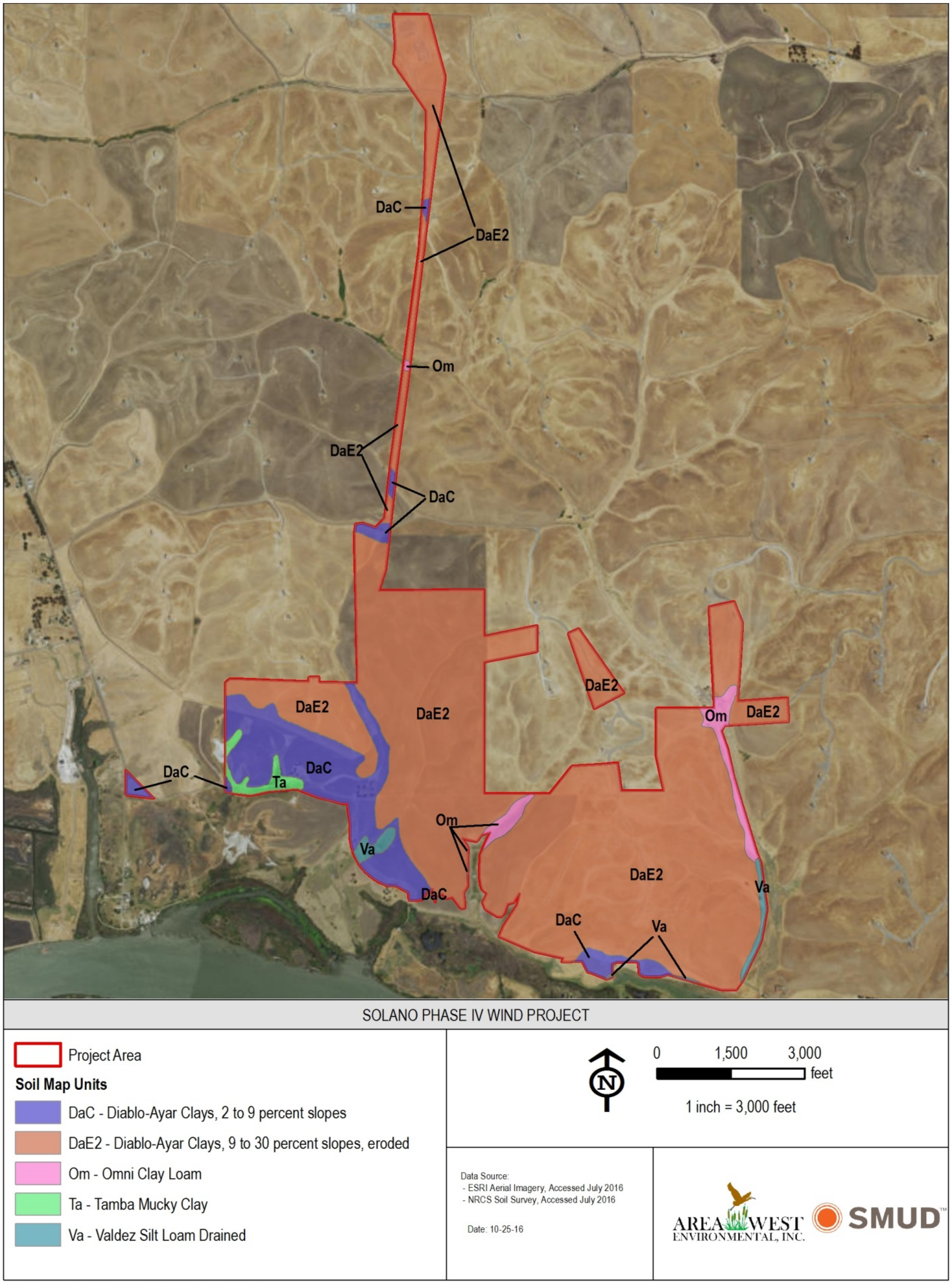

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Figure 4. Project Soils

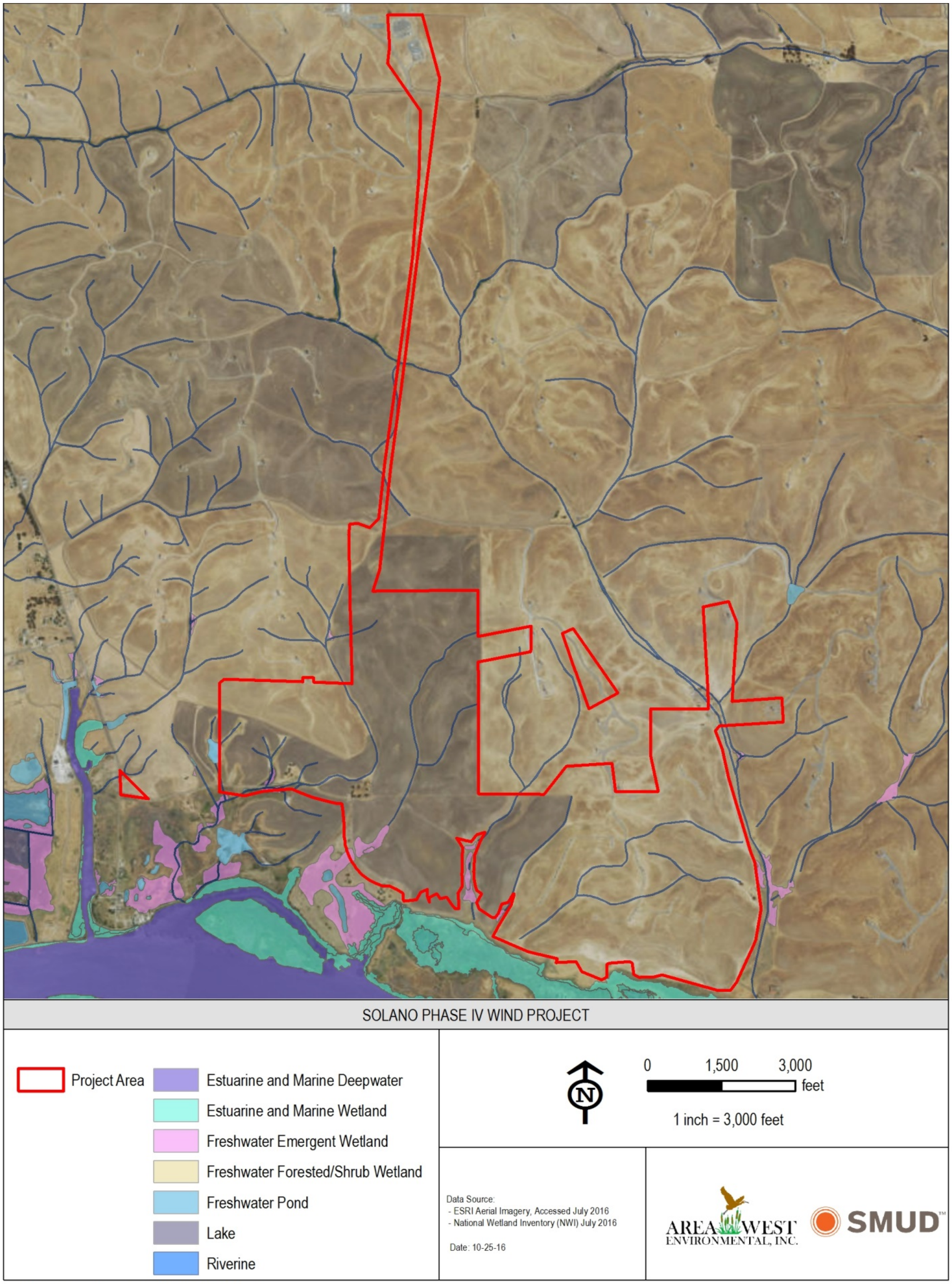

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Figure 5. National Wetlands Inventory

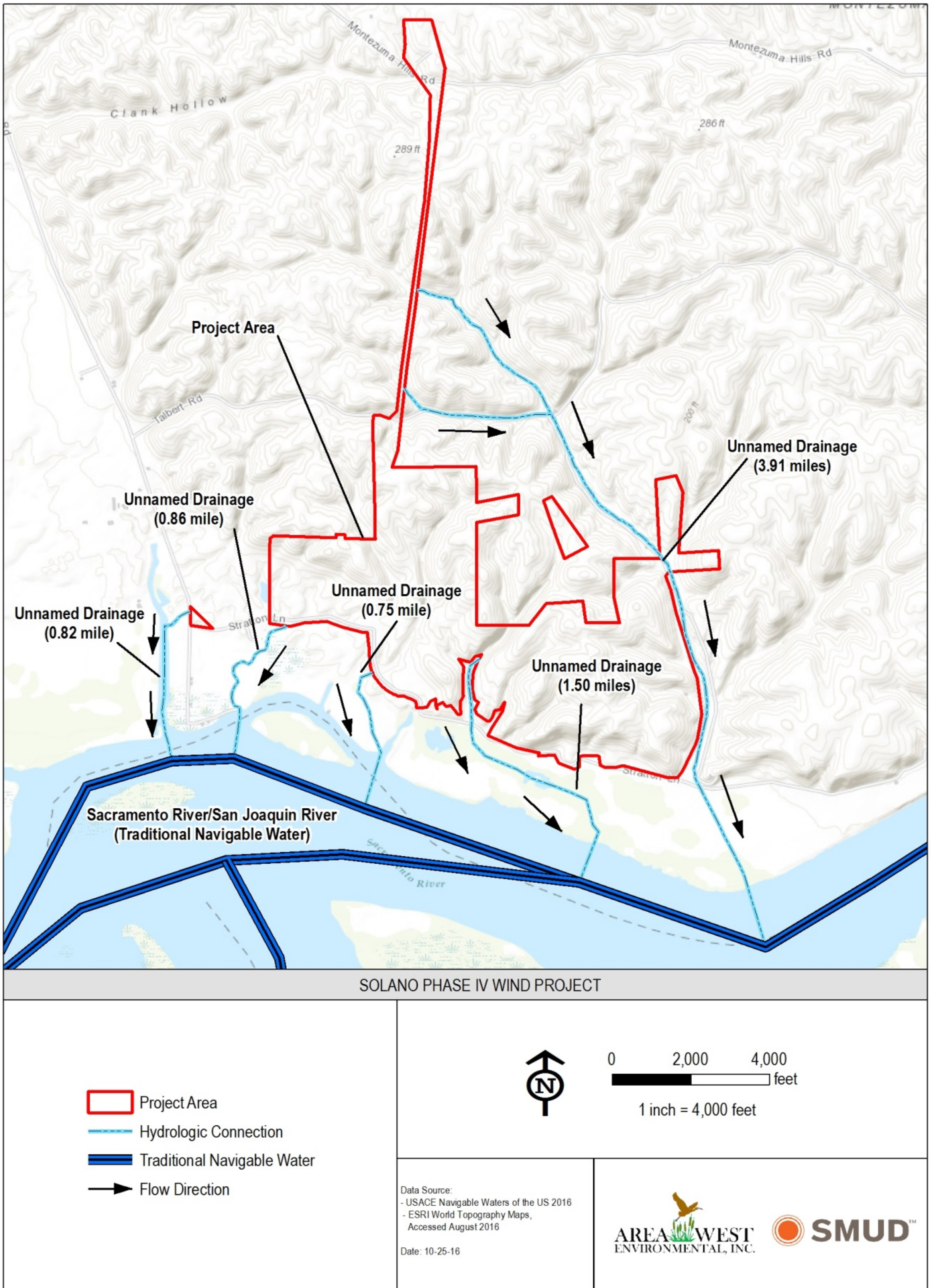

Figure 6. Project Distance to Traditional Navigable Water

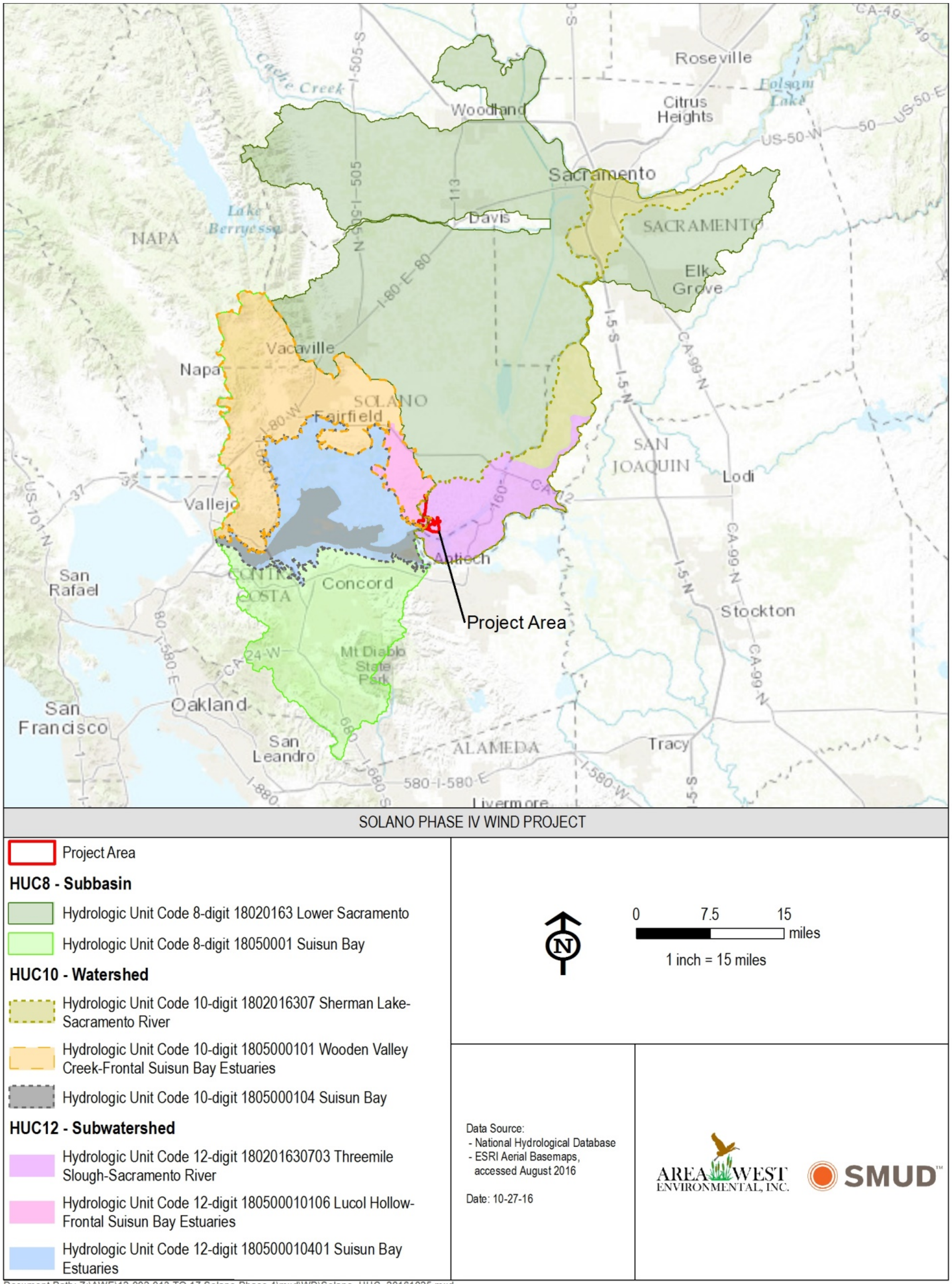

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Figure 7 Project Hydrologic Unit

California (Second Edition) (Baldwin et al. 2012). The wetland indicator status of plant species was based on *The National Wetland Plant List: 2016 Update of Wetland Ratings* (Lichvar et al. 2016).

The wetland vegetation criterion was considered met when more than 50 percent of the dominant plant species across all strata were rated OBL, FACW, or FAC or if the aerial cover of hydrophytic plant species resulted in a prevalence rating of 3.0 or less. The Corps defines "dominant" plant species as those with at least 20 percent coverage of the total canopy. The Corps defines an area to be vegetated if it has 5 percent or more total plant cover at the peak of the growing season. Those sites supporting either a dominance or prevalence of hydrophytes were further examined for indicators of wetland hydrology and hydric soils.

4.2.2 Soils

Soil texture, matrix and mottle colors, and the presence of subsoil layers impervious to water infiltration were documented from hand-excavated soil pits. Soil pits were excavated to 18 inches, where possible. Soil pits not excavated to this depth encountered restrictions to hand excavations such as dry/hard soil conditions, rock, or concrete. Soils were examined for positive hydric soil indicators such as low chromas, mottles, histic epipedons, organic layers, manganese concretions, gleization, and sulfidic odor. The color and texture of the soil layers encountered were recorded. Soil color was determined from moist soil peds using *Munsell Soil Color Charts* (Munsell 2009). Alphanumeric soil descriptions provided on the field data forms are based on those in the Munsell soil color charts.

Paired upland and wetland soil pits were evaluated in order to determine and delineate an abrupt wetland/upland boundary. Hydric soil assessments were predominately based on the guidance provided in the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)* (Corps 2008a) and the *Field Indicators of Hydric Soils in the U.S., Version 7.0* (NRCS 2010). Supplemental soil information for the regional area was also evaluated from the Web Soil Survey (NRCS 2016). Specific pit depths, soil color/texture, and other soil data obtained at each soil sample location are provided on the data forms found within Appendix B.

4.2.3 Hydrology

Areas supporting a prevalence of hydrophytic vegetation and hydric soils were further evaluated for indicators of wetland hydrology. Hydrology information was determined through field observations in order to determine the presence/absence of primary and/or secondary hydrological indicators (i.e., surface water, saturation, sediment debris or drift deposits, watermarks, soil cracks, oxidized root channels, biotic or salt crusts, or other hydrologic indicators). Wetland hydrology was also determined based on the presence of ponding (inundation) or saturation, aerial photographic signature, landscape positions, or the presence of other field indicators such as scour marks.

The site was also surveyed for water bodies (e.g., streams and ponds). A "water body" is defined as any area that in a normal year has water flowing or standing above ground to the extent that evidence of an OHWM is established (Federal Register Volume 67, Number 10, Tuesday January 15, 2002). Water bodies are not required to be dominated by hydrophytic vegetation or to have positive hydric soil indicators to be considered Corps-jurisdictional.

4.3 Data Collection

Data was collected on the general vegetation communities within the Project area, categorized by the dominant vegetation. Drainages exhibiting an OHWM were further characterized using forms provided in the *Updated Datasheet for Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States* (Corps 2010) (Appendix B). Representative photographs of the site and the features are provided in Appendix C. Two paired data points were collected to document wetland and upland boundaries for the mapped potential wetland features, and a single data point was used to document other waters.

4.4 Mapping and Acreage Calculations

The boundaries of potential wetland features were recorded using a handheld Trimble GeoXT 6000 Global Positioning System (GPS) unit with sub-meter accuracy. Data was collected in latitude/longitude in the WGS84 datum. Acreages for these features within the Project were calculated using polygon size in ArcView Geographic Information System (GIS).

5.0 RESULTS

A total of 14.692 acres of potential waters of the U.S. were identified in the 1,172-acre Project area, consisting of 14.481 acres of wetlands, and 0.211 acre of other waters of the U.S (Table 1 and Exhibit A). Habitats in the Project site are discussed further in Section 5.3, "Habitat Types."

The findings of this delineation are preliminary and subject to review and modification by the Corps. Data forms are included in Appendix B. Representative photographs are provided in Appendix C. A list of vascular plant species observed at the Project area is included in Appendix D, and the Aquatic Resources Inventory is provided in Appendix E. A request for jurisdictional determination, including a signed statement allowing Corps staff to access the Project area for the purpose of verifying the delineation, is provided in Appendix F.

5.1 Limitations to Surveys

Limitations to this survey included:

1) Survey date outside of the bloom period for some common wetland plants; due to the delineation being conducted in the mid-summer, some of the herbaceous cover was desiccated and difficult to identify. However, enough vegetation was identifiable to determine feature boundaries and types.

2) Survey dates were after the majority of the Project area was disked for wheat production. As a result, potential aquatic features could have been obscured/removed within these areas. Given the somewhat regular wheat cultivation/disking schedule at the Project area, it is unlikely that potential waters of the U.S. have potential to form/reform long enough to exhibit all three wetland criteria or an OHWM. Within the Project area, multiple NWI "Riverine" features are present in disked areas. However, due to regular disking, the majority of these features are no longer present as documented in Appendix C – Representative Photographs.

3) Annual precipitation for the 2016-2017 wet-season was below average, with a total of 13.4 inches (CIMIS 2016). Despite below-average precipitation levels, potential wetland boundaries were clearly defined by the presence/prevalence of hydrophytes.

5.2 Overview of Site Conditions

The Project is located in Solano County with an elevation that ranges from approximately 0 feet to 275 feet above mean sea level.

Freshwater Pond, Freshwater Emergent Wetland, and Riverine wetland types were identified from the NWI within the Project area (Figure 5). While the majority of the hydrologic inputs in the Project area are derived from precipitation, portions of the Project area may be occasionally flooded by the Sacramento River. Additionally, some areas appear to receive groundwater inputs, as evidenced by two capped springs in the southern portion of the Project area and an overflowing well located offsite to the west and uphill from a perennial swale in the northern linear portion of the Project area (Exhibit A).

Historic climate details for the Project are based on data collected by a Western Regional Climate Center (WRCC) at the Rio Vista monitoring station located approximately 7.1 miles northeast of the Project. Temperatures range from an average high temperature in July of 90 degrees Fahrenheit (°F) to an average low of 53 °F in January according to the WRCC (WRMS 2016). The average annual high temperature in the Project area is approximately 72 °F. The Project area receives an average of approximately 16.6 inches of annual precipitation (rain) (WRCC 2016).

The Project area is located within the HUC 8-digit Suisun Bay subbasin (18050001) and Lower Sacramento subbasin (18020163); the HUC 10-digit Suisun Bay watershed (HUC 1805000104), Wooden Valley Creek Frontal Suisun Bay Estuaries watershed (1805000101), Sherman Lake – Sacramento River watershed (1802016307); and the 12-digit Suisun Bay Estuaries subwatershed (180500010401), Lucol Hollow – Frontal Suisun Bay Estuaries subwatershed (180500010106), and the Threemile Slough – Sacramento River subwatershed (180201630703) (Figure 7).

Located immediately north of the portion of the Sacramento River/San Joaquin River Delta that transitions to the Suisun Bay, hydrologic flows from the Project drain south into the Sacramento River/San Joaquin River Delta, a TNW (Figure 6).

5.3 Soils

Five soil map units are present within the Project area (Figure 4) and include:

- Diablo-Ayar clays, 2 to 9 percent slopes;
- Diablo-Ayar clays, 9 to 30 percent slopes, eroded;
- Omni clay loam;
- Tamba mucky clay; and
- Valdez silt loam drained.

Each soil map unit present in the Project area is described in detail in the NRCS Web Soil Survey, including landform position, horizon textures, depth to restrictive layer, and drainage class (Appendix A). The Omni clay loam, Tamba mucky clay, and Valdez silt loam drained soil map units are listed in the National Hydric Soil List (NHSL) (NRCS 2015). No other soil map units within the Project area are listed in the NHSL.

5.4 Vegetation Communities

A total of 11 vegetation communities were identified at the Project area, including:

- agricultural;
- annual grassland;
- developed;
- alkali pool;
- brackish marsh;
- ephemeral drainage;
- open water;
- perennial swale;
- seasonal swale;

- seasonal wetland; and
- wetland ditch.

The boundaries of all potential waters of the U.S. are shown in Exhibit A, and the following sections describe all vegetation communities observed at the Project area.

5.4.1 Agricultural

The majority of the Project area consists of land that is farmed for wheat (*Triticum aestivum*) (NL) in various stages of crop rotation. In the late winter and spring of 2016, the western half of the Project area was in active wheat production, and these areas of the vegetation community were dominated by wheat. Other plants in the active wheat cultivation area consisted primarily of annual grass species including ripgut brome (*Bromus diandrus*) (NL) and Italian ryegrass (*Festuca perennis*) (FAC) with occasional wild radish (*Raphanus sativus*) (NL).

In the eastern half of the Project area, which was fallow at the time of the June survey, annual grasses were dominant, and consisted primarily of soft chess brome (*Bromus hordeaceus*) (FACU), wild oats (*Avena barbata*) (NL), and hare barley (*Hordeum murinum* ssp. *leporinum*) (FACU). The agricultural vegetation community, both active and fallow, is disked at regular intervals, with the entire vegetation community disked between the June 1 and July 26 site visits.

Data points H and M in Appendix B are representative of the vegetation, soils, and indicators of hydrology of agricultural habitat.

Vegetation. Plants in this vegetation community were entirely herbaceous and consisted mainly of non-native annual grasses including wheat, soft chess brome, wild oats, Italian ryegrass, and Mediterranean barley (*Hordeum marinum* ssp. *gussoneanum*) (FAC). Forbs, including prickly lettuce (*Lactuca serriola*) (FACU) and arroyo lupine (*Lupinus succulentus*) (NL) was also present in this vegetation community. Saltgrass (*Distichlis spicata*) (FAC) were also present at the base of hills where soils had relatively higher salt levels than the hillsides.

Soils. No indicators of hydric soils were observed in this vegetation community.

Hydrology. Surface Soil Cracks (B6), a wetland hydrology indicator, were observed within many areas of this vegetation community.

Justification for Non-jurisdictional Status. Although an indicator of hydrology was present in the agricultural habitat, this represents an upland vegetation community dominated by upland herbaceous species with no observable indicators of hydric soils. This vegetation community is not considered a wetland or an other waters of the U.S., and is not subject to jurisdiction by the Corps.

5.4.2 Annual Grassland

Annual grassland consists primarily of non-native annual grasses with a small forb component. This vegetation community is present in areas generally too steep to cultivate for wheat production, is not disked, and may be grazed by sheep.

Data points B, J, and U in Appendix B are representative of the vegetation, soils, and indicators of hydrology of annual grassland habitat.

Vegetation. Plants in this vegetation community were entirely herbaceous and consisted mainly of non-native annual grasses including ripgut brome, soft chess brome, wild oats, and saltgrass. When present, especially in areas that were heavily grazed, non-native forbs were abundant, including bull thistle (*Cirsium vulgare*) (FACU), bristly ox-tongue (*Helminthotheca echioides*) (FAC), and shortpod mustard (*Hirschfeldia incana*) (NL).

Soils. No indicators of hydric soils were observed in this vegetation community.

Hydrology. Common to many of the upland areas of the Project area, Surface Soil Cracks (B6) were observed in this vegetation community at Data Points B, J, and U.

Justification for Non-jurisdictional Status. Although an indicator of hydrology was present in the annual grasslands, this represents an upland vegetation community dominated by upland herbaceous species with no observable indicators of hydric soils. This vegetation community is not considered a wetland or an other waters of the U.S., and is not subject to jurisdiction by the Corps.

5.4.3 Developed

This vegetation community includes current and former residences in the Project area, roads with associated gravel shoulders, and wind turbine sites. When vegetation is present, it consists primarily of annual grasses, ornamental trees, and ruderal non-native forbs. Goat grazing occurs in many of these areas, and the edges of roads can be mowed or disked to reduce potential fire hazards.

Data points O and R (taken along roadsides) in Appendix B are representative of the vegetation, soils, and indicators of hydrology of developed habitat.

Vegetation. Roadside vegetation consisted almost entirely of non-native annual grasses, including ripgut brome, soft chess brome, Bermuda grass (*Cynodon dactylon*) (FACU) with occasional forbs including prickly lettuce, bristly ox-tongue, yellow starthistle (*Centaurea solstitialis*) (NL). Near former and current residences, species also included red gum (*Eucalyptus camaldulensis* (FAC), Peruvian pepper tree (*Schinus molle*) (FACU), and bull mallow (*Malva nicaeensis*) (NL).

Soils. No indicators of hydric soils were observed in this vegetation community.

Hydrology. No indicators of wetland hydrology were observed in this vegetation community.

Justification for Non-jurisdictional Status. The developed vegetation community represents an upland, and does not support hydrophytic vegetation. Furthermore, no indicators of hydrology were observed in this vegetation community. This vegetation community is not considered a wetland or an other waters of the U.S., and is not subject to jurisdiction by the Corps.

5.4.4 Alkali Pool

A seasonal alkali pool is located at the edge of an annual swale/brackish marsh complex along the southern boundary of the Project area (Exhibit A). As a result of a seasonal hydroperiod and soils with high salt concentrations, this vegetation community is comprised almost entirely of pickleweed (*Salicornia pacifica*) (OBL*) along the slopes and edges of the feature with alkali weed (*Cressa truxillensis*) (FACW) in the bottom. This vegetation community consists of a single aquatic feature that corresponds to a feature mapped as “Freshwater Pond” in the NWI (Figure 6).

Data Point Q is representative of the vegetation, soils, and hydrologic indicators of the alkali pool community.

Vegetation. Vegetation in the alkali seasonal wetland vegetation community was dominated by hydrophytic vegetation and consisted of pickleweed and alkali weed.

Soils. At Data Point Q, Depleted Matrix (F3), a hydric soil indicator, was observed (Appendix B).

Hydrology. At Data Point Q, Surface Soil Cracks (B6), a wetland hydrology indicator, was observed (Appendix B).

Justification for Jurisdictional Status. Based on the prevalence of hydrophytic vegetation, hydric soil indictors, and indicators of wetland hydrology, this habitat is considered a wetland, and is Corps-jurisdictional.

5.4.5 Brackish Marsh

This vegetation community occurs along the southern edge of the Project area in a low, depressional portion of a large seasonal swale complex. Bisected by Stratton Road, which functions as an impoundment to the brackish marsh, portions of this vegetation community are inundated/saturated throughout most of the year. As a result, it supports emergent marsh vegetation typical of freshwater perennial marshes (i.e., cattails [*Typha* spp.] [OBL], tules [*Schoenoplectus acutus*] [OBL], and chairmaker’s club-rush [*Schoenoplectus americanus*] [OBL]). Due to elevated salt concentrations in the soil and water however, this vegetation community also supports salt-tolerant species, including seacoast bulrush (*Bolboschoenus robustus*) (OBL), saltmarsh sandspurry (*Spergularia marina*) (OBL), and western sea-purslane (*Sesuvium verrucosum*) (FACW). This vegetation community correspond to portions of NWI-mapped “Riverine” and “Freshwater Emergent Wetland” aquatic features (Figure 6 and Exhibit A).

Data Point N is representative of the vegetation, soils, and hydrologic indicators of the brackish marsh vegetation community.

Vegetation. Vegetation observed at the edge of this vegetation community included chairmaker’s club-rush, verrucosa seapurslane, saltgrass, and rabbitsfoot grass (*Polypogon monspeliensis*) (FACW). In the deeper portions of the vegetation community, cattails and tules were also present. Shallower portions of this vegetation community were occasionally dominated by dense patches of Mexican rush (*Juncus mexicanus*) (FACW).

Soils. At Data Point N, indicators of hydric soil including Depleted Below Dark Surface (A11) and Depleted Matrix (F3) were observed (Appendix B).

Hydrology. At Data Point N, observed hydrologic indicators included Water Marks (B1), Surface Soil Cracks (B6), Inundation Visible on Aerial Imagery (B7), Biotic Crust (B12), Aquatic Invertebrates (B13), and Hydrogen Sulfide Odor (C1) (Appendix B). Although inundation and saturation were not present at the data point location, portions of this vegetation community were inundated during the July site visits.

Justification for Jurisdictional Status. Based on the prevalence of hydrophytic vegetation, hydric soil indictors, and indicators of wetland hydrology, this habitat is considered a wetland, and is Corps-jurisdictional.

5.4.6 Ephemeral Drainage

The ephemeral drainage vegetation community is present in the northeastern corner of the Project area. Collecting flows from the numerous seasonal swales that drain the surrounding hillslopes north and east of the Project area, this vegetation community displays evidence of an OHWM due to the higher volume of water it conveys during and immediately after storm events relative to seasonal swales. This vegetation community supports primarily annual herbaceous vegetation tolerant of elevated salt levels. Features of this vegetation community in the northeastern corner of the Project area correspond to an NWI-mapped “Riverine” aquatic feature (Figure 6). Within the Project area, two small ephemeral drainages are present that are unvegetated but display an OHWM.

Data Point C is representative of the vegetation, soils, and hydrologic indicators of the ephemeral drainage vegetation community.

Vegetation. Vegetation in the ephemeral drainage, when present, consisted primarily of annual herbaceous species including rabbitsfoot grass, saltgrass, and swamp grass (*Crypsis schoenoides*) (OBL). Forb species included alkali sea-heath (*Frankenia salina*) (FACW) and common tarplant (*Centromadia pungens*) (FAC).

Soils. At Data Point C, Redox Dark Surface (F6), a hydric soil indicator, was observed (Appendix B).

Hydrology. At Data Point C, Surface Soil Cracks (B6), Oxidized Rhizospheres along Living Roots (C3), and Drainage Patterns (B10), wetland hydrology indicators, were observed (Appendix B). An OHWM was defined within the ephemeral drainage vegetation community by a change in vegetation composition and cover, mudcracks, and the presence of a bed and bank (Appendix B).

Justification for Jurisdictional Status. Based on the prevalence of hydrophytic vegetation, hydric soil indictors, and indicators of wetland hydrology (in the vegetated portions of this vegetation community), ephemeral drainage is considered a wetland and due to the presence of a clearly defined OWHM in all ephemeral drainages, the ephemeral drainage vegetation community also qualifies as an other waters of the U.S., and is Corps-jurisdictional.

5.4.7 Open Water

Within the Project area, the open water vegetation community consists of a small portion of a much larger aquatic feature that extends past the western edge of the Project area (Exhibit A). Based on historic aerial photography (Google Earth™ dates: May 19, 2012; April 16, 2013; April 1, 2015), the feature remains ponded throughout the spring and early summer. During the delineation survey dates, the feature was dry. Due to high salt levels, this vegetation community only supports saltgrass around its margins. The single feature that comprises the open water vegetation community corresponds to a feature mapped as “Freshwater Pond” in the NWI.

Data Point S is representative of the vegetation, soils, and hydrologic indicators of the open water vegetation community.

Vegetation. Saltgrass was the only plant species observed growing within the portion of the open water vegetation community within the Project area. Due to the high salt content and relatively long ponding duration, plant cover only consisted of sparse (less than one percent) saltgrass cover.

Soils. Due to the observations of the feature remaining ponded for longer than 2 weeks during previous site visits and in aerial photography, the presence of hydric soils was inferred (Appendix B).

Hydrology. At Data Point S, Water Marks (B1), Sediment Deposits (B2), Inundation Visible on Aerial Imagery (B7), Salt Crust (B11), and Aquatic Invertebrates (B13), wetland hydrology indicators, were observed (Appendix B).

Justification for Jurisdictional Status. As a result of hydrophytic vegetation cover within the feature being less than five percent, the open water vegetation community qualifies as a wetland. Due to the presence of a clearly defined OWHM however, the open water vegetation community qualifies as an other waters of the U.S. Therefore, this vegetation community is Corps-jurisdictional.

5.4.8 Perennial Swale

Perennial swales support a prevalence of perennial monocots, specifically tules and chairmaker’s club-rush. A perennial swale is located downstream from an offsite leaking well/spring, and appears to have formed due to these groundwater hydrologic inputs which supplement the in the area where it is located. This perennial swale corresponds to a mapped “Riverine” feature in the NWI (Figure 6). In the southern portion of the Project area, a perennial swale has formed within a slight depression of a larger seasonal swale complex, where a deeper clay soil layer in the depressional area retains enough water throughout the year to support a vegetation community dominated by tules. This perennial swale corresponds to a mapped “Freshwater Emergent Marsh” aquatic feature in the NWI (Figure 6).

Data Points E and I are representative of the vegetation, soils, and hydrologic indicators of the perennial swale vegetation community.

Vegetation. Vegetation in the perennial swale vegetation community consisted of chairmaker’s club-rush, tule, rabbitsfoot grass, bristly ox-tongue, saltgrass, Italian ryegrass, Mediterranean barley, sow thistle (*Sonchus apser*) (FAC), and curly dock (*Rumex crispus*) (FAC).

Soils. At Data Point E, Thick Dark Surface (A12), a hydric soil indicator, was observed and Depleted Matrix (F3) was observed at Data Point I (Appendix B).

Hydrology. At Data Points E and I, Surface Soil Cracks (B6), a wetland hydrology indicator, were observed (Appendix B). Although not an indicator of hydrology, soils in both locations were observed to be moist (not saturated) during the dry season (Appendix B).

Justification for Jurisdictional Status. Based on the prevalence of hydrophytic vegetation, hydric soil indictors, and indicators of wetland hydrology, this vegetation community is considered a wetland, and is Corps-jurisdictional.

5.4.9 Seasonal Swale

Seasonal swales are present within the Project area along slope-breaks that are too steep to be disked/farmed (these correspond to portions of the "Riverine" features mapped in the NWI) and at the bases of hills as they transition into the floodplain of the Sacramento Delta where soils are too alkaline to support agriculture (these often correspond to "Freshwater Emergent Wetland" features in the NWI) (Figure 6 and Exhibit A). Formed through erosion associated with precipitation, this vegetation community also receives supplemental hydrologic inputs from groundwater on the western edge of the Project area (Exhibit A). Soils within this vegetation community in the southern portion of the Project area have relatively high salt concentrations, and as a result, they are dominated by annual grasses and forbs that can tolerate elevated salt levels. Some depressions within these swales form alkali scalds due to the elevated salt levels in the soil. Swales included portions of drainages mapped in the NWI as "Riverine" where disking for agriculture had not obscured, removed, or otherwise altered the drainages to an extent where they did not support a prevalence of hydrophytes or displayed indicators of hydrology.

Data Points A, F, G, K, and L in Appendix B are representative of the vegetation, soils, and hydrologic indicators of the seasonal swale vegetation community.

Vegetation. Vegetation was dominated by salt-tolerant herbaceous species in the southern portion of the Project area, including saltgrass and alkali seaheath. Other non-halophytic species included ripgut brome, Italian ryegrass, bristly ox-tongue, and common tarweed. In areas with high levels of accumulated salts, scalds had formed. While the interior of these areas were not vegetated, the edges were often bordered by saltgrass, pickleweed, or common tarweed. Seasonal swales present in the central and northern portions of the Project area supported Italian ryegrass, Mediterranean barley, curly dock, and rough cocklebur (*Xanthium strumarium*) (FAC).

Soils. At Data Points A and L, Depleted Matrix (F3) was observed, and at Data Points F and G, Thick Dark Surface (A12), and Loamy Gleyed Matrix (F2), wetland soil indicators, were observed (Appendix B).

Hydrology. At Data Points, A, F, G, K, and L, Surface Soil Cracks (B6) were observed, and Salt Crust (B11), wetland hydrology indicators, was also observed at Data Point K (Appendix B).

Justification for Jurisdictional Status. Based on the prevalence of hydrophytic vegetation, hydric soil indictors, and indicators of wetland hydrology, this habitat is considered a wetland, and is Corps-jurisdictional.

5.4.10 Seasonal Wetland

A seasonal wetland at the head of a large non-wetland swale is present in the southern portion of the Project area (Exhibit A). As a result of having soils with a clay fraction, this vegetation community supports a prevalence of hydrophytes. Although the seasonal wetland is within a swale, soils in the surrounding swale consist entirely of sand, are too well-drained to support a prevalence of hydrophytes or display hydric soil indicators. Further east, a seasonal wetland is also present within a seasonal swale along the northern side of Stratton Road (Exhibit A).

Data Point T is representative of the vegetation, soils, and hydrologic indicators of the seasonal wetland community.

Vegetation. Vegetation in the seasonal wetland consists of Italian ryegrass, Mediterranean barley, saltgrass, curly dock, and ripgut brome.

Soils. At Data Point T, Depleted Matrix (F3), a wetland soil indicator, was observed (Appendix B).

Hydrology. At Data Point T, Surface Soil Cracks (B6), a wetland hydrology indicator, were observed (Appendix B).

Justification for Jurisdictional Status. Based on the prevalence of hydrophytic vegetation, hydric soil indictors, and indicators of wetland hydrology, this habitat is considered a wetland, and is Corps-jurisdictional.

5.4.11 Wetland Ditch

Along the northern edge of a portion of Stratton Road, a small ditch was excavated to drain a seasonal swale/seasonal wetland complex into a brackish marsh. Due to the change in elevation along the ditch, the upslope areas of the ditch support hydrophytic vegetation resembling a seasonal swale while the downslope portions support more of the species found in the adjoining brackish marsh.

Data Point P is representative of the vegetation, soils, and hydrologic indicators of the wetland ditch community.

Vegetation. Near the brackish marsh, vegetation in the wetland ditch vegetation community consisted of rabbitsfoot grass, seacoast bulrush, and saltgrass. Closer to the adjoining seasonal swale, vegetation included Italian ryegrass, Mediterranean barley, and curly dock.

Soils. At Data Point P, Depleted Matrix (F3), a wetland soil indicator, was observed (Appendix B).

Hydrology. At Data Point P, Oxidized Rhizospheres along Living Roots (C3) and Drainage Patterns (B10), wetland hydrology indicators, were observed (Appendix B).

Justification for Jurisdictional Status. Based on the prevalence of hydrophytic vegetation, hydric soil indictors, and indicators of wetland hydrology, this habitat is considered a wetland, and is Corps-jurisdictional.

6.0 CITATIONS

Baldwin, B. G., D. H. Goldman, D. J. Kiel, R. Patterson, T. J. Rosatti, and D. H. Wilken. 2012. *The Jepson Manual: Vascular Plants of California*. Second edition, revised and expanded. Berkeley, California: University of California Press.

Corps. See U.S. Army Corps of Engineers.

U.S. Army Corps of Engineers (Corps), Engineer Research and Development Center. 2008a. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0). Vicksburg, Michigan. September 2008.

_____. 2008b. A Field Guide to the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States. Available: http://www.spk.usace.army.mil/Portals/12/documents/regulatory/pdf/Ordinary_High_Watermark_Manual_Aug_2008.pdf. Accessed February 2016.

_____. 2010. Updated Datasheet for the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States. Available: http://www.spa.usace.army.mil/Portals/16/docs/civilworks/regulatory/Jurisdiction/OHWM%20Arid%20West%20Datasheet.pdf. Accessed February 2016.

Environmental Laboratory, Department of the Army. 1987. Corps of Engineers Wetland Delineation Manual. (Technical Report Y-87-1.) U.S. Army Corps of Engineers. Waterways Experimental Station. Vicksburg, MI.

Google Earth V7.1.2.2041. (May 19, 2012, April 16, 2013, and April 1, 2015). Colusa, California. Google 2016. http://www.earth.google.com. Accessed October 25, 2016.

Lichvar, R.W., M. Butterwick, N.C. Melvin, and W.N. Kirchner. 2016. The National Wetland Plant List: 2016 Wetland Ratings. Phytoneuron 2016-30: 1-17.

McMorris, Chris. Principal Investigator, Historian. JRP Historical Consulting LLC. Personal communication June 27, 2016.

Mead, Elwood and William Elsworth Smythe. 1901. Report of irrigation investigations in California. U.S. Department of Agriculture, Office of Experiment Stations. Bulletin No. 100. Washington: Government Printing Office.

Munsell. 2009. *Munsell Soil Color Charts - 2009 Revision*. New York, California: Macbeth Division of Kollmorgen Instruments Corporation.

NRCS. See U.S. Department of Agriculture, Natural Resources Conservation Service (formerly Soil Conservation Service).

U.S. Department of Agriculture, Natural Resources Conservation Service. 2010. Field Indicators of Hydric Soils in the U.S., Version 7.0. G. W. Hurt and L. M. Vasilas (eds.). U.S. Department of Agriculture Natural Resources Conservation Service in cooperation with the National Technical Committee for Hydric Soils.

_____. 2015. Hydric Soils National List. Available online: http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/use/hydric/. Website accessed June 15, 2016.

_____. 2016. Web Soil Survey. Available online: http://websoilsurvey.nrcs.usda.gov/app/. Website accessed June 9, 2016.

U.S. Fish and Wildlife Service. 2016. National Wetlands Inventory. Available online: http://www.fws.gov/nwi/. Website accessed June 9, 2016.

USFWS. See U.S. Fish and Wildlife Service.

Western Regional Monitoring Station. 2015. *Pine Flat Dam (046896): Period of Record Monthly Climate Summary*. Available: http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca6896. Accessed June 15, 2016.

WRMS. *See* Western Regional Monitoring Station.

Exhibit A.
Delineation Results

DELINEATION OF WATERS OF THE U.S. Cover Page for the Solano Phase IV Wind Project

Project Area
Map Extents
Streets/Roads

Feature Classification
Open Water
Alkaline Pool
Brackish Marsh
Ephemeral Drainage
Perennial Swale
Seasonal Swale
Seasonal Wetland
Wetland Ditch

Feature ID	Acre	Linear Feet
Alkaline Pool		
W-28	0.086	NA
Brackish Marsh		
W-21	1.257	NA
W-27	1.142	NA
W-29	0.011	NA
W-30	0.009	NA
Ephemeral Drainage		
W-5	0.004	42.9
W-6	0.009	64.8
W-10	0.033	140.8
W-11	0.084	325.7
W-13	0.027	74.0
Perennial Swale		
W-1	0.226	NA
W-34	0.455	NA
Seasonal Wetland		
W-18	0.078	NA
W-20	0.977	NA
W-22	0.086	NA

Feature ID	Acre	Linear Feet
Seasonal Swale		
W-2	0.013	NA
W-3	0.039	NA
W-4	0.142	NA
W-7	0.064	NA
W-8	0.026	NA
W-9	0.028	NA
W-12	0.003	NA
W-14	0.009	NA
W-15	1.795	NA
W-16	0.028	NA
W-17	0.261	NA
W-19	0.036	NA
W-24	1.097	NA
W-26	0.884	NA
W-31	0.012	NA
W-33	2.319	NA
W-34	0.083	NA
W-35	0.610	NA
W-36	0.668	NA
W-38	0.470	NA
Wetland Ditch		
W-23	0.015	69.3
W-25	0.033	244.0
Open Water		
W-37	0.053	NA

Feature Type	Acre	Linear Feet
Alkaline Pool	0.086	NA
Brackish Marsh	2.420	NA
Open Water	0.053	NA
Ephemeral Drainage	0.158	648.2
Perennial Swale	0.681	NA
Seasonal Swale	11.076	NA
Seasonal Wetland	0.170	NA
Wetland Ditch	0.048	313.3
Total	14.692	961.5

N
0 0.25 0.5 mile
1 inch = 0.5 mile

Sources:
- Area West Environmental Inc., 2016
- Terraserver, Accessed March 2016

Date: 10-25-16

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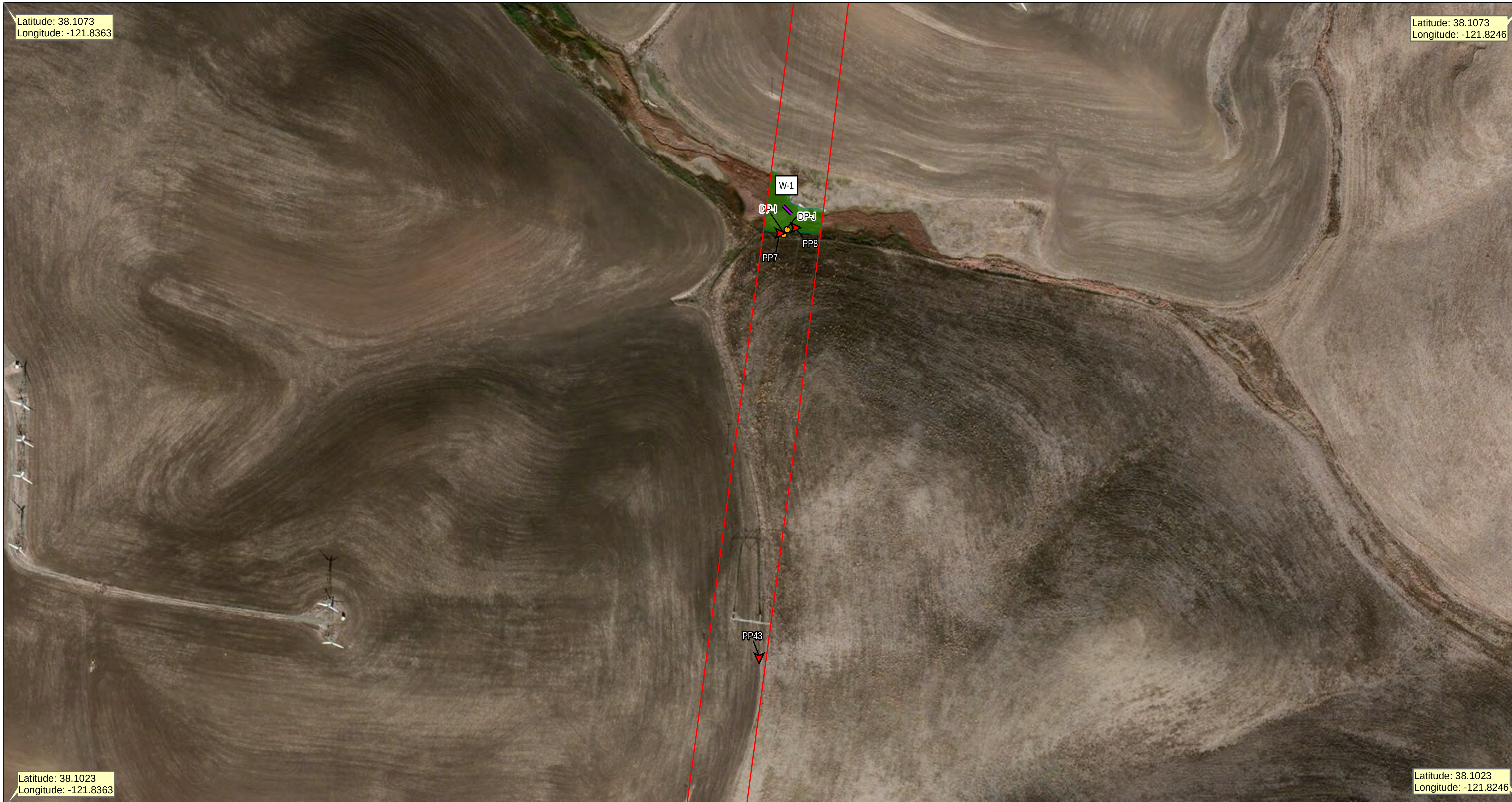


SOLANO PHASE IV WIND PROJECT

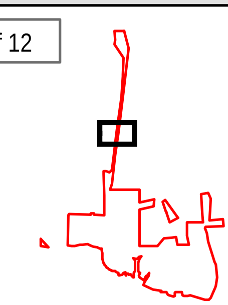
DELINEATION OF WATERS OF THE U.S. for Solano Phase IV Wind Project

Project Area
Ordinary High Water Mark (OHWM)
OHWM Cross Section
Culverts

Photo Point and Direction
Data Points
Spring (Capped)

Feature Classification

Open Water	Perennial Swale
Alkaline Pool	Seasonal Swale
Brackish Marsh	Seasonal Wetland
Ephemeral Drainage	Wetland Ditch



Delineation Performed by
Area West Environmental:
- Mark Noyes
- Mary Bailey
- Callen Keller

Maps Prepared by:
- Samuel Price

N

0 100 200 feet

1 inch = 200 feet

Data Source:
- Area West Environmental, Inc. 2016
- CH2MHILL, 2016
- ESRI Aerial Imagery dated June 2014, Accessed October 2016

Date: 10-25-16

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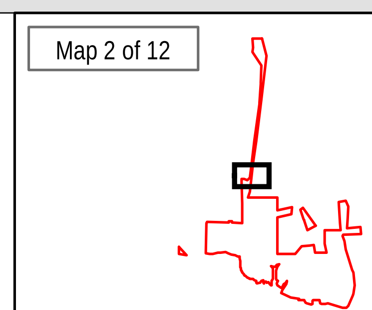
SOLANO PHASE IV WIND PROJECT

DELINEATION OF WATERS OF THE U.S. for Solano Phase IV Wind Project

- Project Area
- Ordinary High Water Mark (OHWM)
- OHWM Cross Section
- Culverts
- Photo Point and Direction
- Data Points
- Spring (Capped)

Feature Classification

- Open Water
- Alkaline Pool
- Brackish Marsh
- Ephemeral Drainage
- Perennial Swale
- Seasonal Swale
- Seasonal Wetland
- Wetland Ditch



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Date: 10-25-16

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DELINEATION OF WATERS OF THE U.S. for Solano Phase IV Wind Project

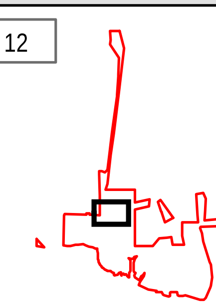
Project Area
Ordinary High Water Mark (OHWM)
OHWM Cross Section
Culverts

Photo Point and Direction
Data Points
Spring (Capped)

Feature Classification

Open Water
Alkaline Pool
Brackish Marsh
Ephemeral Drainage
Perennial Swale
Seasonal Swale
Seasonal Wetland
Wetland Ditch

Map 3 of 12



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SOLANO PHASE IV WIND PROJECT

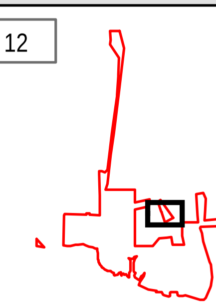
DELINEATION OF WATERS OF THE U.S. for Solano Phase IV Wind Project

- Project Area
- Ordinary High Water Mark (OHWM)
- OHWM Cross Section
- Culverts
- Photo Point and Direction
- Data Points
- Spring (Capped)

Feature Classification

- Open Water
- Alkaline Pool
- Brackish Marsh
- Ephemeral Drainage
- Perennial Swale
- Seasonal Swale
- Seasonal Wetland
- Wetland Ditch

Map 4 of 12



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SOLANO PHASE IV WIND PROJECT

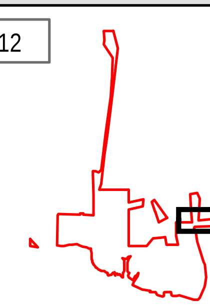
DELINEATION OF WATERS OF THE U.S. for Solano Phase IV Wind Project

Project Area
Ordinary High Water Mark (OHWM)
OHWM Cross Section
Culverts

Photo Point and Direction
Data Points
Spring (Capped)

Feature Classification

Open Water	Perennial Swale
Alkaline Pool	Seasonal Swale
Brackish Marsh	Seasonal Wetland
Ephemeral Drainage	Wetland Ditch



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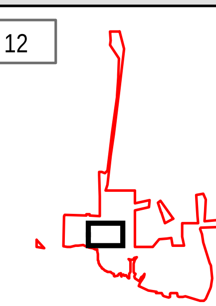
Project Area
Ordinary High Water Mark (OHWM)
OHWM Cross Section
Culverts

Photo Point and Direction
Data Points
Spring (Capped)

Feature Classification

Open Water
Alkaline Pool
Brackish Marsh
Ephemeral Drainage
Perennial Swale
Seasonal Swale
Seasonal Wetland
Wetland Ditch



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SOLANO PHASE IV WIND PROJECT

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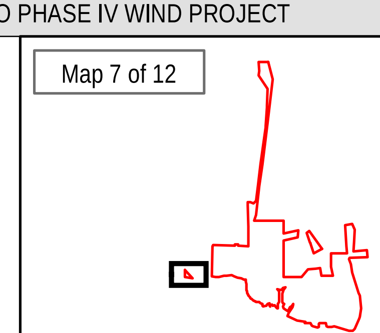
- Project Area
- Ordinary High Water Mark (OHWM)
- OHWM Cross Section
- Culverts
- Photo Point and Direction
- Data Points
- Spring (Capped)

Feature Classification

Open Water	Perennial Swale
Alkaline Pool	Seasonal Swale
Brackish Marsh	Seasonal Wetland
Ephemeral Drainage	Wetland Ditch



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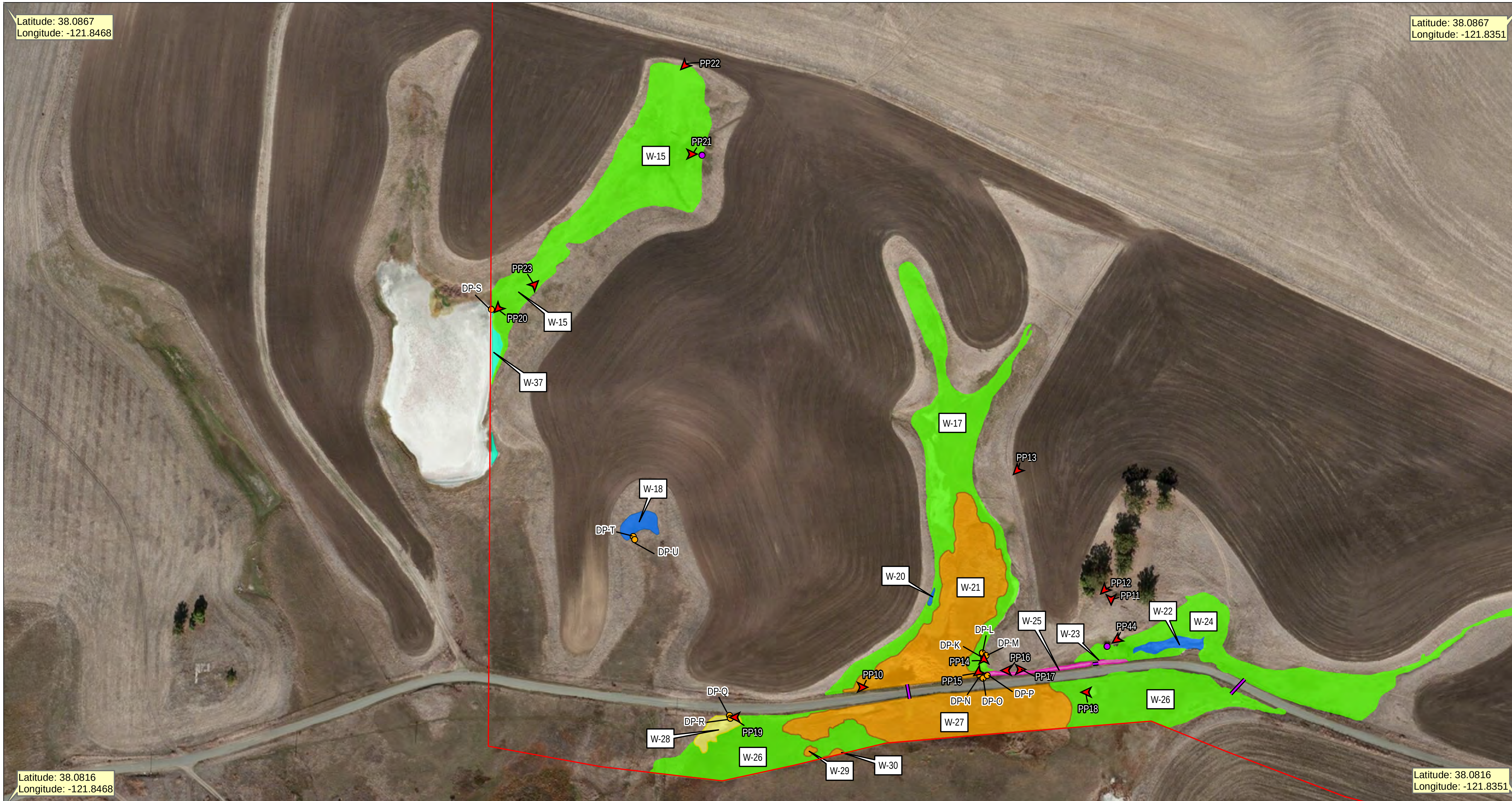


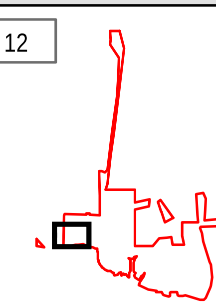
DELINEATION OF WATERS OF THE U.S. for Solano Phase IV Wind Project

- Project Area
- Ordinary High Water Mark (OHWM)
- OHWM Cross Section
- Culverts
- Photo Point and Direction
- Data Points
- Spring (Capped)

Feature Classification

- Open Water
- Alkaline Pool
- Brackish Marsh
- Ephemeral Drainage
- Perennial Swale
- Seasonal Swale
- Seasonal Wetland
- Wetland Ditch

Map 8 of 12



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Maps Prepared by:
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0 100 200 feet

1 inch = 200 feet

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SOLANO PHASE IV WIND PROJECT

DELINEATION OF WATERS OF THE U.S. for Solano Phase IV Wind Project

Project Area
Ordinary High Water Mark (OHWM)
OHWM Cross Section
Culverts

Photo Point and Direction
Data Points
Spring (Capped)

Feature Classification
Open Water
Alkaline Pool
Brackish Marsh
Ephemeral Drainage
Perennial Swale
Seasonal Swale
Seasonal Wetland
Wetland Ditch

Map 9 of 12

Delineation Performed by
Area West Environmental:
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Maps Prepared by:
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0 100 200 feet
1 inch = 200 feet

Data Source:
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SOLANO PHASE IV WIND PROJECT

DELINEATION OF WATERS OF THE U.S. for Solano Phase IV Wind Project

Project Area
Ordinary High Water Mark (OHWM)
OHWM Cross Section
Culverts
Photo Point and Direction
Data Points
Spring (Capped)

Feature Classification
Open Water
Alkaline Pool
Brackish Marsh
Ephemeral Drainage
Perennial Swale
Seasonal Swale
Seasonal Wetland
Wetland Ditch

Map 10 of 12

Delineation Performed by
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Maps Prepared by:
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0 100 200 feet

1 inch = 200 feet

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SOLANO PHASE IV WIND PROJECT

DELINEATION OF WATERS OF THE U.S. for Solano Phase IV Wind Project

- Project Area
- Ordinary High Water Mark (OHWM)
- OHWM Cross Section
- Culverts
- Photo Point and Direction
- Data Points
- Spring (Capped)

Feature Classification

- Open Water
- Alkaline Pool
- Brackish Marsh
- Ephemeral Drainage
- Perennial Swale
- Seasonal Swale
- Seasonal Wetland
- Wetland Ditch

Map 11 of 12

Delineation Performed by
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- Mary Bailey
- Callen Keller

Maps Prepared by:
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N

0 100 200 feet

1 inch = 200 feet

Data Source:
- Area West Environmental, Inc. 2016
- CH2MHILL, 2016
- ESRI Aerial Imagery dated June 2014, Accessed October 2016

Date: 10-25-16

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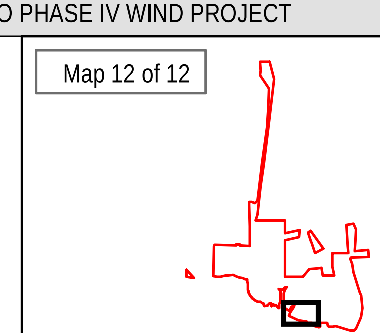
SOLANO PHASE IV WIND PROJECT

DELINEATION OF WATERS OF THE U.S. for Solano Phase IV Wind Project

- Project Area
- Ordinary High Water Mark (OHWM)
- OHWM Cross Section
- Culverts
- Photo Point and Direction
- Data Points
- Spring (Capped)

Feature Classification

- Open Water
- Alkaline Pool
- Brackish Marsh
- Ephemeral Drainage
- Perennial Swale
- Seasonal Swale
- Seasonal Wetland
- Wetland Ditch



Delineation Performed by
Area West Environmental:
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- Mary Bailey
- Callen Keller

Maps Prepared by:
- Samuel Price

0 100 200 feet

1 inch = 200 feet

Data Source:
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- CH2MHILL, 2016
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Date: 10-25-16

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Appendix A.
National Resource Conservation Service Web Soil Survey

United States Department of Agriculture

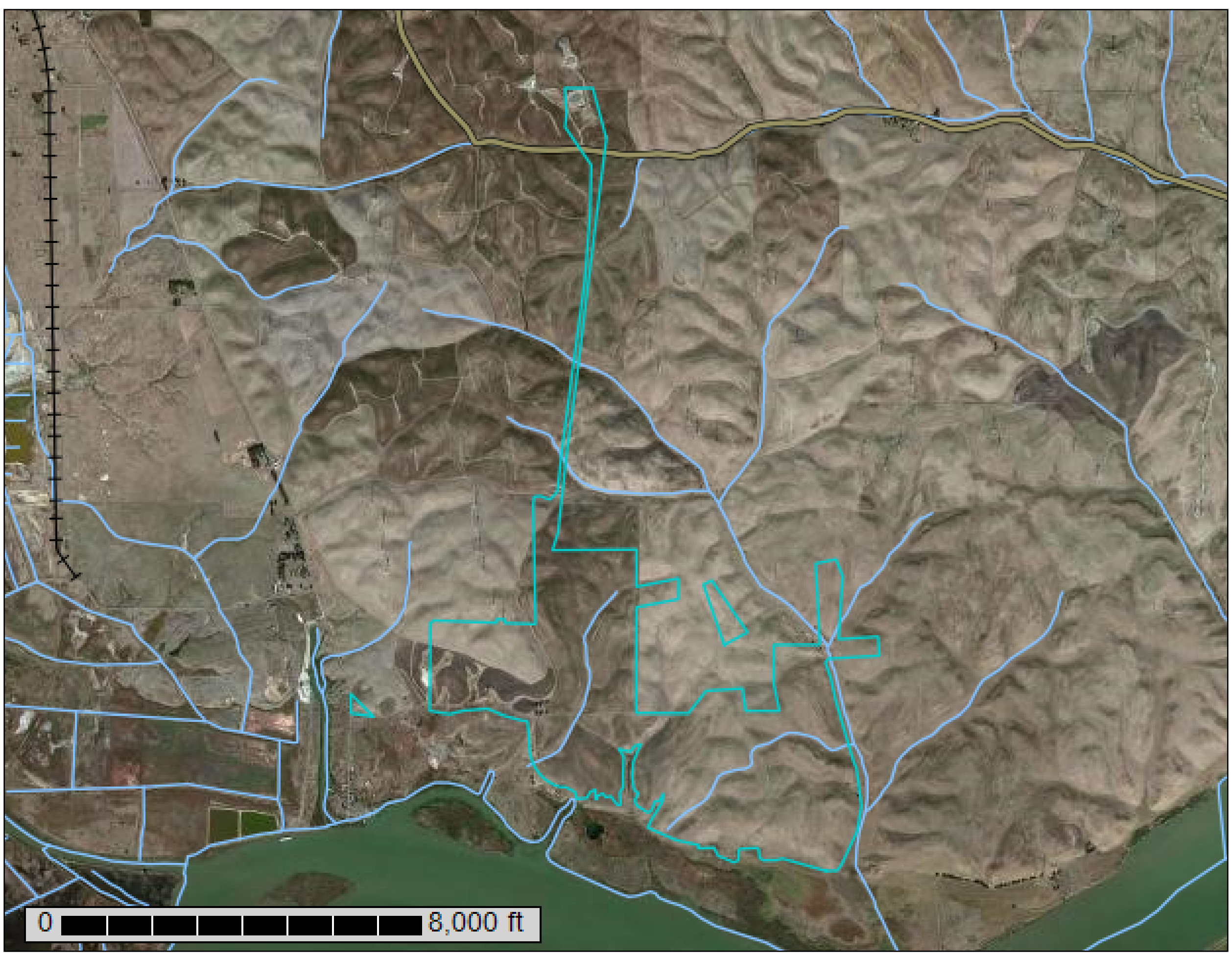
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Solano County, California



July 8, 2016

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map

Map Scale: 1:35,400 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 500, 1000, 2000, 3000

Feet: 0, 1500, 3000, 6000, 9000

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Solano County, California
Survey Area Data: Version 9, Sep 23, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Nov 3, 2010—Apr 29, 2012

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Solano County, California (CA095)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
DaC	Diablo-Ayar clays, 2 to 9 percent slopes	153.4	13.1%
DaE2	Diablo-Ayar clays, 9 to 30 percent slopes, eroded	967.5	82.5%
Om	Omni clay loam	26.1	2.2%
Ta	Tamba mucky clay	12.0	1.0%
Va	Valdez silt loam drained	13.2	1.1%
Totals for Area of Interest		**1,172.3**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Solano County, California

DaC—Diablo-Ayar clays, 2 to 9 percent slopes

Map Unit Setting

National map unit symbol: h9l4
Elevation: 30 to 300 feet
Mean annual precipitation: 16 to 18 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 260 to 280 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Diablo and similar soils: 65 percent
Ayar and similar soils: 25 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Diablo

Setting

Landform: Terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from weakly consolidated sediments

Typical profile

H1 - 0 to 30 inches: clay
H2 - 30 to 40 inches: silty clay
H3 - 40 to 59 inches: weathered bedrock

Properties and qualities

Slope: 5 to 9 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 6.0 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C

Description of Ayar

Setting

Landform: Terraces

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Residuum weathered from weakly consolidated sediments

Typical profile

H1 - 0 to 41 inches: clay
H2 - 41 to 51 inches: clay loam
H3 - 51 to 59 inches: weathered bedrock

Properties and qualities

Slope: 5 to 9 percent
Depth to restrictive feature: 40 to 70 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C

Minor Components

Altamont

Percent of map unit: 5 percent

San benito

Percent of map unit: 5 percent

DaE2—Diablo-Ayar clays, 9 to 30 percent slopes, eroded

Map Unit Setting

National map unit symbol: h9l5
Elevation: 30 to 300 feet
Mean annual precipitation: 16 to 18 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 260 to 280 days
Farmland classification: Not prime farmland

Map Unit Composition

Diablo and similar soils: 60 percent

Ayar and similar soils: 30 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Diablo

Setting

Landform: Terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Riser
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from weakly consolidated sediments

Typical profile

H1 - 0 to 25 inches: clay
H2 - 25 to 40 inches: silty clay
H3 - 40 to 59 inches: weathered bedrock

Properties and qualities

Slope: 9 to 30 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 6.0 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C

Description of Ayar

Setting

Landform: Terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Riser
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Residuum weathered from weakly consolidated sediments

Typical profile

H1 - 0 to 36 inches: clay
H2 - 36 to 46 inches: clay loam
H3 - 46 to 59 inches: weathered bedrock

Properties and qualities

Slope: 9 to 30 percent
Depth to restrictive feature: 40 to 70 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Very high

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 6.9 inches)

Interpretive groups
Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C

Minor Components

Altamont
Percent of map unit: 5 percent

San benito
Percent of map unit: 5 percent

Om—Omni clay loam

Map Unit Setting
National map unit symbol: h9lx
Elevation: 0 to 10 feet
Mean annual precipitation: 16 to 18 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 260 to 280 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Omni and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Omni

Setting
Landform: Basin floors
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Mixed alluvium

Typical profile
H1 - 0 to 8 inches: clay loam
H2 - 8 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 20 to 48 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Strongly saline (16.0 mmhos/cm)
Available water storage in profile: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: D

Minor Components

Clear lake

Percent of map unit: 5 percent
Landform: Basin floors

Solano

Percent of map unit: 5 percent

Rincon

Percent of map unit: 5 percent

Ta—Tamba mucky clay

Map Unit Setting

National map unit symbol: h9mr
Elevation: 0 feet
Mean annual precipitation: 15 to 20 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 240 to 260 days
Farmland classification: Not prime farmland

Map Unit Composition

Tamba and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tamba

Setting

Landform: Tidal flats
Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Organic material and mixed alluvium

Typical profile
H1 - 0 to 10 inches: mucky clay
H2 - 10 to 52 inches: mucky clay
H3 - 52 to 78 inches: mucky clay

Properties and qualities
Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Very poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 12 to 36 inches
Frequency of flooding: Frequent
Frequency of ponding: Frequent
Salinity, maximum in profile: Strongly saline (16.0 mmhos/cm)
Available water storage in profile: Low (about 5.4 inches)

Interpretive groups
Land capability classification (irrigated): 6w
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: C

Minor Components

Reyes
Percent of map unit: 5 percent
Landform: Marshes

Joice
Percent of map unit: 5 percent
Landform: Marshes

Suisun
Percent of map unit: 5 percent
Landform: Marshes

Va—Valdez silt loam drained

Map Unit Setting
National map unit symbol: h9my
Elevation: 0 to 20 feet
Mean annual precipitation: 16 to 19 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 250 to 270 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Valdez and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Valdez

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium

Typical profile

H1 - 0 to 12 inches: silt loam
H2 - 12 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 48 to 60 inches
Frequency of flooding: Rare
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 10.4 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C

Minor Components

Columbia

Percent of map unit: 10 percent

Unnamed, loam

Percent of map unit: 5 percent

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

Appendix B.
Wetland Determination and Ordinary High Water Mark Data Forms

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Solano Wind Phase 4 City/County: Collinsville/Solano County Sampling Date: 6/23/2016

Applicant/Owner: SMUD State: CA Sampling Point: DP-A

Investigator(s): Mark Noyes and Callen Keller Section, Township, Range: S24, T3N, R1E

Landform (hillslope, terrace, etc.): Swale Local relief (concave, convex, none): Concave Slope (%): 1

Subregion (LRR): Mediterranean California Lat: 38.087275 Long: -121.807274 Datum: WSG1984

Soil Map Unit Name: Omni clay loam NWI classification: ______

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:

Swale is documented by Data Point A, which supports all three wetland parameters.
Swale located east of residence and livestock off Talbert Road. Swale adjacent to dirt road and stops at fenced area.

VEGETATION – Use scientific names of plants.

Stratum / Species	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 5x5)			
1.			
2.			
3.			
4.			
= Total Cover	0		
Sapling/Shrub Stratum (Plot size: 5x5)			
1.			
2.			
3.			
4.			
5.			
= Total Cover	0		
Herb Stratum (Plot size: 5x5)			
1. Festuca perennis	60	Y	FAC
2. Hordeum marinum	30	Y	FAC
3. Distichlis spicata	8	N	FAC
4. Lactuca saligna	2	N	UPL
5.			
6.			
7.			
8.			
= Total Cover	100		
Woody Vine Stratum (Plot size: 5x5)			
1.			
2.			
= Total Cover	0		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (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: DP-A

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+	2.5 Y 3/2	95	7.5 YR 5/8	2	C	PL	Clay	
	2.5 Y 3/1	3	2.5 YR 3/1					Manganese concretions

[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:

F12 manganese deposits

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:

Drainage near road with culvert.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Solano Wind Phase 4 City/County: Collinsville/Solano County Sampling Date: 6/23/2016

Applicant/Owner: SMUD State: CA Sampling Point: DP-B

Investigator(s): Mark Noyes and Callen Keller Section, Township, Range: S24, T3N, R1E

Landform (hillslope, terrace, etc.): Swale Local relief (concave, convex, none): Concave Slope (%): 10

Subregion (LRR): Mediterranean California Lat: 38.087259 Long: -121.807252 Datum: WSG1984

Soil Map Unit Name: Omni clay loam NWI classification: ______

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:

Upland from Swale.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5x5)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5x5)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
Herb Stratum (Plot size: 5x5)			
1. Festuca perennis	20	Y	FAC
2. Hordeum marinum	10	N	FAC
3. Distichlis spicata	25	Y	FAC
4. Convolvulus arvensis	3	N	NL
5. Malva neglecta	2	N	NL
6. Hordeum murinum	40	Y	FACU
7.			
8.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: 5x5)			
1.			
2.			
	0 = 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: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 67% (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: DP-B

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+	2.5 Y 3/2	100					Clay	

[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: Solano Wind Phase 4 City/County: Collinsville/Solano County Sampling Date: 6/23/2016

Applicant/Owner: SMUD State: CA Sampling Point: DP-C

Investigator(s): Mark Noyes and Callen Keller Section, Township, Range: S24, T3N, R1E

Landform (hillslope, terrace, etc.): Drainage Local relief (concave, convex, none): Concave Slope (%): 5

Subregion (LRR): Mediterranean California Lat: 38.086445 Long: -121.808157 Datum: WSG1984

Soil Map Unit Name: Omni clay loam NWI classification: ______

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:

Ephemeral drainage.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 3x5)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: 3x5)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
Herb Stratum (Plot size: 3x5)			
1. Cressa truxillensis	25	Y	FACW
2. Polypogon monspeliensis	3	N	FACW
3. Distichlis spicata	20	Y	FAC
4. Cyropsis schoenoides	1	N	OBL
5.			
6.			
7.			
8.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: 3x5)			
1.			
2.			
	0 = 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: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (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: DP-C

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	10 YR 3/1	90	10 YR 5/8	10	C	M	Sandy cla	
11-18+	10 YR 3/1	100					Sandy cla	

[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:

Soil moist starting at ~2 inches below the surface.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Solano Wind Phase 4 City/County: Collinsville/Solano County Sampling Date: 6/23/2016

Applicant/Owner: SMUD State: CA Sampling Point: DP-D

Investigator(s): Mark Noyes and Callen Keller Section, Township, Range: S24, T3N, R1E

Landform (hillslope, terrace, etc.): Drainage Local relief (concave, convex, none): Concave Slope (%): 15

Subregion (LRR): Mediterranean California Lat: 38.08644 Long: -121.808167 Datum: WSG1984

Soil Map Unit Name: Omni clay loam NWI classification: ____

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:

Upland from ephemeral drainage.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5x5)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5x5)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
Herb Stratum (Plot size: 5x5)			
1. Cressa truxillensis	5	N	FACW
2. Hordeum marinum	40	Y	FAC
3. Festuca perennis	50	Y	FAC
4. Carduus pycnocephalus	1	N	NL
5. Centromadia pungens	4	N	FAC
6.			
7.			
8.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: 5x5)			
1.			
2.			
	0 = 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: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (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: DP-D

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
0-18+	10 YR 3/1	100					Sandy loa	

[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: Solano Wind Phase 4 City/County: Collinsville/Solano County Sampling Date: 6/23/2016

Applicant/Owner: SMUD State: CA Sampling Point: DP-E

Investigator(s): Mark Noyes and Callen Keller Section, Township, Range: S26, T3N, R1E

Landform (hillslope, terrace, etc.): Drainage Local relief (concave, convex, none): Concave Slope (%): 10

Subregion (LRR): Mediterranean California Lat: 38.078961 Long: -121.832678 Datum: WSG1984

Soil Map Unit Name: Valdez silt loam drained NWI classification: Freshwater Emergent

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:

Ephemeral marsh.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 5x5)			
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5x5)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
Herb Stratum (Plot size: 5x5)			
1. Schoenoplectus acutus	25	Y	OBL
2. Bromus diandrus	1	N	NL
3. Helminthotheca echioides	65	Y	FACU
4. Polypogon monspeliensis	2	N	FACW
5. Sonchus asper	1	N	UPL
6. Rumex crispus	1	N	FAC
7.			
8.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: 5x5)			
1.			
2.			
	0 = 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: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	25	x 1 = 25
FACW species	2	x 2 = 4
FAC species	1	x 3 = 3
FACU species	65	x 4 = 260
UPL species	1	x 5 = 5
Column Totals:	99 (A)	297 (B)

Prevalence Index = B/A = 3.00

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: DP-E

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
0-12	Gley 1 2.5/N	100					Clay	
13-18+	2.5 Y 3/2	95	10 YR 5/8	5	C	M	Sand	

[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:

Soil was moist but not saturated.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Solano Wind Phase 4 City/County: Collinsville/Solano County Sampling Date: 6/23/2016

Applicant/Owner: SMUD State: CA Sampling Point: DP-F

Investigator(s): Mark Noyes and Callen Keller Section, Township, Range: S26, T3N, R1E

Landform (hillslope, terrace, etc.): Basin Local relief (concave, convex, none): Concave Slope (%): 0

Subregion (LRR): Mediterranean California Lat: 38.07898 Long: -121.83269 Datum: WSG1984

Soil Map Unit Name: Valdez silt loam drained NWI classification: Freshwater Emergent

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:

Seasonal wetland.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5x5)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot size: 5x5)			
1.			
2.			
3.			
4.			
5.			
	0	= Total Cover	
Herb Stratum (Plot size: 5x5)			
1. Lotus corniculatus	50	Y	FAC
2. Rumex crispus	2	N	FAC
3. Hordeum marinum	23	Y	FAC
4. Festuca perrenis	25	Y	FAC
5.			
6.			
7.			
8.			
	100	= Total Cover	
Woody Vine Stratum (Plot size: 5x5)			
1.			
2.			
	0	= 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: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (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: DP-F

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	Gley 1 2.5/N	100					Clay	
7-18	10 YR 5/2	95	10 YR 5/8	5	C	M	Sand	

[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: Solano Wind Phase 4 City/County: Collinsville/Solano County Sampling Date: 6/23/2016

Applicant/Owner: SMUD State: CA Sampling Point: DP-G

Investigator(s): Mark Noyes and Callen Keller Section, Township, Range: S26, T3N, R1E

Landform (hillslope, terrace, etc.): Basin Local relief (concave, convex, none): Concave Slope (%): 1

Subregion (LRR): Mediterranean California Lat: 38.079136 Long: -121.832717 Datum: WSG1984

Soil Map Unit Name: Valdez silt loam drained NWI classification: Freshwater Emergent

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:

Seasonal wetland.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5x5)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5x5)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
Herb Stratum (Plot size: 5x5)			
1. Hordeum marinum	30	Y	FAC
2. Festuca perrenis	40	N	FAC
3. Distichlis spicata	20	Y	FAC
4.			
5.			
6.			
7.			
8.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: 5x5)			
1.			
2.			
	0 = 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: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (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: DP-G

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	Gley 1 2.5/N	100					Sandy loa	
7-18	10 YR 5/2	95	10 YR 5/8	5	C	M	Sand	

[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: Solano Wind Phase 4 City/County: Collinsville/Solano County Sampling Date: 6/23/2016

Applicant/Owner: SMUD State: CA Sampling Point: DP-H

Investigator(s): Mark Noyes and Callen Keller Section, Township, Range: S26, T3N, R1E

Landform (hillslope, terrace, etc.): ______ Local relief (concave, convex, none): Concave Slope (%): 1

Subregion (LRR): Mediterranean California Lat: 38.079158 Long: -121.832719 Datum: WSG1984

Soil Map Unit Name: Diablo-Ayar clays, 2 to 9 percent slopes NWI classification: Freshwater Emergent

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:

Seasonal wetland.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5x5)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5x5)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
Herb Stratum (Plot size: 5x5)			
1. Hordeum marinum	30	Y	FAC
2. Festuca perrenis	40	N	FAC
3. Distichlis spicata	20	Y	FAC
4.			
5.			
6.			
7.			
8.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: 5x5)			
1.			
2.			
	0 = 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: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (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: DP-H

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	Gley 1 2.5/N	100					Sandy loa	
7-18	10 YR 5/2	95	10 YR 5/8	5	C	M	Sand	

[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: Solano Wind Phase 4 City/County: Collinsville/Solano County Sampling Date: 7/1/2016

Applicant/Owner: SMUD State: CA Sampling Point: DP-I

Investigator(s): Mark Noyes Section, Township, Range: S14, T3N, R1E

Landform (hillslope, terrace, etc.): Bass of hill Local relief (concave, convex, none): Concave Slope (%): 1

Subregion (LRR): Mediterranean California Lat: 38.105921 Long: -121.830252 Datum: WSG1984

Soil Map Unit Name: Omni clay loam NWI classification: ____

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:

Wetland

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 5x5)			
1.			
2.			
3.			
4.			
= Total Cover	0		
Sapling/Shrub Stratum (Plot size: 5x5)			
1.			
2.			
3.			
4.			
5.			
= Total Cover	0		
Herb Stratum (Plot size: 5x5)			
1. Polypogon monspeliensis	15	N	FACW
2. Festuca perrenis	30	Y	FAC
3. Distichilis spicata	40	Y	FAC
4. Schoenoplectus americanus	5	N	OBL
5. Helminthotheca echioides	5	N	FAC
6. Hordeum marinum	5	N	FAC
7.			
8.			
= Total Cover	95		
Woody Vine Stratum (Plot size: 5x5)			
1.			
2.			
= Total Cover	0		

% Bare Ground in Herb Stratum 5 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (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 disturbed- grazed

SOIL

Sampling Point: DP-I

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
0-3	10 YR 3/2	100					Silty clay	
3-18+	10 YR 4/2	85	5 YR 4/6	15	D	M	Clay, clay	clay, clay loam

[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:

Soil moist 4'' below surface, but not saturated.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Solano Wind Phase 4 City/County: Collinsville/Solano County Sampling Date: 7/1/2016

Applicant/Owner: SMUD State: CA Sampling Point: DP-J

Investigator(s): Mark Noyes Section, Township, Range: S14, T3N, R1E

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Convex Slope (%): 5

Subregion (LRR): Mediterranean California Lat: 38.105892 Long: -121.830276 Datum: WSG1984

Soil Map Unit Name: Omni clay loam NWI classification: ______

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:

Upland

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5x5)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5x5)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
Herb Stratum (Plot size: 5x5)			
1. Cirsium vulgare	12	Y	FACU
2. Helminthotheca echioides	10	Y	FAC
3. Hirshfeldia incana	15	Y	NL
4. Distichlis spicata	3	N	FAC
5.			
6.			
7.			
8.			
	40 = Total Cover		
Woody Vine Stratum (Plot size: 5x5)			
1.			
2.			
	0 = 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: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species	13	x 3 =	39
FACU species	12	x 4 =	48
UPL species	15	x 5 =	75
Column Totals:	40 (A)		162 (B)

Prevalence Index = B/A = 4.05

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 disturbed- grazed

SOIL

Sampling Point: DP-J

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+	10 YR 3/3	95	2.5 YR 4/6	5			Silty clay	

[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:

Deeper portions down by the tules and Schoenopletus americanus with blackberries in patches. Schoenopletus throughout, but sparse. Higher areas in swale dense with hydrophyte grasses, road with swale across drainage in lowest part= drainage portion

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Solano Wind Phase 4 City/County: Collinsville/Solano County Sampling Date: 7/1/2016

Applicant/Owner: SMUD State: CA Sampling Point: DP-K

Investigator(s): Mark Noyes Section, Township, Range: S23, T3N, R1E

Landform (hillslope, terrace, etc.): Basin Local relief (concave, convex, none): Concave Slope (%): <1

Subregion (LRR): Mediterranean California Lat: 38.082681 Long: -121.839290 Datum: WSG1984

Soil Map Unit Name: Tamba mucky clay NWI classification: ______

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:

Alkali scald/sink= depressed area, no vegetation in center, ringed with halophytes. Swallow basin, salt content right hide hydric soil indicators.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5x5)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5x5)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
Herb Stratum (Plot size: 5x5)			
1. Salicornia pacifica	3	Y	OBL*
2. Distichlis spicata	2	Y	FAC
3.			
4.			
5.			
6.			
7.			
8.			
	5 = Total Cover		
Woody Vine Stratum (Plot size: 5x5)			
1.			
2.			
	0 = Total Cover		

% Bare Ground in Herb Stratum 50 % Cover of Biotic Crust 45

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (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:

Biotic crust cover is referring to the salt crust.

*=OBL rating is based on ratings of congeners and based on local knowledge.

SOIL

Sampling Point: DP-K

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
0-1	2.5 YR 5/2	98	10 YR 6/6	2	C	M	Clay loam	high salt content
1-2	10 YR 5/4	80	2.5 YR 6/4	20	D	M	Clay	
2-12+	2.5 YR 5/4	100					Clay	unconsolidated

[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: Solano Wind Phase 4 City/County: Collinsville/Solano County Sampling Date: 7/1/2016

Applicant/Owner: SMUD State: CA Sampling Point: DP-L

Investigator(s): Mark Noyes Section, Township, Range: S23, T3N, R1E

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Concave Slope (%): <1

Subregion (LRR): Mediterranean California Lat: 38.082711 Long: -121.839300 Datum: WSG1984

Soil Map Unit Name: Tamba mucky clay NWI classification: ______

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:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5x5)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5x5)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
Herb Stratum (Plot size: 5x5)			
1. Hordeum marinum	30	Y	FAC
2. Frankenia salina	20	Y	FACW
3. Distichlis spicata	18	Y	FAC
4. Festuca perennis	2	N	FAC
5.			
6.			
7.			
8.			
	70 = Total Cover		
Woody Vine Stratum (Plot size: 5x5)			
1.			
2.			
	0 = Total Cover		

% Bare Ground in Herb Stratum 30 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (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: DP-L

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
0-4	7.5 YR 3/2	100					Clay loam	
4-18+	10 YR 4/2	95	10 YR 5/6	5	C	M	Clay	

[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: Solano Wind Phase 4 City/County: Collinsville/Solano County Sampling Date: 7/1/2016

Applicant/Owner: SMUD State: CA Sampling Point: DP-M

Investigator(s): Mark Noyes Section, Township, Range: S23, T3N, R1E

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Convex Slope (%): 2

Subregion (LRR): Mediterranean California Lat: 38.082696 Long: -121.839272 Datum: WSG1984

Soil Map Unit Name: Tamba mucky clay NWI classification: ______

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:

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 5x5)			
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5x5)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
Herb Stratum (Plot size: 5x5)			
1. Frankenia salina	8	N	FACW
2. Distichlis spicata	8	N	FAC
3. Lupinus succulentus	2	N	NL
4. Bromus hordeaceus	60	Y	FACU
5. Festuca perennis	14	N	FAC
6. Hordeum marinum	8	N	FAC
7.			
8.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: 5x5)			
1.			
2.			
	0 = 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: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	8	x 2 =	16
FAC species	30	x 3 =	90
FACU species	60	x 4 =	240
UPL species	2	x 5 =	10
Column Totals:	100 (A)		366 (B)

Prevalence Index = B/A = 3.66

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: DP-M

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+	7.5 YR 3/2	100					Clay loam	

[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: Solano Wind Phase 4 City/County: Collinsville/Solano County Sampling Date: 7/1/2016

Applicant/Owner: SMUD State: CA Sampling Point: DP-N

Investigator(s): Mark Noyes Section, Township, Range: S23, T3N, R1E

Landform (hillslope, terrace, etc.): Basin Local relief (concave, convex, none): Concave Slope (%): <1

Subregion (LRR): Mediterranean California Lat: 38.082572 Long: -121.839318 Datum: WSG1984

Soil Map Unit Name: Tamba mucky clay NWI classification: ______

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:

Datapoint was taken in shallow portion of marsh. Other deeper parts had tules, cat-tails, and ponding. Higher in the landscape is ringed with Mexican rush.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 5x5)			
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5x5)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
Herb Stratum (Plot size: 5x5)			
1. Bolboschoenus robustus	15	Y	OBL
2. Sesuvium verrucosum	28	Y	FACW
3. Distichlis spicata	10	N	FAC
4. Polypogon monspeliensis	2	N	FACW
5.			
6.			
7.			
8.			
	55 = Total Cover		
Woody Vine Stratum (Plot size: 5x5)			
1.			
2.			
	0 = 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: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (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: DP-N

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
0-3	10 YR 3/1	95	5 YR 3/3	5	C	M	Clay	
3-18+	10 YR 3/2	95	10 YR 5/8	5	C	M	Silt loam	

[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: Solano Wind Phase 4 City/County: Collinsville/Solano County Sampling Date: 7/26/2016

Applicant/Owner: SMUD State: CA Sampling Point: DP-O

Investigator(s): Mark Noyes Section, Township, Range: S23, T3N, R1E

Landform (hillslope, terrace, etc.): Levee Local relief (concave, convex, none): None Slope (%): <1

Subregion (LRR): Mediterranean California Lat: 38.082559 Long: -121.839297 Datum: WSG1984

Soil Map Unit Name: Tamba mucky clay NWI classification: ______

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:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5x5)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
= Total Cover	0		
Sapling/Shrub Stratum (Plot size: 5x5)			
1.			
2.			
3.			
4.			
5.			
= Total Cover	0		
Herb Stratum (Plot size: 5x5)			
1. Cynodon dactylon	60	Y	FACU
2. Helminthotheca echioides	5	N	FACU
3. Lactuca serriola	5	N	FACU
4. Bromus diandrus	10	N	NL
5. Festuca perennis	10	N	FAC
6. Bromus hordeaceus	10	N	FACU
7.			
8.			
= Total Cover	100		
Woody Vine Stratum (Plot size: 5x5)			
1.			
2.			
= Total Cover	0		

% 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: 0 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species	10	x 3 =	30
FACU species	80	x 4 =	320
UPL species	10	x 5 =	50
Column Totals:	100 (A)		400 (B)

Prevalence Index = B/A = 4

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: DP-O

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
0-3	10 YR 3/2	100					Clay loam	

[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: gravel

Depth (inches): 3+

Hydric Soil Present? Yes ___ No ✓

Remarks:

Thin soil layer over gravel for levee/road construction.

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: Solano Wind Phase 4 City/County: Collinsville/Solano County Sampling Date: 7/26/2016

Applicant/Owner: SMUD State: CA Sampling Point: DP-P

Investigator(s): Mark Noyes Section, Township, Range: S23, T3N, R1E

Landform (hillslope, terrace, etc.): Hillslope- base Local relief (concave, convex, none): Convex Slope (%): 1

Subregion (LRR): Mediterranean California Lat: 38.082575 Long: -121.839264 Datum: WSG1984

Soil Map Unit Name: Tamba mucky clay NWI classification: ______

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:

Data point taken within an ditch constructed to drain an adjoining wetland.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 3x8)			
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: 3x8)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
Herb Stratum (Plot size: 3x8)			
1. Polypogon monspeliensis	60	Y	FACW
2. Schoenoplectus robustus	35	Y	OBL
3. Distichilis spicata	5	N	FAC
4.			
5.			
6.			
7.			
8.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: 3x8)			
1.			
2.			
	0 = 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: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (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: DP-P

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
0-4	10 YR 4/2	95	10 YR 5/4	5	C	M	Clay	
4-18+	2.5 YR 4/2	90	5 YR 4/6	10	C	PL	Clay	

[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: Solano Wind Phase 4 City/County: Collinsville/Solano County Sampling Date: 7/26/2016

Applicant/Owner: SMUD State: CA Sampling Point: DP-Q

Investigator(s): Mark Noyes Section, Township, Range: S23, T3N, R1E

Landform (hillslope, terrace, etc.): Basin Local relief (concave, convex, none): Concave Slope (%): 1

Subregion (LRR): Mediterranean California Lat: 38.082318 Long: -121.841236 Datum: WSG1984

Soil Map Unit Name: Tamba mucky clay NWI classification: Freshwater pond

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:

Depressional wetland ringed with Salicornia pacifica and Cressa truxillensis in the bottom.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5x5)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5x5)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
Herb Stratum (Plot size: 5x5)			
1. Salicornia pacifica	90	Y	OBL*
2. Cressa truxillensis	5	N	FACW
3.			
4.			
5.			
6.			
7.			
8.			
	95 = Total Cover		
Woody Vine Stratum (Plot size: 5x5)			
1.			
2.			
	0 = Total Cover		

% Bare Ground in Herb Stratum 5 % 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: 100% (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:

*=OBL rating is based on ratings of congeners and based on local knowledge.

SOIL

Sampling Point: DP-Q

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
0-4	10 YR 5/1	100					Clay loam	
4-18+	10 YR 4/1	100					Loam	

[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: Solano Wind Phase 4 City/County: Collinsville/Solano County Sampling Date: 7/27/2016

Applicant/Owner: SMUD State: CA Sampling Point: DP-R

Investigator(s): Mark Noyes Section, Township, Range: S23, T3N, R1E

Landform (hillslope, terrace, etc.): Levee/road Local relief (concave, convex, none): Convex Slope (%): 2

Subregion (LRR): Mediterranean California Lat: 38.082335 Long: -121.841242 Datum: WSG1984

Soil Map Unit Name: Tamba mucky clay NWI classification: ____

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:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5x5)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5x5)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
Herb Stratum (Plot size: 5x5)			
1. Centaurea solstitialis	10	N	NL
2. Bromus diandrus	30	Y	NL
3. Bromus hordeaceus	30	Y	FACU
4. Carduus pycnocephalus	10	N	NL
5. Sonchus asper	10	N	FAC
6. Avena fatua	10	N	NL
7.			
8.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: 5x5)			
1.			
2.			
	0 = 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 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 =
FACW species	0	x 2 =
FAC species	10	x 3 = 30
FACU species	30	x 4 = 120
UPL species	60	x 5 = 300
Column Totals:	100 (A)	450 (B)

Prevalence Index = B/A = 4.5

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: DP-R

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10 YR 3/2	100					Clay loam	

[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: gravel

Depth (inches): 3+

Hydric Soil Present? Yes ______ No ✓

Remarks:

Soil overlain gravel used for levee/road.

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: Solano Wind Phase 4 City/County: Collinsville/Solano County Sampling Date: 7/27/2016

Applicant/Owner: SMUD State: CA Sampling Point: DP-S

Investigator(s): Mark Noyes Section, Township, Range: S23, T3N, R1E

Landform (hillslope, terrace, etc.): Basin Local relief (concave, convex, none): Convex Slope (%): <1

Subregion (LRR): Mediterranean California Lat: 38.084801 Long: -121.843065 Datum: WSG1984

Soil Map Unit Name: Tamba mucky clay NWI classification: Freshwater pond

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:

Open water with detected OHWM= other water

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5x5)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5x5)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
Herb Stratum (Plot size: 5x5)			
1. Distichilis spicata	1	N	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	1 = Total Cover		
Woody Vine Stratum (Plot size: 5x5)			
1.			
2.			
	0 = Total Cover		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 99

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 0 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species	1	x 3 = 3
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	1 (A)	3 (B)

Prevalence Index = B/A = 3.00

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:

<5% hydrophyte cover

SOIL

Sampling Point: DP-S

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
0-3	10 YR 3/1	100					Sandy loa	
3-18+	7.5 YR 4/2	100					Clay loam	

[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:

Scald-like, large open water feature in winter/spring

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Solano Wind Phase 4 City/County: Collinsville/Solano County Sampling Date: 7/27/2016

Applicant/Owner: SMUD State: CA Sampling Point: DP-T

Investigator(s): Mark Noyes Section, Township, Range: S23, T3N, R1E

Landform (hillslope, terrace, etc.): Basin Local relief (concave, convex, none): Concave Slope (%): 1

Subregion (LRR): Mediterranean California Lat: 38.083421 Long: -121.841977 Datum: WSG1984

Soil Map Unit Name: Diablo-Ayar clays, 2 to 9 percent slopes NWI classification: ______

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:

Depressional wetland is large wetland swale due to slay soils, surrounding area is sandy and drains.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5x5)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5x5)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
Herb Stratum (Plot size: 5x5)			
1. Festuca perennis	40	Y	FAC
2. Hordeum marinum	20	Y	FAC
3. Distichilis spicata	30	Y	FAC
4. Rumex crispus	2	N	FAC
5. Bromus diandrus	8	N	NL
6.			
7.			
8.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: 5x5)			
1.			
2.			
	0 = 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: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (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: DP-T

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	10 YR 5/2	60	5 YR 4/6	40	C	M	Sandy loa	
6-18+	10 YR 3/2	70	5 YR 3/6	30	C	M	Loam	manganese soft bodies

[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: Solano Wind Phase 4 City/County: Collinsville/Solano County Sampling Date: 7/27/2016

Applicant/Owner: SMUD State: CA Sampling Point: DP-U

Investigator(s): Mark Noyes Section, Township, Range: S23, T3N, R1E

Landform (hillslope, terrace, etc.): Basin Local relief (concave, convex, none): Convex Slope (%): 2

Subregion (LRR): Mediterranean California Lat: 38.083402 Long: -121.841966 Datum: WSG1984

Soil Map Unit Name: Diablo-Ayar clays, 2 to 9 percent slopes NWI classification: ______

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:

Sandy area within natural drainage (not wet), drains too fast for wetlands, no hydric soils.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 5x5)			
1.			
2.			
3.			
4.			
= Total Cover	0		
Sapling/Shrub Stratum (Plot size: 5x5)			
1.			
2.			
3.			
4.			
5.			
= Total Cover	0		
Herb Stratum (Plot size: 5x5)			
1. Avena fatua	50	Y	NL
2. Distichilis spicata	26	Y	FAC
3. Lactuca serriola	2	N	FACU
4. Festuca perennis	5	N	FAC
5. Bromus diandrus	15	N	NL
6. Rumex crispus	2	N	FAC
7.			
8.			
= Total Cover	100		
Woody Vine Stratum (Plot size: 5x5)			
1.			
2.			
= Total Cover	0		

% Bare Ground in Herb Stratum 0 % 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: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species	33	x 3 =	99
FACU species	2	x 4 =	8
UPL species	65	x 5 =	325
Column Totals:	100 (A)		432 (B)

Prevalence Index = B/A = 4.32

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: DP-U

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
0-18+	7.5 YR 3/2	100					Sand	

[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:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Solano Wind Phase 4	**Date:** 6/23/2016	**Time:** 10:10 am
Project Number:	**Town:** Collinsville	**State:** CA
Stream: Ephemeral Drainage 1	**Photo begin file#:** PP2	**Photo end file#:** PP3
Investigator(s): Noyes, Mark		

Y ☒ / N ☐ Do normal circumstances exist on the site?	**Location Details:** 50 ft. east of Talber Rd
Y ☐ / N ☒ Is the site significantly disturbed?	**Projection:** WGS84 **Datum:** d_wgs_1984 **Coordinates:** 38.436678, -121.351778

Potential anthropogenic influences on the channel system:

Culvert and livestock (goats)

Brief site description:

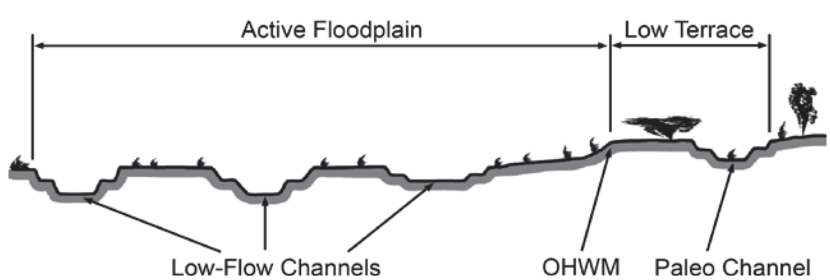
Drainage ditch located approximately 50 ft. east of Talber Rd and adjacent livestock feeding lot.

Checklist of resources (if available):

- ☒ Aerial photography
  Dates:
- ☐ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☒ Global positioning system (GPS)
- ☐ Other studies

- ☐ Stream gage data
  Gage number:
  Period of record:
  - ☐ History of recent effective discharges
  - ☐ Results of flood frequency analysis
  - ☐ Most recent shift-adjusted rating
  - ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units

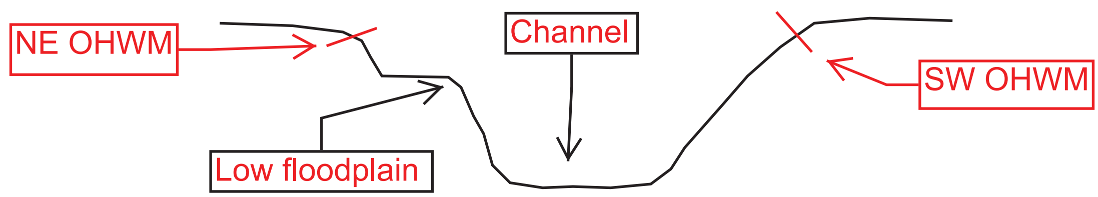


Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☐ Mapping on aerial photograph
   - ☒ GPS
   - ☐ Digitized on computer
   - ☐ Other:

Project ID: **Cross section ID:** **Date:** **Time:**

Cross section drawing:



OHWM

GPS point: NE= 38.086453, -121.808221 and SW= 38.086434, -121.808163

Indicators:

- [X] Change in average sediment texture
- [X] Change in vegetation species
- [ ] Change in vegetation cover
- [X] Break in bank slope
- [ ] Other: ____________
- [ ] Other: ____________

Comments:

Located on the edge of a terrace.

Floodplain unit: [X] Low-Flow Channel [ ] Active Floodplain [ ] Low Terrace

GPS point: 38.086445, -121.808157

Characteristics of the floodplain unit:

Average sediment texture: Sandy clay

Total veg cover: 50 % Tree: 0 % Shrub: 0 % Herb: 50 %

Community successional stage:

- [ ] NA
- [X] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Indicators:

- [X] Mudcracks
- [ ] Ripples
- [ ] Drift and/or debris
- [X] Presence of bed and bank
- [ ] Benches
- [ ] Soil development
- [ ] Surface relief
- [X] Other: Change in dominant plant species
- [ ] Other: ____________
- [ ] Other: ____________

Comments:

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☒ Low Terrace

GPS point: 38.086440, -121.808167

Characteristics of the floodplain unit:

Average sediment texture: Sandy loam

Total veg cover: 40 % Tree: 0 % Shrub: 0 % Herb: 40 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☒ Presence of bed and bank
- ☒ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: ____________________
- ☐ Other: ____________________
- ☐ Other: ____________________

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: ____________________

Characteristics of the floodplain unit:

Average sediment texture: ____________________

Total veg cover: _____ % Tree: _____ % Shrub: _____ % Herb: _____ %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: ____________________
- ☐ Other: ____________________
- ☐ Other: ____________________

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

<table>
<tr><td colspan="2">Project: Solano Wind Phase 4
Project Number:
Stream: Ephemeral Drainage 2
Investigator(s): Noyes, Mark</td><td>Date: 6/23/2016
Town: Collinsville
Photo begin file#: PP4</td><td>Time: 12:00 pm
State: CA
Photo end file#:</td></tr>
<tr><td colspan="2">Y ☒ / N ☐ Do normal circumstances exist on the site?</td><td colspan="2">Location Details:
50 ft. east of Talber Rd</td></tr>
<tr><td colspan="2">Y ☐ / N ☒ Is the site significantly disturbed?</td><td colspan="2">Projection: WGS84 Datum: d_wgs_1984
Coordinates: 38.088293, -121.817385</td></tr>
</table>

Potential anthropogenic influences on the channel system:

Road grading and possible ground disking

Brief site description:

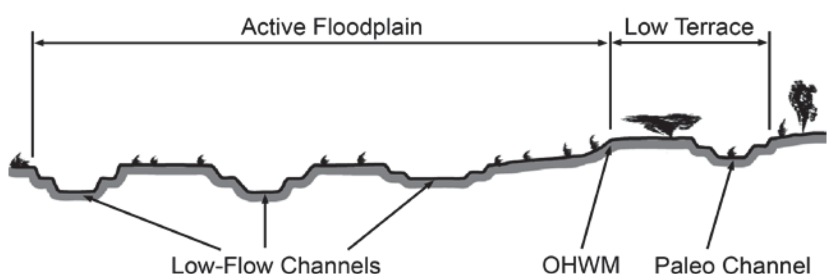
Drainage coming off road, up-slope area goes under ground and the OHWM is where it comes back out of the ground again.

Checklist of resources (if available):

- ☒ Aerial photography
  Dates:
- ☐ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☒ Global positioning system (GPS)
- ☐ Other studies

- ☐ Stream gage data
  Gage number:
  Period of record:
  - ☐ History of recent effective discharges
  - ☐ Results of flood frequency analysis
  - ☐ Most recent shift-adjusted rating
  - ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units

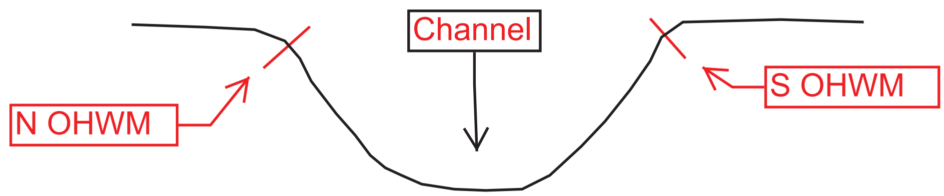


Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☐ Mapping on aerial photograph
   - ☒ GPS
   - ☐ Digitized on computer
   - ☐ Other:

Project ID: **Cross section ID:** **Date:** **Time:**

Cross section drawing:



OHWM

GPS point: N= 38.088293, -121.817385 and S= 38.088279, -121.817382

Indicators:

- [ ] Change in average sediment texture
- [ ] Change in vegetation species
- [X] Change in vegetation cover
- [X] Break in bank slope
- [ ] Other: ____________________
- [ ] Other: ____________________

Comments:

Located on the edge of a terrace.

Floodplain unit:

- [ ] Low-Flow Channel
- [ ] Active Floodplain
- [ ] Low Terrace

GPS point: ____________________

Characteristics of the floodplain unit:

Average sediment texture: ____________________

Total veg cover: ______ % Tree: ______% Shrub: ______% Herb: ______%

Community successional stage:

- [ ] NA
- [ ] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Indicators:

- [ ] Mudcracks
- [ ] Ripples
- [ ] Drift and/or debris
- [ ] Presence of bed and bank
- [ ] Benches
- [ ] Soil development
- [ ] Surface relief
- [ ] Other: Change in dominant plant species
- [ ] Other: ____________________
- [ ] Other: ____________________

Comments:

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☒ Low Terrace

GPS point: 38.086440, -121.808167

Characteristics of the floodplain unit:

Average sediment texture: Sandy loam

Total veg cover: 40 % Tree: 0 % Shrub: 0 % Herb: 40 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☒ Presence of bed and bank
- ☒ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: ____________________
- ☐ Other: ____________________
- ☐ Other: ____________________

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: ____________________

Characteristics of the floodplain unit:

Average sediment texture: ____________________

Total veg cover: _____ % Tree: _____ % Shrub: _____ % Herb: _____ %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: ____________________
- ☐ Other: ____________________
- ☐ Other: ____________________

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Solano Wind Phase 4	**Date:** 6/23/2016	**Time:** 11:45 am
Project Number: 12-002-013	**Town:** Collinsville	**State:** CA
Stream: W-6	**Photo begin file#:** PP4	**Photo end file#:** PP4
Investigator(s): Mark Noyes, Callen Keller		

Y ☒ / N ☐ Do normal circumstances exist on the site?	**Location Details:** Approximately 0.34 miles west of Talbert Lane
Y ☐ / N ☒ Is the site significantly disturbed?	**Projection:** WGS84 **Datum:** d_wgs_1984 **Coordinates:** 38.088287, -121.817360

Potential anthropogenic influences on the channel system:

Upslope road construction

Brief site description:

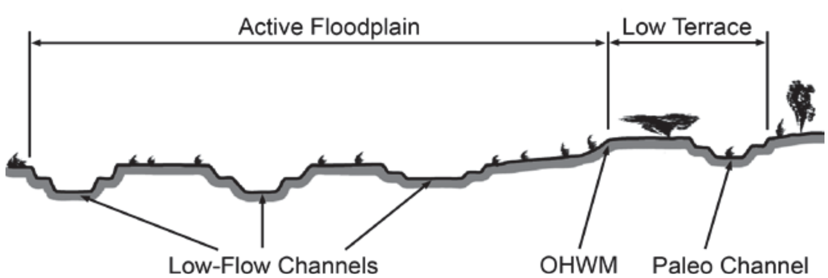
Ephemeral drainage on side slope of steep hill in annual grassland

Checklist of resources (if available):

- ☐ Aerial photography
  Dates:
- ☐ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☒ Global positioning system (GPS)
- ☐ Other studies

- ☐ Stream gage data
  Gage number:
  Period of record:
  - ☐ History of recent effective discharges
  - ☐ Results of flood frequency analysis
  - ☐ Most recent shift-adjusted rating
  - ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units

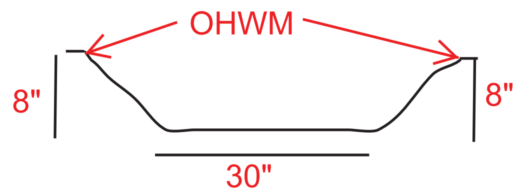


Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☐ Mapping on aerial photograph
   - ☒ GPS
   - ☐ Digitized on computer
   - ☐ Other:

Project ID: Solano Wind Phase 4 **Cross section ID:** OHWM-3 **Date:** 6/23/2016 **Time:** 11:45 am

Cross section drawing:



OHWM

GPS point: 38.088287, -121.817360

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☒ Change in vegetation cover
- ☒ Break in bank slope
- ☐ Other: ______
- ☐ Other: ______

Comments:

OHWM is delineated by drainage in slope and change in vegetation cover from <1% to 90% outside of feature.

Floodplain unit: ☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: 38.088287, -121.817360

Characteristics of the floodplain unit:

Average sediment texture: Clay Loam

Total veg cover: <1% % Tree: 0 % Shrub: 0 % Herb: <1% %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☒ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: ______
- ☐ Other: ______
- ☐ Other: ______

Comments:

Due to steep banks, the OHWM and boundaries of the low flow channel are the same.

Appendix C.
Representative Photographs

Photo Point 1. Data Point A in a seasonal swale adjacent to annual grassland (facing south).
Coordinates: 38.087284, -121.807254
Taken on June 23, 2016.

Photo Point 2. Data Point C in an ephemeral drainage next to annual grassland (facing south).
Coordinates: 38.086524, -121.808219
Taken on June 23, 2016.

Photo Point 3. Ephemeral drainage surrounded by a developed area (facing north).
Coordinates: 38.086650, -121.808210
Taken on June 23, 2016.

Photo Point 4. Ephemeral drainage within annual grasslands (facing west).
Coordinates: 38.088287, -121.817360
Taken on June 23, 2016.

Photo Point 5. Data Point E in a perennial swale surrounded by a seasonal swale (facing northeast).
Coordinates: 38.078907, -121.832778
Taken on June 23, 2016.

Photo Point 6. Data Point G in a seasonal swale (right) next to Data Point H in an agricultural field (facing east)
Coordinates: 38.079149, -121.832816
Taken on June 23, 2016.

<table>
<tr>
<td>
Photo Point 7. Boundary of perennial swale (left) and annual grassland (right) (facing east).
Coordinates: 38.105899, -121.830302
Taken on July 1, 2016.</td>
<td>
Photo Point 8. Chairmaker's club-rush growing within Himalayan blackberry in perennial swale (facing east).
Coordinates: 38.105931, -121.830183
Taken on July 1, 2016.</td>
</tr>
<tr>
<td>
Photo Point 9. Seasonal swale surrounding perennial swale (background) (facing northeast).
Coordinates: 38.078540, -121.833466
Taken on July 1, 2016.</td>
<td>
Photo Point 10. Brackish marsh just north of Stratton Road (facing east).
Coordinates: 38.082503, -121.840220
Taken on July 1, 2016.</td>
</tr>
<tr>
<td>
Photo Point 11. Overview of vegetation communities near Stratton Road (facing south).
Coordinates: 38.083032, -121.838313
Taken on July 26, 2016.</td>
<td>
Photo Point 12. Overview of vegetation communities near Stratton Road (facing southwest).
Coordinates: 38.083090, -121.838366
Taken on July 26, 2016.</td>
</tr>
</table>

Photo Point 13. Seasonal swale surrounding brackish marsh (facing southwest).
Coordinates: 38.083816, -121.839035
Taken on July 26, 2016.

Photo Point 14. Edge of a seasonal swale with a small scald adjacent to an agricultural field with brackish marsh in the background (facing north).
Coordinates: 38.082676, -121.839289
Taken on July 26, 2016.

Photo Point 15. Edge of brackish marsh (Data Point N) against developed road (facing southwest).
Coordinates: 38.082592, -121.839336
Taken on July 26, 2016.

Photo Point 16. Wetland ditch (Data Point P) flowing into brackish marsh (facing west).
Coordinates: 38.082604, -121.839119
Taken on July 26, 2016.

Photo Point 17. Wetland ditch along Stratton Road (facing east).
Coordinates: 38.082604, -121.839119
Taken on July 26, 2016.

Photo Point 18. Large scald within a seasonal swale (facing west).
Coordinates: 38.082472, -121.838507
Taken on July 26, 2016.

Photo Point 19. Alkaline pool (Data Point R) dominated by pickleweed (left) (facing west).
Coordinates: 38.082324, -121.841202
Taken on July 26, 2016.

Photo Point 20. Open water with saltgrass edge (Data Point S) (facing southwest).
Coordinates: 38.084805, -121.843014
Taken on July 27, 2016.

Photo Point 21. Capped spring near the head of a seasonal swale (facing east).
Coordinates: 38.085739, -121.841522
Taken on July 27, 2016.

Photo Point 22. Head of a large seasonal swale with a capped spring to the south (left) (facing southwest).
Coordinates: 38.086276, -121.841582
Taken on July 27, 2016.

Photo Point 23. Seasonal swale (facing northeast).
Coordinates: 38.084952, -121.842731
Taken on July 27, 2016.

Photo Point 24. Seasonal swale within NWI-mapped “Riverine” habitat (facing east).
Coordinates: 38.082977, -121.835052
Taken on July 27, 2016.

Photo Point 25. Annual grassland/agricultural vegetation communities within a NWI-mapped "Riverine" habitat (facing north).
Coordinates: 38.083980, -121.831956
Taken on July 27, 2016.

Photo Point 26. Seasonal swale within NWI-mapped "Riverine" habitat (facing northwest).
Coordinates: 38.087285, -121.833834
Taken on July 27, 2016.

Photo Point 27. Agricultural vegetation community in NWI-mapped "Riverine" habitat (facing east).
Coordinates: 38.090654, -121.834935
Taken on July 27, 2016.

Photo Point 28. Annual grassland/agricultural vegetation communities within a NWI-mapped "Riverine" habitat (facing northeast).
Coordinates: 38.090388, -121.826632
Taken on July 27, 2016.

Photo Point 29. Seasonal swale within NWI-mapped "Riverine" habitat (facing southwest).
Coordinates: 38.090269, -121.826795
Taken on July 27, 2016.

Photo Point 30. Seasonal swale replaced by agricultural vegetation community within NWI-mapped "Riverine" habitat (facing south).
Coordinates: 38.086951, -121.829581
Taken on July 27, 2016.

 Photo Point 31. Agricultural vegetation community in NWI-mapped “Riverine” habitat (facing east). Coordinates: 38.083522, -121.829045 Taken on July 27, 2016.	 Photo Point 32. Agricultural vegetation community in NWI-mapped “Riverine” habitat (facing south). Coordinates: 38.081306, -121.830318 Taken on July 27, 2016.
 Photo Point 33. Seasonal swale within NWI-mapped “Riverine” habitat (northeast). Coordinates: 38.079655, -121.824386 Taken on July 27, 2016.	 Photo Point 34. Annual grassland at head of a seasonal swale within NWI-mapped “Riverine” habitat (southwest). Coordinates: 38.081777, -121.821962 Taken on July 27, 2016.
 Photo Point 35. Agricultural vegetation community within NWI-mapped “Riverine” habitat (facing south). Coordinates: 38.081819, -121.818238 Taken on July 27, 2016.	 Photo Point 36. Agricultural vegetation community within NWI-mapped “Riverine” habitat (facing east). Coordinates: 38.079347, -121.813877 Taken on July 27, 2016.

Photo Point 37. Agricultural vegetation community within NWI-mapped "Riverine" habitat (facing southwest).
Coordinates: 38.078319, -121.814304
Taken on July 27, 2016.

Photo Point 38. Agricultural vegetation community within NWI-mapped "Riverine" habitat (facing east).
Coordinates: 38.078424, -121.813413
Taken on July 27, 2016.

Photo Point 39. Agricultural vegetation community within NWI-mapped "Riverine" habitat (facing east).
Coordinates: 38.076027, -121.812997
Taken on July 27, 2016.

Photo Point 40. Agricultural vegetation community within NWI-mapped "Riverine" habitat (facing west).
Coordinates: 38.076066, -121.813537
Taken on July 27, 2016.

Photo Point 41. Annual grassland/agricultural vegetation communities within NWI-mapped "Riverine" habitat (facing northeast).
Coordinates: 38.076276, -121.817914
Taken on July 27, 2016.

Photo Point 42. Seasonal swale within NWI-mapped "Riverine" habitat (northwest).
Coordinates: 38.099099, -121.831134
Taken on July 27, 2016.

<table>
<tr>
<td>
Photo Point 43. Agricultural vegetation community within NWI-mapped “Riverine” habitat (facing south).
Coordinates: 38.103325, -121.830472
Taken on July 27, 2016.</td>
<td>
Photo Point 44. Capped spring in southern portion of Project area near Stratton Road (facing southwest).
Coordinates: 38.082788, -121.838271
Taken on July 26, 2016.</td>
</tr>
</table>

Appendix D
List of Vascular Plant Species Observed

Scientific Name	Common Name	Family	Nativity	Wetland Indicator Status (Arid West Region)[1]
Ambrosia psilostachya	Perennial ragweed	Asteraceae	Native	FACU
Amsinckia intermedia	Common fiddleneck	Boraginaceae	Native	NL
Amsinckia menziesii	Common fiddleneck	Boraginaceae	Native	NL
Anthemis cotula	Stinking chamomile	Asteraceae	Naturalized	FACU
Artemisia douglasiana	Douglas' wormwood	Asteraceae	Native	FAC
Asclepias fascicularis	Narrow-leaf milkweed	Apocynaceae	Native	FAC
Asparagus officinalis	Asparagus	Asparagaceae	Naturalized	FACU
Atriplex prostrata	Hastate orache	Chenopodiaceae	Naturalized	FACW
Avena barbata	Slender wild oat	Poaceae	Naturalized	NL
Avena fatua	Wild oat	Poaceae	Naturalized	NL
Bolboschoenus robustus	Seaside club-rush	Cyperaceae	Native	OBL
Brassica nigra	Black mustard	Brassicaceae	Naturalized	NL
Bromus caroli-henrici	Weedy brome	Brassicaceae	Naturalized	NL
Bromus diandrus	Ripgut brome	Poaceae	Naturalized	NL
Bromus hordeaceus	Soft brome	Poaceae	Naturalized	FACU
Carduus pycnocephalus	Italian thistle	Asteraceae	Naturalized	NL
Centaurea solstitialis	Yellow star-thistle	Asteraceae	Naturalized	NL
Centromadia fitchii	Fitch’s false tarplant	Asteraceae	Native	FACU
Centromadia pungens	Common spikeweed	Asteraceae	Native	FAC
Chenopodium album	Lamb's-quarter	Chenopodiaceae	Naturalized	FACU
Cirsium vulgare	Bull thistle	Asteraceae	Naturalized	FACU
Conium maculatum	Poison-hemlock	Apiaceae	Naturalized	FACW
Convolvulus arvensis	Bindweed	Convolvulaceae	Naturalized	NL
Cotula coronopifolia	Common brassbuttons	Asteraceae	Naturalized	OBL
Cressa truxillensis	Spreading alkali-weed	Convolvulaceae	Native	FACW
Croton setiger	Dove weed	Euphorbiaceae	Native	NL
Crypsis schoenoides	Swamp prickle grass	Poaceae	Naturalized	OBL
Cynara cardunculus	Artichoke	Asteraceae	Naturalized	FACU
Cynodon dactylon	Bermuda grass	Poaceae	Naturalized	FACU
Deinandra lobbii	Threeray tarweed	Asteraceae	Native	NL
Distichilis spicata	Saltgrass	Poaceae	Native	FAC
Dysphania ambrosioides	Mexican tea	Chenopodiaceae	Naturalized	FAC
Eleocharis (palustris) macrostachya	Common spikerush	Cyperaceae	Native	OBL
Eucalyptus camaldulensis	Red gum	Myrtaceae	Naturalized	FAC
Euthamia occidentalis	Western goldenrod	Asteraceae	Native	FACW
Festuca (Vulpia) myuros	Six-weeks grass	Poaceae	Naturalized	FACU
Festuca perennis	Italian ryegrass	Poaceae	Naturalized	FAC
Foeniculum vulgare	Fennel	Apiaceae	Naturalized	NL
Frankenia salina	Alkali sea-heath	Frankeniaceae	Native	FACW
Grindelia camporum	Foothill gumplant	Asteraceae	Native	FACW
Helminthotheca echioides	Bristly ox-tongue	Asteraceae	Naturalized	FACU
Heliotropium curassavicum	Alkali heliotrope	Boraginaceae	Native	FACU
Heterothotheca grandiflora	Telegraph weed	Asteraceae	Native	NL
Hirschfeldia incana	Summer mustard	Brassicaceae	Naturalized	NL
Hordeum depressum	Dwarf barley	Poaceae	Native	FACW
Hordeum marinum subsp. *gussoneanum*	Mediterranean barley	Poaceae	Naturalized	FAC

Scientific Name	Common Name	Family	Nativity	Wetland Indicator Status (Arid West Region)[1]
Hordeum murinum subsp. *leporinum*	Wall barley	Poaceae	Naturalized	FACU
Hypochaeris glabra	Smooth cat's-ear	Asteraceae	Naturalized	NL
Isolepis cernua	Low bulrush	Cyperaceae	Native	OBL
Juncus bufonius	Toad rush	Juncaceae	Native	FACW
Juncus mexicanus	Mexican rush	Juncaceae	Native	FACW
Lactuca saligna	Willow-leaf lettuce	Asteraceae	Naturalized	UPL
Lactuca serriola	Prickly wild lettuce	Asteraceae	Naturalized	FACU
Lepidium acutidens	Net pepper grass	Brassicaceae	Native	FAC
Lepidium latifolium	Perennial pepperweed	Brassicaceae	Naturalized	FAC
Lepidium nitidum	Shining pepperwort	Brassicaceae	Native	FAC
Lotus corniculatus	Garden bird's-foot-trefoil	Fabaceae	Naturalized	FAC
Lupinus bicolor	Miniature lupine	Fabaceae	Native	NL
Lupinus succulentus	Arroyo lupine	Fabaceae	Native	NL
Malvella leprosa	Alkali-mallow	Malvaceae	Native	FACU
Malva neglecta	Common mallow	Malvaceae	Naturalized	NL
Malva nicaeensis	Bull mallow	Malvaceae	Naturalized	NL
Marrubium vulgare	White horehound	Lamiaceae	Naturalized	FACU
Melilotus albus	White sweetclover	Fabaceae	Naturalized	NL
Nitrophila occidentalis	Boraxweed	Amaranthaceae	Native	FACW
Paspalum dialatatum	Dallis grass	Poaceae	Naturalized	FAC
Parapholis incurva	Sickle grass	Poaceae	Naturalized	FAC
Plantago lanceolata	English plantain	Plantaginaceae	Naturalized	FAC
Plantago major	Common plantain	Plantaginaceae	Naturalized	FAC
Polypogon maritimus	Maritime rabbit's-foot grass	Poaceae	Naturalized	OBL
Polypogon monspeliensis	Rabbitsfoot grass	Poaceae	Naturalized	FACW
Pseudognaphalium canescens	Wright's rabbit-tobacco	Asteracae	Native	FACU
Raphanus sativus	Wild radish	Brassicaceae	Naturalized	NL
Rubus armeniacus	Himalayan blackberry	Rosaceae	Naturalized	FAC
Rumex crispus	Curly dock	Polygonaceae	Naturalized	FAC
Rumex pulcher	Fiddle dock	Polygonaceae	Naturalized	FAC
Sarcocornia pacifica	Pacific swampfire	Chenopodiaceae	Native	OBL
Salsola tragus	Prickly russian-thistle	Chenopodiaceae	Naturalized	FACU
Schinus molle	Peruvian peppertree	Anacardiaceae	Naturalized	FACU
Schoenoplectus acutus	Common tule	Cyperaceae	Native	OBL
Schoenoplectus americanus	Chairmaker's club-rush	Cyperaceae	Native	OBL
Schoenoplectus californicus	California club-rush	Cyperaceae	Native	OBL
Sesuvium verrucosum	Western sea-purslane	Aizoaceae	Native	FACW
Sinapis arvensis	Charlock	Brassicaceae	Naturalized	NL
Silybum marianum	Milk thistle	Asteraceae	Naturalized	NL
Sonchus asper	Spiny sowthistle	Asteraceae	Naturalized	NL
Sonchus oleraceus	Common sow-thistle	Asteraceae	Naturalized	UPL
Soliva sessilis	Lawn burrweed	Asteraceae	Naturalized	FACU
Spergularia marina	Saltmarsh sandspurry	Caryophllyaceae	Native	OBL
Sisymbrium officinale	Hedge mustard	Brassicaceae	Naturalized	NL
Tragopogon porrifolius	Salsify	Asteraceae	Naturalized	NL

Scientific Name	Common Name	Family	Nativity	Wetland Indicator Status (Arid West Region)[1]
Trichostema lanceolatum	Vinegar-weed	Lamiaceae	Native	FACU
Trifolium dubium	Little hop clover	Fabaceae	Naturalzied	UPL
Trifolium fragiferum	Strawberry clover	Fabaceae	Naturalized	FACU
Triticum aestivum	Wheat	Poaceae	Naturalized	NL
Typha angustifolia	Narrow-leaf cat-tail	Typhaceae	Native or Naturalized	OBL
Typha domingensis	Southern cat-tail	Typhaceae	Native	OBL
Typha latifolia	Broad-leaf cat-tail	Typhaceae	Native	OBL
Xanthium spinosum	Spiny cockleburr	Asteraceae	Native	FACU
Xanthium strumarium	Rough cockleburr	Asteraceae	Native	FAC

[1]Wetland indicator status is from Lichvar et al. 2016.

Appendix E
Aquatic Resources Inventory

Waters_Name	State	Cowardin_Code	HGM_Code	Meas_Type	Amount	Units	Waters_Type	Latitude	Longitude	Local_Waterway
Alkaline Pool (W-28)	California	PEM1	DEPRESS	Area	0.086	ACRE	DELINPJD	38.082247	-121.841344	
Emergent Marsh Brackish (W-21)	California	PEM1	DEPRESS	Area	1.257	ACRE	DELINPJD	38.082976	-121.839538	
Emergent Marsh Brackish (W-27)	California	PEM1	DEPRESS	Area	1.142	ACRE	DELINPJD	38.082333	-121.839572	
Emergent Marsh Brackish (W-29)	California	PEM1	DEPRESS	Area	0.011	ACRE	DELINPJD	38.082117	-121.840625	
Emergent Marsh Brackish (W-30)	California	PEM1	DEPRESS	Area	0.009	ACRE	DELINPJD	38.082106	-121.840430	
Ephemeral Drainage (W-10)	California	R6	RIVERINE	Area	0.033	ACRE	DELINPJD	38.086687	-121.808406	
Ephemeral Drainage (W-11)	California	R6	RIVERINE	Area	0.084	ACRE	DELINPJD	38.086290	-121.808044	
Ephemeral Drainage (W-13)	California	R6	RIVERINE	Area	0.027	ACRE	DELINPJD	38.085843	-121.807896	
Ephemeral Drainage (W-5)	California	R6	RIVERINE	Area	0.004	ACRE	DELINPJD	38.088533	-121.817052	
Ephemeral Drainage (W-6)	California	R6	RIVERINE	Area	0.009	ACRE	DELINPJD	38.088282	-121.817473	
Open Water (W-37)	California	PUB2	DEPRESS	Area	0.053	ACRE	DELINPJD	38.084431	-121.843032	
Perennial Swale (W-1)	California	PEM1	DEPRESS	Area	0.226	ACRE	DELINPJD	38.106033	-121.830238	
Perennial Swale (W-34)	California	PEM1	DEPRESS	Area	0.455	ACRE	DELINPJD	38.078903	-121.832512	
Seasonal Swale (W-12)	California	PEM1	DEPRESS	Area	0.003	ACRE	DELINPJD	38.086074	-121.808082	
Seasonal Swale (W-14)	California	PEM1	DEPRESS	Area	0.009	ACRE	DELINPJD	38.085668	-121.808063	
Seasonal Swale (W-15)	California	PEM1	DEPRESS	Area	1.795	ACRE	DELINPJD	38.085575	-121.842021	
Seasonal Swale (W-16)	California	PEM1	DEPRESS	Area	0.028	ACRE	DELINPJD	38.085347	-121.829368	
Seasonal Swale (W-17)	California	PEM1	DEPRESS	Area	1.564	ACRE	DELINPJD	38.083790	-121.839582	
Seasonal Swale (W-19)	California	PEM1	DEPRESS	Area	0.036	ACRE	DELINPJD	38.083046	-121.829425	
Seasonal Swale (W-2)	California	PEM1	DEPRESS	Area	0.013	ACRE	DELINPJD	38.099420	-121.831278	
Seasonal Swale (W-24)	California	PEM1	DEPRESS	Area	1.389	ACRE	DELINPJD	38.082710	-121.836502	
Seasonal Swale (W-26)	California	PEM1	DEPRESS	Area	1.736	ACRE	DELINPJD	38.082286	-121.839470	
Seasonal Swale (W-3)	California	PEM1	DEPRESS	Area	0.073	ACRE	DELINPJD	38.096422	-121.831929	
Seasonal Swale (W-31)	California	PEM1	DEPRESS	Area	0.021	ACRE	DELINPJD	38.081719	-121.830157	
Seasonal Swale (W-32)	California	PEM1	DEPRESS	Area	0.083	ACRE	DELINPJD	38.080443	-121.823468	
Seasonal Swale (W-35)	California	PEM1	DEPRESS	Area	0.610	ACRE	DELINPJD	38.078654	-121.833784	
Seasonal Swale (W-36)	California	PEM1	DEPRESS	Area	0.668	ACRE	DELINPJD	38.073912	-121.821753	
Seasonal Swale (W-4)	California	PEM1	DEPRESS	Area	0.142	ACRE	DELINPJD	38.089160	-121.827943	
Seasonal Swale (W-7)	California	PEM1	DEPRESS	Area	0.064	ACRE	DELINPJD	38.087772	-121.807036	
Seasonal Swale (W-8)	California	PEM1	DEPRESS	Area	0.026	ACRE	DELINPJD	38.087188	-121.807430	
Seasonal Swale (W-9)	California	PEM1	DEPRESS	Area	0.028	ACRE	DELINPJD	38.086778	-121.833353	
Seasonal Wetland (W-18)	California	PEM1	DEPRESS	Area	0.078	ACRE	DELINPJD	38.083496	-121.841932	
Seasonal Wetland (W-20)	California	PEM1	DEPRESS	Area	0.006	ACRE	DELINPJD	38.083044	-121.839694	
Seasonal Wetland (W-22)	California	PEM1	DEPRESS	Area	0.086	ACRE	DELINPJD	38.082758	-121.837858	
Seasonal Wetland (W-33)	California	PEM1	DEPRESS	Area	2.319	ACRE	DELINPJD	38.079243	-121.832435	
Wetland Ditch (W-23)	California	PEM1	DEPRESS	Area	0.015	ACRE	DELINPJD	38.082659	-121.838305	
Wetland Ditch (W-25)	California	PEM1	DEPRESS	Area	0.033	ACRE	DELINPJD	38.082606	-121.838861	

Appendix F
Request for Jurisdictional Determination

REQUEST FOR JURISDICTIONAL DETERMINATION

This form should be used when a jurisdictional determination (JD) is required from the U.S. Army Corps of Engineers, Sacramento District. It is intended to help both the requestor and the Corps in determining which type of JD, if any, is appropriate. Use of the form is optional; however the information and consent is needed to complete a JD. If you are applying for a Department of the Army permit, you do not need to request a JD. A jurisdictional determination is not required to process a permit application. At the time an application is submitted, the Corps will assume the aquatic resources on the parcel/within the review area are waters of the United States for the purpose of making a permit decision. With no JD requested, the permit application may be processed more quickly. The permittee retains the ability to request a JD any time during or after the permit application review process.

I am requesting the U.S. Army Corps of Engineers, Sacramento District, complete a jurisdictional determination for the parcel/review area located at:

Street Address: 1785 Toland Lane City: Rio Vista County: Solano
State: CA Zip: 94571 Section: 2, 11, 14, 22, 23 Township: 3 North Range: 1 and 2 East
Latitude (decimal degrees): 38.080932 Longitude (decimal degrees): -121.827222
The approximate size of the review area for the JD is 1,172 acres. **(Please attach location map)**

Choose one:
- ☐ I currently own this property.
- ☐ I plan to purchase this property.
- ☑ I am an agent/consultant acting on behalf of the requestor.
- ☐ Other: ____

Choose one:
- ☐ I am requesting an Approved JD.
- ☑ I am requesting a Preliminary JD.
- ☐ I am unclear as to which JD I would like to request and require additional information to inform my decision.

Reason for request: (check all that apply)
- ☐ I intend to construct/develop a project or perform activities on this parcel/review area which would be designed to avoid all aquatic resources.
- ☐ I intend to construct/develop a project or perform activities on this parcel/review area which would be designed to avoid all jurisdictional aquatic resources under Corps authority.
- ☑ I intend to construct/develop a project or perform activities on this parcel/review area which may require authorization from the Corps, and the JD would be used to avoid and minimize impacts to jurisdictional aquatic resources and as an initial step in a future permitting process.
- ☐ I intend to construct/develop a project or perform activities on this parcel/review area which may require authorization from the Corps; this request is accompanied by my permit application and the JD is to be used in the permitting process.
- ☐ I intend to construct/develop a project or perform activities in a navigable water of the U.S. which is included on the district's list of navigable waters under Section 10 of the Rivers and Harbors Act of 1899 and/or is subject to the ebb and flow of the tide.
- ☐ A JD is required in order to obtain my local/state authorization.
- ☐ I intend to contest jurisdiction over a particular aquatic resource and request the Corps confirm that jurisdiction does/does not exist over the aquatic resource on the parcel/review.
- ☐ I believe that the parcel/review area may be comprised entirely of dry land.
- Other: ____

Attached Information:
- ☑ Maps depicting the general location and aquatic resources within the review area consistent with Map and Drawing Standards for the South Pacific Division Regulatory Program (Public Notice February 2016, http://www.spd.usace.army.mil/Missions/Regulatory/Public-Notices-and-References/Article/651327/updated-map-and-drawing-standards/)
- ☑ Aquatic Resources Delineation Report, if available, consistent with the Sacramento District's Minimum Standards for Acceptance (Public Notice January 2016, http://1.usa.gov/1V68IYa)

By signing below, you are indicating that you have the authority, or are acting as the duly authorized agent of a person or entity with such authority, to and do hereby grant Corps personnel right of entry to legally access the site if needed to perform the JD. Your signature shall be an affirmation that you possess the requisite property rights to request a JD on the subject property.

*Signature: ____ Date: ____
Name: ____ Company name: ____
Address: ____
____
Telephone: ____ Email: ____

***Authorities:** Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Program of the U.S. Army Corps of Engineers; Final Rule for 33 CFR Parts 320-332.
Principal Purpose: The information that you provide will be used in evaluating your request to determine whether there are any aquatic resources within the project area subject to federal jurisdiction under the regulatory authorities referenced above.
Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public, and may be made available as part of a public notice as required by federal law. Your name and property location where federal jurisdiction is to be determined will be included in the approved jurisdictional determination (AJD), which will be made available to the public on the District's website and on the Headquarters USACE website.
Disclosure: Submission of requested information is voluntary; however, if information is not provided, the request for an AJD cannot be evaluated nor can an AJD be issued.

Protocol-Level Special-status Plant Surveys Conducted for the Solano 4 Wind Project

AREA WEST
ENVIRONMENTAL, INC.

July 18, 2017

Jose Bodipo-Memba
Environmental Management Supervisor
SMUD Environmental Management
6201 S Street, Sacramento, CA 95817
(916) 732-6493
Jose.Bodipo-Memba@smud.org

SUBJECT: Protocol-Level Special-status Plant Surveys Conducted for the Solano Phase 4 Wind Project

Dear Mr. Bodipo-Memba,

Area West Environmental, Inc. (AWE) conducted protocol-level special-status[1] plant surveys for the Solano Phase 4 Wind Project (Project) on July 26 and 27, 2016, and on April 6, 2017, targeting special-status plant species bloom periods. For the purposes of this report, special-status plants are defined as federally and/or state threatened or endangered species as well as California Native Plant Society (CNPS) Rank 1 and 2 species. The survey followed the protocols outlined in the California Department of Fish and Wildlife (CDFW) 2009 "Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities."

Introduction

Sacramento Municipal Utility District (SMUD) is proposing to replace wind turbines in the Phase 4 area of the Solano Wind Farm Project near Collinsville, Solano County, California. Project construction would include replacement of turbines, installation of electrical collection lines, and grading for staging areas and access roads. The Project area is approximately 1,172 acres and is located in the Montezuma Hills, in Solano County (Figure 1).

Based on record searches of the CNPS database for the Antioch North and Birds U.S. Geological Survey (USGS) 7.5-minute quadrangle maps and surrounding quadrangles, federally threatened or endangered species list from the US Fish and Wildlife Service (USFWS), and CDFW's California Natural Diversity Database (CNDDB) for special-status plants within 5 miles of the Project area a total of 72 special-status plant species were identified as having potential to occur within the Project vicinity (Attachment 1).

[1] Special-status plants are generally defined as plants listed as candidate, threatened, or endangered by the State or Federal Endangered Species Act, or List 1 or 2 plant identified by the California Native Plant Society.

A list of the 72 species with potential to occur within the Project vicinity is included in Table 1, which includes the status, flowering period, elevation range, and the potential for each special-status plant species and their habitat to occur within the Project area.

Methods

AWE biologists visited accessible reference populations near the Project area and contacted botanists familiar with the local flora to determine the flowering state of targeted special-status plant species. On April 6, 2016 in anticipation of beginning surveys, AWE botanist Mary Bailey visited reference populations for two early blooming species; *Lasthenia conjugens* (Contra Costa goldfields) and *Sidalcea keckii* (Keck's checkerbloom). However, these reference populations appeared to have been extirpated; one location has been converted into wheat fields and the other two locations are now a residential development. AWE biologist Mark Noyes coordinated with ecologist Jake Schweitzer of Vollmar Natural Lands Consulting and confirmed that *Amsinckia grandilfora* (large-flowered fiddleneck) was in bloom at the beginning of April. However, Mr. Schweitzer did not feel that the Montezuma hills area was steep enough to provide appropriate habitat for the species.

On July 26 and 27, 2016 Mary Bailey conducted protocol-level special-status plant surveys on foot within a 250-foot buffer of all the facilities within the Project area (Study area) (Figure 2). As part of the survey protocol, all plants observed were identified to the taxonomic level required to determine if they were special-status (Table 2). Plants not readily identifiable were collected and identified using the *Jepson Manual: Vascular Plants of California* (Baldwin et al. 2012). Known reference populations of targeted special-status plant species with late bloom were not visited for this survey.

Additionally, wetland delineation fieldwork was conducted by Mark Noyes on July 1, 2016; July 26, 2016; and July 27, 2016. As part of the delineation protocol, complete inventories of all plant species observed were compiled and are also included in Table 2.

On April 5, 2017, Mary Bailey visited a Contra Costa goldfields reference population located near the Potrero Hill Landfill outside Suisun City (Scally Lane), and confirmed that the species was blooming. On April 6, 2017 Mary Bailey and Callen Keller conducted protocol-level special-status plant surveys throughout the Study area to target species with early bloom periods that were not covered during the July 2016 surveys.

Results

No special-status plants were detected within the Study area during the special-status surveys or the Project area during the wetland delineation. A complete list of plants found within the Project area during the surveys and wetland delineation can be found in Table 2.

Sincerely,

Becky Rozumowicz

Becky Rozumowicz

Enclosed:

Figure 1. Project Vicinity

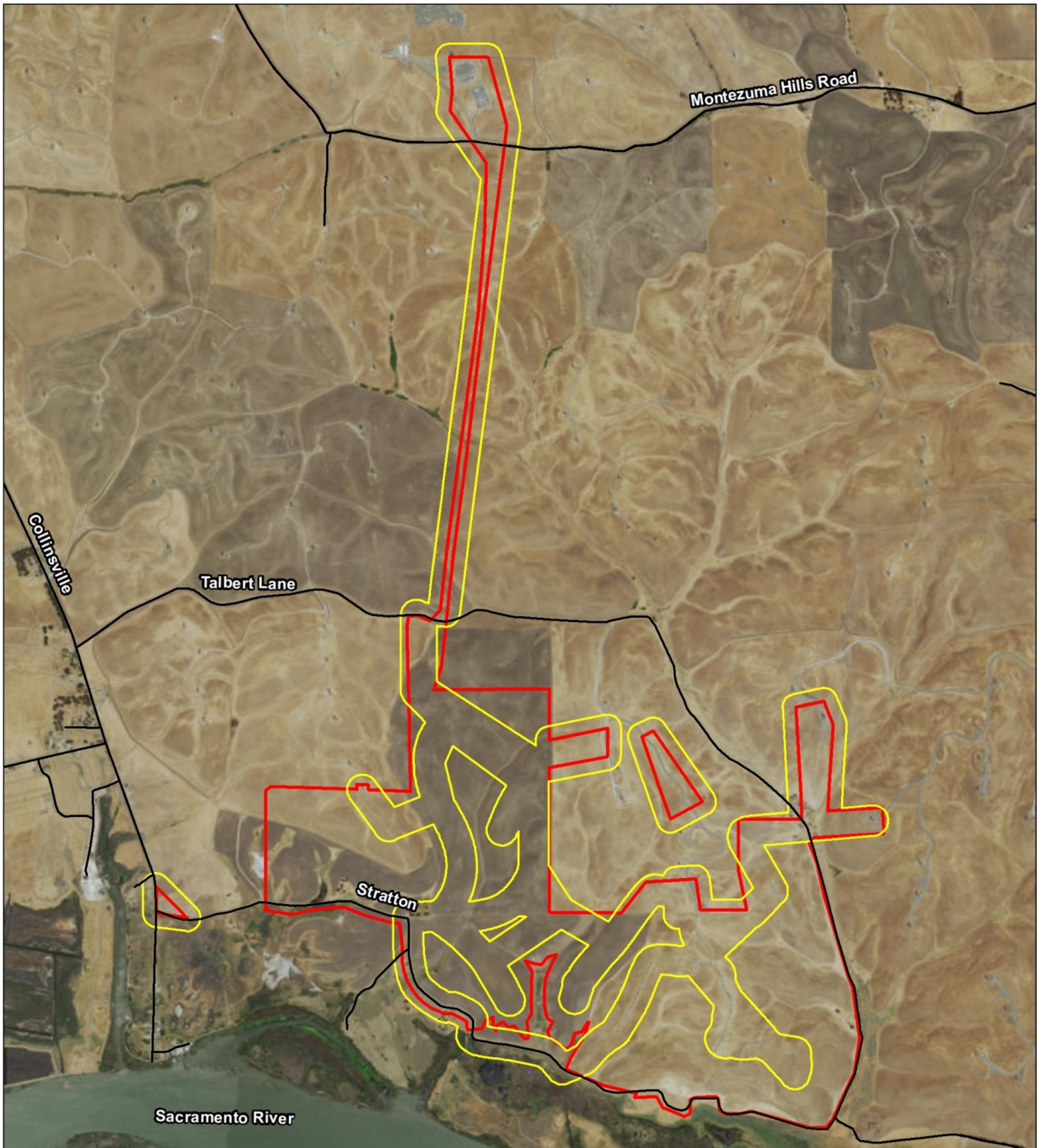
Figure 2. Study Area

Table 1. Special-status Plant Species with the Potential to Occur in the Vicinity of the Project

Table 2. Vascular Plants Observed

Attachment 1. CNPS, USFWS, and CNDDB Species Searches

Figure 1. Project Vicinity



SOLANO PHASE 4 WIND PROJECT

Project Area (1,172 acres)

Special-status Plant Study Area (900 acres)

Road

N

0 1,500 3,000 feet

1 inch = 3,000 feet

Data Source:
- ESRI Aerial Basemaps, June 6, 2014.
Date: 5-16-17

AREA WEST ENVIRONMENTAL, INC.

SMUD

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Figure 2. Study Area

Table 1. Special-status Plant Species with the Potential to Occur in the Vicinity of the Project

Common and Scientific Name	Legal Status[1] Federal/State/ CNPS	Distribution	Habitat Association	Identification Period	Habitat Present/ Absent	Species Present/ Absent	Survey Results/Rational
Large-flowered fiddleneck *Amsinckia grandiflora*	FE/SE/1B.1	Alameda, Contra Costa, and San Joaquin counties.	Cismontane woodland, valley and foothill grassland. 275 – 550 meters.	April – May	Present	Absent	Suitable habitat present within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. The nearest CNDDB occurrence is approximately 8.1 miles south of the project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Mt. Diablo manzanita *Arctostaphylos auriculata*	--/--/1B.3	Contra Costa County.	Chaparral (sandstone) and cismontane woodland. 135 – 650 meters.	January – March	Absent	Absent	No suitable habitat within the Project area. Mt. Diablo manzanita is not known to occur in Solano County. Not observed during special-status plant surveys. This is a shrub and would be detectable year round. However, it would not be identifiable to species level outside of the blooming period.
Contra Costa manzanita *Arctostaphylos manzanita* ssp. *Laevigata*	--/--/1B.2	Contra Costa county.	Chaparral (rocky). 430 – 1,100 meters.	January – April	Absent	Absent	No suitable habitat present within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. Not observed during special-status plant surveys. This is a shrub and would be detectable year round. However, it would not be identifiable to species level outside of the blooming period.

Common and Scientific Name	Legal Status[1] Federal/State/ CNPS	Distribution	Habitat Association	Identification Period	Habitat Present/ Absent	Species Present/ Absent	Survey Results/Rational
Ferris' milk-vetch *Astragalus tener* var. *ferrisiae*	--/--/1B.1	Sacramento Valley.	Vernally mesic meadows and seeps as well as subalkaline flat valley and foothill grasslands. 2 - 75 meters.	April – May	Present	Absent	Potential habitat for the species (seeps and alkaline valley and foothill grassland) is present within the Project area. There are no CNDDB occurrences within 10 miles of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Alkali milk-vetch *Astragalus tener* var. *tener*	--/--/1B.2	Central western California.	Mainly alkaline with adobe clay, valley and foothill grassland, vernal pools, and playas. 1 – 60 meters.	March – June	Present	Absent	Suitable habitat present within the Project area. One CNDDB occurrence located approximately 1.4 miles west of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Heartscale *Atriplex cordulata* var. *cordulata*	--/--/1B.2	Alameda, Butte, Contra Costa, Colusa, Fresno, Gelnn, Kern, Madera, Merced, San Luis Obispo, Solano, and Tulare counties.	Saline or alkaline soils in chenopod scrub, meadows and seeps, valley and foothill grassland (sandy). 0 – 560 meters.	April – October	Present	Absent	Suitable habitat present within the Project area. One CNDDB occurrence located approximately 2.5 miles northwest of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Brittlescale *Atriplex depressa*	--/--/1B.2	Known occurrences in Alameda, Contra Costa, Colusa, Fresno, Glenn, Kern, Merced, Solano, Stanislaus, Tulare, and Yolo counties.	Alkaline clay soils in chenopod scrub, meadows and seeps, playas, valley and foothill grassland, and vernal pools. 1 – 320 meters.	April – October	Present	Absent	Suitable habitat present within the Project area. One CNDDB occurrence located approximately 3.1 miles west of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.

Common and Scientific Name	Legal Status[1] Federal/State/ CNPS	Distribution	Habitat Association	Identification Period	Habitat Present/ Absent	Species Present/ Absent	Survey Results/Rational
Vernal Pool Smallscale *Atriplex persistens*	--/--/1B.2	Colusa, Glenn, Madera, Merced, Solano, and Tulare counties.	Vernal pools (alkaline). 10 - 115 meters.	June – October	Absent	Absent	Potential habitat for the species (alkaline vernal pool) is present within the Project area. The nearest CNDDB occurrence is 9.2 miles from the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Big tarplant *Blepharizonia plumose*	--/--/1B.1	Alameda, Contra Costa, San Joaquin, Solano, and Stanislaus counties.	Valley and foothill grassland, usually in clay soils. 30 – 505 meters.	July – October	Present	Absent	Suitable habitat present within the Project area. There are three CNDDB occurrences within 5 miles of the Project area; the closest is located approximately 3.5 miles to the southwest. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Round leaved filaree *California macrophylla*	--/--/1B.2	Ranges from Butte County south to San Diego County.	Clay soil in cismontane woodland, and valley and foothill grassland. 15 – 1,200 meters.	March – May	Present	Absent	Suitable habitat present within the Project area. One CNDDB occurrence located approximately 3.7 miles south of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Mt. Diablo fairy-lantern *Calochortus pulchellus*	--/--/1B.2	Alameda, Contra Costa, and Solano counties.	Chaparral, cismontane woodland, riparian woodland, and valley and foothill grassland. 30-840 meters.	April – June	Present	Absent	Suitable habitat present within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. The nearest CNDDB occurrence is 8.9 miles southeast of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.

Common and Scientific Name	Legal Status[1] Federal/State/ CNPS	Distribution	Habitat Association	Identification Period	Habitat Present/ Absent	Species Present/ Absent	Survey Results/Rational
Chaparral harebell *Campanula exigua*	--/--/1B.2	Alameda, Contra Costa, San Benito, Santa Clara, and Stanislaus counties.	Chaparral (rocky, usually serpentinite). 275 – 1,250 meters.	May – June	Absent	Absent	No suitable habitat present within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. Not observed during special-status plant surveys.
Congdon's tarplant *Centromadia parryi* ssp. *congdonii*	--/--/1B.1	Alameda, Contra Costa, Monterey, Santa Clara, Santa Cruz, San Luis Obispo, San Mateo, and Solano counties.	Valley and foothill grassland (alkaline soils). 0 – 300 meters.	May – November	Present	Absent	Suitable habitat present within the Project area. There are two CNDDB occurrences within 5 miles of the Project area; the closest is located approximately 3.3 miles to the northwest. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Pappose tarplant *Centromadia parryi* ssp. *parryi*	--/--/1B.2	Reported to occur in six counties in the Sacramento Valley and inner north Coast Ranges: Solano, Napa, Sonoma, Lake, Glenn, and Butte counties.	Often alkaline soils in coastal prairie, meadows and seeps, coastal salt marshes and swamps, vernally mesic valley and foothill grassland, chaparral. 0 – 420 meters.	May – November	Present	Absent	Suitable habitat present within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Hispid bird's-beak *Chloropyron molle* ssp. *hispidum*	--/--/1B.1	Alameda, Fresno, Kern, Merced, Placer, and Solano counties.	Playas, meadows and seeps, and valley and foothill grasslands. 1 – 155 meters.	June – September	Present	Absent	Suitable habitat present within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.

Common and Scientific Name	Legal Status[1] Federal/State/ CNPS	Distribution	Habitat Association	Identification Period	Habitat Present/ Absent	Species Present/ Absent	Survey Results/Rational
Soft bird's-beak *Chloropyron molle* ssp. *molle*	FE/SR/1B.2	Contra Costa, Marin, Napa, Sacramento, Solano, and Sonoma counties.	Marshes and swamps (coastal salt). 0 – 10 meters.	July – November	Absent	Absent	No suitable habitat present within the Project area. One CNDDB occurrence located approximately 4 miles northwest of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Bolander's water-hemlock *Cicuta maculata* var. *bolanderi*	--/--/2B.1	Contra Costa, Los Angeles, Marin, Sacramento, Santa Barbara, San Luis Obispo, and Solano counties.	Coastal marshes and swamps, fresh or brackish water. 0 – 200 meters.	July – September	Present	Absent	Suitable habitat present within the Project area. There are two CNDDB occurrences within 5 miles of the Project area; the closest is located directly to the southwest. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Suisun thistle *Cirsium hydrophilum* var. *hydrophilum*	FE/--/1B.1	Known from four occurrences in Solano County in the Suisun Marsh.	Marshes and swamps (salt). 0 – 1 meters.	June – September	Absent	Absent	No suitable habitat present within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Mt. Diablo bird's-beak *Cordylanthus nidularius*	--/SR/1B.1	Contra Costa County.	Chaparral (serpentinite). 600 – 800 meters.	June – August	Absent	Absent	No suitable habitat (serpentine soils) within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.

Common and Scientific Name	Legal Status[1] Federal/State/ CNPS	Distribution	Habitat Association	Identification Period	Habitat Present/ Absent	Species Present/ Absent	Survey Results/Rational
Hoover's cryptantha *Cryptantha hooveri*	--/--/1A	Contra Costa, Kern, Madera, and Stanislaus counties.	Inland dunes, valley and foothill grassland (sandy). 9 – 150 meters.	April – May	Present	Absent	Suitable habitat present within the Project area. One CNDDB occurrence located approximately 3.7 miles south of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Hospital Canyon larkspur *Delphinium californicum* ssp. *Interius*	--/--/1B.2	Alameda, Contra Costa, Merced, Monterey, San Benito, Santa Clara, San Joaquin, and Stanislaus counties.	Chaparral (openings), cismontane woodland (mesic), coastal scrub. 195 – 1,095 meters.	April – June	Absent	Absent	No suitable habitat present within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. Not observed during special-status plant surveys.
Recurved larkspur *Delphinium recurvatum*	--/--/1B.2	Alameda, Contra Costa, Fresno, Glenn, Kings, Kern, Madera, Merced, Monterey, San Joaquin, San Luis Obispo, Solano, Sutter, and Tulare counties.	Alkaline soils in chenopod scrub, cismontane woodland, and valley and foothill grassland. 3 - 790 meters.	March – June	Present	Absent	Potential habitat for the species (alkaline valley and foothill grassland) is present in the Project area. There are no CNDDB occurrences within 10 miles of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Dwarf downingia *Downingia pusilla*	--/--/2B.2	Southern Sacramento Valley, northern San Joaquin Valley, and southern North Coast Ranges.	Vernal pools in valley and foothill grasslands. 1 – 445 meters.	March – May	Absent	Absent	No suitable habitat within the Project area. There are two CNDDB occurrences within 5 miles of the Project area; the closest is located 1.7 miles northwest. Not observed during special-status plant surveys.

Common and Scientific Name	Legal Status[1] Federal/State/ CNPS	Distribution	Habitat Association	Identification Period	Habitat Present/ Absent	Species Present/ Absent	Survey Results/Rational
Lime Ridge eriastrum *Eriastrum ertterae*	--/--/1B.1	Contra Costa county.	Alkaline or semi-alkaline, sandy. Chaparral (openings or edges). 200 – 290 meters.	June – July	Absent	Absent	No suitable habitat present within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Antioch Dunes buckwheat *Eriogonum nudum* var. *psychicola*	--/--/1B.1	Contra Costa county.	Inland dunes. 0 - 20 meters.	July – October	Absent	Absent	Suitable habitat present within the Project area. One CNDDB occurrence located approximately 3.7 miles south of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Mt. Diablo buckwheat *Eriogonum truncatum*	--/--/1B.1	Alameda, Contra Costa, and Solano counties.	Sandy soils in chaparral, coastal scrub, and valley and foothill grassland. 200 – 400 meters.	April – December	Present	Absent	Suitable habitat present within the Project area. One CNDDB occurrence located approximately 3.7 miles south of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Contra Costa wallflower *Erysimum capitatum* var. *angustatum*	FE/SE/1B.1	Contra Costa county.	Inland dunes. 3 – 20 meters.	March – July	Absent	Absent	No suitable habitat present within the Project area. There are four CNDDB occurrences within 5 miles of the Project area; the closest is located 2.5 miles southwest. Not observed during special-status plant surveys conducted during the appropriate bloom period.

Common and Scientific Name	Legal Status[1] Federal/State/ CNPS	Distribution	Habitat Association	Identification Period	Habitat Present/ Absent	Species Present/ Absent	Survey Results/Rational
Diamond-petaled California poppy *Eschscholzia rhombipetala*	--/--/1B.1	Alameda, Contra Costa, Colusa, San Joaquin, San Luis Obispo, and Stanislaus counties.	Valley and foothill grassland (alkaline, clay). 0 – 975 meters.	March – April	Present	Absent	Suitable habitat present within the Project area. One CNDDB occurrence located approximately 3.7 miles south of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.
San Joaquin spearscale *Etriplex joaquinana*	--/--/1B.2	Alameda, Contra Costa, Colusa, Fresno, Glenn, Merced, Monterey, Napa, San Benito, Santa Clara, San Joaquin, San Luis Obispo, Solano, Tulare, and Yolo counties.	Alkaline soils in chenopod scrub, meadows and seeps, playas, and valley and foothill grassland. 0 – 840 meters.	April – October	Present	Absent	Suitable habitat present within the Project area. One CNDDB occurrence located approximately 1.2 miles northwest of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Fragrant fritillary *Fritillaria liliacea*	--/--/1B.2	Alameda, Contra Costa, Monterey, Marin, San Benito, Santa Clara, San Francisco, San Mateo, Solano, and Sonoma counties.	Often serpentinite soils in cismontane woodland, coastal prairie, coastal scrub, and valley and foothill grassland. 0 – 200 meters.	February – April	Absent	Absent	No suitable habitat (serpentine soils) within the Project area. One CNDDB occurrence located approximately 1.5 miles northwest of the Project area. Not observed during special-status plant surveys.
Adobe-lily *Fritillaria pluriflora*	--/--/1B.2	Foothills bordering the western and northern Sacramento Valley.	Often adobe soils in chaparral, cismontane woodland, and valley and foothill grassland. 60 - 705 meters.	February – April	Present	Absent	Suitable habitat (valley and foothill grassland) present within the Project area. There are no CNDDB occurrences within 10 miles of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.

Common and Scientific Name	Legal Status[1] Federal/State/ CNPS	Distribution	Habitat Association	Identification Period	Habitat Present/ Absent	Species Present/ Absent	Survey Results/Rational
Boggs Lake hedge-hyssop *Gratiola heterosepala*	--/SE/1B.2	Fresno, Lake, Lassen, Madera, Merced, Modoc, Placer, Sacramento, Shasta, Siskiyou, San Joaquin, Solano, Sonoma, and Tehama counties.	Clay soil in marshes and swamps (lake margins) and vernal pools. 10 - 2,375 meters.	April – August	Absent	Absent	No suitable habitat present within the Project area. The nearest CNDDB occurrence is 9.0 miles from the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Toren's grimmia *Grimmia torenii*	--/--/1B.3	Contra Costa, Colusa, Lake, Mendocino, Monterey, Santa Cruz, and San Mateo counties.	Chaparral, Cismontane woodland, and lower montane coniferous forest. 325 – 1160 meters.	Year–round	Absent	Absent	No suitable habitat present within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Diablo helianthella *Helianthella castanea*	--/--/1B.2	Alameda, Contra Costa, and San Mateo Counties. Extirpated from San Francisco and Marin counties.	Broadleaf upland forest, chaparral, cismontane woodland, coastal scrub, riparian woodland, valley and foothill grassland. 60 – 1,300 meters.	March – June	Present	Absent	Suitable habitat present within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Brewer's western flax *Hesperolinon breweri*	--/--/1B.2	Occurs in Contra Costa, Napa, and Solano counties.	Chaparral, cismontane woodland, and valley and foothill grassland. 30 – 945 meters.	May – July	Present	Absent	Suitable habitat present within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.

Common and Scientific Name	Legal Status[1] Federal/State/ CNPS	Distribution	Habitat Association	Identification Period	Habitat Present/ Absent	Species Present/ Absent	Survey Results/Rational
Woolly rose-mallow *Hibiscus lasiocarpos* var. *occidentalis*	--/--/1B.2	Butte, Contra Costa, Colusa, Glenn, Sacramento, San Joaquin, Solano, Sutter, and Yolo counties.	Often in riprap on sides of levees in marshes and swamps (freshwater). 0 – 120 meters.	June – September	Absent	Absent	No suitable habitat present within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Carquinez goldenbush *Isocoma arguta*	--/--/1B.1	Solano County.	Valley and foothill grasslands in alkaline soils and flats. 0 – 20 meters.	August – December	Present	Absent	Suitable habitat present within the Project area. There are three CNDDB occurrences within 5 miles of the Project area; the closest is located 2.7 miles north. Not observed during special-status plant surveys. This is a shrub and would be detectable year round. However, it would not be identifiable to species level outside of the blooming period.
Northern California black walnut *Juglans hindsii*	--/--/1B.1	Contra Costa, Napa, Sacramento, Solano, and Yolo Counties.	Riparian forest and riparian woodland. 0 – 440 meters.	April – May	Absent	Absent	No suitable habitat present within the Project area. Not observed during special-status plant surveys. This is a tree and would be detectable year round. However, it would not be identifiable to species level outside of the blooming period.

Common and Scientific Name	Legal Status[1] Federal/State/ CNPS	Distribution	Habitat Association	Identification Period	Habitat Present/ Absent	Species Present/ Absent	Survey Results/Rational
Contra Costa goldfields *Lasthenia conjugens*	FE/--/1B.1	Currently, known from about 15 populations. The largest concentration and number of populations occur in the Fairfield-Suisun area in Solano County. Other presumably extant populations are in Alameda, Contra Costa, Napa, Marin, Mendocino, and Monterey counties.	Mesic soils in cismontane woodland, alkaline playas, valley and foothill grassland, and vernal pools. 0 – 100 meters.	March – June	Present	Absent	Suitable habitat present within the Project area. One CNDDB occurrence located approximately 3.7 miles south of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Delta tule pea *Lathyrus jepsonii* var. *jepsonii*	--/--/1B.2	Contra Costa, Napa, Sacramento, San Joaquin, Solano, and Sonoma counties.	Marshes and swamps (freshwater and brackish). 0 – 30 meters .	May – September	Present	Absent	Suitable habitat present within the Project area. There are 24 CNDDB occurrences within 5 miles of the Project area; the closest is located 0.2 miles southwest. Not observed during special-status plant surveys conducted during the appropriate bloom period.

Common and Scientific Name	Legal Status[1] Federal/State/ CNPS	Distribution	Habitat Association	Identification Period	Habitat Present/ Absent	Species Present/ Absent	Survey Results/Rational
Legenere *Legenere limosa*	--/--/1B.1	Southern Sacramento Valley, south North Coast Ranges in Alameda, Lake, Monterey, Napa, Placer, Sacramento, Santa Clara, Shasta, San Joaquin, San Mateo, Solano, Sonoma, Stanislaus, Tehama, and Yuba counties.	Vernal pools. 1 – 880 meters.	April – June	Absent	Absent	No suitable habitat (vernal pools) within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. Not observed during special-status plant surveys.
Heckard's pepper-grass *Lepidium latipes* var. *heckardii*	--/--/1B.2	Glenn, Merced, Sacramento, Solano, and Yolo counties.	Alkaline flats in valley and foothill grasslands. 2 - 200 meters.	March – May	Present	Absent	Suitable habitat (alkaline flats in annual swales) present within the Project area. The nearest CNDDB occurrence is 9.7 miles from the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Mason's lilaeopsis *Lilaeopsis masonii*	--/SR/1B.1	Alameda, Contra Costa, Marin, Napa, Sacramento, San Joaquin, Solano, and Yolo counties.	Marshes and swamps (brackish or freshwater) and riparian scrub. 0 –36 meters.	April – November	Present	Absent	Suitable habitat present within the Project area. There are 39 CNDDB occurrences within 5 miles of the Project area; the closest is located 0.2 miles southwest. Not observed during special-status plant surveys conducted during the appropriate bloom period.

Common and Scientific Name	Legal Status[1] Federal/State/ CNPS	Distribution	Habitat Association	Identification Period	Habitat Present/ Absent	Species Present/ Absent	Survey Results/Rational
Delta mudwort *Limosella australis*	--/--/2B.1	Contra Costa, Sacramento, San Joaquin, and Solano counties.	Usually mud banks in marshes and swamps (freshwater or brackish) and riparian scrub. 0 – 10 meters.	May – August	Present	Absent	Suitable habitat present within the Project area. There are 10 CNDDB occurrences within 5 miles of the Project area; the closest is located 0.2 miles southwest. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Showy golden madia *Madia radiata*	--/--/1B.1	Contra Costa, Fresno, Kings, Kern, Monterey, Santa Barbara, San Benito, Santa Clara, San Joaquina, San Luis Obispo, and Stanislaus counties.	Cismontane woodland and valley and foothill grassland. 25 – 1,215 meters.	March – May	Present	Absent	Suitable habitat present within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Hall's bush-mallow *Malacothamnus hallii*	--/--/1B.2	Contra Costa, Lake, Mendocino, Merced, Santa Clara, San Mateo, and Stanislaus counties.	Chaparral, Coastal scrub. 10 – 760 meters.	May – October	Absent	Absent	No suitable habitat present within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Marsh microseris *Microseris paludosa*	--/--/1B.2	Mendocino, Monterey, Marin, San Benito, Santa Cruz, San Luis Obispo, and Sonoma counties.	Closed-cone coniferous forest, cismontane woodland, coastal scrub, and valley and foothill grassland. 5 – 300 meters.	April – July	Present	Absent	Suitable habitat present within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.

Common and Scientific Name	Legal Status[1] Federal/State/ CNPS	Distribution	Habitat Association	Identification Period	Habitat Present/ Absent	Species Present/ Absent	Survey Results/Rational
Woodland woolythreads *Monolopia gracilens*	--/--/1B.2	Alameda, Contra Costa, Monterey, Santa Clara, Santa Cruz, San Luis Obispo, and San Mateo counties.	Serpentinite soil in broadleafed upland forest (openings), chaparral (openings), cismontane woodland, valley and foothill grassland, and North Coast coniferous forest (openings). 100 – 1,200 meters.	February – July	Absent	Absent	No suitable habitat (serpentine soils) within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Lime Ridge navarretia *Navarretia gowenii*	--/--/1B.1	Contra Costa and Stanislaus counties.	Chaparral. 180 – 305 meters.	May – June	Absent	Absent	No suitable habitat within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. Not observed during special-status plant surveys..
Baker's navarretia *Navarretia leucocephala* ssp. *bakeri*	--/--/1B.1	North Coast Ranges, Central Coast, and the San Francisco Bay Area.	Cismontane woodland, meadows and seeps, vernal pools, valley and foothill grasslands, and lower montane coniferous forest. 5 – 1,740 meters.	April – July	Present	Absent	Suitable habitat present within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Shining navarretia *Navarretia nigelliformis* ssp. *radians*	--/--/1B.2	Alameda, Contra Costa, Fresno, Merced, Monterey, San Benito, San Joaquin, and San Luis Obispo counties.	Sometimes clay soil in cismontane woodland, valley and foothill grassland, and vernal pools. 76 – 1,000 meters.	April – July	Present	Absent	Suitable habitat present within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.

Common and Scientific Name	Legal Status[1] Federal/State/ CNPS	Distribution	Habitat Association	Identification Period	Habitat Present/ Absent	Species Present/ Absent	Survey Results/Rational
Colusa grass *Neostapfia colusana*	FT/SE/1B.1	Southern Sacramento Valley, Northern San Joaquin Valley.	Large vernal pools (adobe). 5 – 200 meters.	May – August	Absent	Absent	No suitable habitat (large vernal pools) within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Antioch Dunes evening-primrose *Oenothera deltoides* ssp. *howellii*	FE/SE/1B.1	Contra Costa and Sacramento counties.	Inland dunes. 0 – 30 meters.	March – September	Absent	Absent	No suitable habitat (inland dunes) within the Project area. There are six CNDDB occurrences within 5 miles of the Project area; the closest is located 3.1 miles southwest. Not observed during special-status plant surveys conducted during the appropriate bloom period.
San Joaquin Valley Orcutt grass *Orcuttia inaequalis*	FT/SE/1B.1	Fresno, Madera, Merced, Solano, Stanislaus, and Tulare counties.	Vernal pools. 10 - 755 meters.	April – September	Absent	Absent	No suitable habitat present within the Project area. There are no CNDDB occurrences within 10 miles of the Project area.
Mt. Diablo phacelia *Phacelia phacelioides*	--/--/1B.2	Contra Costa, San Benito, Santa Clara, and Stanislaus counties.	Rocky soils in chaparral and cismontane woodland. 500 – 1,370 meters.	April – May	Absent	Absent	No suitable habitat present within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. Not observed during special-status plant surveys.

Common and Scientific Name	Legal Status[1] Federal/State/ CNPS	Distribution	Habitat Association	Identification Period	Habitat Present/ Absent	Species Present/ Absent	Survey Results/Rational
Bearded popcorn-flower *Plagiobothrys hystriculus*	--/--/1B.1	Napa, Solano, and Yolo counties.	Vernal pool margins, valley and foothill grasslands (mesic), often in vernal swales. 0 – 50 meters.	April – May	Present	Absent	Suitable habitat present within the Project area. There are four CNDDB occurrences within 5 miles of the Project area; the closest CNDDD occurrence's population polygon overlaps the northern boundary of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Eel-grass pondweed *Potamogeton zosteriformis*	--/--/2B.2	Contra Costa, Lake, Lassen, Modoc, and Shasta counties.	Marshes and swamps (assorted freshwater). 0 – 1,860 meters.	June – July	Present	Absent	Suitable habitat present within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.
California alkali grass *Puccinellia simplex*	--/--/1B.2	Alameda, Butte, Contra Costa, Colusa, Fresno, Glenn, Kern, Lake, Los Angeles, Madera, Merced, Napa, San Bernardino, Santa Clara, Santa Cruz, San Luis Obispo, Solano, Stanislaus, Tulare, and Yolo counties.	Alkaline, vernally mesic (sinks, flats, and lake margins), chenopod scrub, meadows and seeps, valley and foothill grassland, and vernal pools. 2 – 930 meters.	March – May	Present	Absent	Suitable habitat present within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.

Common and Scientific Name	Legal Status[1] Federal/State/ CNPS	Distribution	Habitat Association	Identification Period	Habitat Present/ Absent	Species Present/ Absent	Survey Results/Rational
Sanford's arrowhead *Sagittaria sanfordii*	--/--/1B.2	Scattered localities throughout the Central Valley and adjacent foothills.	Marshes and swamps (assorted shallow freshwater). 0 – 650 meters.	May – November	Present	Absent	Suitable habitat present within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Rock sanicle *Sanicula saxatilis*	--/SR/1B.2	Contra Costa and Santa Clara counties.	Rocky soils in broadleafed upland forest, chaparral, and valley and foothill grassland. 620 – 1,175 meters.	April – May	Absent	Absent	No suitable habitat (rocky soils) present within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. Not observed during special-status plant surveys.
Chaparral ragwort *Senecio aphanactis*	--/--/2B.2	Alameda, Contra Costa, Fresno, Los Angeles, Merced, Monterey, Orange, Riverside, Santa Barbara, Santa Clara, Santa Catalina Island, Santa Cruz Island, San Diego, San Luis Obispo, Solano, Santa Rosa Island, and Ventura counties.	Sometimes alkaline, chaparral, cismontane woodland, coastal scrub. 15 – 800 meters.	January – April	Absent	Absent	No suitable habitat present within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. Not observed during special-status plant surveys.

Common and Scientific Name	Legal Status[1] Federal/State/ CNPS	Distribution	Habitat Association	Identification Period	Habitat Present/ Absent	Species Present/ Absent	Survey Results/Rational
Keck's checkerbloom *Sidalcea keckii*	FE/--/1B.1	Fresno, Merced, and Tulare counties. Possible occurrences in Colusa, Napa, Solano, and Yolo counties.	Serpentinite clay soils in cismontane woodland and valley and foothill grassland. 75 – 650 meters.	April – June	Absent	Absent	No suitable habitat (serpentine soils) within the Project area. There are two CNDDB occurrences within 5 miles of the Project area; the closest is located 0.6 miles west. Not observed during special-status plant surveys.
Most beautiful jewel-flower *Streptanthus albidus* ssp. *peramoenus*	--/--/1B.2	Alameda, Contra Costa, Monterey, Santa Clara, and San Luis Obispo counties.	Serpentinite soils in chaparral, cismontane woodland, and valley and foothill grassland. 95 – 1,000 meters.	March – October	Absent	Absent	No suitable habitat (serpentine soils) within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Mt. Diablo jewel-flower *Streptanthus hispidus*	--/--/1B.3	Contra Costa county.	Rocky soils in chaparral and valley and foothill grassland. 365 – 1,200 meters.	March – June	Absent	Absent	No suitable habitat (rocky soils) present within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. Not observed during special-status plant surveys.
Slender-leaved pondweed *Stuckenia filiformis* ssp. *alpina*	--/--/2B.2	Alameda, Butte, Contra Costa, El Dorado, Lassen, Merced, Mono, Modoc, Mariposa, Nevada, Placer, Santa Clara, Shasta, Sierra, San Mateo, Solano, and Sonoma counties.	Marshes and swamps (assorted shallow freshwater). 300 – 2,150 meters.	May – July	Present	Absent	Suitable habitat present within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.

Common and Scientific Name	Legal Status[1] Federal/State/ CNPS	Distribution	Habitat Association	Identification Period	Habitat Present/ Absent	Species Present/ Absent	Survey Results/Rational
Suisun Marsh aster *Symphyotrichum lentum*	--/--/1B.2	Contra Costa, Napa, Sacramento, San Joaquin, Solano, and Yolo counties.	Marshes and swamps (brackish and freshwater). 0 – 300 meters.	May – November	Present	Absent	Suitable habitat present within the Project area. There are 39 CNDDB occurrences within 5 miles of the Project area; the closest is located 0.2 miles southwest. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Two-fork clover *Trifolium amoenum*	FE/--/1B.1	Marin, Napa, Santa Clara, San Mateo, and Solano counties.	Coastal bluff scrub and valley and foothill grassland (sometimes serpentinite). 5 - 415 meters.	April – June	Present	Absent	Suitable habitat (valley and foothill grassland) present within the Project area. There are no CNDDB occurrences within 10 miles of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Saline clover *Trifolium hydrophilum*	--/--/1B.2	Alameda, Contra Costa, Colusa, Lake, Monterey, Napa, Sacramento, San Benito, Santa Clara, Santa Cruz, San Joaquin, San Luis Obispo, San Mateo, Solano, Sonoma, and Yolo counties.	Marshes and swamps. Valley and foothill grassland (mesic, alkaline) and vernal pools. 0 – 300 meters.	April – June	Present	Absent	Suitable habitat present within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.

Common and Scientific Name	Legal Status[1] Federal/State/ CNPS	Distribution	Habitat Association	Identification Period	Habitat Present/ Absent	Species Present/ Absent	Survey Results/Rational
Coastal triquetrella *Triquetrella californica*	--/--/1B.2	Known from 11 occurrences in Contra Costa, Del Norte, Mendocino, Marin, San Diego, San Francisco, San Mateo, and Sonoma counties.	Coastal bluff scrub, coastal scrub. 10 – 100 meters.	Year–round	Absent	Absent	No suitable habitat present within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Caper-fruited tropidocarpum *Tropidocarpum capparideum*	--/--/1B.1	Alamedaa, Contra Costa, Fresno, Glenn, Monterey, Santa Clara, San Joaquin, and San Luis Obispo counties.	Valley and foothill grassland (alkaline hills). 1 – 455 meters.	March – April	Present	Absent	Suitable habitat present within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Crampton's tuctoria *Tuctoria mucronata*	FE/SE/1B.1	Solano and Yolo counties.	Vernal pools and mesic areas in valley and foothill grassland (Pescadero clay). 5 - 10 meters.	April – August	Absent	Absent	No suitable habitat present within the Project area. The nearest CNDDB occurrence is 9.2 miles from the Project area. Not observed during special-status plant surveys conducted during the appropriate bloom period.
Oval-leaved viburnum *Viburnum ellipticum*	--/--/2B.3	Contra Costa, El Dorado, Fresno, Glenn, Humboldt, Mendocino, Napa, Placer, Shasta, and Sonoma counties.	Chaparral, cismontane woodland, and lower montane coniferous forest. 215 – 1,400 meters.	May – June	Absent	Absent	No suitable habitat within the Project area. There are no CNDDB occurrences within 5 miles of the Project area. Additionally, the shrub and it would be identifiable outside of the blooming period. Not observed during special-status plant surveys.

[1]Status explanations:

--	=	no listing.

Federal

FE	=	listed as endangered under the federal Endangered Species Act.
FT	=	listed as threatened under the federal Endangered Species Act.

State

SE	=	listed as endangered under the California Endangered Species Act.
SR	=	listed as rare under the California Endangered Species Act.

California Native Plant Society

1B	=	Rank 1B species: rare, threatened, or endangered in California and elsewhere.
2B	=	Rank 2B species: rare, threatened, or endangered in California but more common elsewhere.
0.1	=	Seriously threatened in California (over 80% of occurrences threatened/high degree and immediacy of threat)
0.2	=	Moderately threatened in California (20%-80% occurrences threatened/moderate degree and immediacy of threat)

Table 2. List of Vascular Plant Species Observed

Scientific Name	Common Name	Family	Nativity
Achyrachaena mollis	Blow-wives	Asteraceae	Native
Amaranthus albus	Tumbleweed	Amaranthaceae	Naturalized
Amaranthus blitoides	Mat amaranth	Amaranthaceae	Native
Ambrosia psilostachya	Perennial ragweed	Asteraceae	Native
Amsinckia intermedia	Common fiddleneck	Boraginaceae	Native
Amsinckia menziesii	Common fiddleneck	Boraginaceae	Native
Anthemis cotula	Stinking chamomile	Asteraceae	Naturalized
Artemisia douglasiana	Douglas' wormwood	Asteraceae	Native
Asclepias fascicularis	Narrow-leaf milkweed	Apocynaceae	Native
Asparagus officinalis	Asparagus	Asparagaceae	Naturalized
Atriplex prostrata	Hastate orache	Chenopodiaceae	Naturalized
Avena barbata	Slender wild oat	Poaceae	Naturalized
Avena fatua	Wild oat	Poaceae	Naturalized
Bolboschoenus maritimus subsp. *paludosus*	Saltmarsh bulrush	Cyperaceae	Native
Bolboschoenus robustus	Seaside club-rush	Cyperaceae	Native
Brassica nigra	Black mustard	Brassicaceae	Naturalized
Bromus caroli-henrici	Weedy brome	Brassicaceae	Naturalized
Bromus diandrus	Ripgut brome	Poaceae	Naturalized
Bromus hordeaceus	Soft brome	Poaceae	Naturalized
Calandrinia menziesii	Red maids	Montiaceae	Native
Capsella bursa-pastoris	Shepherd’s purse	Brassicaceae	Naturalized
Carduus pycnocephalus	Italian thistle	Asteraceae	Naturalized
Castilleja exserta	Owl’s clover	Orobanchaceae	Native
Centaurea solstitialis	Yellow star-thistle	Asteraceae	Naturalized
Centromadia fitchii	Fitch’s false tarplant	Asteraceae	Native
Centromadia pungens	Common spikeweed	Asteraceae	Native
Chenopodium album	Lamb's-quarter	Chenopodiaceae	Naturalized
Cirsium vulgare	Bull thistle	Asteraceae	Naturalized
Claytonia exigua	Little spring beauty	Montiaceae	Native
Claytonia perfoliata	Miner’s lettuce	Montiaceae	Native
Conium maculatum	Poison-hemlock	Apiaceae	Naturalized
Convolvulus arvensis	Bindweed	Convolvulaceae	Naturalized
Cotula coronopifolia	Common brassbuttons	Asteraceae	Naturalized
Cressa truxillensis	Spreading alkali-weed	Convolvulaceae	Native
Croton setiger	Dove weed	Euphorbiaceae	Native
Crypsis schoenoides	Swamp prickle grass	Poaceae	Naturalized
Cynara cardunculus	Artichoke	Asteraceae	Naturalized
Cynodon dactylon	Bermuda grass	Poaceae	Naturalized
Cyperus eragrostis	Tall flat sedge	Cyperaceae	Native
Deinandra lobbii	Threeray tarweed	Asteraceae	Native
Distichilis spicata	Saltgrass	Poaceae	Native
Dysphania ambrosioides	Mexican tea	Chenopodiaceae	Naturalized
Echinochloa crus-galli	Large barnyard grass	Poaceae	Naturalized
Eleocharis (palustris) macrostachya	Common spikerush	Cyperaceae	Native
Elymus ponticus	Tall wheat grass	Poaceae	Naturalized
Erodium botrys	Big heron’s bill	Geraniaceae	Naturalized
Erodium brachycarpum	Foothill filaree	Geraniaceae	Naturalized
Erigeron canadensis	Canadian horseweed	Asteraceae	Native

Scientific Name	Common Name	Family	Nativity
Erodium cicutarium	Redstem filaree	Geraniaceae	Naturalized
Eucalyptus camaldulensis	Red gum	Myrtaceae	Naturalized
Euthamia occidentalis	Western goldenrod	Asteraceae	Native
Festuca (Vulpia) myuros	Six-weeks grass	Poaceae	Naturalized
Festuca perennis	Italian ryegrass	Poaceae	Naturalized
Foeniculum vulgare	Fennel	Apiaceae	Naturalized
Frankenia salina	Alkali sea-heath	Frankeniaceae	Native
Geranium dissectum	Wild geranium	Geraniaceae	Naturalized
Grindelia camporum	Foothill gumplant	Asteraceae	Native
Helminthotheca echioides	Bristly ox-tongue	Asteraceae	Naturalized
Heliotropium curassavicum	Alkali heliotrope	Boraginaceae	Native
Heterothotheca grandiflora	Telegraph weed	Asteraceae	Native
Hirschfeldia incana	Summer mustard	Brassicaceae	Naturalized
Hordeum brachyantherum	Meadow barley	Poaceae	Native
Hordeum depressum	Dwarf barley	Poaceae	Native
Hordeum marinum subsp. *gussoneanum*	Mediterranean barley	Poaceae	Naturalized
Hordeum murinum subsp. *leporinum*	Wall barley	Poaceae	Naturalized
Hydrocotyle umbellata	Many-flower marsh-pennywort	Araliaceae	Native
Hypochaeris glabra	Smooth cat's-ear	Asteraceae	Naturalized
Isolepis cernua	Low bulrush	Cyperaceae	Native
Juncus bufonius	Toad rush	Juncaceae	Native
Juncus mexicanus	Mexican rush	Juncaceae	Native
Lactuca saligna	Willow-leaf lettuce	Asteraceae	Naturalized
Lactuca serriola	Prickly wild lettuce	Asteraceae	Naturalized
Lamium amplexicaule	Henbit deadnettle	Lamiaceae	Naturalized
Lemna minor	Common duckweed	Araceae	Native
Lepidium acutidens	Net pepper grass	Brassicaceae	Native
Lepidium latifolium	Perennial pepperweed	Brassicaceae	Naturalized
Lepidium nitidum	Shining pepperwort	Brassicaceae	Native
Lotus corniculatus	Garden bird's-foot-trefoil	Fabaceae	Naturalized
Lupinus bicolor	Miniature lupine	Fabaceae	Native
Lupinus succulentus	Arroyo lupine	Fabaceae	Native
Lysimachia arvensis	Scarlet pimpernel	Myrsimaceae	Naturalized
Malvella leprosa	Alkali-mallow	Malvaceae	Native
Malva neglecta	Common mallow	Malvaceae	Naturalized
Malva nicaeensis	Bull mallow	Malvaceae	Naturalized
Marah fabaceae	California man-root	Cucurbitaceae	Native
Marrubium vulgare	White horehound	Lamiaceae	Naturalized
Melilotus albus	White sweetclover	Fabaceae	Naturalized
Nitrophila occidentalis	Boraxweed	Amaranthaceae	Native
Paspalum dialatatum	Dallis grass	Poaceae	Naturalized
Parapholis incurva	Sickle grass	Poaceae	Naturalized
Phacelia ciliate	Great valley phacelia	Boraginaceae	Native
Phragmites australis	Common reed	Poaceae	Native
Plantago lanceolata	English plantain	Plantaginaceae	Naturalized
Plantago major	Common plantain	Plantaginaceae	Naturalized
Polypogon maritimus	Maritime rabbit's-foot grass	Poaceae	Naturalized
Polypogon monspeliensis	Rabbitsfoot grass	Poaceae	Naturalized

Scientific Name	Common Name	Family	Nativity
Potamogeton crispus	Curly pondweed	Potamogetonaceae	Naturalized
Pseudognaphalium canescens	Wright's rabbit-tobacco	Asteracae	Native
Raphanus sativus	Wild radish	Brassicaceae	Naturalized
Rosa californica	California rose	Rosaceae	Native
Rubus armeniacus	Himalayan blackberry	Rosaceae	Naturalized
Rumex crispus	Curly dock	Polygonaceae	Naturalized
Rumex pulcher	Fiddle dock	Polygonaceae	Naturalized
Sarcocornia pacifica	Pacific swampfire	Chenopodiaceae	Native
Salsola tragus	Prickly russian-thistle	Chenopodiaceae	Naturalized
Schinus molle	Peruvian peppertree	Anacardiaceae	Naturalized
Schoenoplectus acutus	Common tule	Cyperaceae	Native
Schoenoplectus americanus	Chairmaker's club-rush	Cyperaceae	Native
Schoenoplectus californicus	California club-rush	Cyperaceae	Native
Schoenoplectus pungens var. *longispicatus*	Three-square	Cyperaceae	Native
Schoenoplectus robustus	Seaside club-rush	Cyperaceae	Native
Sesuvium verrucosum	Western sea-purslane	Aizoaceae	Native
Sinapis arvensis	Charlock	Brassicaceae	Naturalized
Silybum marianum	Milk thistle	Asteraceae	Naturalized
Sonchus asper	Spiny sowthistle	Asteraceae	Naturalized
Sonchus oleraceus	Common sow-thistle	Asteraceae	Naturalized
Soliva sessilis	Lawn burrweed	Asteraceae	Naturalized
Spergularia marina	Saltmarsh sandspurry	Caryophllyaceae	Native
Sisymbrium officinale	Hedge mustard	Brassicaceae	Naturalized
Tragopogon porrifolius	Salsify	Asteraceae	Naturalized
Trichostema lanceolatum	Vinegar-weed	Lamiaceae	Native
Trifolium dubium	Little hop clover	Fabaceae	Naturalzied
Trifolium fragiferum	Strawberry clover	Fabaceae	Naturalized
Trifolium willdenovii	Tomcat clover	Fabaceae	Naturalized
Tritelelia laxa	Ithuriel's spear	Themidaceae	Native
Triticum aestivum	Wheat	Poaceae	Naturalized
Typha angustifolia	Narrow-leaf cat-tail	Typhaceae	Native or Naturalized
Typha domingensis	Southern cat-tail	Typhaceae	Native
Typha latifolia	Broad-leaf cat-tail	Typhaceae	Native
Xanthium spinosum	Spiny cockleburr	Asteraceae	Native
Xanthium strumarium	Rough cockleburr	Asteraceae	Native

Attachment 1.

CNPS, USFWS, and CNDDB Species Searches

CNPS California Native Plant So Rare and Endangered Plant Inventory

Plant List

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

Search Criteria

Found in 9 Quads around 38121B7

Scientific Name	Common Name	Family	Lifeform	Rare Plant Rank	State Rank	Global Rank
Astragalus tener var. ferrisiae	Ferris' milk-vetch	Fabaceae	annual herb	1B.1	S1	G2T1
Astragalus tener var. tener	alkali milk-vetch	Fabaceae	annual herb	1B.2	S2	G2T2
Atriplex cordulata var. cordulata	heartscale	Chenopodiaceae	annual herb	1B.2	S2	G3T2
Atriplex coronata var. coronata	crownscale	Chenopodiaceae	annual herb	4.2	S3	G4T3
Atriplex depressa	brittlescale	Chenopodiaceae	annual herb	1B.2	S2	G2
Atriplex persistens	vernal pool smallscale	Chenopodiaceae	annual herb	1B.2	S2	G2
Blepharizonia plumosa	big tarplant	Asteraceae	annual herb	1B.1	S2	G2
California macrophylla	round-leaved filaree	Geraniaceae	annual herb	1B.2	S3?	G3?
Centromadia parryi ssp. congdonii	Congdon's tarplant	Asteraceae	annual herb	1B.1	S2	G3T2
Centromadia parryi ssp. parryi	pappose tarplant	Asteraceae	annual herb	1B.2	S2	G3T2
Centromadia parryi ssp. rudis	Parry's rough tarplant	Asteraceae	annual herb	4.2	S3	G3T3
Chloropyron molle ssp. hispidum	hispid bird's-beak	Orobanchaceae	annual herb (hemiparasitic)	1B.1	S2	G2T2
Chloropyron molle ssp. molle	soft bird's-beak	Orobanchaceae	annual herb (hemiparasitic)	1B.2	S1	G2T1
Cicuta maculata var. bolanderi	Bolander's water-hemlock	Apiaceae	perennial herb	2B.1	S2	G5T4
Cirsium hydrophilum var. hydrophilum	Suisun thistle	Asteraceae	perennial herb	1B.1	S1	G2T1
Convolvulus simulans	small-flowered morning-glory	Convolvulaceae	annual herb	4.2	S4	G4
Cryptantha hooveri	Hoover's cryptantha	Boraginaceae	annual herb	1A	SH	GH
Delphinium recurvatum	recurved larkspur	Ranunculaceae	perennial herb	1B.2	S2?	G2?
Downingia pusilla	dwarf downingia	Campanulaceae	annual herb	2B.2	S2	GU
Eriogonum nudum var. psychicola	Antioch Dunes buckwheat	Polygonaceae	perennial herb	1B.1	S1	G5T1
Eriogonum truncatum	Mt. Diablo buckwheat	Polygonaceae	annual herb	1B.1	S2	G2
Erysimum capitatum var.						

angustatum	Contra Costa wallflower	Brassicaceae	perennial herb	1B.1	S1	G5T1
Eschscholzia rhombipetala	diamond-petaled California poppy	Papaveraceae	annual herb	1B.1	S1	G1
Extriplex joaquinana	San Joaquin spearscale	Chenopodiaceae	annual herb	1B.2	S2	G2
Fritillaria liliacea	fragrant fritillary	Liliaceae	perennial bulbiferous herb	1B.2	S2	G2
Fritillaria pluriflora	adobe-lily	Liliaceae	perennial bulbiferous herb	1B.2	S2S3	G2G3
Gratiola heterosepala	Boggs Lake hedge-hyssop	Plantaginaceae	annual herb	1B.2	S2	G2
Hibiscus lasiocarpos var. occidentalis	woolly rose-mallow	Malvaceae	perennial rhizomatous herb	1B.2	S2	G5T2
Isocoma arguta	Carquinez goldenbush	Asteraceae	perennial shrub	1B.1	S1	G1
Juglans hindsii	Northern California black walnut	Juglandaceae	perennial deciduous tree	1B.1	S1	G1
Lasthenia conjugens	Contra Costa goldfields	Asteraceae	annual herb	1B.1	S1	G1
Lasthenia ferrisiae	Ferris' goldfields	Asteraceae	annual herb	4.2	S3	G3
Lathyrus jepsonii var. jepsonii	Delta tule pea	Fabaceae	perennial herb	1B.2	S2	G5T2
Legenere limosa	legenere	Campanulaceae	annual herb	1B.1	S2	G2
Lepidium latipes var. heckardii	Heckard's pepper-grass	Brassicaceae	annual herb	1B.2	S2	G4T2
Lessingia hololeuca	woolly-headed lessingia	Asteraceae	annual herb	3	S3?	G3?
Lilaeopsis masonii	Mason's lilaeopsis	Apiaceae	perennial rhizomatous herb	1B.1	S2	G2
Limosella australis	Delta mudwort	Scrophulariaceae	perennial stoloniferous herb	2B.1	S2	G4G5
Madia radiata	showy golden madia	Asteraceae	annual herb	1B.1	S2	G2
Microseris paludosa	marsh microseris	Asteraceae	perennial herb	1B.2	S2	G2
Myosurus minimus ssp. apus	little mousetail	Ranunculaceae	annual herb	3.1	S2	G5T2Q
Navarretia leucocephala ssp. bakeri	Baker's navarretia	Polemoniaceae	annual herb	1B.1	S2	G4T2
Neostapfia colusana	Colusa grass	Poaceae	annual herb	1B.1	S2	G2
Oenothera deltoides ssp. howellii	Antioch Dunes evening-primrose	Onagraceae	perennial herb	1B.1	S1	G5T1
Orcuttia inaequalis	San Joaquin Valley Orcutt grass	Poaceae	annual herb	1B.1	S1	G1
Perideridia gairdneri ssp. gairdneri	Gairdner's yampah	Apiaceae	perennial herb	4.2	S4	G5T4
Plagiobothrys hystriculus	bearded popcornflower	Boraginaceae	annual herb	1B.1	S2	G2
Potamogeton zosteriformis	eel-grass pondweed	Potamogetonaceae	annual herb	2B.2	S3	G5
Puccinellia simplex	California alkali grass	Poaceae	annual herb	1B.2	S2	G3
Sagittaria sanfordii	Sanford's arrowhead	Alismataceae	perennial rhizomatous herb	1B.2	S3	G3
Senecio hydrophiloides	sweet marsh ragwort	Asteraceae	perennial herb	4.2	S3	G5

Sidalcea keckii	Keck's checkerbloom	Malvaceae	annual herb	1B.1	S2	G2
Symphyotrichum lentum	Suisun Marsh aster	Asteraceae	perennial rhizomatous herb	1B.2	S2	G2
Trifolium amoenum	two-fork clover	Fabaceae	annual herb	1B.1	S1	G1
Trifolium hydrophilum	saline clover	Fabaceae	annual herb	1B.2	S2	G2
Tuctoria mucronata	Crampton's tuctoria or Solano grass	Poaceae	annual herb	1B.1	S1	G1

Suggested Citation

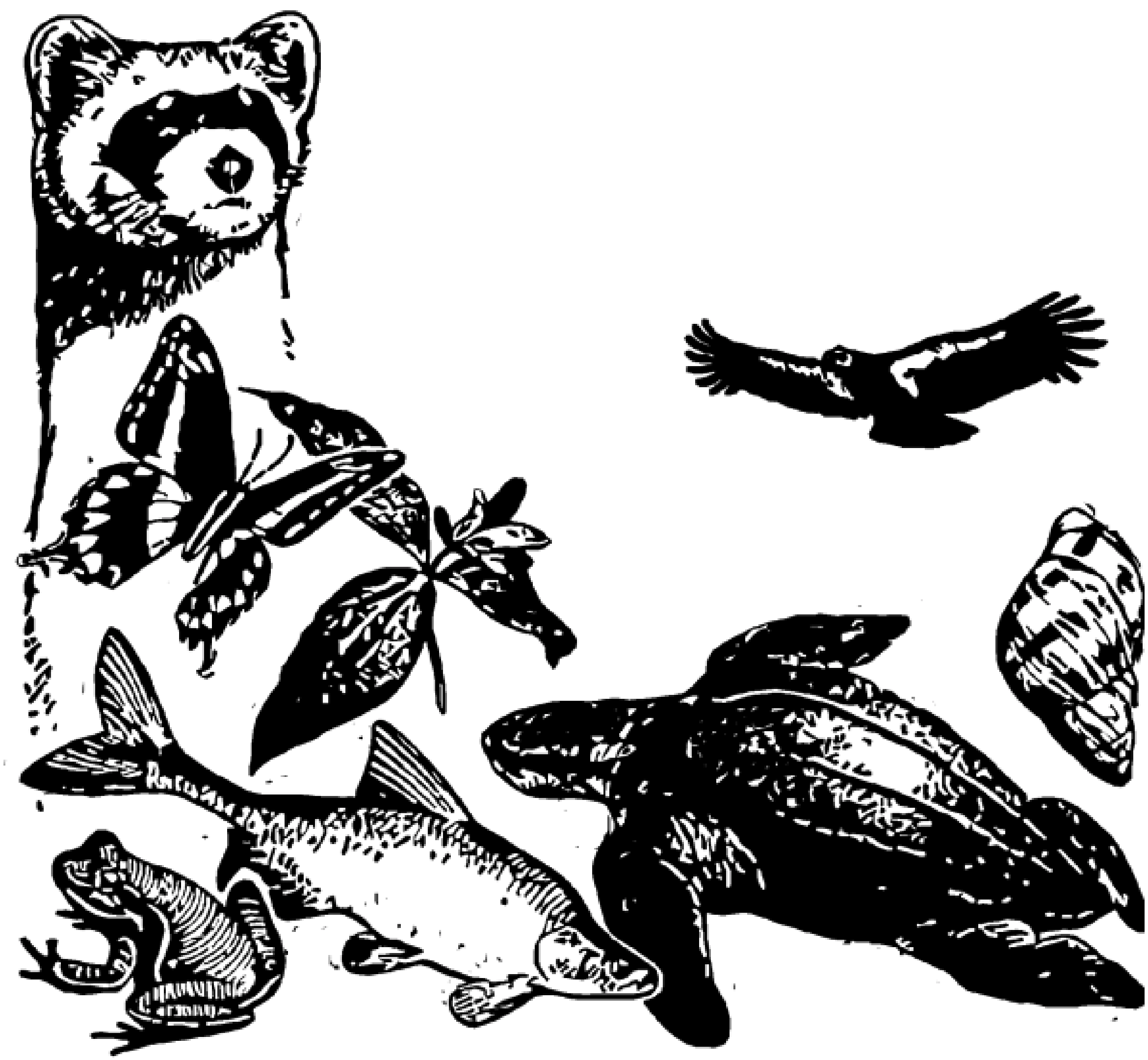
CNPS, Rare Plant Program. 2016. Inventory of Rare and Endangered Plants (online edition, v8-02). California Native Plant Society, Sacramento, CA. Website http://www.rareplants.cnps.org [accessed 02 June 2016].

U.S. Fish & Wildlife Service

IPaC Trust Resources Report

Generated June 02, 2016 01:14 PM MDT, IPaC v3.0.7

This report is for informational purposes only and should not be used for planning or analyzing project level impacts. For project reviews that require U.S. Fish & Wildlife Service review or concurrence, please return to the IPaC website and request an official species list from the Regulatory Documents page.



IPaC - Information for Planning and Conservation (https://ecos.fws.gov/ipac/): A project planning tool to help streamline the U.S. Fish & Wildlife Service environmental review process.

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U.S. Fish & Wildlife Service

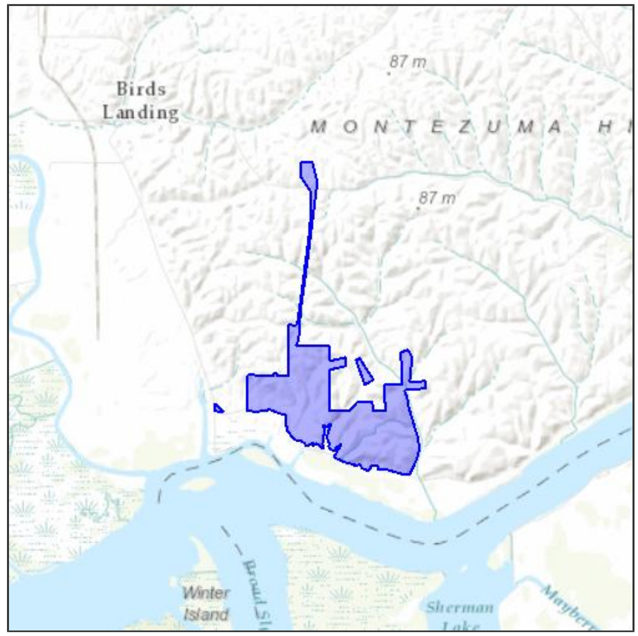
IPaC Trust Resources Report

LOCATION

Solano County, California

IPAC LINK

https://ecos.fws.gov/ipac/project/Z53LJ-36GOF-HK5JI-YBQUS-ZI45RI



U.S. Fish & Wildlife Service Contact Information

Trust resources in this location are managed by:

San Francisco Bay-delta Fish And Wildlife
650 Capitol Mall
Suite 8-300
Sacramento, CA 95814
(916) 930-5603

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

Endangered Species

Proposed, candidate, threatened, and endangered species are managed by the Endangered Species Program of the U.S. Fish & Wildlife Service.

This USFWS trust resource report is for informational purposes only and should not be used for planning or analyzing project level impacts.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list from the Regulatory Documents section.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency.

A letter from the local office and a species list which fulfills this requirement can only be obtained by requesting an official species list either from the Regulatory Documents section in IPaC or from the local field office directly.

The list of species below are those that may occur or could potentially be affected by activities in this location:

Amphibians

California Red-legged Frog Rana draytonii

Threatened

MANAGED BY
Sacramento Fish And Wildlife Office
San Francisco Bay-delta Fish And Wildlife

CRITICAL HABITAT
There is **final** critical habitat designated for this species.

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=D02D

California Tiger Salamander Ambystoma californiense

Threatened

MANAGED BY
Sacramento Fish And Wildlife Office
San Francisco Bay-delta Fish And Wildlife

CRITICAL HABITAT
There is **final** critical habitat designated for this species.

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=D01T

Birds

California Clapper Rail Rallus longirostris obsoletus — Endangered

MANAGED BY
Sacramento Fish And Wildlife Office
San Francisco Bay-delta Fish And Wildlife

CRITICAL HABITAT
No critical habitat has been designated for this species.

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B04A

California Least Tern Sterna antillarum browni — Endangered

MANAGED BY
Sacramento Fish And Wildlife Office
San Francisco Bay-delta Fish And Wildlife

CRITICAL HABITAT
No critical habitat has been designated for this species.

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B03X

Crustaceans

Conservancy Fairy Shrimp Branchinecta conservatio — Endangered

MANAGED BY
Sacramento Fish And Wildlife Office

CRITICAL HABITAT
There is **final** critical habitat designated for this species.

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=K03D

Vernal Pool Fairy Shrimp Branchinecta lynchi — Threatened

MANAGED BY
Sacramento Fish And Wildlife Office
San Francisco Bay-delta Fish And Wildlife

CRITICAL HABITAT
There is **final** critical habitat designated for this species.

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=K03G

Vernal Pool Tadpole Shrimp Lepidurus packardi — Endangered

MANAGED BY
Sacramento Fish And Wildlife Office
San Francisco Bay-delta Fish And Wildlife

CRITICAL HABITAT
There is **final** critical habitat designated for this species.

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=K048

Fishes

Delta Smelt Hypomesus transpacificus

Threatened

MANAGED BY

Sacramento Fish And Wildlife Office
San Francisco Bay-delta Fish And Wildlife

CRITICAL HABITAT

There is **final** critical habitat designated for this species.

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=E070

Steelhead Oncorhynchus (=Salmo) mykiss

Threatened

MANAGED BY

Sacramento Fish And Wildlife Office

CRITICAL HABITAT

There is **final** critical habitat designated for this species.

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=E08D

Flowering Plants

Antioch Dunes Evening-primrose Oenothera deltoides ssp. howellii — Endangered

MANAGED BY
Sacramento Fish And Wildlife Office
San Francisco Bay-delta Fish And Wildlife

CRITICAL HABITAT
There is **final** critical habitat designated for this species.

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q1ZN

Colusa Grass Neostapfia colusana — Threatened

MANAGED BY
Sacramento Fish And Wildlife Office
San Francisco Bay-delta Fish And Wildlife

CRITICAL HABITAT
There is **final** critical habitat designated for this species.

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q19I

Contra Costa Goldfields Lasthenia conjugens — Endangered

MANAGED BY
Sacramento Fish And Wildlife Office
San Francisco Bay-delta Fish And Wildlife

CRITICAL HABITAT
There is **final** critical habitat designated for this species.

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q122

Contra Costa Wallflower Erysimum capitatum var. angustatum — Endangered

MANAGED BY
Sacramento Fish And Wildlife Office
San Francisco Bay-delta Fish And Wildlife

CRITICAL HABITAT
There is **final** critical habitat designated for this species.

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q1WA

Keck's Checker-mallow Sidalcea keckii — Endangered

MANAGED BY
Sacramento Fish And Wildlife Office

CRITICAL HABITAT
There is **final** critical habitat designated for this species.

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q1OS

Soft Bird's-beak Cordylanthus mollis ssp. mollis Endangered

MANAGED BY
Sacramento Fish And Wildlife Office
San Francisco Bay-delta Fish And Wildlife

CRITICAL HABITAT
There is **final** critical habitat designated for this species.

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q0GT

Insects

Delta Green Ground Beetle Elaphrus viridis Threatened

MANAGED BY
Sacramento Fish And Wildlife Office
San Francisco Bay-delta Fish And Wildlife

CRITICAL HABITAT
There is **final** critical habitat designated for this species.

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=I01G

Lange's Metalmark Butterfly Apodemia mormo langei Endangered

MANAGED BY
Sacramento Fish And Wildlife Office
San Francisco Bay-delta Fish And Wildlife

CRITICAL HABITAT
No critical habitat has been designated for this species.

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=I00H

San Bruno Elfin Butterfly Callophrys mossii bayensis Endangered

MANAGED BY
Sacramento Fish And Wildlife Office
San Francisco Bay-delta Fish And Wildlife

CRITICAL HABITAT
No critical habitat has been designated for this species.

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=I00Q

Valley Elderberry Longhorn Beetle Desmocerus californicus dimorphus Threatened

MANAGED BY
Sacramento Fish And Wildlife Office
San Francisco Bay-delta Fish And Wildlife

CRITICAL HABITAT
There is **final** critical habitat designated for this species.

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=I01L

Mammals

Salt Marsh Harvest Mouse Reithrodontomys raviventris — Endangered

MANAGED BY
Sacramento Fish And Wildlife Office
San Francisco Bay-delta Fish And Wildlife

CRITICAL HABITAT
No critical habitat has been designated for this species.

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A03Y

San Joaquin Kit Fox Vulpes macrotis mutica — Endangered

MANAGED BY
Sacramento Fish And Wildlife Office
San Francisco Bay-delta Fish And Wildlife

CRITICAL HABITAT
No critical habitat has been designated for this species.

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A006

Reptiles

Giant Garter Snake Thamnophis gigas — Threatened

MANAGED BY
Sacramento Fish And Wildlife Office
San Francisco Bay-delta Fish And Wildlife

CRITICAL HABITAT
No critical habitat has been designated for this species.

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=C057

Critical Habitats

This location overlaps all or part of the critical habitat for the following species:

Delta Smelt Hypomesus transpacificus

Final designated critical habitat
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=E070#crithab

Migratory Birds

Birds are protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act.

Any activity that results in the take of migratory birds or eagles is prohibited unless authorized by the U.S. Fish & Wildlife Service.[1] There are no provisions for allowing the take of migratory birds that are unintentionally killed or injured.

Any person or organization who plans or conducts activities that may result in the take of migratory birds is responsible for complying with the appropriate regulations and implementing appropriate conservation measures.

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1. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

Additional information can be found using the following links:

- Birds of Conservation Concern
  http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Conservation measures for birds
  http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Year-round bird occurrence data
  http://www.birdscanada.org/birdmon/default/datasummaries.jsp

The following species of migratory birds could potentially be affected by activities in this location:

Allen's Hummingbird Selasphorus sasin — Bird of conservation concern
Season: Breeding
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0LI

Bald Eagle Haliaeetus leucocephalus — Bird of conservation concern
Year-round
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B008

Bell's Sparrow Amphispiza belli — Bird of conservation concern
Year-round
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0HE

Black Oystercatcher Haematopus bachmani — Bird of conservation concern
Year-round
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0KJ

Black Rail Laterallus jamaicensis — Bird of conservation concern
Season: Breeding
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B09A

Burrowing Owl Athene cunicularia — Bird of conservation concern
Year-round
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0NC

Fox Sparrow Passerella iliaca — Bird of conservation concern
Season: Wintering

Lawrence's Goldfinch Carduelis lawrencei — Bird of conservation concern
Season: Breeding
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0J8

Least Bittern Ixobrychus exilis
Season: Breeding
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B092

Lesser Yellowlegs Tringa flavipes — Bird of conservation concern
Season: Wintering
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0MD

Lewis's Woodpecker Melanerpes lewis — Bird of conservation concern
Season: Wintering
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0HQ

Loggerhead Shrike Lanius ludovicianus — Bird of conservation concern
Year-round
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0FY

Long-billed Curlew Numenius americanus — Bird of conservation concern
Season: Wintering
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B06S

Marbled Godwit Limosa fedoa — Bird of conservation concern
Season: Wintering
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0JL

Mountain Plover Charadrius montanus — Bird of conservation concern
Season: Wintering
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B078

Nuttall's Woodpecker Picoides nuttallii — Bird of conservation concern
Year-round
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0HT

Oak Titmouse Baeolophus inornatus — Bird of conservation concern
Year-round
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0MJ

Peregrine Falcon Falco peregrinus — Bird of conservation concern
Year-round
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0FU

Rufous-crowned Sparrow Aimophila ruficeps — Bird of conservation concern
Year-round
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0MX

Short-billed Dowitcher Limnodromus griseus — Bird of conservation concern
Season: Wintering
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0JK

Short-eared Owl Asio flammeus — Bird of conservation concern
Season: Wintering
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0HD

Snowy Plover Charadrius alexandrinus — Bird of conservation concern
Season: Breeding

Song Sparrow Melospiza melodia maxillaris — Bird of conservation concern
Year-round
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B08R

Swainson's Hawk Buteo swainsoni — Bird of conservation concern
Season: Breeding
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B070

Tricolored Blackbird Agelaius tricolor — Bird of conservation concern
Year-round
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B06P

Western Grebe aechmophorus occidentalis — Bird of conservation concern
Year-round
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0EA

Yellow Rail Coturnicops noveboracensis — Bird of conservation concern
Season: Wintering
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0JG

Yellow-billed Magpie Pica nuttalli — Bird of conservation concern
Year-round
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0N8

Wildlife refuges and fish hatcheries

There are no refuges or fish hatcheries in this location

Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

DATA LIMITATIONS

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

DATA EXCLUSIONS

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

DATA PRECAUTIONS

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

This location overlaps all or part of the following wetlands:

Freshwater Emergent Wetland

PEM1B
PEM1C
PEM1Ch
PEM1Fh

Freshwater Pond

PUBHx
PUSCh

Riverine

R4SBA

A full description for each wetland code can be found at the National Wetlands Inventory website: http://107.20.228.18/decoders/wetlands.aspx

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Query Criteria: Quad IS (Dozier (3812137) OR Elmira (3812138) OR Liberty Island (3812136))

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Agelaius tricolor tricolored blackbird	ABPBXB0020	None	None	G2G3	S1S2	SSC
Ambystoma californiense California tiger salamander	AAAAA01180	Threatened	Threatened	G2G3	S2S3	SSC
Andrena blennospermatis Blennosperma vernal pool andrenid bee	IIHYM35030	None	None	G2	S2	
Ardea alba great egret	ABNGA04040	None	None	G5	S4	
Astragalus tener var. ferrisiae Ferris' milk-vetch	PDFAB0F8R3	None	None	G2T1	S1	1B.1
Astragalus tener var. tener alkali milk-vetch	PDFAB0F8R1	None	None	G2T2	S2	1B.2
Athene cunicularia burrowing owl	ABNSB10010	None	None	G4	S3	SSC
Atriplex cordulata var. cordulata heartscale	PDCHE040B0	None	None	G3T2	S2	1B.2
Atriplex depressa brittlescale	PDCHE042L0	None	None	G2	S2	1B.2
Atriplex persistens vernal pool smallscale	PDCHE042P0	None	None	G2	S2	1B.2
Bombus occidentalis western bumble bee	IIHYM24250	None	None	G2G3	S1	
Branchinecta conservatio Conservancy fairy shrimp	ICBRA03010	Endangered	None	G2	S2	
Branchinecta lynchi vernal pool fairy shrimp	ICBRA03030	Threatened	None	G3	S3	
Branchinecta mesovallensis midvalley fairy shrimp	ICBRA03150	None	None	G2	S2S3	
Buteo swainsoni Swainson's hawk	ABNKC19070	None	Threatened	G5	S3	
California macrophylla round-leaved filaree	PDGER01070	None	None	G3?	S3?	1B.2
Centromadia parryi ssp. parryi pappose tarplant	PDAST4R0P2	None	None	G3T2	S2	1B.2
Chloropyron molle ssp. hispidum hispid salty bird's-beak	PDSCR0J0D1	None	None	G2T2	S2	1B.1
Cicuta maculata var. bolanderi Bolander's water-hemlock	PDAPI0M051	None	None	G5T4	S2	2B.1

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Coastal and Valley Freshwater Marsh Coastal and Valley Freshwater Marsh	CTT52410CA	None	None	G3	S2.1	
Delphinium recurvatum recurved larkspur	PDRAN0B1J0	None	None	G2?	S2?	1B.2
Downingia pusilla dwarf downingia	PDCAM060C0	None	None	GU	S2	2B.2
Elaphrus viridis Delta green ground beetle	IICOL36010	Threatened	None	G1	S1	
Emys marmorata western pond turtle	ARAAD02030	None	None	G3G4	S3	SSC
Extriplex joaquinana San Joaquin spearscale	PDCHE041F3	None	None	G2	S2	1B.2
Fritillaria liliacea fragrant fritillary	PMLIL0V0C0	None	None	G2	S2	1B.2
Fritillaria pluriflora adobe-lily	PMLIL0V0F0	None	None	G2G3	S2S3	1B.2
Gratiola heterosepala Boggs Lake hedge-hyssop	PDSCR0R060	None	Endangered	G2	S2	1B.2
Hibiscus lasiocarpos var. occidentalis woolly rose-mallow	PDMAL0H0R3	None	None	G5T2	S2	1B.2
Hydrochara rickseckeri Ricksecker's water scavenger beetle	IICOL5V010	None	None	G2?	S2?	
Hypomesus transpacificus Delta smelt	AFCHB01040	Threatened	Endangered	G1	S1	
Isocoma arguta Carquinez goldenbush	PDAST57050	None	None	G1	S1	1B.1
Lasthenia conjugens Contra Costa goldfields	PDAST5L040	Endangered	None	G1	S1	1B.1
Lathyrus jepsonii var. jepsonii Delta tule pea	PDFAB250D2	None	None	G5T2	S2	1B.2
Legenere limosa legenere	PDCAM0C010	None	None	G2	S2	1B.1
Lepidium latipes var. heckardii Heckard's pepper-grass	PDBRA1M0K1	None	None	G4T2	S2	1B.2
Lepidurus packardi vernal pool tadpole shrimp	ICBRA10010	Endangered	None	G4	S3S4	
Lilaeopsis masonii Mason's lilaeopsis	PDAPI19030	None	Rare	G2	S2	1B.1
Limosella australis Delta mudwort	PDSCR10050	None	None	G4G5	S2	2B.1
Linderiella occidentalis California linderiella	ICBRA06010	None	None	G2G3	S2S3	

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Melospiza melodia song sparrow ("Modesto" population)	ABPBXA3010	None	None	G5	S3?	SSC
Navarretia leucocephala ssp. bakeri Baker's navarretia	PDPLM0C0E1	None	None	G4T2	S2	1B.1
Neostapfia colusana Colusa grass	PMPOA4C010	Threatened	Endangered	G1	S1	1B.1
Northern Claypan Vernal Pool Northern Claypan Vernal Pool	CTT44120CA	None	None	G1	S1.1	
Oncorhynchus mykiss irideus steelhead - Central Valley DPS	AFCHA0209K	Threatened	None	G5T2Q	S2	
Orcuttia inaequalis San Joaquin Valley Orcutt grass	PMPOA4G060	Threatened	Endangered	G1	S1	1B.1
Plagiobothrys hystriculus bearded popcornflower	PDBOR0V0H0	None	None	G2	S2	1B.1
Puccinellia simplex California alkali grass	PMPOA53110	None	None	G3	S2	1B.2
Sagittaria sanfordii Sanford's arrowhead	PMALI040Q0	None	None	G3	S3	1B.2
Spirinchus thaleichthys longfin smelt	AFCHB03010	Candidate	Threatened	G5	S1	SSC
Symphyotrichum lentum Suisun Marsh aster	PDASTE8470	None	None	G2	S2	1B.2
Thamnophis gigas giant garter snake	ARADB36150	Threatened	Threatened	G2	S2	
Trifolium amoenum two-fork clover	PDFAB40040	Endangered	None	G1	S1	1B.1
Trifolium hydrophilum saline clover	PDFAB400R5	None	None	G2	S2	1B.2
Tuctoria mucronata Crampton's tuctoria or Solano grass	PMPOA6N020	Endangered	Endangered	G1	S1	1B.1
Valley Needlegrass Grassland Valley Needlegrass Grassland	CTT42110CA	None	None	G3	S3.1	

Record Count: 56

Invasive Species Monitoring Report

Invasive Species Monitoring Report

for

Solano Wind Farm

Rio Vista, Solano County

Prepared for

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Cover Page: Overlooking rangeland with minimal weed infestation on Solano Wind Farm. April 25, 2017.

1.0 Executive Summary

- Total land covered with invasive weed species was less in April 2017 compared with weed surveys from April 2015 or April 2016. Approximate total area covered by weeds in April each year:

  341acres in 2015
  1043 acres in 2016
  252 acres in 2017

- Late-season weed surveys were completed for the first time in 2017 and documented approximately 364.6 acres. Adding late-season weeds to the April weed area, 616.3 acres of weeds were documented throughout the spring and summer seasons.
- White horsenettle (*Solanum elaeagnifolium*) was a new priority weed identified in low densities in Field 4.
- Rush skeleton weed *(Chondrilla juncea)* was a new priority weed identified in low densities in Field 16.
- Density and distribution of broadleaf pepperweed (*Lepidium latifolium*) in Field 21 (i.e. Lower 7) and Field 15 (i.e. Field 6) was lower in 2017 than in 2015 or 2016.

2.0 Introduction

This is the third Invasive Weed Monitoring Report for the Solano Wind Farm (Project) located in Rio Vista, at the eastern end of Solano County (Figure 1). The Project is located in the Collinsville-Montezuma Wind Resource Area and consists of approximately 5,500 acres with 102 wind turbine generators (WTG) and an additional 1,305-acres of adjacent land. The Solano Wind Farm is owned by the Sacramento Municipal Utilities District (SMUD) was developed in three Phases, Phase 1 comprises 498 acres, Phase 2 1,633-acres, and Phase 3 2,962-acres that cover portions of 21 fenced pastures (Figure 2). Solano Wind Farms also owns four pastures (Phase 4) adjacent to the wind farm that are currently leased for livestock grazing and dry farm cropping.

Per Services Agreement NO. 4500090462, baseline weed surveys were completed during April 2015 (Althouse and Meade 2015; Attachment 1), Year 2 monitoring was completed during April 2016 (Althouse and Meade 2016; Attachment 2), and Year 3 surveys were completed during April 24 through 27, 2017. Additional late-season weed surveys were completed between August 7 through 10, 2017 to document late-season species. This report summarizes the 2017 survey results, compares April 2015, 2016, and 2017 weed surveys, compares current conditions (including April 2017 and September 2017 surveys) to original 2015 conditions, and provides recommendations for future management.

Land use on the Project site includes WTG operations, with lease agreements for livestock grazing and dryland wheat and barley farming. Areas under the lease agreement are available for livestock grazing or dryland farming on a rotating basis (URS 2010). Target weeds identified on the Project include Italian thistle (*Carduus pycnocephalus*), milk thistle (*Silybum marianum*), black mustard (*Brassica nigra*), broadleaved pepperweed (*Lepidium latifolium*), fennel (*Foeniculum vulgare*), artichoke thistle (*Cynara cardunculus*), yellow starthistle (*Centaurea solstitialis*), purple starthistle (*Centaurea calcitrapa*), rush skeleton weed (*Chondrilla juncea*), and white horsenettle (*Solanum* e*laeagnifolium*) (Table 1).

2.1 Solano County Weed Management

Solano County targets specific weed species for management and control. All California Department of Food and Agriculture (CDFA) List A or B Species are considered high priorities for management (Linda Pinfold pers. comm. 2017). CDFA List A species are known to have an economic or environmental impact with the potential for invasion into California or limited distribution that allows for eradication (CDFA 2013). List B species have a known economic or environmental impact with limited distribution in California (CDFA 2013). Solano County specifically targets control of artichoke thistle (*Cynara dracunculus*), yellow starthistle (*Centaurea solstitialis*), purple star thistle (*Centaurea calcitrapa*), and rush skeleton weed (*Chondrilla juncea*) (Linda Pinfold pers. comm. 2017). Solano County does not have specific regulations or target management thresholds for invasive species in the County.

TABLE 1. INVASIVE WEED SPECIES ONSITE.

Common Name	Scientific Name	CAL IPC Rating	CDFA Rating
Artichoke thistle	*Cynara cardunculus*	Moderate	List B
Black mustard	*Brassica nigra*	Moderate	n/a
Broadleaved pepperweed	*Lepidium latifolium*	High	List B
Fennel	*Foeniculum vulgare*	High	n/a
Italian thistle	*Carduus pycnocephalus*	Moderate	List C
Milk thistle	*Silybum marianum*	Limited	n/a
Purple starthistle	*Centaurea calcitrapa*	Moderate	List B
Rush skeleton weed	*Chondrilla juncea*	Moderate	List A
White horsenettle	*Solanum elaeagnifolium*	n/a	List B
Yellow starthistle	*Centaurea solstitialis*	High	List B

3.0 Methods

Weed populations identified during 2015 and 2016 surveys were re-assessed and current densities determined. New weed populations identified were mapped, and densities determined. Weed densities were measured using a 1-square-meter quadrat. Individual weed species were identified, and counted by age class (i.e., seedling or mature). Population density classes of "High", "Moderate", and "Low" were developed for each target species based on quadrat densities (Table 2). The identified classes were used to map weed populations across the entire Project. The same density classes were used during all survey years to allow comparison between years. All access roads were driven and inspected for weeds. Rangelands were evaluated for weeds while driving all roads. Areas containing weed populations were mapped and density class recorded.

Weed species occurring sporadically were mapped based on number of individuals observed at unique points (e.g., fennel, purple starthistle, rush skeleton weed, and white horsenettle; Figure 10).

TABLE 2. WEED SPECIES DENSITY CLASSES. Densities defined by number of individual plants per 1-square meter.

Common Name	Scientific Name	Low	Moderate	High
Artichoke thistle	*Cynara dracunculus*	1	2	3
Black mustard	*Brassica nigra*	<5	5-9	>10
Broadleaf pepperweed	*Lepidium latifolium*	<15	16-34	>35
Fennel	*Foeniculum vulgare*	1	2	3
Italian thistle	*Carduus pycnocephalus*	<20	21-99	>100
Milk thistle	*Silybum marianum*	<2	2-5	>5
Purple start thistle	*Centaurea calcitrapa*	<2	3-5	>5
Yellow starthistle	*Centaurea solstitialis*	<5	6-24	>25

4.0 Results and Discussion

Weed distribution was typically associated with areas of disturbance including roadsides, within and adjacent to eroding areas, and around recently installed erosion control measures (Figure 2, Photos 1-5). During spring surveys, Phase 3 had the largest area covered in weed species (Table 3), this result is expected because this was the last Phase constructed. Consequently, this Phase has disturbed soils creating ideal conditions for weed establishment. Late-season weed surveys documented approximately 364.6-acres of weeds growing along roadsides and throughout rangelands, primarily in Phase 1 and 3. Yellowstar thistle was the dominant species observed throughout rangelands during late season surveys.

Total area covered by weeds in 2015 was approximately 341.3-acres. In 2016, approximately 439.3-acres were mapped in Phases 1 and 2, and an additional 604.1-acres were mapped in Phase 3. Percent increase in weed populations including Phase 3 was 154.7-percent from 2015 to 2016. Increase in weed populations during 2016 may be explained by increases in temperature, and precipitation during 2016. In 2017, approximately 612.23-acres were mapped in Phases 1 through 4 during early and late season surveys. Comparing April surveys between 2015 and 2017 weed population area decreased by 38-percent.

Acres of black mustard, broadleaf pepperweed, fennel, milk thistle, and Italian thistle decreased from 2015 to 2017 (Table 5). Artichoke thistle, purple starthistle, and yellowstar thistle increased in acres from 2015 to 2017. White horsenettle was observed for the first time in 2017 in Field 4, and rush skeleton weed was also observed for the first time in Field 16.

TABLE 3. 2017 WEED POPULATION AREAS BY PHASE. Includes April and August weed surveys by phase. Phase 3 installed erosion control measures during 2016, increasing area of disturbed soil and weed infestation.

Common Name	**Scientific Name**	**Phase 1** (acres)	**Phase 2** (acres)	**Phase 3** (acres)	**Phase 4** (acres)	**Total** (acres)
Artichoke thistle	*Cynara dracunculus*	0.002	2.310	2.920	3.500	8.730
Black mustard	*Brassica nigra*	1.830	2.250	2.130	11.370	17.580
Broadleaf pepperweed	*Lepidium latifolium*	n/a	0.008	53.080	n/a	53.080
Fennel	*Foeniculum vulgare*	0.005	0.440	0.090	0.400	0.940
Italian thistle	*Carduus pycnocephalus*	3.540	18.870	63.800	1.850	88.060
Milk thistle	*Silybum marianum*	1.700	9.910	36.740	3.060	51.410
Purple starthistle	*Centaurea calcitrapa*	0.160	0.003	2.190	0.900	3.250
Yellow starthistle	*Centaurea solstitialis*	107.480	80.860	170.810	8.990	368.140

TABLE 4. 2015-2017 CHANGE IN WEED POPULATION. **Bold** text indicates an increase in area between 2015 and 2016. **Red** text indicates a decrease in area from 2015 to 2017. Results are for April surveys only.

Year	**Total Acreage**	**Change from Baseline** (acres)	**Change from Baseline** (percent)
2015	409.7	n/a	n/a
2016	1043.4	**+633.7**	**+107.2**
2017	251.7	**-158.0**	**-38.0**

TABLE 5. WEED POPULATIONS BY SPECIES AND YEAR. Red text indicates an increase in area from 2015, **BOLD** indicates a reduction in weed acres. This table includes April and August 2017 weed surveys.

Common Name	**Scientific Name**	**2015 Acres**	**2016 Acres**	**2017 Acres**	**Acre Change** (2015-2016)	**Acre Change** (2015-2017)
Artichoke thistle	*Cynara dracunculus*	0.0	0.3	11.8	+0.3	+11.8
Black mustard	*Brassica nigra*	99.6	370.8	20.6	+271.2	**-79.2**
Broadleaf pepperweed	*Lepidium latifolium*	146.9	101.3	55.9	**-45.5**	**-91.0**
Fennel	*Foeniculum vulgare*	8.3	0.4	5.7	**-7.9**	**-2.7**
Italian thistle	*Carduus pycnocephalus*	96.9	197.6	90.9	+100.8	**-6.1**
Milk thistle	*Silybum marianum*	58.1	170.3	54.4	+112.2	**-3.7**
Purple startthistle	*Centaurea calcitrapa*	0.0	15.0	3.3	+15.0	+3.3
Yellow starthistle	*Centaurea solstitialis*	0.0	187.6	370.0	+187.6	+370.0
		409.7	**1,043.4**	**612.23**		

Results for each weed species are summarized below:

Artichoke thistle (*Cynara dracunculus*)

Artichoke thistle was identified in Fields 2, 4, 8, 9, 14, 15, 16, 17, 18, 22, and 23 (Figure 9). Artichoke thistle is a perennial thistle common throughout California on disturbed sites, rangelands, and riparian areas (Cal IPC 2016). This species is rated Moderate by California Invasive Plant Council (Cal IPC) and is a target species for management and control by Solano County (Linda Pinfield pers. comm. 2017). Artichoke thistle can reproduce by seed and vegetatively by root fragments (Cal IPC 2016). Distribution of artichoke thistle increased from 2015 to 2017 on the Project. High densities of artichoke thistle were observed on neighboring lands adjacent to the Project (Photo 8). The highest density of artichoke thistle observed onsite was immediately down-wind of a very large population on High Winds Wind Farm (Photo 9). Phase 4 was surveyed for the first time this year and had 3.5-acres of artichoke thistle. Phases 1 through 3 had 5.22-acres of artichoke thistle, 4.9-acres more than observed in 2016. Eradication of this species onsite is not likely due to the high densities on surrounding farms.

Black mustard (*Brassica nigra)*

Patches of black mustard were identified in Fields 4, 15, 17, 19, 22, and 23 during 2017 surveys (Figure 4). Black mustard was a dominant plant observed during the 2015 and 2016 invasive species surveys covering approximately 99.6-acres and 370.8-acres, respectively. During 2017 invasive weed surveys total area covered by black mustard was reduced to 20.6-acres. The majority of black mustard was documented in Phase 4 within fields that have not been surveyed during previous years.

Black mustard is a common rangeland weed, rated as Moderate by Cal IPC. Black mustard grows and reproduces quickly allowing it to invade new areas. Dense infestations can produce greater than 1000 seeds/m^2, seeds are produced annually and remain viable in the soil for at least three years (Cal IPC 2016). Properties adjacent to SMUD were densely covered in black mustard, particularly land adjacent to Phase 1. Seed spread from adjacent lands and high rainfall may explain the increase in acres of black mustard during 2016. It produces allelopathic chemicals that prevent germination of native plants, explaining why it grows in isolated patches that exhibit minimal species diversity on the Property.

Broadleaf pepperweed (*Lepidium latifolium)*

Broadleaf pepperweed was identified in Fields 15, 20, and 21 during 2017 surveys (Figure 6). Broadleaf pepperweed is a very aggressive perennial herb rated High by the Cal IPC. Field 21 was dominated by broadleaf pepperweed during 2015 surveys. During 2016 surveys broadleaf pepperweed was documented in Field 15, indicating that it had spread west up the drainage from Field 21. Broadleaf pepperweed density and distribution was reduced between 2016 and 2017. Three small patches of were documented in Field 21 (Photo 7), one new patch was documented along the road within a drainage in Field 15. Broadleaf pepperweed was not observed in the drainage to the west of Field 21 during 2017 surveys. Herbicide application and management of this species appears to be effective.

Broadleaf pepperweed requires high soil moisture to grow and reproduce. All populations documented onsite are within drainages or growing within a wetland adjacent to a creek in Field 21. This species reproduces by seed and vegetatively by roots allowing it to quickly spread and establish (Cal IPC 2016). Herbicide control and management likely prevented new growth and establishment within the existing population identified in 2015 and 2016. Broadleaf pepperweed distribution decreased from 2015 to 2017 by 45.5-acres.

Fennel (*Foeniculum vulgare*)

Fennel was observed in Fields 9 and 17 during 2017 surveys (Figure 10). Fennel is a perennial herb common throughout California and rated as High by Cal IPC. Fennel is not common on the Project and is limited primarily to roadsides near Operations and Maintenance with a few scattered patches on hillslopes in Field 9 (Photo 10). Distribution of fennel decreased from 2015 to 2017 by 2.7-acres, but increased from 2016 by 5.3-acres. The increase in fennel between 2016 and 2017 was primarily in Field 9 where patches of fennel were growing adjacent to the road and around wind turbines.

Italian thistle (*Carduus pycnocephalus*)

Italian thistle was identified in Fields 1, 4, 8, 9, 12, 14, 15, 16, 17, 18, and 22 during 2017 surveys (Figure 3). Italian thistle is a winter annual forb that is common throughout California and primarily grows in disturbed areas with bare ground, and along roadsides. It is rated Moderate by Cal IPC. Italian thistle was observed along road edges or within drainages where the soil has been recently disturbed. Italian thistle was most prevalent along roadsides in Field 14. Overall area covered by Italian thistle has decreased between 2015 and 2017 by 6.1-acres. Control measures used between 2015 and 2017 surveys appear to be effectively reducing Italian thistle populations.

Milk thistle (*Silybum marianum*)

Milk thistle was identified in Fields 1, 4, 5, 8, 9, 13, 14, 15, 16, 17, 18, 19, 21, and 23 (Figure 5). Milk thistle is a winter annual or biennial that is widely spread throughout California, primarily on overgrazed pastures, along fencelines or roads, and within disturbed areas (Cal IPC 2016). Cal IPC rates it as Limited. This species grows in dense patches, outcompeting other species (Photo 1). Density and distribution of milk thistle decreased from 2015 to 2017 (Table 5). Approximately 86-percent of the populations documented onsite are low density (less than 20 plants per square meter), compared with 2016 where only 58-percent of the population was low density with 25-percent high-density, and 16-percent moderate density. Milk thistle was observed along roadsides and within drainages where soil moisture content was higher.

Purple starthistle (*Centaurea calcitrapa*)

Purple starthistle was first observed in 2016, and was identified in Fields 4, 8, 15, and 18 during 2017 surveys (Figure 8; Photos 11 and 12). Purple starthistle can grow in many conditions including rangelands, roadsides, and disturbed sites. Species in the *Centaurea* genus may produce allelopathic chemicals preventing establishment of other species (Cal IPC 2016). Purple starthistle typically blooms July through October. Because this is a late season species, surveys were completed in August 2017 to inventory additional populations that may not have germinated or bolted during April 2017. Field 4 had the highest prevalence of purple starthistle, this field was surveyed for the first time during 2017.

Rush skeleton weed (*Chondrilla juncea*)

Rush skeleton weed was observed for the first time during April 2017 surveys in Field 16. One small patch of plants was documented adjacent to the road in Field 17 (Photo 13). Rush skeleton weed is ranked as Moderate by Cal-IPC, is listed as List B by the CDFA, and is a priority weed species for management by Solano County (Linda Pinfold pers. comm. 2017). Populations of rush skeleton weed are documented along California's coastline with the highest density of populations in north-eastern California (CalFlora 2017). Hand removal is recommended for the small population in Field 16.

White horsenettle (*Solanum eleagnifolium*)

White horsenettle was observed for the first time during April 2017 surveys in Field 4. One small patch of plants was documented along the roadside. White horsenettle is a CDFA List B rating and is not listed by Cal-IPC. White horsenettle leaves and berries are poisonous to livestock (CDFA 2017a). White horsenettle has been documented throughout Central and Southern California with scattered occurrences along California's coastline (CalFlora 2017). Hand removal multiple times throughout the season, as needed, is recommended for the small population in Field 4. Tilling is not recommended as this species sprouts from root fragments. Tilling or disking can increase the rate of spread and population area (CDFA 2017a).

Yellow starthistle (*Centaurea solstitialis*)

Yellow starthistle was observed in Fields 4, 8, 9, 14, 15, 16, 17, 18, 19, 21, and 23 (Figure 7). Yellow starthistle is a winter annual common throughout California and rated High by Cal IPC. Yellow starthistle is a high priority weed for management in Solano County (Linda Pinfold pers. comm. 2017). Bloom period typically occurs from late April through September. During the rosette phase (typically January through April) plants are not easily identifiable as they began to grow underneath other grasses and forbs. Because this is a late season species surveys were conducted during August 2017 to inventory populations that had not germinated or bolted during April surveys. This species propagates rapidly by seed (up to 75,000 seeds per plant), and quickly invades rangelands, roadsides, and disturbed sites (Cal IPC 2016). Density and distribution of yellow starthistle increased from 2015 through 2017 on the Property (Photos 14 and 15). Yellow starthistle was most prevalent on rangelands that had been previously plowed for dry farming. Fields 15, 18 and 19 had the largest area covered in yellow starthistle (Figure 7). Properties adjacent to SMUD have high density populations of yellow starthistle providing a seed source that spreads to SMUD lands (Photo 16).

5.0 Adaptive Management and Recommendations

Continue to apply management practices used during 2016 on all existing and new weed populations onsite (Table 7). Weed control and population reduction takes time (up to 5 years for some species) to see significant reductions in population because seeds can remain viable in the soil for several years. Effective weed control typically requires an integrative approach combining different methods to produce the greatest control. Herbicides documented in research for control of each weed species is provided in Table 8. If herbicides are applied, broadleaf specific herbicides are recommended to avoid creating bare ground where new weed populations may establish. Timeline for optimal weed control using herbicides, mechanical methods, or grazing is summarized in Table 9.

5.1 Grazing Management Recommendations

Livestock grazing can be used as part of an integrated weed management program (DiTomaso et al. 2013). Managed high intensity, short duration grazing is recommended when targeting grazing to invasive species. Temporary fencing (typically electric) is commonly used to concentrate livestock in areas with high concentrations of weeds. On Project lands, black mustard, broadleaf pepperweed, Italian thistle, and yellow starthistle can be grazed by livestock. Fields 1 and 2 have been grazed by goats and sheep and have lower weed densities compared with other fields (Photo 17).

5.1.1 *Black mustard:* graze by cattle, sheep, or goats prior to bloom period (typically February through May). Fields 17, 22, and 23 are ideal locations for grazing management.

5.1.2 *Broadleaf pepperweed:* graze by cattle, sheep, or goats early spring through summer. Recommend concentrating livestock grazing during spring, prior to flowering, by use of electric fencing in moderate density population in Field 21 (Figure 6). Livestock grazing in low density populations in Field 21 may reduce spread of population.

5.1.3 *Italian thistle:* graze with sheep or goats during the rosette stage in late winter. Cattle will graze Italian thistle during bolting stage typically January through June. Goats will graze Italian thistle during all life stages, including flowering after it has developed spikes. Grazing by goats and sheep is recommended for all populations of Italian thistle.

5.1.4 *Yellow star thistle:* sheep, goats, and cattle graze yellow starthistle before spines form on the plants (typically December through May). Goats will continue to eat yellow starthistle after spines have developed. Managed grazing in Fields 4, 8, 9, 14, 15, 16, 17, 18, 19, 21, and 23 is recommended to help control spread of yellow starthistle.

5.2 Weed Survey Recommendations

Continue monitoring weed population area and density annually to determine if populations are increasing, maintaining, or declining. Continue with late-season surveys in July or August for yellow starthistle, and purple starthistle to more accurately map and calculate the density of these species.

5.3 Priority Weeds for Management

Weed species onsite were separated into two management categories: "Control" and "Manage" (Table 6, Figure 11). Priority species for management, population control, and reduction are listed as "Control." Species included in this category are artichoke thistle, broadleaf pepperweed, fennel, yellow starthistle, purple starthistle, white horsenettle, and rush skeleton weed. Each of these species have the potential to significantly alter rangeland condition.

Weed species commonly observed on California rangelands are rated as "Manage." Eradication or significant reduction in populations of these species is not practicable because of their prevalence on California rangelands. Species included in this category have low impacts on rangelands and include black mustard, Italian thistle, and milk thistle.

TABLE 6. WEED MANAGEMENT CATEGORIES.

Common Name	Scientific Name	Management Category	Acres
Artichoke thistle	*Cynara dracunculus*	Control	0.3
Black mustard	*Brassica nigra*	Manage	370.8
Broadleaf pepperweed	*Lepidium latifolium*	Control	101.3
Fennel	*Foeniculum vulgare*	Control	0.4
Italian thistle	*Carduus pycnocephalus*	Manage	197.6
Milk thistle	*Silybum marianum*	Manage	170.3
Purple starthistle	*Centaurea calcitrapa*	Control	15.0
Rush skeleton weed	*Chondrilla juncea*	Control	<0.1
White horsenettle	*Solanum elaeagnifolium*	Control	<0.1
Yellow starthistle	*Centaurea solstitialis*	Control	187.6

TABLE 7. RECOMMENDATION SUMMARY.

Control Priority	Common Name	Scientific Name	Bloom Period	Control Options	Control Timing	Site Specific Recommendations	References
1	Artichoke thistle	*Cynara cardunculus*	April -July	Mow or cultivate, cut flower stems, herbicide application	Seedling stage, before maturity then treat regrowth with herbicide	Spot spray individual plants during spring.	DiTomaso and Healy 2007; DiTomaso et al. 2013
2	Broadleaf pepperweed	*Lepidium latifolium*	May-July	Cultivate, livestock grazing, herbicide application	Early spring throughout summer	Graze in spring, then apply herbicide. Seed native/naturalized grass if necessary.	DiTomaso and Healy 2007; DiTomaso et al. 2013
3	Purple starthistle	*Centaurea calcitrapa*	July-October	Hand removal or herbicide application	Prior to flowering, late winter or spring	Hand remove patches, bag and dispose of plants. Apply herbicide during winter or spring.	Cal IPC 2016, DiTomaso et al. 2013
4	Yellow starthistle	*Centaurea solstitialis*	April-September	Mow or cultivate, graze, herbicide application	Prior to flowering	Graze infested areas during rosette and bolting phase (typically April through June), apply herbicide during winter or spring (depending on herbicide used).	DiTomaso and Healy 2007; DiTomaso et al. 2013
5	Fennel	*Foeniculum vulgare*	May-September	Mow or cultivate, herbicide application	Prior to flowering	Mow in spring, spot spray in summer.	DiTomaso and Healy 2007; DiTomaso et al. 2013

Control Priority	Common Name	Scientific Name	Bloom Period	Control Options	Control Timing	Site Specific Recommendations	References
6	Milk thistle	*Silybum marianum*	April-July	Mow or herbicide application	Prior to flowering	Apply herbicide during spring.	DiTomaso and Healy 2007; DiTomaso et al. 2013
7	Italian thistle	*Carduus pycnocephalus*	February-July	Mow or herbicide application, livestock grazing	Mow or herbicide prior to seed-set, graze during flowering	Apply herbicide during spring.	DiTomaso and Healy 2007; DiTomaso et al. 2013
8	Black mustard	*Brassica nigra*	April-July	Mow or cultivate, livestock grazing, herbicide application	Prior to flowering	Use livestock for population control, apply herbicides if necessary.	DiTomaso and Healy 2007; DiTomaso et al. 2013
9	White horsenettle	*Solanum elaeagnifolium*	May-September	Hand removal, mow, herbicide application	Prior to flowering	Hand remove population, ensuring to remove root system when pulling.	CDFA 2017(a)
10	Rush skeleton weed	*Chondrilla juncea*	July-October	Hand removal, livestock grazing, herbicide application	Prior to flowering	Hand remove population, manage with grazing	CDFA 2017 (b)

TABLE 8. EFFECTIVE HERBICIDES FOR TARGET SPECIES. Recommendations are provided from DiTomaso and Healy 2007, DiTomaso et al. 2013, CDFA 2017a, and CDFA 2017b.

Common Name	**Scientific Name**	**Perspective**	**Milestone**	**Transline**	**Curtail**	**2,4-D**	**Banvel/ Clarity**	**Campaign**	**Telar**	**Matrix**	**Garlon**	**Roundup**	**Crossbow**	**Canter R+P**	**Escort**	**Habitat**	**Vista**	**Oust**	**Velpar**
Artichoke thistle	*Cynara cardunculus*	X	X	X	X						X		X		X				
Black mustard	*Brassica nigra*	X				X	X		X	X	X	X		X				X	
Perennial pepperweed	*Lepidium latifolium*	X				X			X			X				X			
Fennel	*Foeniculum vulgare*					X					X	X							
Italian thistle	*Carduus pycnocephalus*	X	X	X	X	X	X		X		X	X	X			X	X	X	X
Milk thistle	*Silybum marianum*	X	X	X	X	X	X	X	X	X									
Purple starthistle	*Centaurea calcitrapa*	X	X	X	X	X	X					X						X	X
Yellow star thistle	*Centaurea solstitialis*	X	X	X	X	X	X		X			X							
White horsenettle	*Solanum elaeagnifolium*					X						X							
Rush skeleton weed	*Chondrilla juncea*					X													

TABLE 9. TIMELINE FOR TARGET SPECIES CONTROL.

Common Name	Scientific Name	Control	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Artichoke thistle	*Cynara dracunculus*	Herbicide Control		■	■	■	■							
Black mustard	*Brassica nigra*	Herbicide Control		■	■	■	■							
		Mechanical Control		■	■	■	■							
		Grazing		■	■	■	■							
Fennel	*Foeniculum vulgare*	Herbicide Control				■	■	■	■	■				
		Mechanical Control		■	■	■								
Italian thistle	*Carduus pycnocephalus*	Herbicide Control		■	■	■	■							
		Mechanical Control				■	■							
		Grazing		■	■	■	■	■	■					
Milk thistle	*Silybum marianum*	Herbicide Control				■	■	■						
		Mechanical Control				■	■							
Perennial pepperweed	*Lepidium latifolium*	Herbicide Control			■	■	■							
		Mechanical Control		■	■	■	■							
		Grazing		■	■	■								
Purple starthistle	*Centaurea calcitrapa*	Herbicide Control		■	■	■	■							
		Mechanical Control						■	■	■	■	■		
		Grazing	■	■	■	■	■	■						

Herbicide Control | Mechanical Control | Grazing

Common Name	Scientific Name	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Rush skeleton weed	*Chondrilla juncea*												
White horsenettle	*Solanum elaeagnifolium*												
Yellow starthistle	*Centaurea solstitialis*												

Herbicide Control Mechanical Control Grazing

6.0 References

Althouse and Meade, Inc. 2015. April 2015 Site Visit and Weed Inventory Survey Results. May 2015.

Althouse and Meade, Inc. 2016. April 2016 Site Visit and Weed Inventory Survey Results. June 2016.

Calflora: Information on California plants for education, research and conservation, with data contributed by public and private institutions and individuals, including the Consortium of California Herbaria. [web application]. 2017. Berkeley, California: The Calflora Database [a non-profit organization]. Available: http://www.calflora.org/ (Accessed: Sep 20, 2017).

California Department of Food and Agriculture (CDFA). 2013. Encycloweedia: Weed Ratings. Available at https://www.cdfa.ca.gov/plant/IPC/encycloweedia/winfo_weedratings.html Accessed September 2017.

California Department of Food and Agriculture (CDFA). 2017a. Encycloweedia: *Solanum elaeagnifolium.* Available at https://www.cdfa.xca.gov/plant/ipc/encycloweedia/weedinfo/solanum-carolinense.htm Accessed September 20, 2017.

California Department of Food and Agriculture (CDFA). 2017b. Encycloweedia: Chondrilla juncea. Available at https://www.cdfa.ca.gov/plant/ipc/encycloweedia/weedinfo/chondrilla-juncea.htm Accessed September 20, 2017.

California Invasive Plant Council (Cal IPC). 2016. Inventory Database. Accessed May 30, 2016. http://www.cal-ipc.org/paf/

DiTomaso, J.M, G.B. Kyser et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California. 544 pp.

DiTomaso, Joseph and Evelyn Healy. 2007. Weeds of California and Other Western States. Publication 3488. University of California Agriculture and Natural Resources

Pinfold, L. Personal Communication September 21, 2017. Solano County Agriculture Commissioner Office, Exclusion and Pest Prevention.

URS Corporation (URS). 2010. Land Management Plan for the SMUD Solano Property. July 2010.

7.0 Figures

Figure 1. General Location Map

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Solano Wind Project
Phase 2 Land Management Plan

Service Layer Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Map Updated: July 25, 2017, 09:35 AM

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Figure 2a. Weed Locations - April

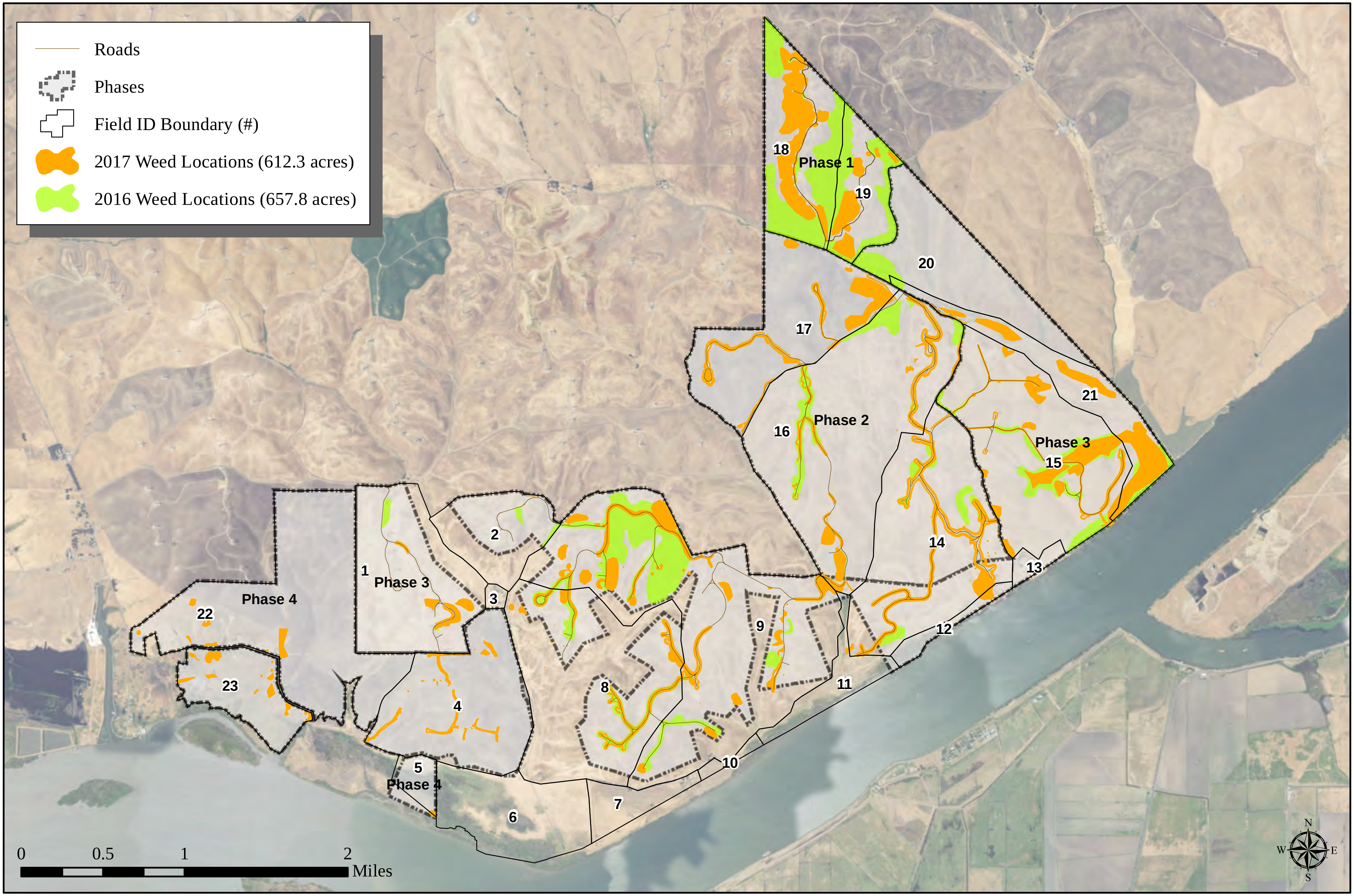

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Figure 2b. 2017 Weed Locations - August

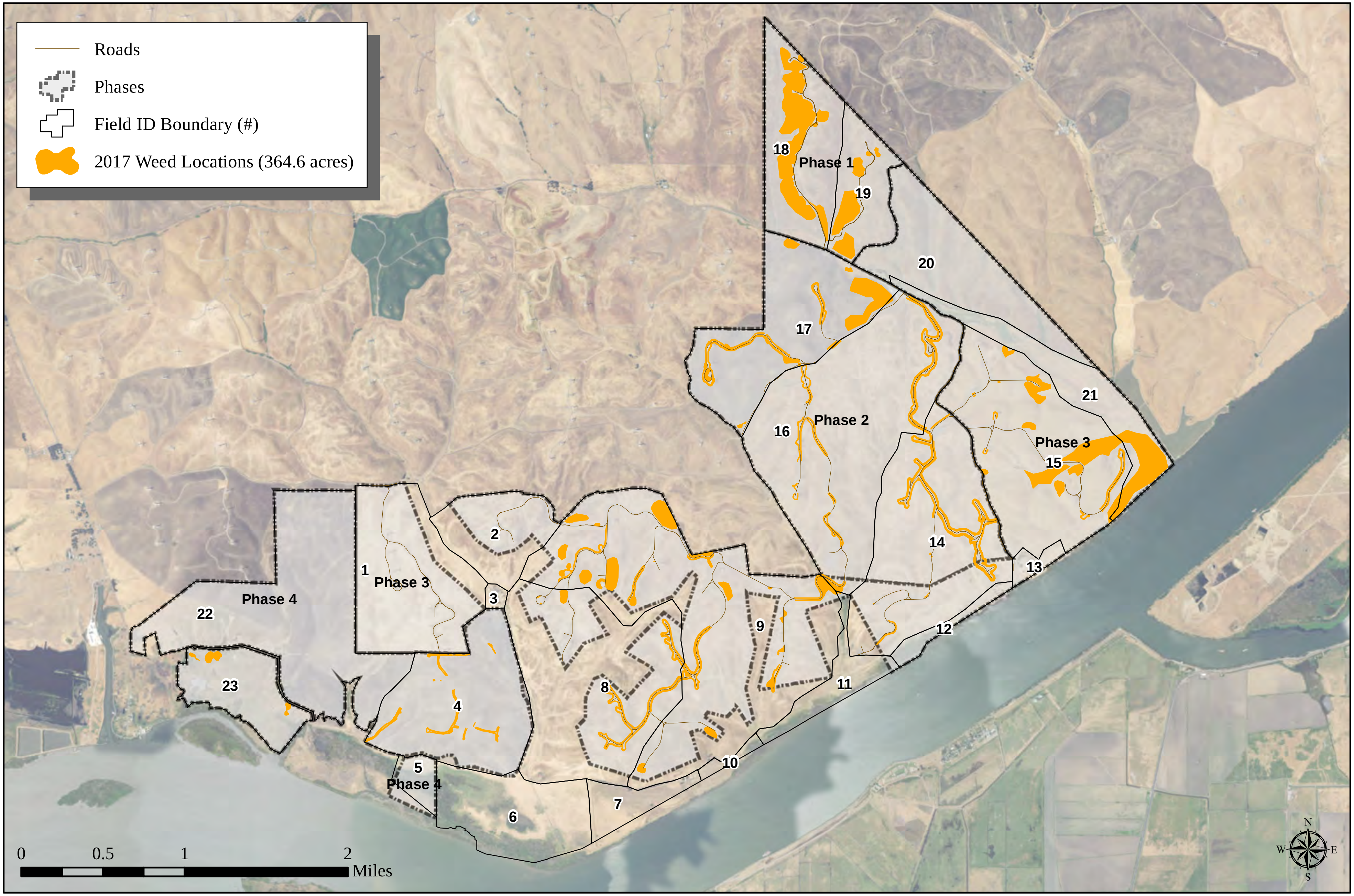

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Figure 3. *Carduus pycnocephalus* Density

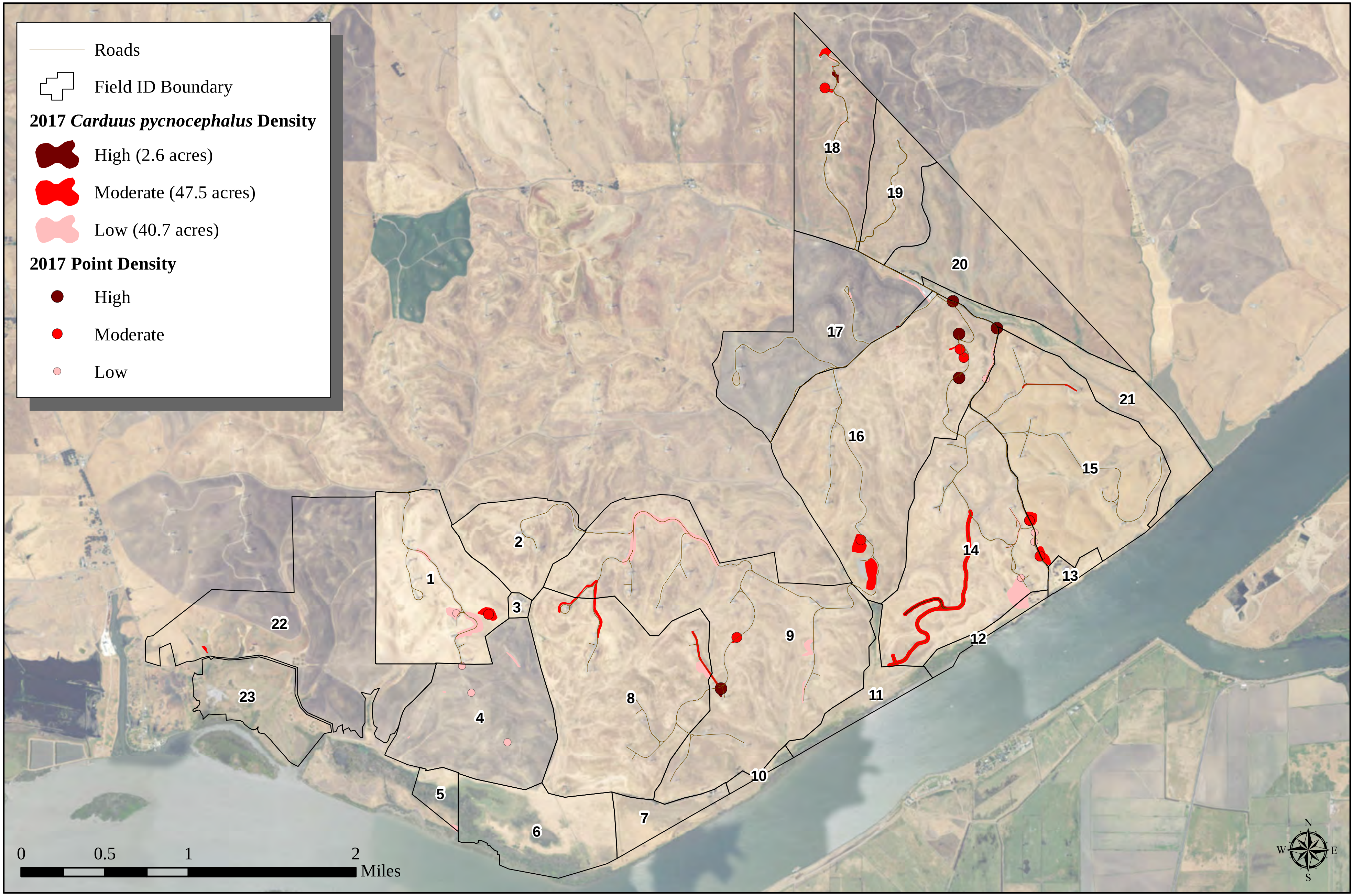

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Figure 4. *Brassica nigra* Density

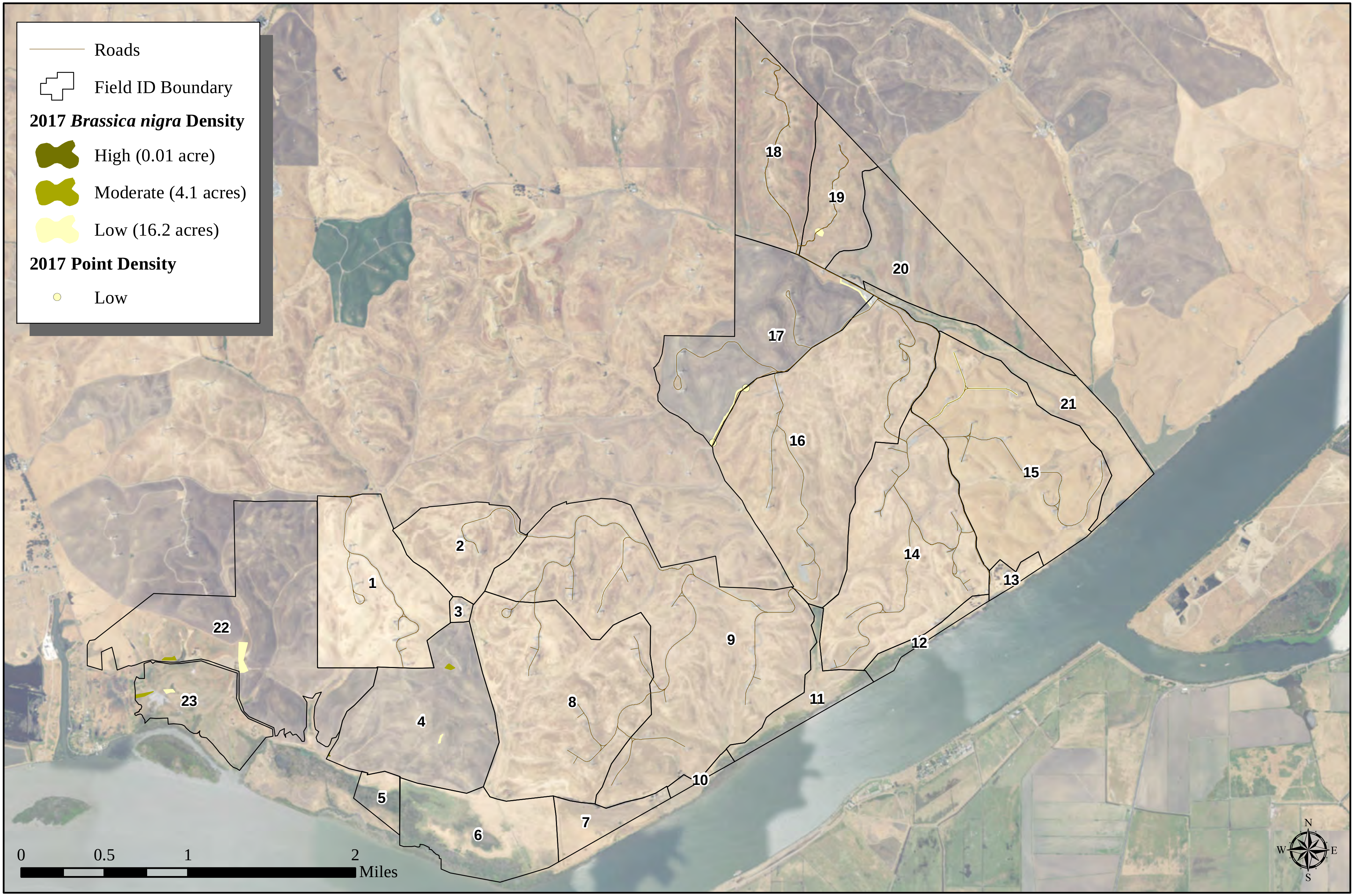

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Figure 5. *Silybum marianum* Density

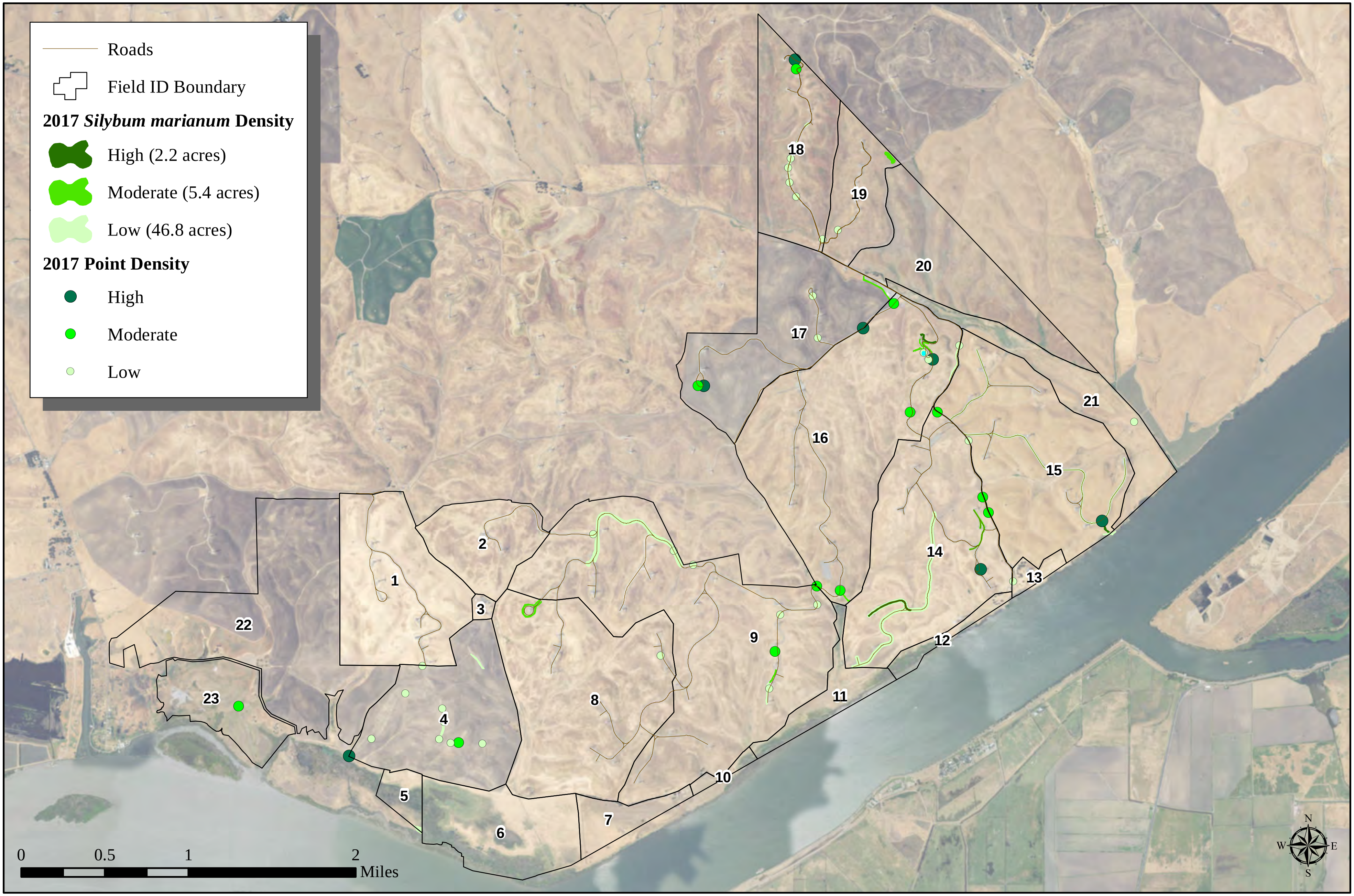

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Figure 6. *Lepidium latifolium* Density

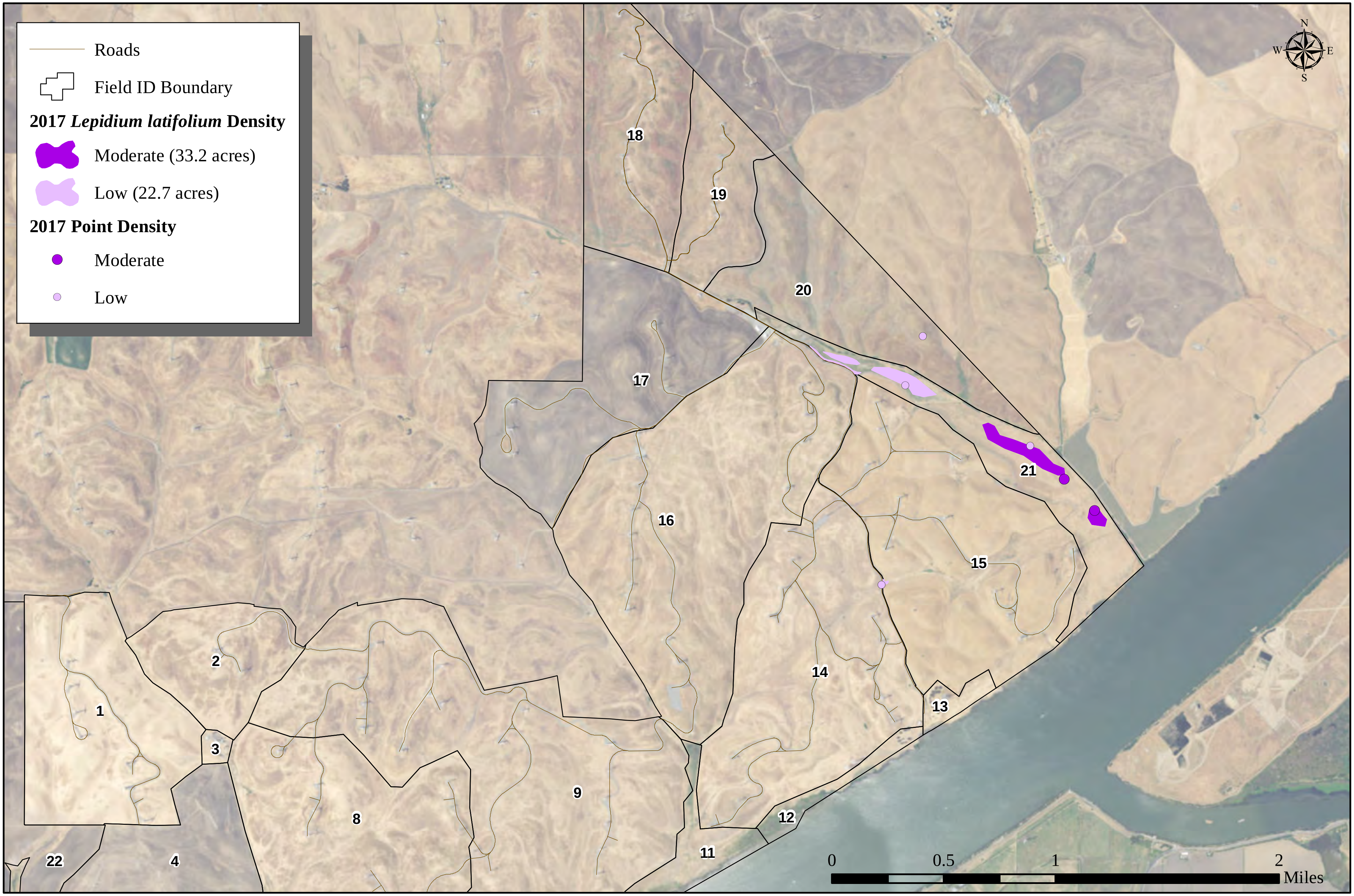

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Figure 7. *Centaurea solstitialis* Density

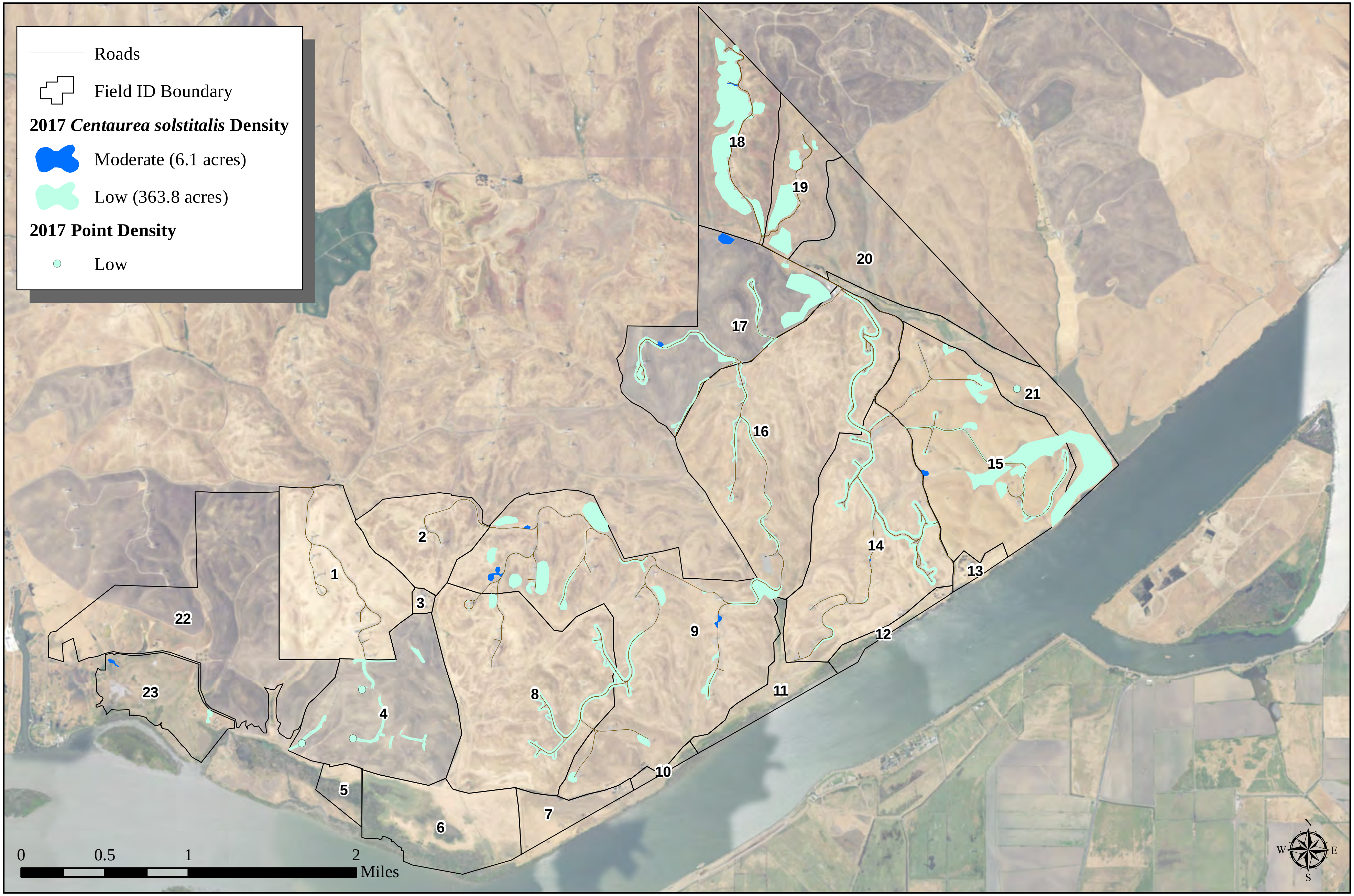

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Figure 8. *Centaurea calcitrapa* Density

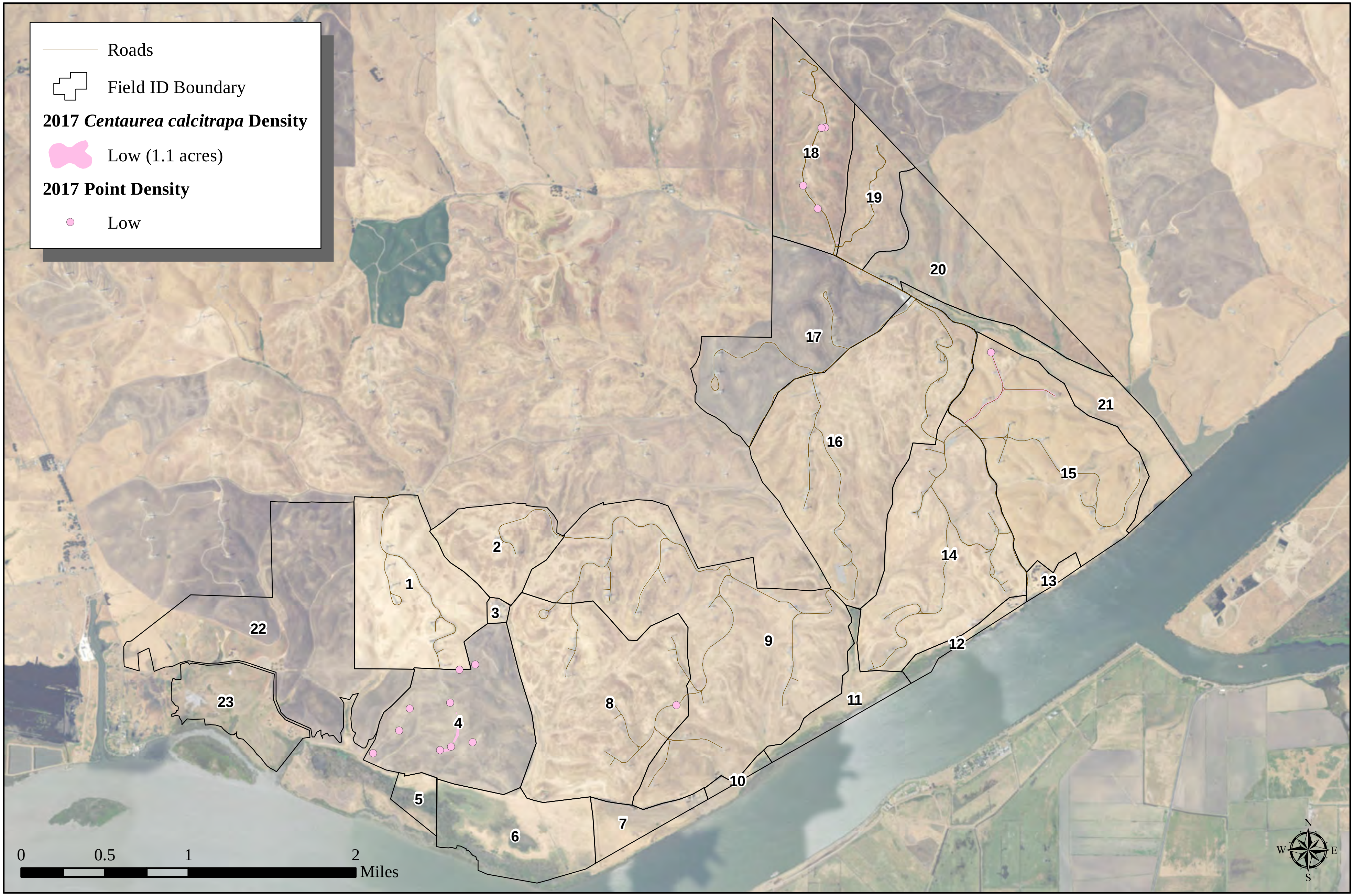

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Figure 9. *Cynara dracunculus* Density

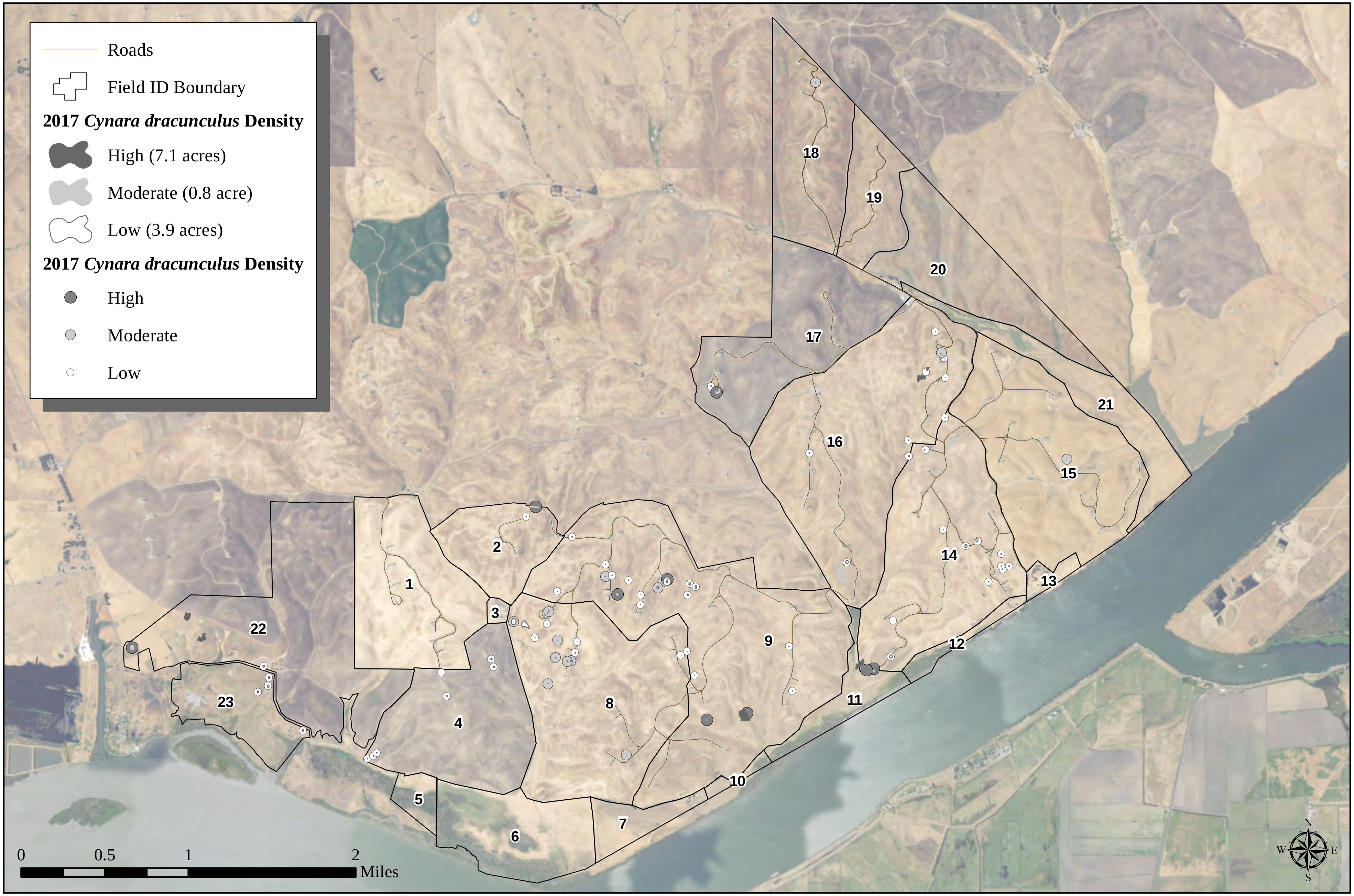

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Figure 10. Weed Points

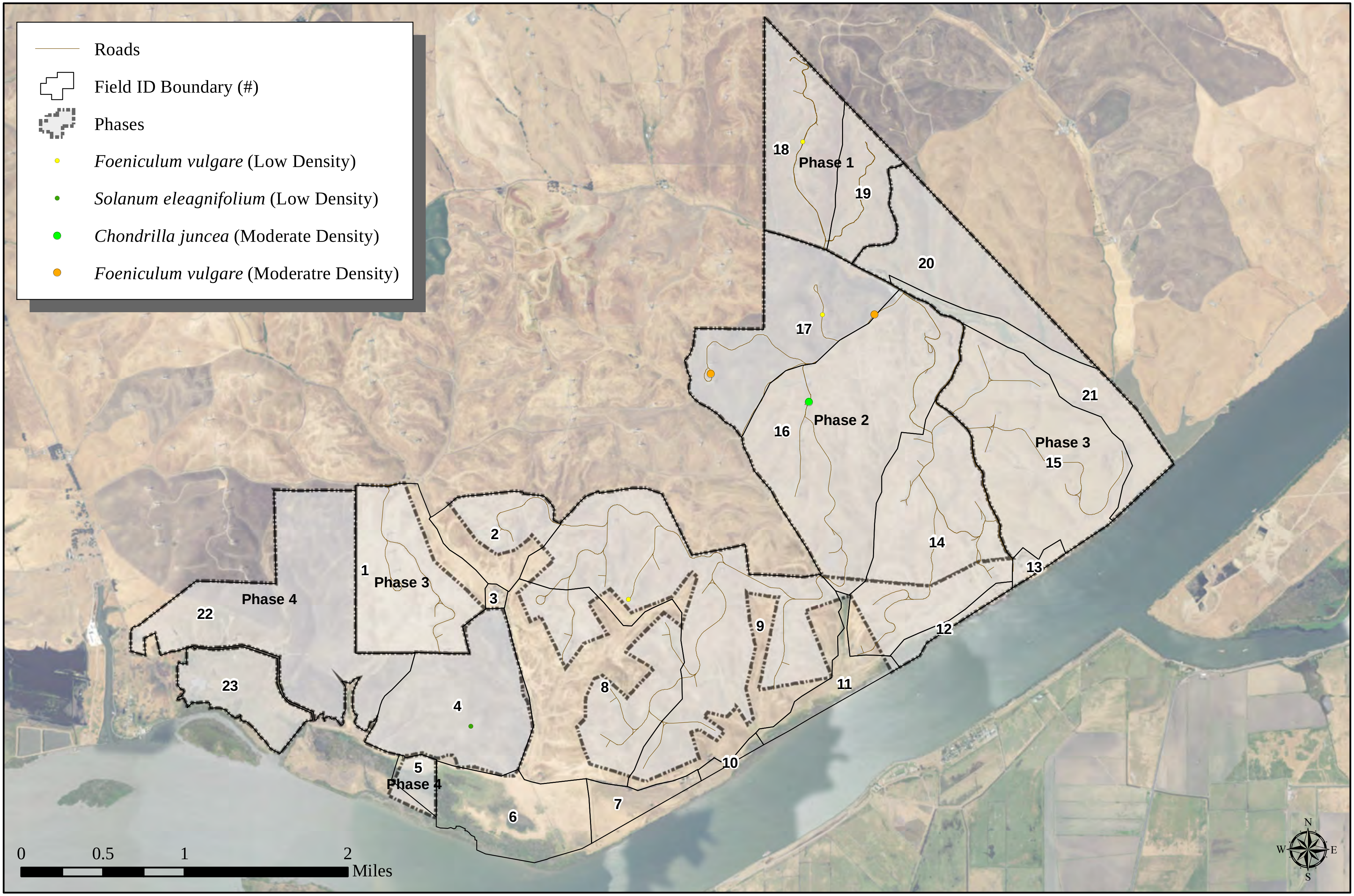

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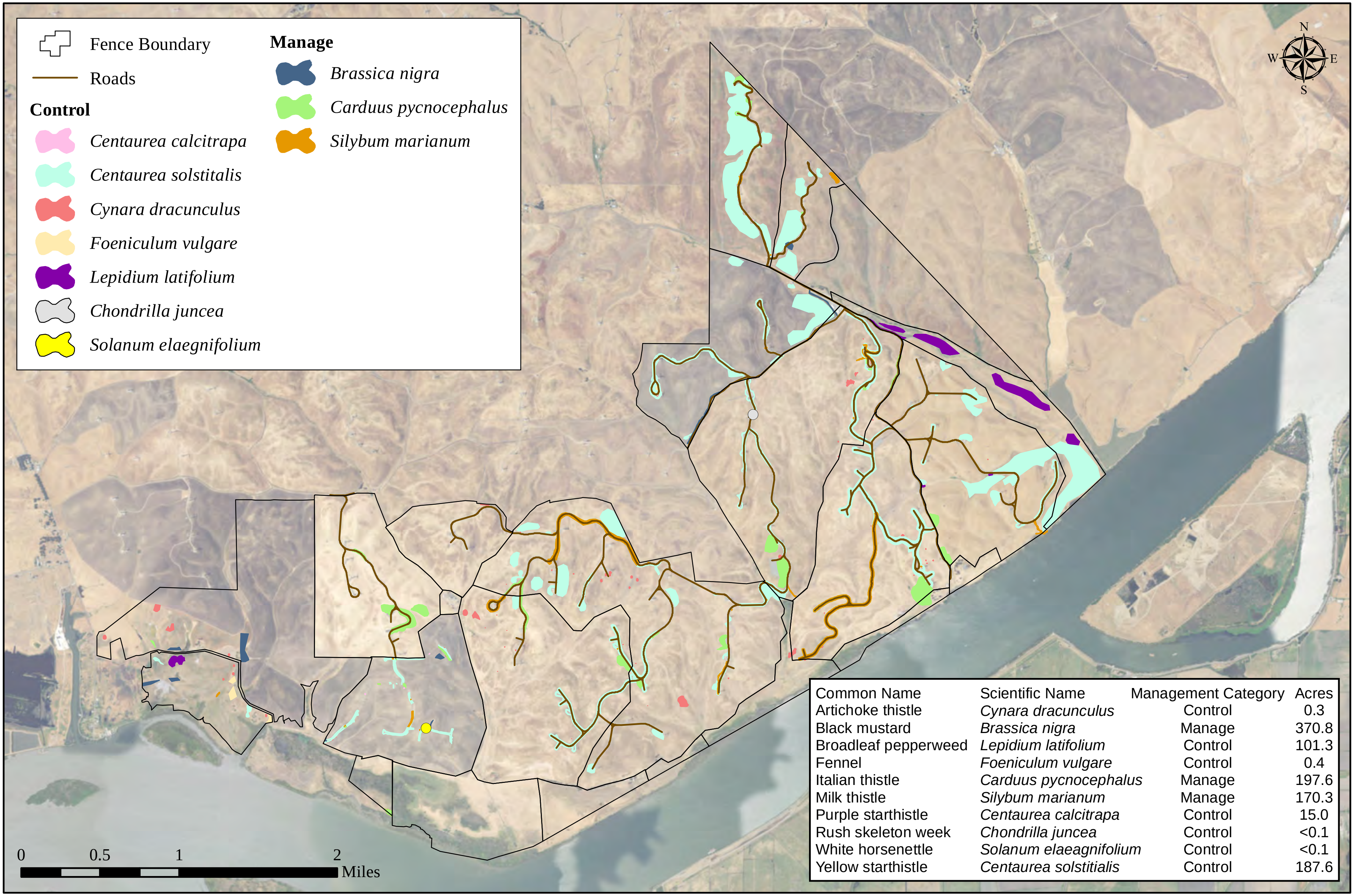
Figure 11. Management Priority



Common Name	Scientific Name	Management Category	Acres
Artichoke thistle	*Cynara dracunculus*	Control	0.3
Black mustard	*Brassica nigra*	Manage	370.8
Broadleaf pepperweed	*Lepidium latifolium*	Control	101.3
Fennel	*Foeniculum vulgare*	Control	0.4
Italian thistle	*Carduus pycnocephalus*	Manage	197.6
Milk thistle	*Silybum marianum*	Manage	170.3
Purple starthistle	*Centaurea calcitrapa*	Control	15.0
Rush skeleton week	*Chondrilla juncea*	Control	<0.1
White horsenettle	*Solanum elaeagnifolium*	Control	<0.1
Yellow starthistle	*Centaurea solstitialis*	Control	187.6

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Figure 12. 2015 Weed Locations & 2017 Weed Locations

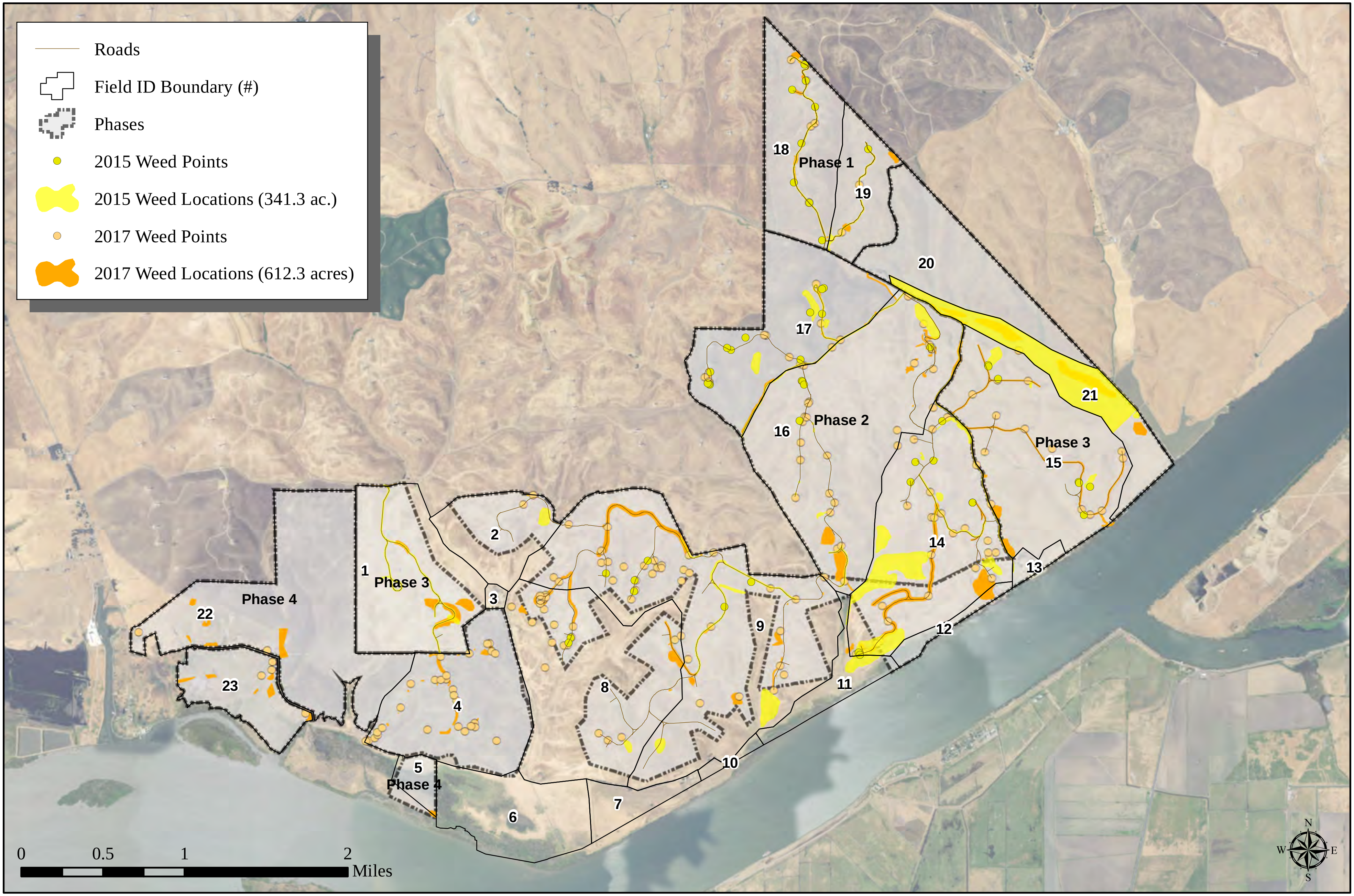

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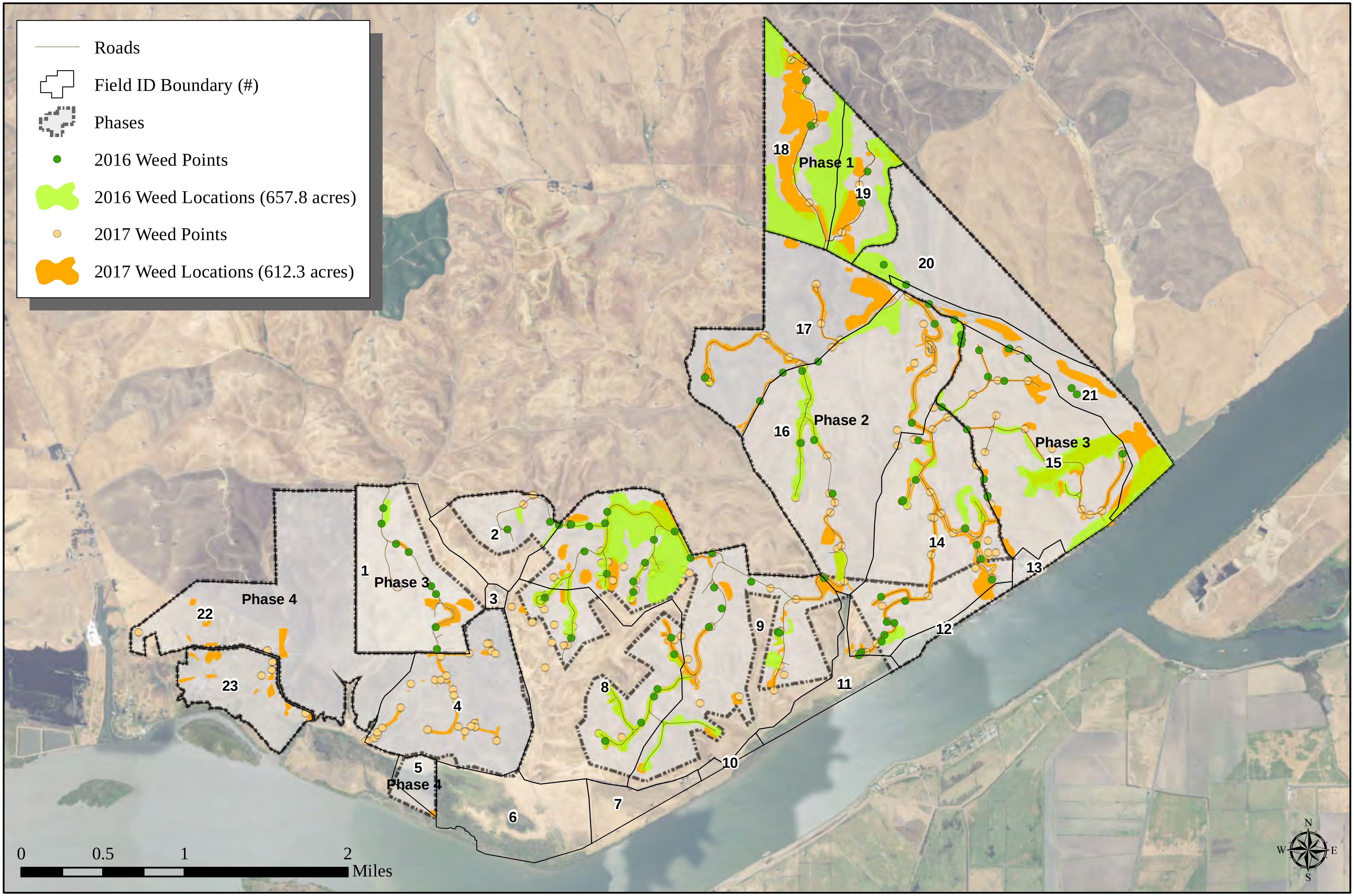
Figure 13. 2016 Weed Locations & 2017 Weed Locations



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8.0 Photographs

Photo 1. Milk thistle growing along roadside in Field 16. Typical growth pattern along roadsides throughout the Project. April 24, 2017.

Photo 2. Italian thistle growing along drainage in Field 4. Invasive species were common along drainages throughout the Project. April 24, 2017.

Photo 3. Artichoke thistle growing along road in Field 3. April 24, 2017.

Photo 4. Invasive weeds growing along fence-line behind Operations and Maintenance building. April 25, 2017.

Photo 5. Italian thistle along roadsides in Phase 4. April 26, 2017.

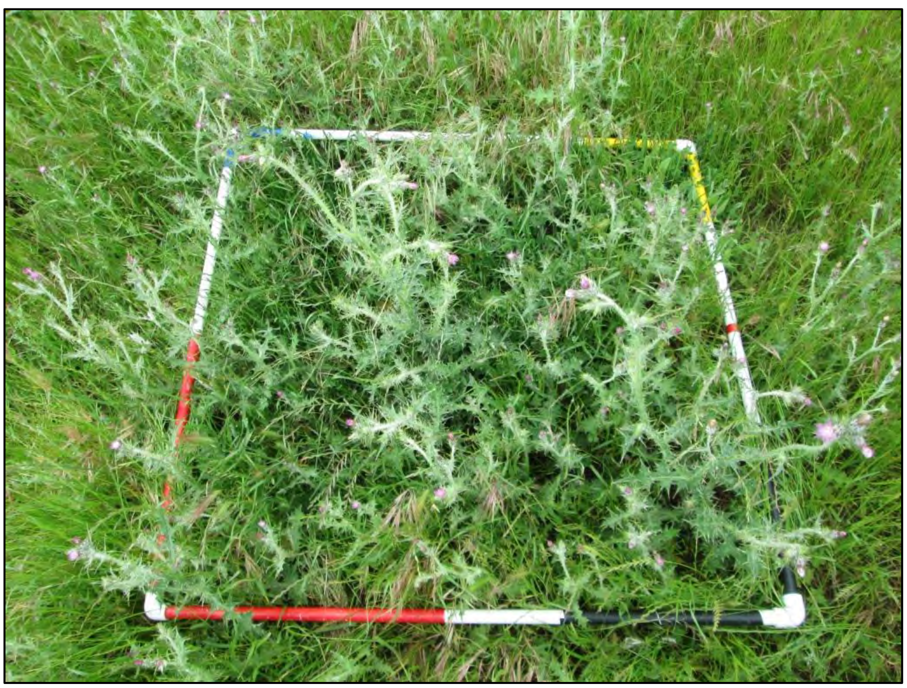

Photo 6. High density plot of mature, flowering Italian thistle in Field 4. April 24, 2017.

Photo 7. Low density broadleaf pepperweed population growing in Field 21. April 25, 2017.

Photo 8. Large populations of artichoke thistle were observed growing on neighboring lands. Seed source for populations on S.M.U.D. property. April 25, 2017.

Photo 9. Artichoke thistle population in Field 9. April 24, 2017.

Photo 10. Fennel growing adjacent to roadside in Field 17. April 25, 2017.

Photo 11. Purple start thistle was in flower throughout the site during August 2017 surveys. August 7, 2017.

Photo 12. Purple star thistle was observed growing along roadsides, Field 18. August 7, 2017.

Photo 13. Rush skeleton weed was observed for the first time during August 2017 surveys in Field 4. August 8, 2017.

Photo 14. Yellow starthistle growing within drainage in Field 15. August 7, 2017.

Photo 15. Yellow starthistle growing on hillslopes (green patches) throughout Field 17. August 7, 2017.

Photo 16. Yellow starthistle growing in high density on adjacent property north of Field 17. August 7, 2017.

Photo 17. Rangeland grazed by goats and sheep with minimal invasive species in Field 2. August 8, 2017.

Attachment 1

April 2015 Site Visit and Weed Inventory Survey Results

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1602 Spring Street, Paso Robles, CA 93446
(805) 237-9626 • Fax (805) 237-9181 • www.althouseandmeade.com

MEMO

To: Eric Poff

From: Katie Tierney

Date: May 5, 2015

Cc: Pat Mock, LynneDee Althouse

Re: April 2015 Site Visit and Weed Inventory Survey Results

Per Proposal No. 1452 a baseline weed inventory was completed for Solano Wind Project on April 6-10, 2015. Individual weed species density and distribution were recorded and mapped. This information will be used to compare weed distribution and abundance over time.

Methods

Target weed species onsite include Italian thistle (*Carduus pycnocephalus*), milk thistle (*Silybum marianum*), black mustard (*Brassica nigra*), broadleaved pepperweed (*Lepidium latifolium*), fennel (*Foeniculum vulgare*), artichoke thistle (*Cynara cardunculus*), and yellow starthistle (*Centaurea solstitialis*) (Table 1). Weed density was measured using the Density Method described in the Interagency Technical Reference (BLM 1999). All access roads were driven and inspected for weeds. Rangelands were evaluated for weeds while driving all roads. Areas containing weed populations were mapped and densities recorded. Species occurring sporadically were mapped based on number of individuals (e.g. artichoke thistle, star thistle Figure 7).

Results

Overall, weed distribution was primarily in areas of disturbance (e.g. along roadsides, areas of active erosion, around recently installed erosion control material. Figure 1). Italian thistle, and black mustard were the most wide spread weeds on the site (Figures 2 and 3). Milk thistle, artichoke thistle, and yellow starthistle were observed intermittently throughout the site at lower densities than Italian thistle, black mustard and broadleaved pepperweed (Figures 4, 5, 6 and 7). Broadleaved pepperweed was limited to Field 21 (Figure 5). Phase 3 had the highest density of weeds along roadsides (Figure 1); this result is expected as Phase 3 was the most recently completed Phase and weed species are typically the first species to colonize bare soil. Phases 1 and 2 have had a longer time period for native and naturalized grasses and forbs to re-establish. We can expect similar results in Phase 3.

TABLE 1. INVASIVE WEED SPECIES ONSITE. Invasive weed species observed onsite with their California Invasive Plant Council (CAL IPC) and California Department of Food and Agriculture (CDFA) rating.

Common Name	Scientific Name	CAL IPC Rating	CDFA Rating
Artichoke thistle	*Cynara cardunculus*	Moderate	List B
Black mustard	*Brassica nigra*	Moderate	n/a
Broadleaved pepperweed	*Lepidium latifolium*	High	List B
Fennel	*Foeniculum vulgare*	High	n/a
Italian thistle	*Carduus pycnocephalus*	Moderate	List C
Milk thistle	*Silybum marianum*	Limited	n/a
Yellow star thistle	*Centaurea solstitialis*	High	List B

TABLE 2. AVERAGE PLOT DENSITY. Plot density of weed species mapped as polygons.

	Density (plants/square meter)		
Species	**High**	**Moderate**	**Low**
Carduus pycnocephalus	67.8	7.6	0.2
Brassica nigra	27.0	8.6	4.7
Foeniculum vulgare	n/a	n/a	0.6
Lepidium latifolium	13.0	n/a	0.01
Silybum marianum	3.2	1.7	0.3

Results for each species are summarized below:

Italian thistle (*Carduus pycnocephalus*)

Italian thistle was observed in Fields 1, 2, 8, 9, 14, 15, 16, 17, 18, and 19. Italian thistle was observed at high densities on approximately 5.5 acres, at moderate densities on 27.1 acres, and at low densities on 64.3 acres (Figure 2, Table 2). This species was the most widespread, with the highest density across the site, occurring along roadsides, disturbed areas, and rangelands.

Black Mustard (*Brassica nigra*)

Black mustard was observed in Fields 11, 12, 14, 15, 16, 18, 19 and 21 growing in large patches across hillsides (Photo 1). Black mustard was observed at high densities on approximately 40.4 acres, at moderate densities on 52.7 acres, and at low densities on 6.3 acres (Figure 3, Table 2). This is a common rangeland weed, rated as Moderate by the California Invasive Plant Council (Cal IPC). Occurrences of black mustard onsite were isolated to patches on hillside, it was rarely observed along roadsides.

Milk thistle (*Silybum marianum*)

Milk thistle was observed in relatively low densities in Fields 9, 11, 14, 15, 16, 17, 18, 19, and 21. Milk thistle was observed in high densities on 0.7 acre, at moderate densities on 1.3 acres, and at low densities on 56.1 acres (Figure 4, Table 2).

Broadleaved Pepperweed (*Lepidium latifolium*)

Broadleaved pepperweed is limited to Field 21 where its distribution expands the majority of the field (Figure 5). Approximately 7.4 acres of Field 21 contain high densities (13 plants/square meter) of broadleaved pepperweed, an additional 139.4 acres of the Field contain low densities (0.01 plants/square meter). Broadleaved pepperweed prefers habitats with high soil moisture therefore it is not widely spread across the site.

Artichoke thistle (*Cynara cardunculus)*

Artichoke thistle was observed sporadically across the site in Fields 8, 9, 14, 15, 16, 17, 18, and 19 (Figure 7). Each point contained less than 30 individuals.

Yellow star thistle (Centaurea solstitialis)

Yellow starthistle was observed sporadically in Fields 17 and 18 (Figure 7). Three different locations were observed, each contained less than 30 individuals. Yellow starthistle blooms later in the season (April through September); therefore, additional surveys later in the season may be necessary to determine full extent of this species.

Fennel (*Foeniculum vulgare*)

Fennel was observed in Fields 16, 17, and 18 with distribution limited to recently disturbed soils. Fennel was observed on approximately 8.3 acres and has the lowest density compared with other species across the site (Figure 6, Table 2).

References

California Invasive Plant Council. 2015. Inventory Database. Accessed May 5, 2015. http://www.cal-ipc.org/paf/

The Jepson Herbarium. 2014. The Jepson Online Interchange for California Floristics. Accessed May 4, 2015. http://ucjeps.berkeley.edu/interchange/

United States Department of Agriculture (USDA) Bureau of Land Management. 1999. Sampling Vegetation Attributes Interagency Technical Reference. National Business Center, Denver Colorado. p94-102.

United States Department of Agriculture (USDA) Natural Resources Conservation Service. 2015. Plants Database. Accessed May 5, 2015. http://plants.usda.gov/java/

Photographs

Photo 1. Black mustard (*Brassica nigra*) patch in Field 14, high density. April 8, 2015.

Photo 2. Typical black mustard (*Brassica* nigra) quadrat in Field 14. April 8, 2015.

Photo 3. Artichoke thistle (*Cynara cardunculus*) growing near road in Field 9. April 7, 2015.

Figure 1. Weed Locations

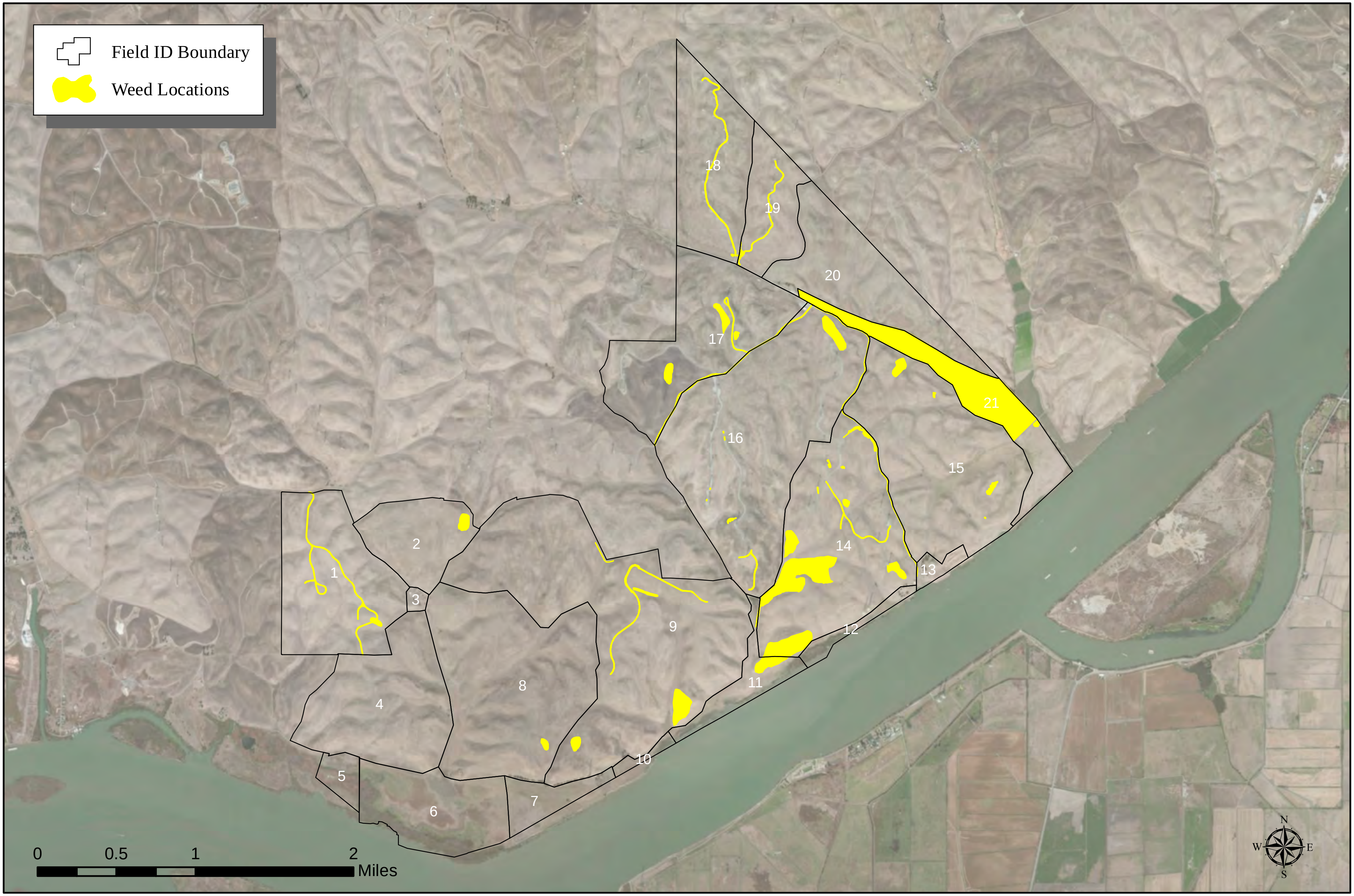

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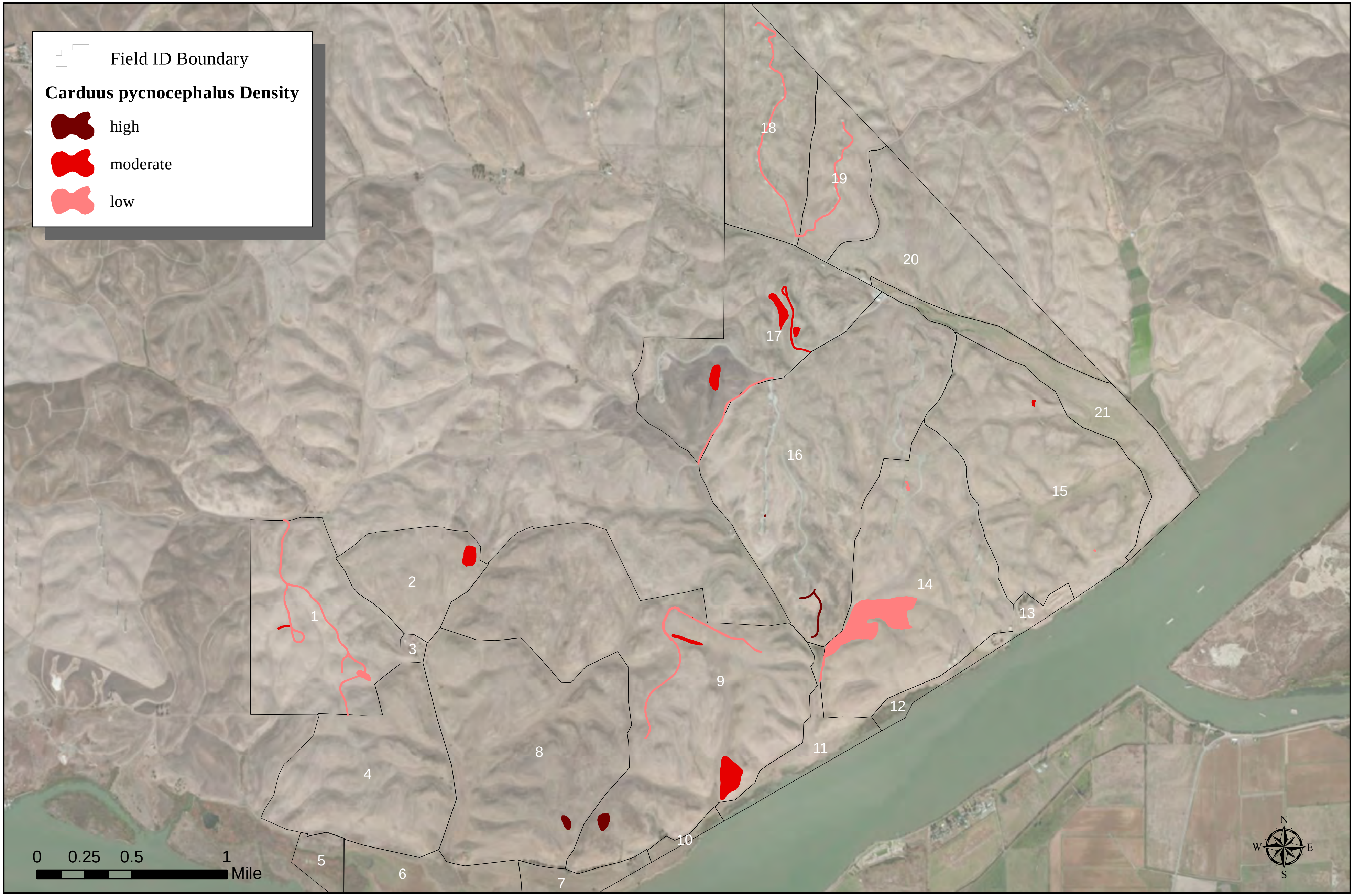
Figure 2. Carduus pycnocephalus Density



SMUD
Solana Wind Project
Phase 2 Land Management Plan

Map Updated: 5/5/2015 at 1:57:06 PM
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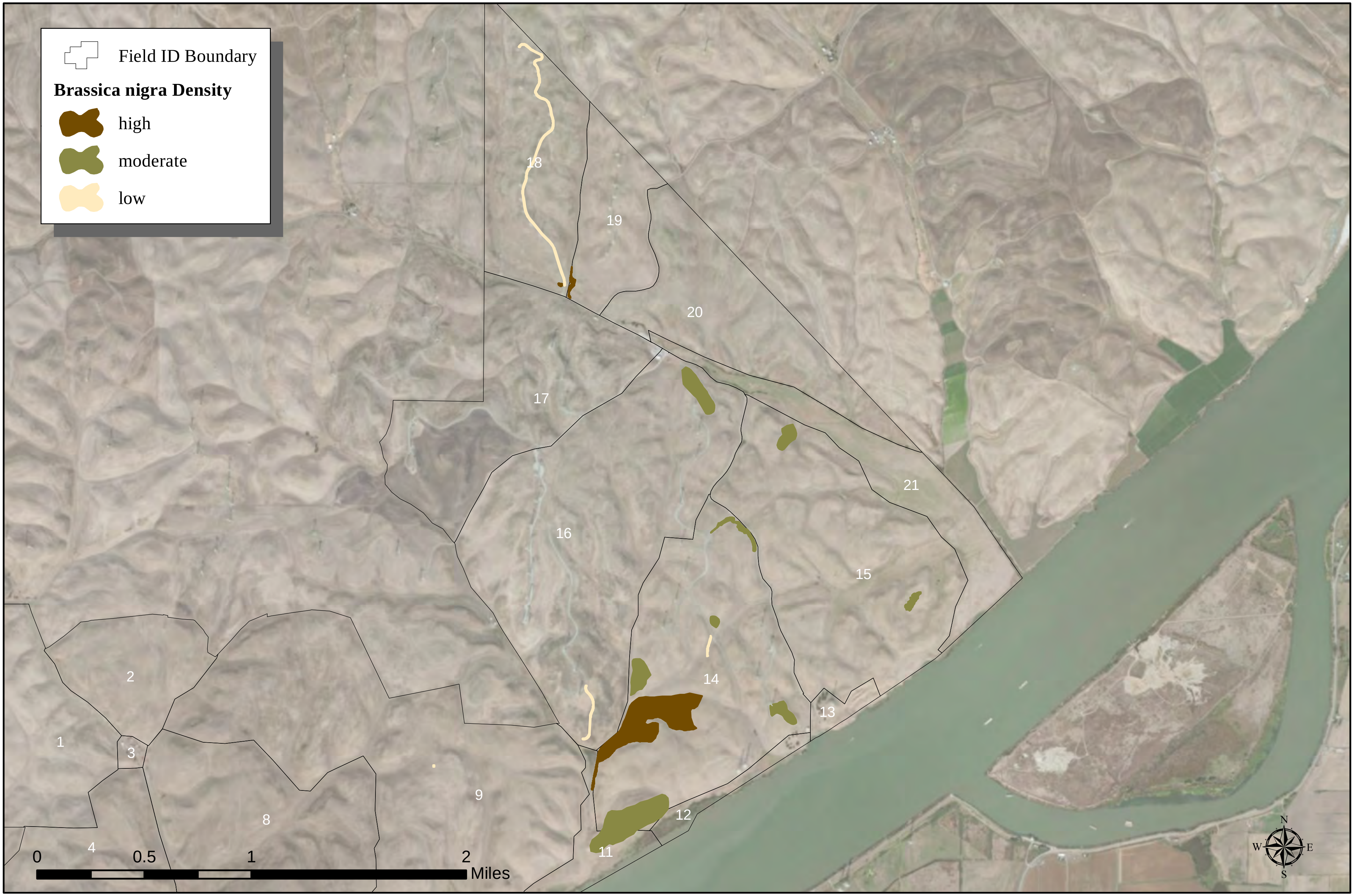
Figure 3. Brassica nigra Density



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Phase 2 Land Management Plan

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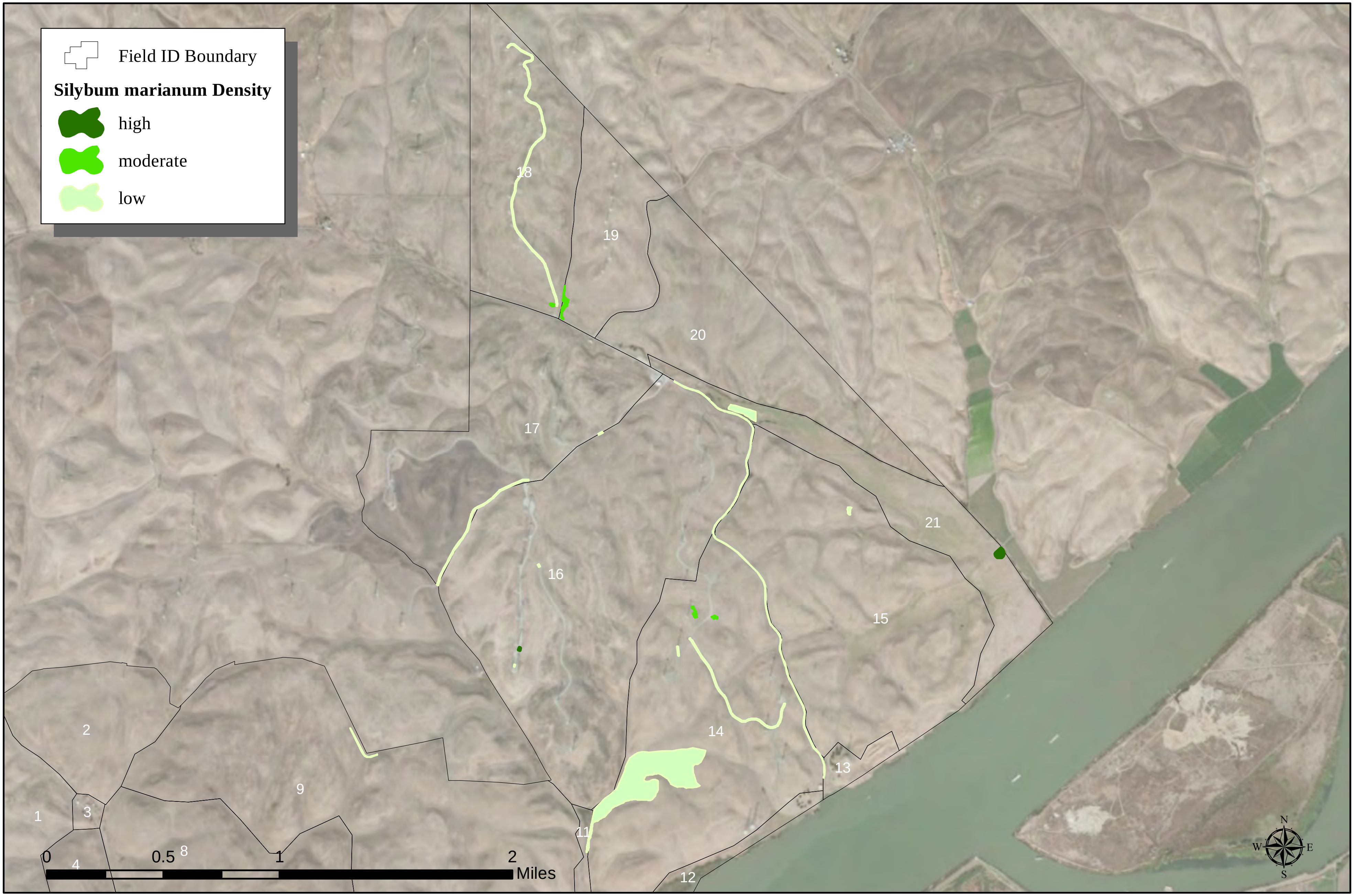
Figure 4. Silybum marianum Density



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Map Updated: 5/5/2015 at 1:56:51 PM
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Figure 5. Lepidium latifolium Density

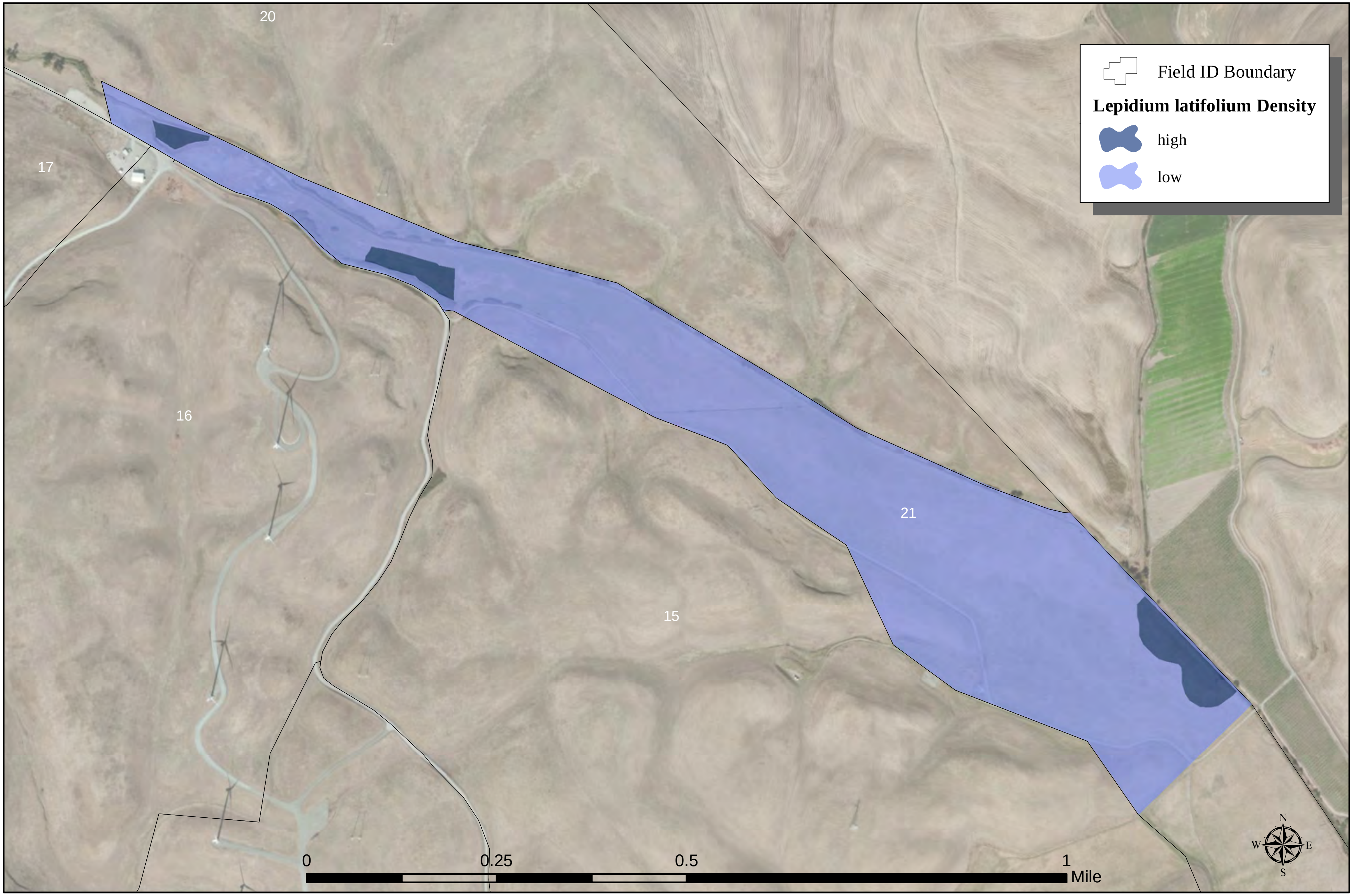

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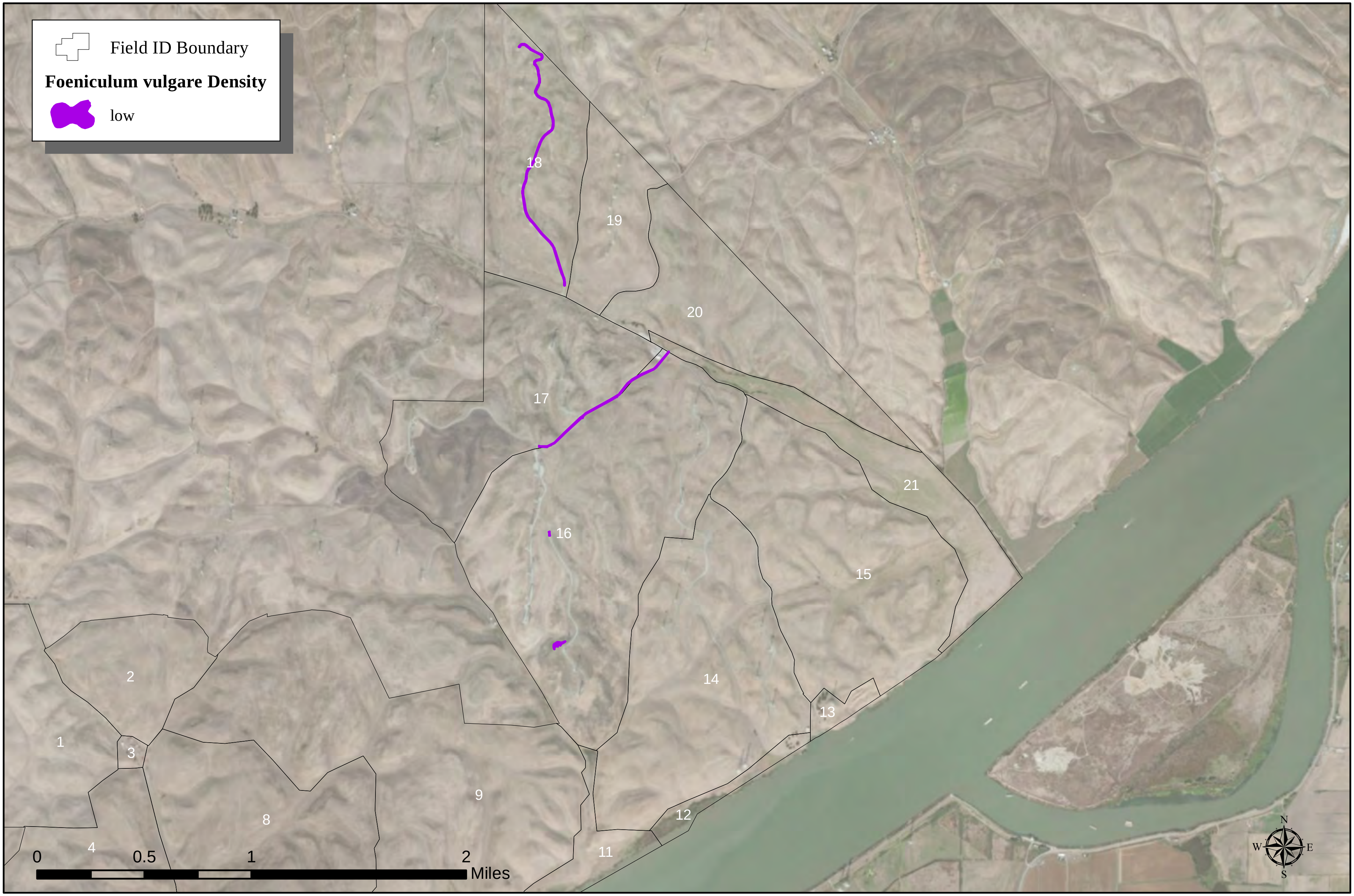
Figure 6. Foeniculum vulgare Density



SMUD
Solana Wind Project
Phase 2 Land Management Plan

Map Updated: 5/5/2015 at 1:58:03 PM
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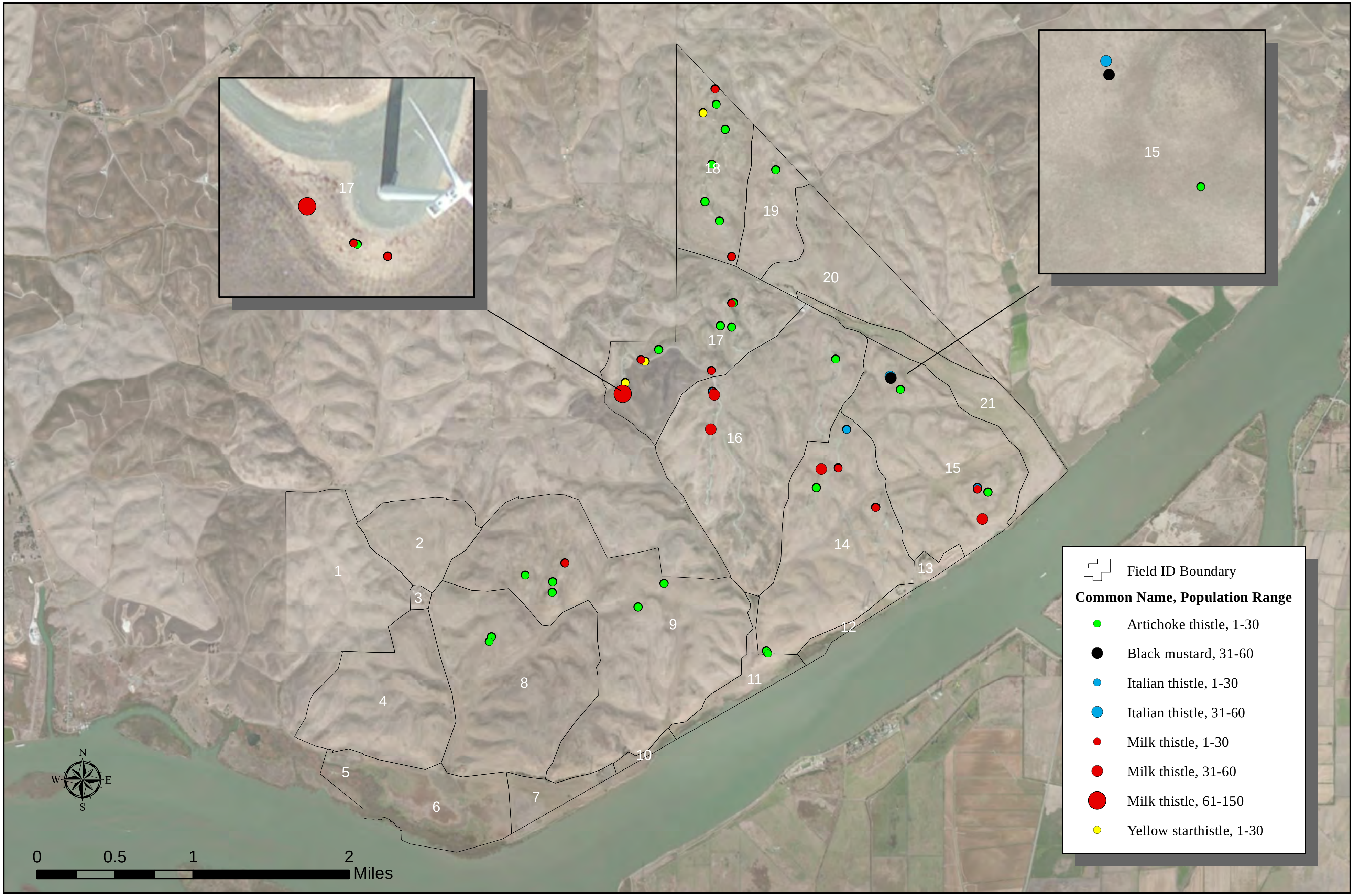
Figure 7. Weed Density Points



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Phase 2 Land Management Plan

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Attachment 2

April 2016 Site Visit and Weed Inventory Survey Results

Invasive Weed Species Monitoring Report

for

Solano Wind Farm

Rio Vista, Solano County

Prepared for

S.M.U.D.
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June 2016

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Cover Page: Field 14 currently being grazed by livestock and dominated with perennial and annual grasses. April 12, 2016.

1.0 Executive Summary

- Overall, weed density and distribution increased between 2015 and 2016.
    - Total area covered by weeds in 2015 was approximately 1043.4 acres.
    - In 2016, weed cover increased in Phases 1 and 2 by107.2% percent to 439.3 acres.
- Phase 3, was recently disturbed by installing erosion control measures, and is occupied by 604.1 acres of weeds.
- Purple starthistle was a new priority weed identified in Phases 2 and 3.
- Density of broadleaf pepperweed in Field 21 (i.e. Lower 7) was lower in 2016 than in 2015.

2.0 Introduction

This is the second Invasive Weed Monitoring Report for the Solano Wind Farm (Project) located in Rio Vista, at the eastern end of Solano County (Figure 1). The Project is located in the Collinsville-Montezuma Wind Resource Area and consists of approximately 5,500 acres with 102 wind turbine generators (WTG). The Solano Wind Farm was developed in three Phases, Phase 1 comprises 498 acres, Phase 2 1633 acres, and Phase 3 2962 acres that cover portions of 21 fenced pastures (Figure 2). Per Services Agreement NO. 4500090462, baseline weed surveys were completed during April 2015 (Althouse and Meade 2015; Attachment 1), and Year 2 monitoring was completed during April 11–14, 2016. This report summarizes 2016 survey results, compares current conditions to 2015 conditions, and provides recommendations for future management.

Land use on the Project site includes WTG operations, with lease agreements for livestock grazing and dryland wheat farming. Areas under lease agreement are available for livestock grazing or dryland farming on a rotating basis (URS 2010). Target weeds identified on the Project include Italian thistle (*Carduus pycnocephalus*), milk thistle (*Silybum marianum*), black mustard (*Brassica nigra*), broadleaved pepperweed (*Lepidium latifolium*), fennel (*Foeniculum vulgare*), artichoke thistle (*Cynara cardunculus*), yellow starthistle (*Centaurea solstitialis*), and purple starthistle (*Centaurea calcitrapa*) (Table 1).

TABLE 1. INVASIVE WEED SPECIES ONSITE.

Common Name	Scientific Name	CAL IPC Rating	CDFA Rating
Artichoke thistle	*Cynara cardunculus*	Moderate	List B
Black mustard	*Brassica nigra*	Moderate	n/a
Broadleaved pepperweed	*Lepidium latifolium*	High	List B
Fennel	*Foeniculum vulgare*	High	n/a
Italian thistle	*Carduus pycnocephalus*	Moderate	List C
Milk thistle	*Silybum marianum*	Limited	n/a
Yellow starthistle	*Centaurea solstitialis*	High	List B
Purple starthistle	*Centaurea calcitrapa*	Moderate	List B

3.0 Methods

Weed populations identified during 2015 surveys were re-assessed and current densities determined. New weed populations identified were mapped, and densities determined. Weed densities were measured using a 1-square-meter quadrat. Individual weed species were identified, and counted by age class (seedling or mature). Population density classes of "High", "Moderate", and "Low" were developed for each target species based on quadrat densities (Table 2). The identified classes were used to map weed populations across the entire Project. All access roads were driven and inspected for weeds. Rangelands were evaluated for weeds while driving all roads. Areas containing weed populations were mapped and density class recorded.

Weed species occurring sporadically were mapped based on number of individuals observed at unique points (e.g. artichoke thistle, *Cynara dracunculus;* fennel *Foeniculum vulgare;* and purple starthistle *Centaure calcitrapa* Figure 8).

TABLE 2. WEED SPECIES DENSITY CLASSES. Densities defined by number of individual plants per 1-square meter.

Common Name	Scientific Name	Low	Moderate	High
Black mustard	*Brassica nigra*	<5	5-9	>10
Broadleaf pepperweed	*Lepidium latifolium*	<15	16-34	>35
Fennel	*Foeniculum vulgare*	1	2	3
Italian thistle	*Carduus pycnocephalus*	<20	21-99	>100
Milk thistle	*Silybum marianum*	<2	2-5	>5
Purple start thistle	*Centaurea calcitrapa*	<2	3-5	>5
Yellow starthistle	*Centaurea solstitialis*	<5	6-24	>25

4.0 Results and Discussion

Weed distribution was typically associated with areas of disturbance: along roadsides, within and adjacent to eroding areas, and around recently installed erosion control measures (Figure 2, Photos 1-7). Phase 3 had the largest area covered in weed species (Table 3), this result is expected because this was the last Phase constructed and additional erosion control measures were installed for long-term management. Consequently, this Phase has disturbed soils creating ideal conditions for weed establishment. Because this disturbance is temporary and disturbed areas will re-vegetate over time, Phase 3 is excluded from the total area covered by weeds, calculated in Table 4.

Total area covered by weeds in 2015 was approximately 409.7 acres. In 2016, approximately 439.3 acres were mapped in Phases 1 and 2, and an additional 604.1 acres were mapped in Phase 3. Percent increase in weed populations including Phase 3 and excluding Phase 3 was 154.7% and 107.2%, respectively. Increase in weed populations may be explained by increases in temperature, and precipitation.

Total area of black mustard, Italian thistle, milk thistle, and yellow starthistle increased on the Property (Table 5). Densities of black mustard and Italian thistle decreased from 2015 to 2016 (Table 5). Purple starthistle was identified in low densities during 2016, and had not been observed on site in 2015 (Figure 8, Photo 8). Density of broadleaf pepperweed mapped during 2015 in Field

21 (i.e. Lower Field 7) was reduced to the point that it did not require mapping. Broadleaf pepperweed was identified in low densities at the south end of Field 21 (i.e. Lower Field 7) continuing into Field 15, this population was not observed during 2015 surveys. A contiguous valley east of Field 21 in Field 15 had high densities of broadleaf pepperweed (Figure 6, Photo 15) that were not observed during 2015 surveys.

TABLE 3. 2016 WEED POPULATION AREAS BY PHASE. Phase 3 (highlighted) because of recently installed erosion control measures increasing area of disturbed soil and weed infestation.

Common Name	Scientific Name	Phase 1 (acres)	Phase 2 (acres)	Phase 3 (acres)	Total (acres)
Artichoke thistle	*Cynara dracunculus*	0	0.3	0	0.3
Black mustard	*Brassica nigra*	176.8	36.0	158.0	370.8
Broadleaf pepperweed	*Lepidium latifolium*	0	0	101.3	101.3
Fennel	*Foeniculum vulgare*	0	0.4	0	0.4
Italian thistle	*Carduus pycnocephalus*	43.8	34.4	119.4	197.6
Milk thistle	*Silybum marianum*	43.8	38.9	87.6	170.3
Purple starthistle	*Centaurea calcitrapa*		1.8	13.2	15.0
Yellow starthistle	*Centaurea solstitialis*	2.0	61.1	124.5	187.6
Grand Total		**266.4**	**172.9**	**604.1**	**1043.4**

TABLE 4. 2015-2016 CHANGE IN WEED POPULATION. Red text indicates an increase in density or area from 2015 to 2016. Phase 3 is excluded from the total weed area acreage because of recently installed erosion control measures.

Year	Total Acreage	Total Acreage (minus 2016 Phase 3)
2015	409.7	409.7
2016	1043.4	440.7
Difference	633.7	31.0
Percent Increase	154.7%	107.2%

TABLE 5. WEED POPULATIONS BY SPECIES AND YEAR. Red text indicates an increase in density or area from 2015 to 2016, (-) indicates a reduction in weed density or acres. This table includes Phase 3 weed populations.

Common Name	Scientific Name	2015 Avg. Plot Density	2016 Avg. Plot Density	Density Change (2015-2016)	2015 Acres	2016 Acres	Acre Change (2015-2016)
Artichoke thistle	*Cynara dracunculus*	n/a	n/a	n/a	0.0	0.3	0.3
Black mustard	*Brassica nigra*	8.1	4.8	-3.3	99.6	370.8	271.2

Common Name	Scientific Name	2015 Avg. Plot Density	2016 Avg. Plot Density	Density Change (2015-2016)	2015 Acres	2016 Acres	Acre Change (2015-2016)
Broadleaf pepperweed	*Lepidium latifolium*	16.7	24.7	8.0	146.9	101.3	-45.5
Fennel	*Foeniculum vulgare*	1.5	2	0.5	8.3	0.4	-7.9
Italian thistle	*Carduus pycnocephalus*	40	30	-10.0	96.9	197.6	100.8
Milk thistle	*Silybum marianum*	3.4	4	0.6	58.1	170.3	112.2
Purple startthistle	*Centaurea calcitrapa*	n/a	4	4.0	0.0	15.0	15.0
Yellow starthistle	*Centaurea solstitialis*	n/a	14	14.0	0.0	187.6	187.6
			Total		**409.7**	**1043.4**	**633.7**

Results for each species are summarized below:

Italian thistle (*Carduus pycnocephalus*)

Italian thistle was identified in Fields 1, 2, 8, 9, 14, 15, 16, 18, and 19 during 2016 surveys (Figure 3). Italian thistle is a winter annual forb that is common throughout California and primarily grows in disturbed areas with bare ground, and along roadsides. It is rated Moderate by Cal IPC. Italian thistle is the most widespread species onsite (Figure 3). Many of the roadsides covered with Italian thistle during 2015 surveys did not have thistle during 2016 surveys (Figure 9). Average density of Italian thistle decreased from 2015 to 2016 by 10 plants/m^2 (Photo 6, and 12). Control measures used between 2015 and 2016 surveys were successful in reducing density of Italian thistle.

Black mustard (*Brassica nigra)*

Patches of black mustard were identified in Fields 9, 14, 15, 16, 18, 19, and 21 during 2016 surveys (Figure 4). Average plot density of black mustard decreased by 3.3 individuals from 2015 through 2016. Approximately 33 acres of large High density populations identified in 2015 were reduced or eliminated during 2016 surveys; currently only 7.1 acres of High density populations exist on the Project. New populations of black mustard were identified in 2016, predominantly in Phase 1. Moderate density (5-9 species/m^2) of black mustard was most prevalent on the Property. Black mustard was most commonly observed in areas of disturbance and as isolated patches on hillslopes.

Black mustard is a common rangeland weed, rated as Moderate by the California Invasive Plant Council (Cal IPC). Black mustard grows and reproduces quickly allowing it to invade new areas. Dense infestations can produce greater than 1000 seeds/m^2, seeds are produced annually and remain viable in the soil for at least three years (Cal IPC 2016). Properties adjacent to S.M.U.D were densely covered in black mustard, particularly land adjacent to Phase 1. Seed spread from adjacent lands and high rainfall may explain the increase in acres of black mustard. It produces allelopathic chemicals that prevent germination of native plants, explaining why it grows in isolated patches with minimal species diversity on the Property.

Milk thistle (*Silybum marianum*)

Milk thistle was identified in Fields 2, 9, 14, 15, 16, 17, 18, 19, 20, and 21 (Figure 5). Milk thistle is a winter annual or biennial that is widely spread throughout California, primarily on overgrazed pastures, along fencelines or roads, and within disturbed areas (Cal IPC 2016). Cal IPC rates it as Limited. This species grows in dense patches, outcompeting other species (Photo 13). Density and distribution of milk thistle increased from 2015 to 2016 (Table 5). Continued drought conditions during 2015 followed by high rainfall during 2016 allowed species to capitalize on water resources and establish in areas with poor range condition (i.e. high bare ground) and ground disturbance (e.g. along roadsides, active eroding areas, newly installed erosion control measures).

Broadleaf pepperweed (*Lepidium latifolium)*

Broadleaf pepperweed was identified in Fields 9, 16, 15 and 21 during 2016 surveys (Figure 6). Broadleaf pepperweed is a very agressive perennial herb rated High by the Cal IPC. Field 21 was dominated by broadleaf pepperweed during 2015 surveys. Surveys in 2016 detected minimal to no broadleaf pepperweed in the 2015 population (Photo 9) mapped in Field 21 (i.e. Lower Field 7). Herbicide application and management of this area appear to be effective. Two populations were identified in Field 15 and the southern portion of Field 21 during 2016 surveys with higher average densities than the 2015 population in Field 21. One moderate density population (16-34 individuals/m^2) is adjacent to Field 21 in a contiguous valley within Field 15 (Photo 15, Figure 6). A second population with low density (<15 individuals/m^2) was observed along the north bank of the Sacramento River in Fields 21 and 15.

Broadleaf pepperweed requires high soil moisture to grow and reproduce. This species reproduces by seed and vegetatively by roots allowing it to quickly spread and establish (Cal IPC 2016). High rainfall during the 2016 rain year may have contributed to the increase in broadleaf pepperweed observed. The moderate density patch observed in Field 15 is within a swale, water flow and movement may have carried seed and root fragments allowing the population to quickly expand. Herbicide control likely prevented new growth and establishment within the existing population identified in 2015. Broadleaf pepperweed distribution decreased from 2015 to 2016 by 45.5 acres.

Yellow starthistle (*Centaurea solstitialis*)

Yellow starthistle was observed in Fields 9, 15, 16, 18, 19, and 21 (Figure 7). Yellow starthistle is a winter annual common throughout California and rated High by Cal IPC. This species propagates rapidly by seed (up to 75,000 seeds per plant), and quickly invades rangelands, roadsides, and disturbed sites (Cal IPC 2016). Density and distribution of yellow starthistle increased from 2015 to 2016 on the Property. Bloom period typically occurs from late April through September. During the rosette phase (typically January through April) plants are not easily identifiable as they began to grow underneath other grasses and forbs. Yellow starthistle may not have been bolting and flowering during April 2015 surveys resulting in lower densities and area mapped. Climatic factors explained for purple starthistle may also explain the increase in density and distribution of yellow starthistle.

Purple starthistle (*Centaurea calcitrapa*)

Purple starthistle was not observed in 2015, and was identified in Fields 9, 14, and 18 (Figure 8; Photo 14). Purple starthistle can grow in many conditions including rangelands, roadsides, and disturbed sites. Species in the *Centaurea* genus may produce allelopathic chemicals preventing establishment of other species (Cal IPC 2016). Purple starthistle typically blooms July through October which may explain why it was not observed during April 2015 surveys. Precipitation started early during the 2016 rain year (July 1 2015-June 30, 2016), temperatures also began to increase early, shifting the blooming period earlier than typically observed.

Fennel (*Foeniculum vulgare*)

Fennel was observed in Fields 8, 16, 19 and 21 during 2016 surveys (Figure 8). Fennel is a perennial herb common throughout California and rated as High by Cal IPC. Fennel is not common on the Project and is limited primarily to roadsides near Operations and Maintenance (O&M, Photo 10), with a few scattered patches on hillslopes in Fields 8, 16, 17, and 19 (Photo 11). Distribution of fennel decreased from 2015 to 2016 by 7.9 acres.

Artichoke thistle (*Cynara cardunculus*)

Artichoke thistle was identified in Fields 8, 9, 14, 16, 17, 18, 20, and 21 (Figure 8). Artichoke thistle is a perennial thistle common throughout California on disturbed sites, rangelands, and riparian areas (Cal IPC 2016). This species is rated Moderate by Cal IPC. Artichoke thistle can reproduce by seed and vegetatively by root fragments (Cal IPC 2016). Distribution of artichoke thistle increased from 2015 to 2016 on the Project. High densities of artichoke thistle were observed on neighboring lands adjacent to the Project. The highest density of artichoke thistle observed onsite was immediately down-wind of a very large population on High Winds Wind Farm (Photo 15, and 16). Eradication of this species onsite is not likely due to the high densities on surrounding farms.

5.0 Adaptive Management and Recommendations

Continue to apply management practices used during 2015 on all existing and new weed populations onsite (Table 7). Weed control and population reduction takes time (up to 5 years for some species) to see significant reductions in population because seeds can remain viable in the soil for several years. Effective weed control typically requires an integrative approach combining different methods of control to produce the greatest control. Herbicides for control of each weed species is provided in Table 8. Timeline for optimal weed control using herbicides, mechanical methods, or grazing is summarized in Table 9.

5.1 Grazing Management Recommendations

Livestock grazing can be used as part of an integrated weed management program (DiTomaso et al. 2013). Managed high intensity, short duration grazing is recommended when targeting grazing to invasive species. Temporary fencing (typically electric) is commonly used to concentrate livestock in areas with high concentrations of weeds. On Project lands, black mustard, broadleaf pepperweed, Italian thistle, and yellow starthistle can be grazed by livestock.

5.1.1 *Black mustard:* graze by cattle, sheep, or goats prior to bloom period (typically February through May). Fields 9, 18, and 19 are ideal locations for grazing management.

5.1.2 *Braodleaf pepperweed:* graze by cattle, sheep, or goats early spring through summer. Recommend concentrating livestock grazing during spring, prior to flowering, by use of electric fencing in moderate density population in Field 15 (Figure 6.). Livestock grazing in low density populations in Field 15 and 21 may reduce spread of population.

5.1.3 *Italian thistle:* graze with sheep or goats during the rosette stage in late winter. Cattle will graze Italian thistle during bolting stage typically January through June. Goats will graze Italian thistle during all life stages, including flowering after it has developed spikes. Large populations in Fields 8, 9, 16, and 19 are recommended grazing management control.

5.1.4 *Yellow star thistle:* sheep, goats, and cattle graze yellow starthistle before spines form on the plants (typically December through May). Goats will continue to eat yellow starthistle after spines have developed. Managed grazing in Fields 9, 16, 15, 18, and 21 is recommended to help control spread of yellow starthistle.

5.2 Weed Survey Recommendations

Continue monitoring weed population area and density annually to determine if populations are increasing, maintaining, or declining. Late season surveys for yellow startthistle, and purple starthistle are recommended to more accurately map and calculate density of these species. Surveys completed during July or August while plants are in bloom will give a better representation of their distribution on the Project lands.

5.3 Priority Weeds for Management

Weed species onsite were separated into two management categories: “Control” and “Manage” (Table 6, Figure 10). Priority species for management, population control and reduction are listed as “Control”. Species included in this category are artichoke thistle, broadleaf pepperweed, fennel, yellow starthistle, and purple starthistle. Each of these species have the potential to significantly alter rangeland condition.

Weed species commonly observed on California ranglands are rated as “Manage”. Eradication or significant reduction in populations of these species is not practicable because of their prevalence on California rangelands. Species included in this category have low impacts on rangelands and include black mustard, Italian thistle, and milk thistle.

TABLE 6. WEED MANAGEMENT CATEGORIES.

Common Name	Scientific Name	Magement Category	Acres
Artichoke thistle	*Cynara dracunculus*	Control	0.3
Black mustard	*Brassica nigra*	Manage	370.8
Broadleaf pepperweed	*Lepidium latifolium*	Control	101.3
Fennel	*Foeniculum vulgare*	Control	0.4
Italian thistle	*Carduus pycnocephalus*	Manage	197.6

Common Name	Scientific Name	Magement Category	Acres
Milk thistle	*Silybum marianum*	Manage	170.3
Purple starthistle	*Centaurea calcitrapa*	Control	15.0
Yellow starthistle	*Centaurea solstitialis*	Control	187.6

TABLE 7. RECOMMENDATION SUMMARY.

Control Priority	Common Name	Scientific Name	Bloom Period	Control Options	Control Timing	Site Specific Recommendations	References
1	Artichoke thistle	*Cynara cardunculus*	April - July	Mow or cultivate, cut flower stems, herbicide application	Seedling stage, before maturity then treat regrowth with herbicide	Spot spray individual plants during spring.	DiTomaso and Healy 2007; DiTomaso et al. 2013
2	Broadleaf pepperweed	*Lepidium latifolium*	May-July	Cultivate, livestock grazing, herbicide application	Early spring throughout summer	Graze in spring, then apply herbicide. Seed native/naturalized grass if necessary.	DiTomaso and Healy 2007; DiTomaso et al. 2013
3	Purple starthistle	*Centaurea calcitrapa*	July-October	Hand removal or herbicide application	Prior to flowering, late winter or spring	Hand remove patches, bag and dispose of plants. Apply herbicide during winter or spring.	Cal IPC 2016, DiTomaso et al. 2013
4	Yellow starthistle	*Centaurea solstitialis*	April-September	Mow or cultivate, graze, herbicide application	Prior to flowering	Graze infested areas during rosette and bolting phase (typically April through June), apply herbicide during winter or spring (depending on herbicide used).	DiTomaso and Healy 2007; DiTomaso et al. 2013
5	Fennel	*Foeniculum vulgare*	May-September	Mow or cultivate, herbicide application	Prior to flowering	Mow in spring, spot spray in summer.	DiTomaso and Healy 2007; DiTomaso et al. 2013

Control Priority	Common Name	Scientific Name	Bloom Period	Control Options	Control Timing	Site Specific Recommendations	References
6	Milk thistle	*Silybum marianum*	April-July	Mow or herbicide application	Prior to flowering	Apply herbicide during spring.	DiTomaso and Healy 2007; DiTomaso et al. 2013
7	Italian thistle	*Carduus pycnocephalus*	February-July	Mow or herbicide application, livestock grazing	Mow or herbicide prior to seed-set, graze during flowering	Apply herbicide during spring.	DiTomaso and Healy 2007; DiTomaso et al. 2013
8	Black mustard	*Brassica nigra*	April - July	Mow or cultivate, livestock grazing, herbicide application	Prior to flowering	Use livestock for population control, apply herbicides if necessary.	DiTomaso and Healy 2007; DiTomaso et al. 2013

TABLE 8. EFFECTIVE HERBICIDES FOR TARGET SPECIES.

Common Name	Scientific Name	Perspective	Milestone	Transline	Curtail	2,4-D	Banvel/ Clarity	Campaign	Telar	Matrix	Garlon	Roundup	Crossbow	Canter R+P	Escort	Habitat	Vista	Oust	Velpar
Artichoke thistle	*Cynara cardunculus*	X	X	X	X						X		X		X				
Black mustard	*Brassica nigra*	X				X	X		X	X	X	X		X				X	
Perennial pepperweed	*Lepidium latifolium*	X				X			X			X				X			
Fennel	*Foeniculum vulgare*					X					X	X							
Italian thistle	*Carduus pycnocephalus*	X	X	X	X	X	X		X		X	X	X			X	X	X	X
Milk thistle	*Silybum marianum*	X	X	X	X	X	X	X	X	X									
Purple starthistle	*Centaurea calcitrapa*	X	X	X	X	X	X					X						X	X
Yellow star thistle	*Centaurea solstitialis*	X	X	X	X	X	X		X			X							

TABLE 9. TIMELINE FOR TARGET SPECIES CONTROL.

Common Name	Scientific Name	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Artichoke thistle	*Cynara cardunculus*		Herbicide	Herbicide	Herbicide	Herbicide							
Black mustard	*Brassica nigra*		Herbicide Mechanical Grazing	Herbicide Mechanical Grazing	Herbicide Mechanical Grazing	Herbicide Mechanical Grazing							
Perennial pepperweed	*Lepidium latifolium*		Mechanical Grazing	Herbicide Mechanical Grazing	Herbicide Mechanical Grazing	Herbicide Mechanical							
Fennel	*Foeniculum vulgare*		Mechanical	Mechanical	Herbicide Mechanical	Herbicide	Herbicide	Herbicide	Herbicide				
Italian thistle	*Carduus pycnocephalus*		Herbicide Grazing	Herbicide Grazing	Herbicide Mechanical Grazing	Herbicide Mechanical Grazing	Grazing	Grazing					
Milk thistle	*Silybum marianum*				Herbicide Mechanical	Herbicide Mechanical	Herbicide						
Purple starthistle	*Centaurea calcitrapa*	Grazing	Herbicide Grazing	Herbicide Grazing	Herbicide Grazing	Herbicide Grazing	Mechanical Grazing	Mechanical	Mechanical	Mechanical	Mechanical		
Yellow starthistle	*Centaurea solstitialis*			Herbicide Mechanical Grazing	Herbicide Mechanical Grazing	Herbicide Mechanical Grazing	Herbicide Mechanical Grazing	Herbicide					

Herbicide Control
Mechanical Control
Grazing

6.0 References

Althouse and Meade, Inc. 2015. April 2015 Site Visit and Weed Inventory Survey Reults. May 2015.

California Invasive Plant Council. 2016. Inventory Database. Accessed May 30, 2016. http://www.cal-ipc.org/paf/

DiTomaso, J.M, G.B. Kyser et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California. 544 pp.

DiTomaso, Joseph and Evelyn Healy. 2007. Weeds of California and Other Western States. Publication 3488. University of California Agriculture and Natural Resources

The Jepson Herbarium. 2014. The Jepson Online Interchange for California Floristics. Accessed May 4, 2015. http://ucjeps.berkeley.edu/interchange/

United States Department of Agriculture (USDA) Natural Resources Conservation Service. 2015. Plants Database. Accessed May 5, 2015. http://plants.usda.gov/java/

URS Corporation. 2010. Land Management Plan for the SMUD Solano Property. July 2010.

7.0 Figures

Figure 1. General Location Map

0 2.5 5 10 Miles

SMUD
Solano Wind Project
Phase 2 Land Management Plan

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Map Updated: June 02, 2016, 11:18 AM

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Figure 2. Weed Locations

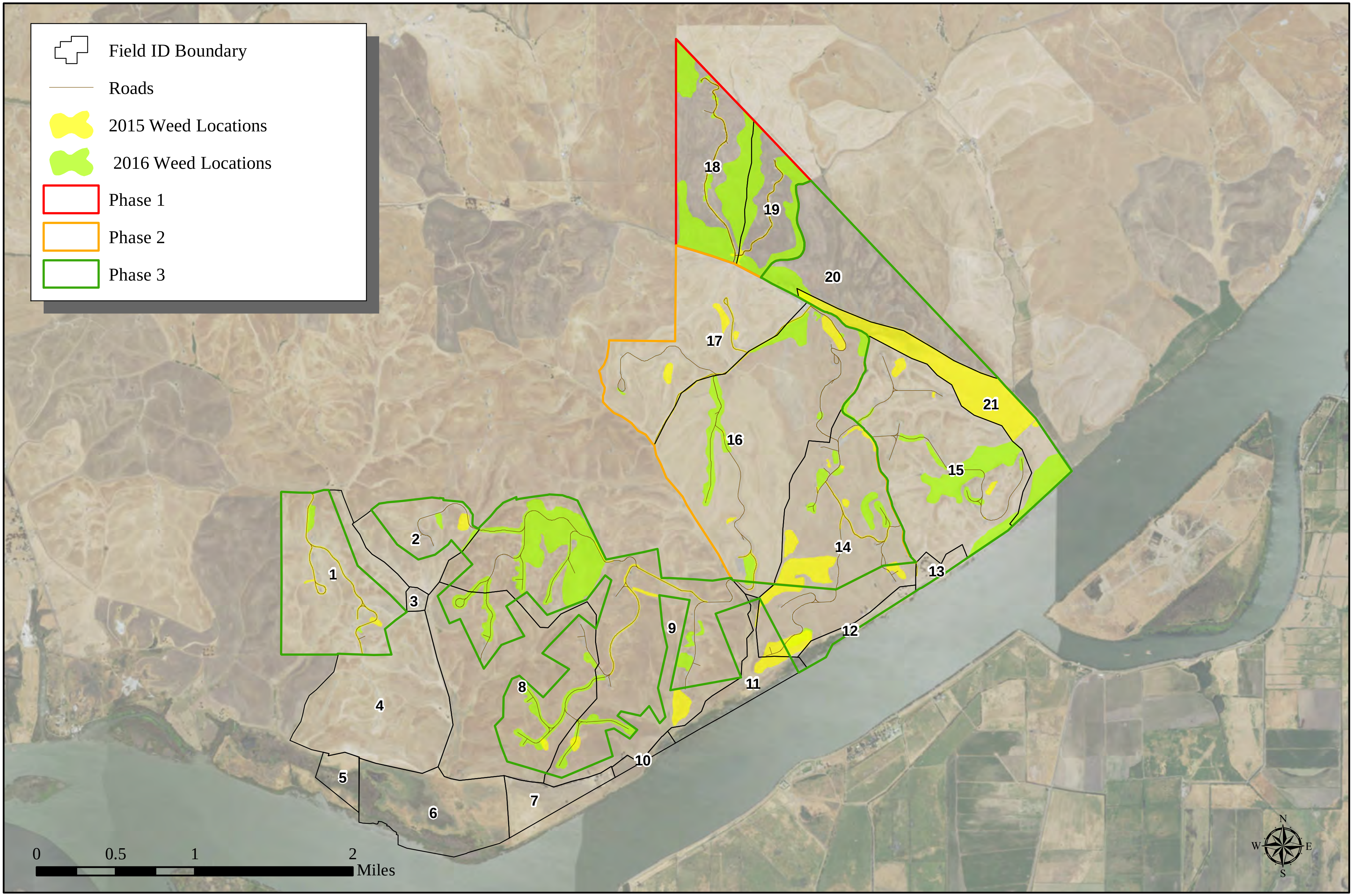

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Figure 3. *Carduus pycnocephalus* Density

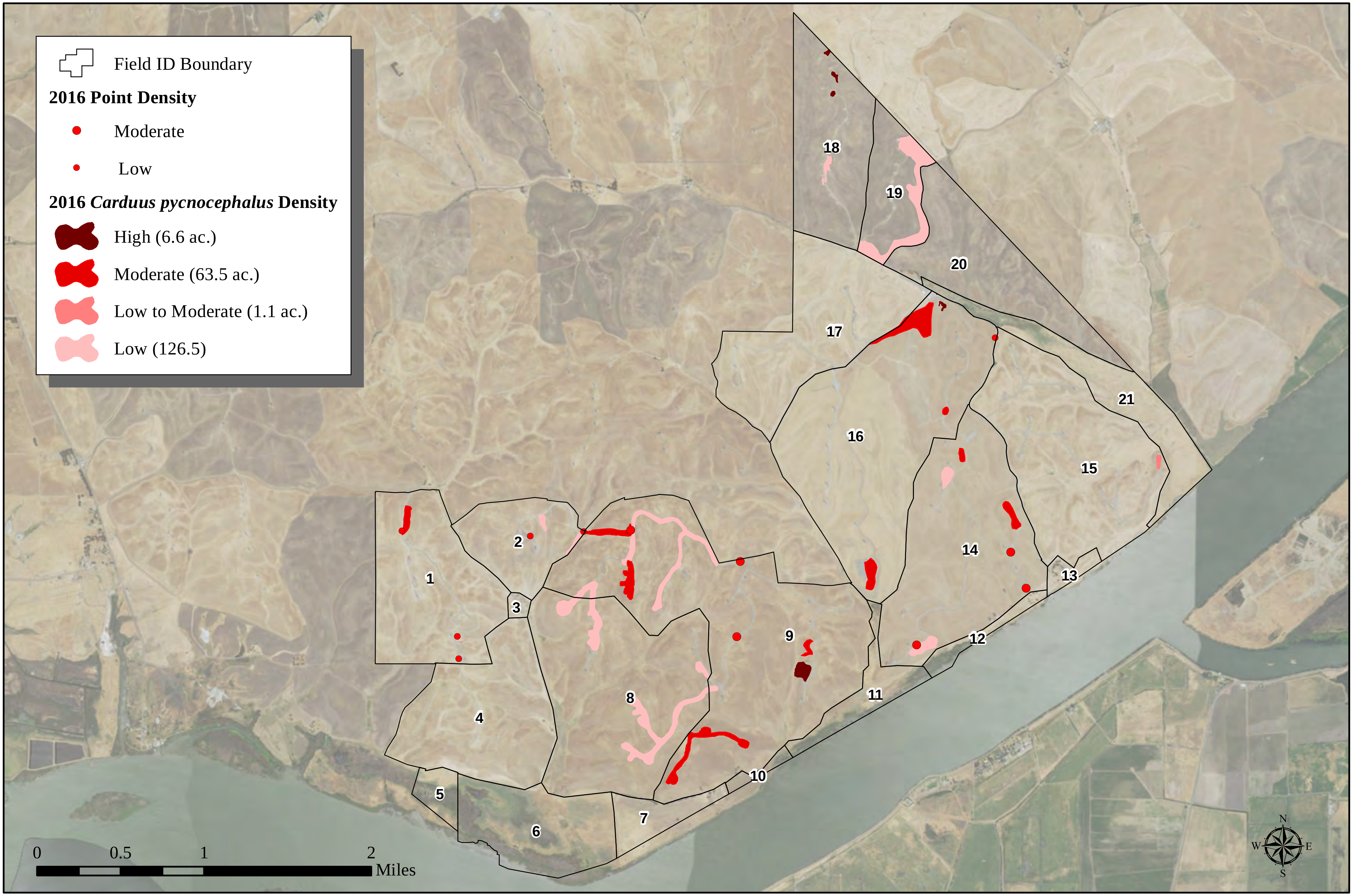

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Figure 4. *Brassica nigra* Density

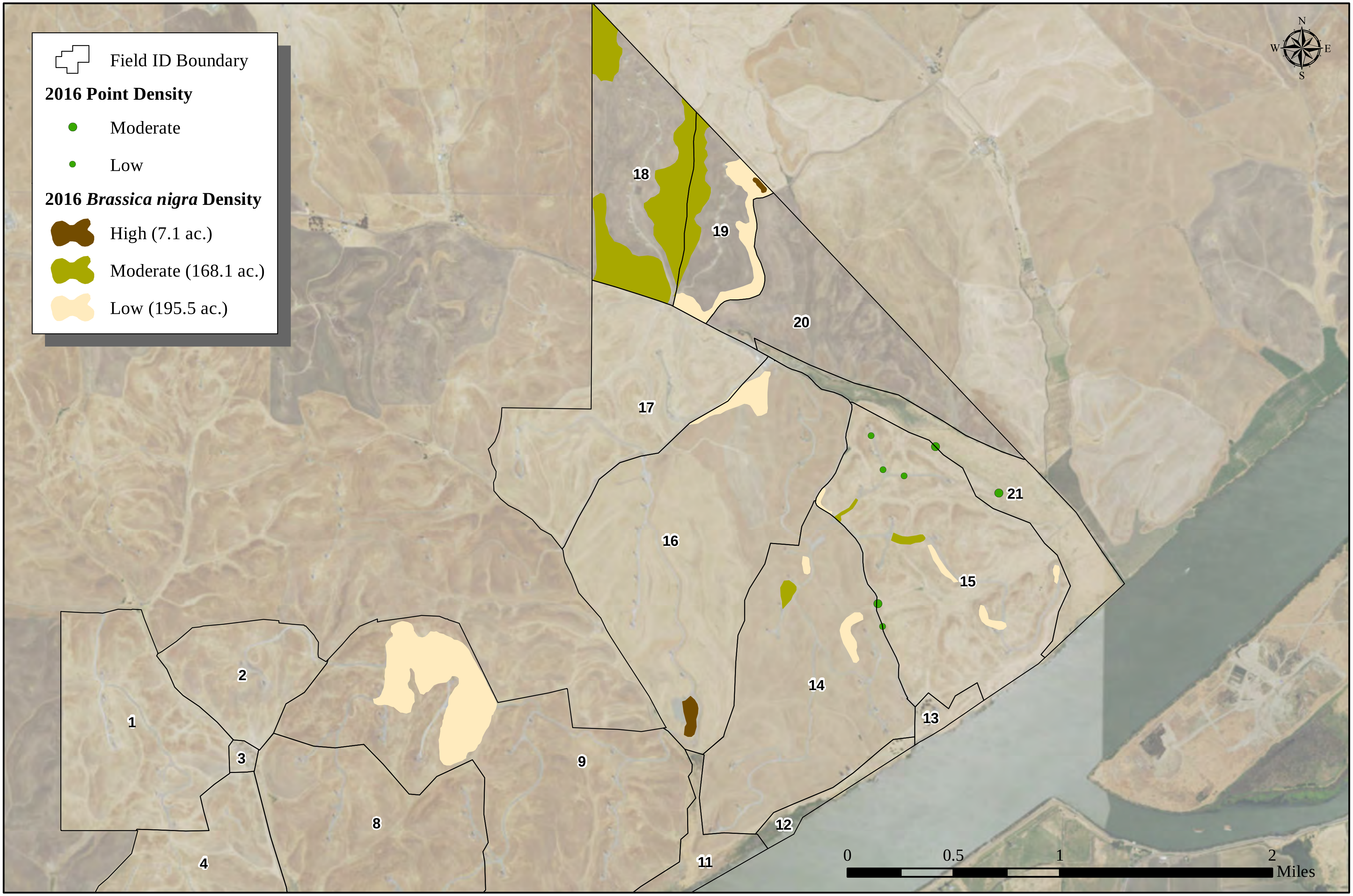

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Figure 5. *Silybum marianum* Density

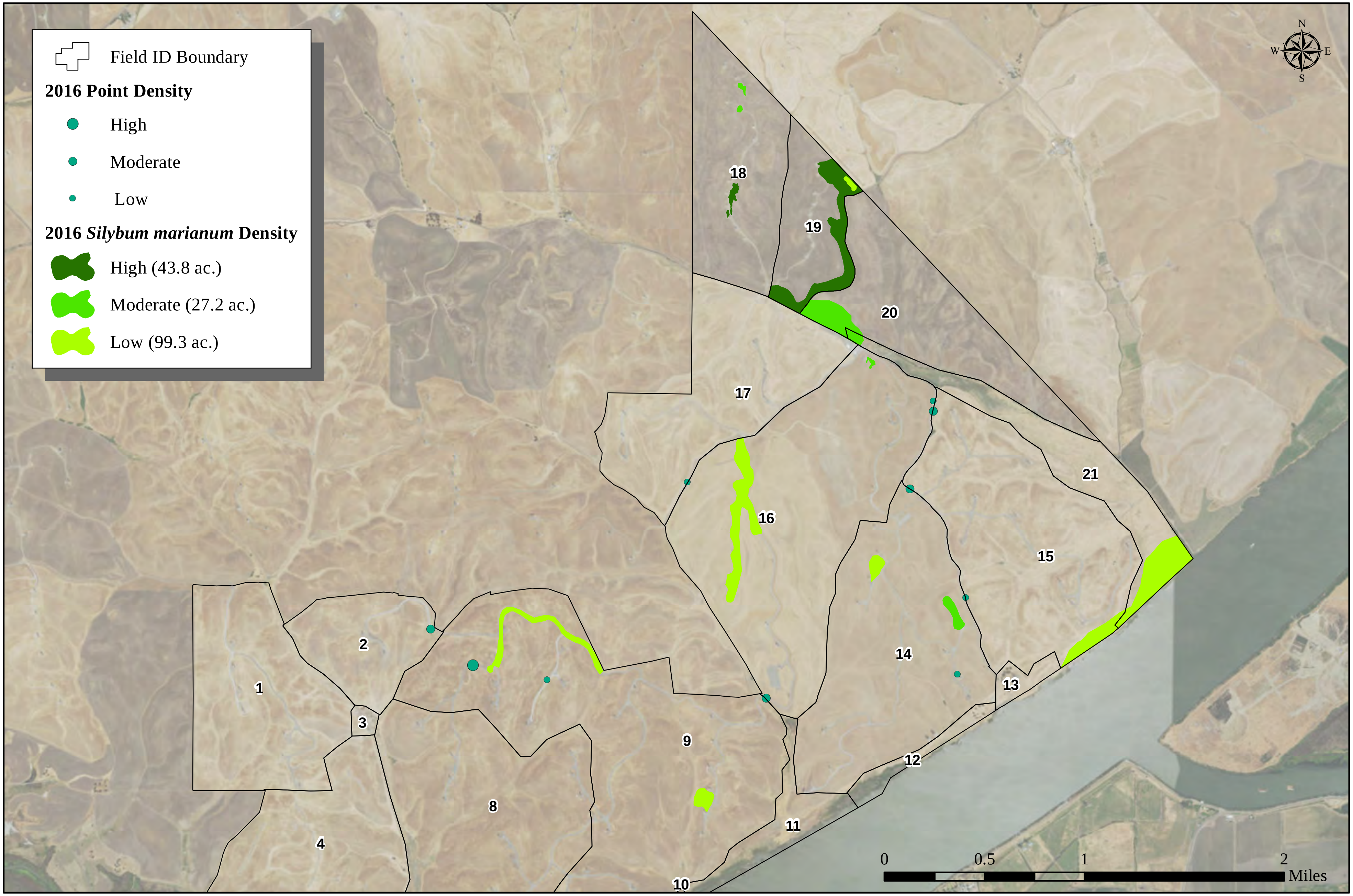

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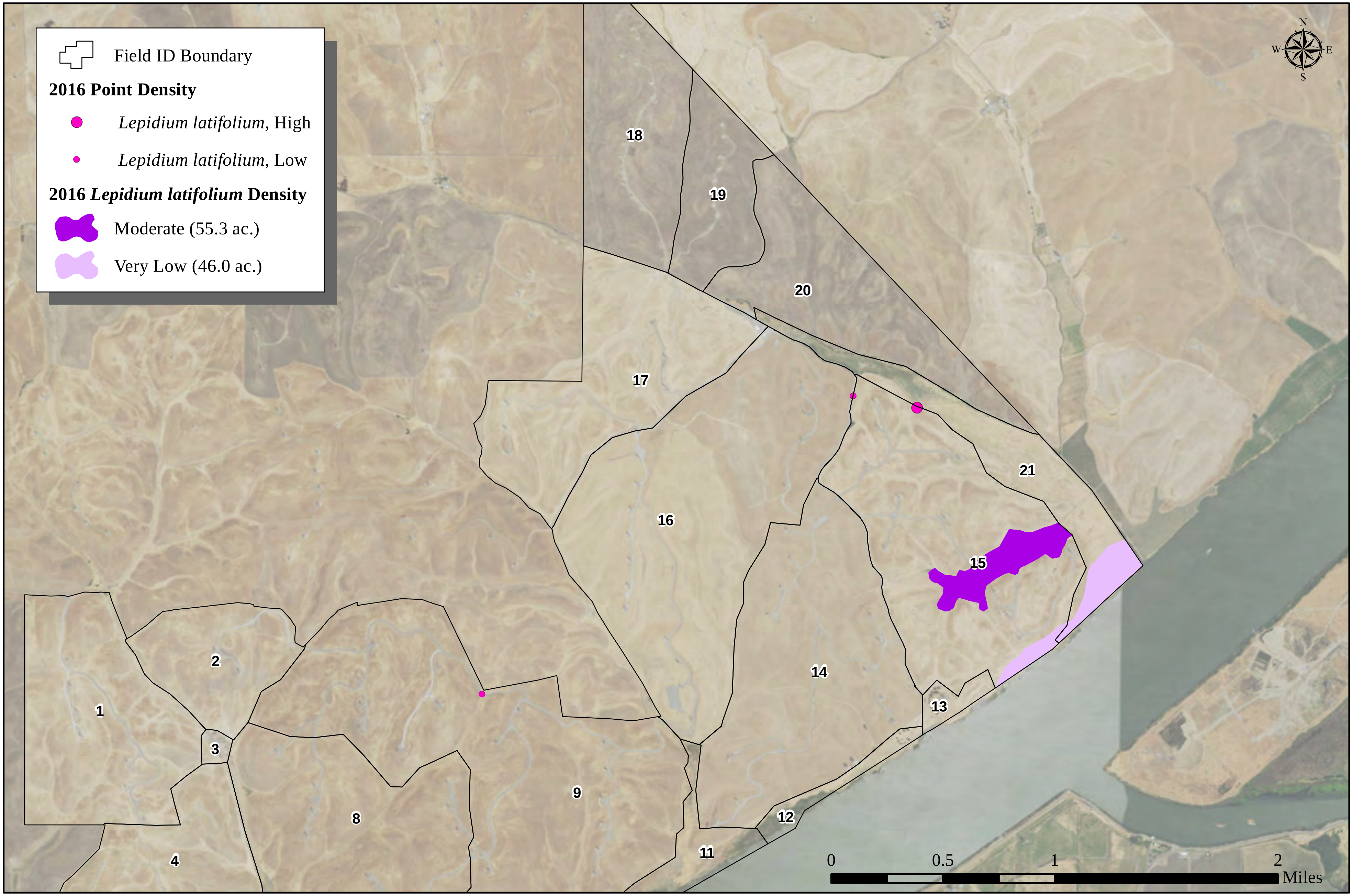
Figure 6. *Lepidium latifolium* Density



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Phase 2 Land Management Plan

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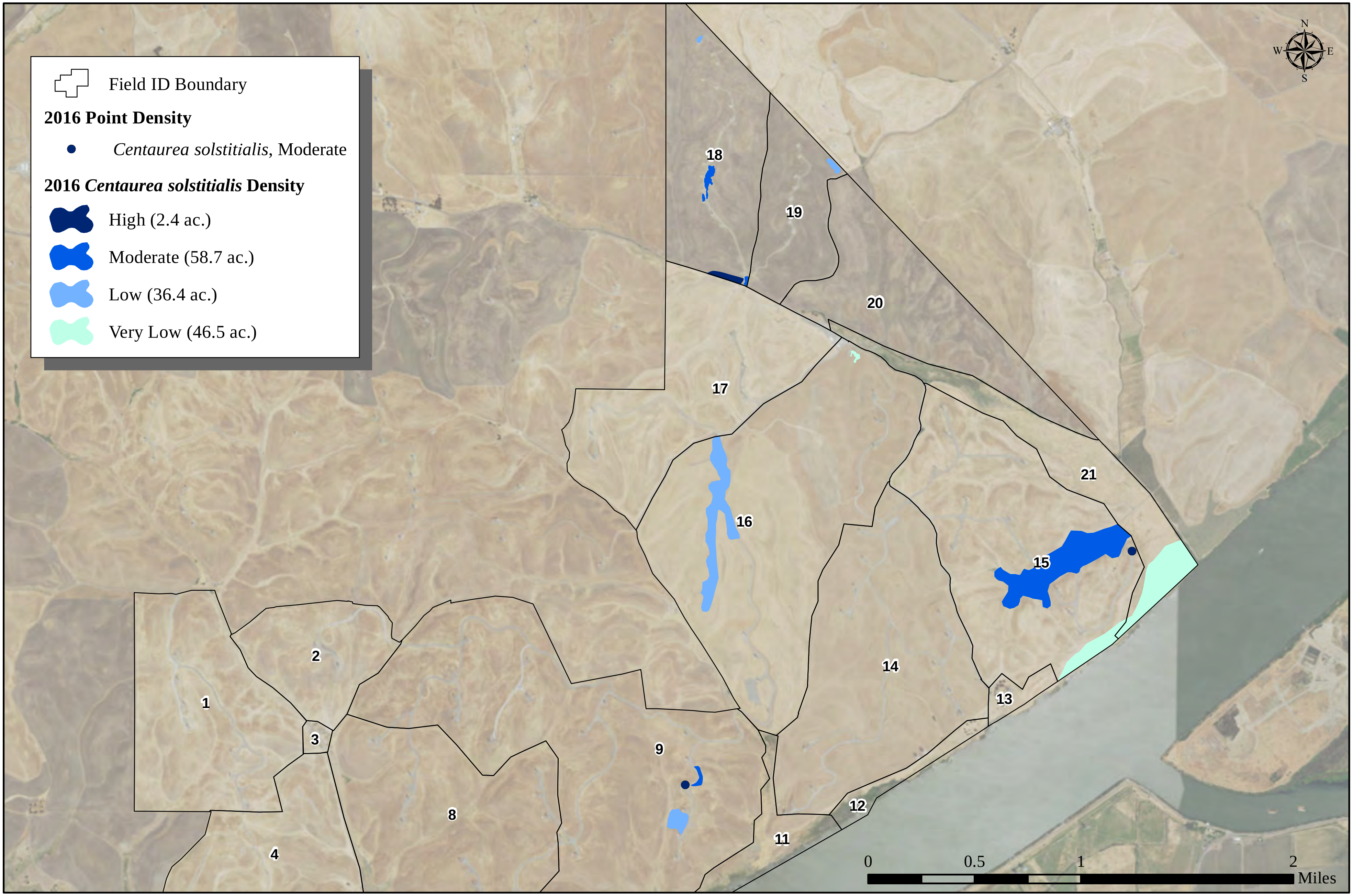
Figure 7. *Centaurea solstitialis* Density



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ALTHOUSE AND MEADE, INC.
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Figure 8. *Centaurea calcitrapa* Density

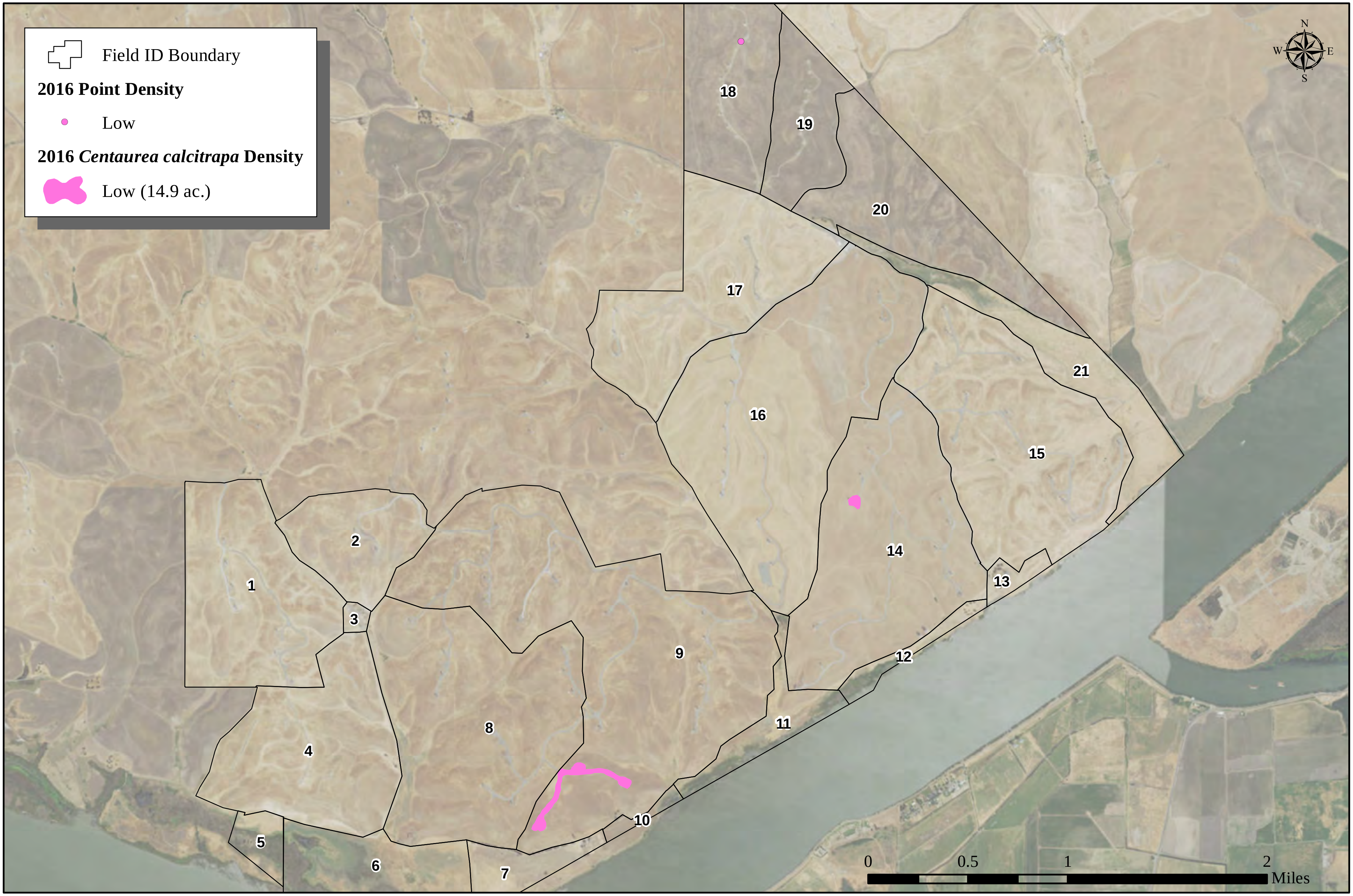

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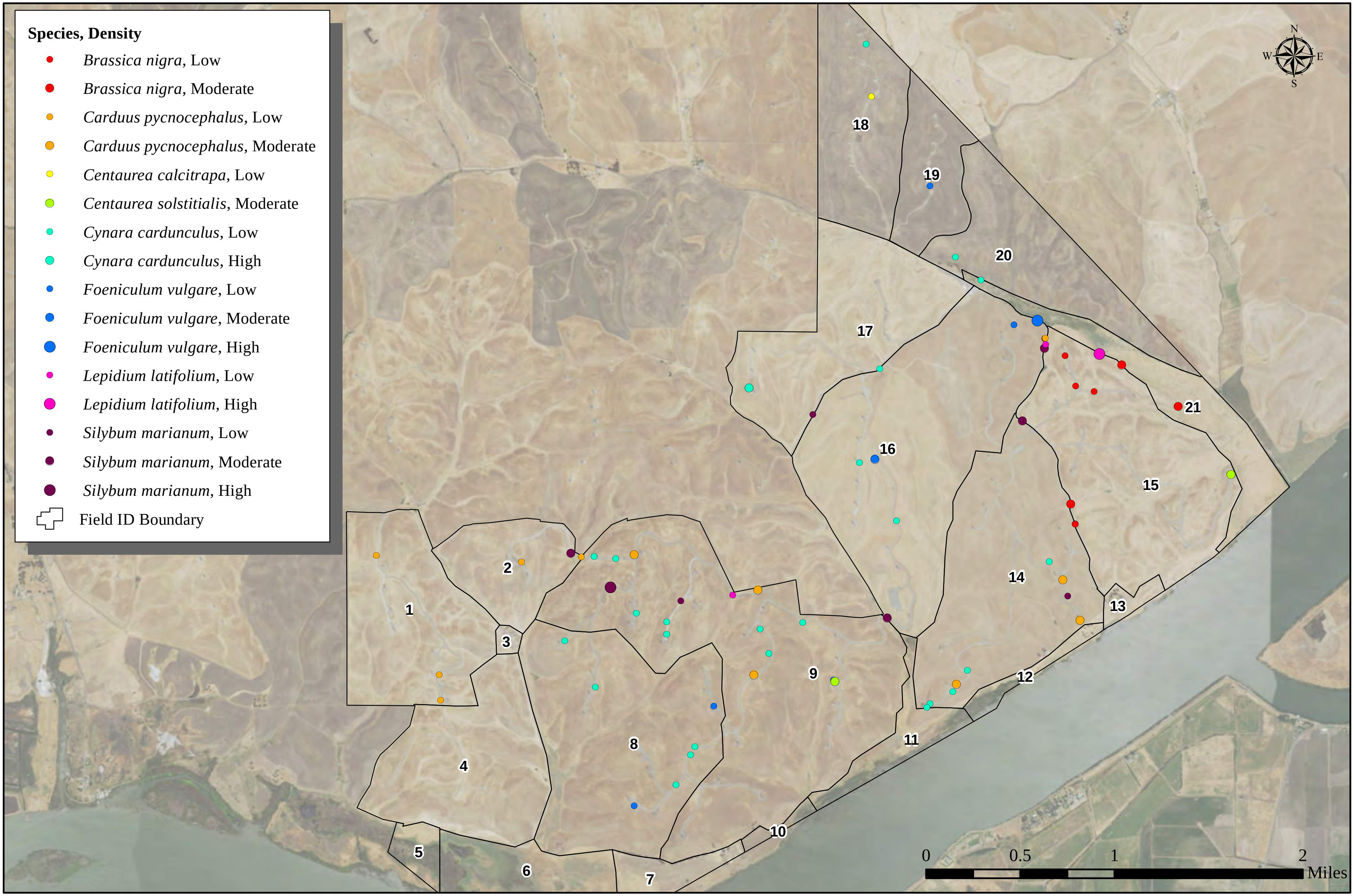
Figure 9. Weed Density Points



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Phase 2 Land Management Plan

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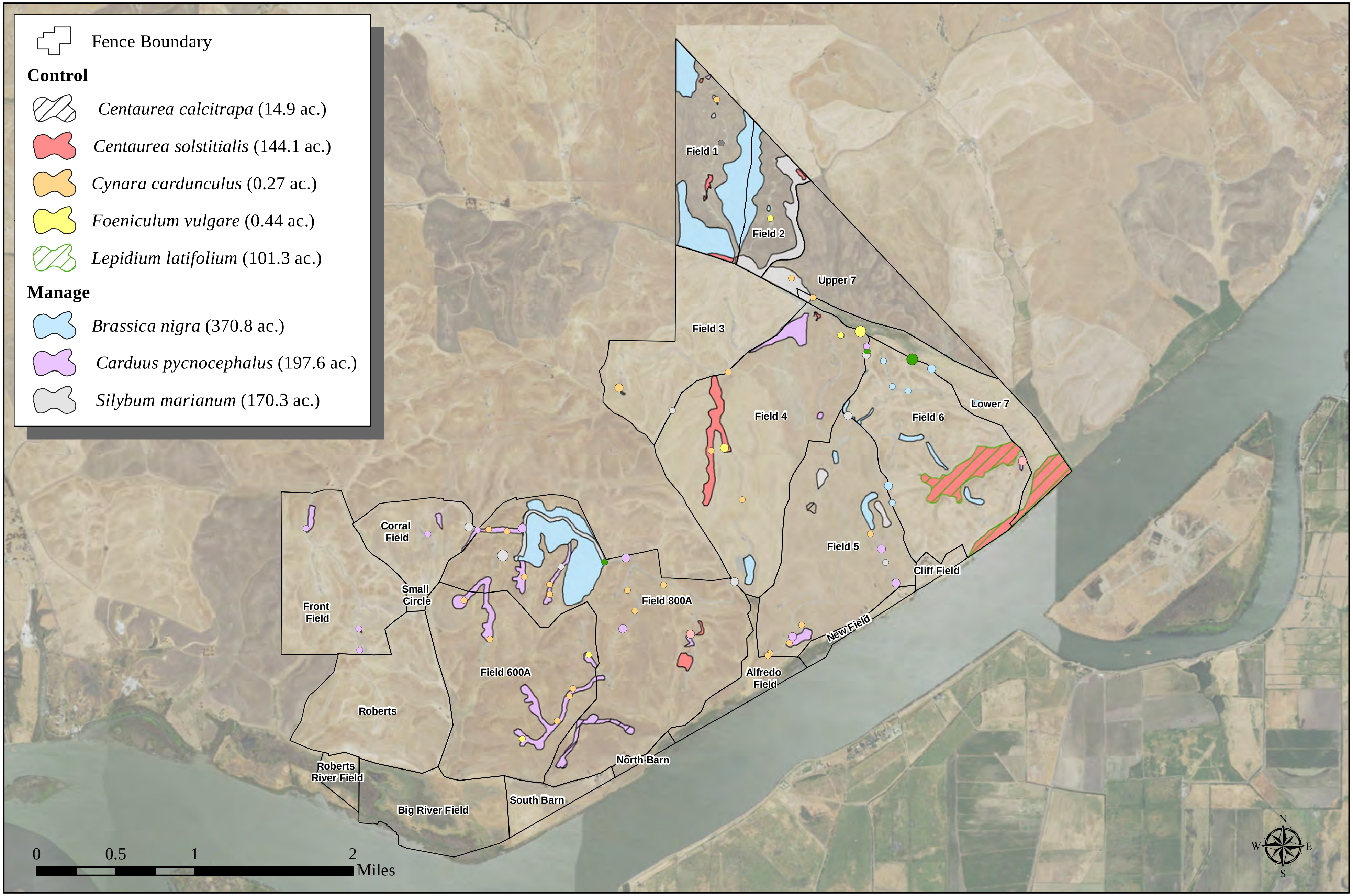
Figure 10. Management Priority



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BIOLOGICAL AND ENVIRONMENTAL SERVICES

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Photo 4. Field 21, milk thistle growing along fence, view northeast. April 12, 2016.

Photo 5. Field 17, artichoke thistle, milk thistle, and Italian thistle growing along road and hillslope, view west. Neighboring property infested with same species. April 13, 2016.

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Photo 17. Dense population of artichoke thistle growing on adjacent property. Field 17 artichoke thistle is downwind from this population. April 13, 2016.

Attachment 1

April 2015 Site Visit and Weed Inventory Survey Results

Burrowing Owl Habitat Assessment

AECOM
2020 L Street, Suite 400
Sacramento, CA 95811
USA
aecom.com

Project name:
Solano 4 Wind Project

From:
AECOM Technical Services

Date:
August 23, 2018

To:
Ammon Rice
Sacramento Municipal Utility District
6201 S Street, Mail Stop H201
Sacramento, CA 95817
P.O. Box 15830
Sacramento, CA 95852-0830

Memo

Subject: Burrowing Owl Habitat Assessment for the Solano 4 Wind Project

Dear Mr. Rice,

This memorandum documents the methods and results of the habitat assessment for western burrowing owl (*Athene cunicularia*), a California Species of Special Concern, for the proposed Solano 4 Wind Project (proposed project) in Solano County, California. The goal of this habitat assessment was to determine whether burrowing owls, or habitats that could potentially support the species, are present in the study area, and to map the habitat to support this determination.

Project Description and Location

The Sacramento Municipal Utility District (SMUD) is proposing to permit and construct the Solano 4 Wind Project. The proposed project would involve the construction and operation of wind turbine generators, an associated electricity collection system, and access roads, and minor upgrades to the existing Russell Substation. The proposed project would be implemented in the Montezuma Hills Wind Resource Area (MHWRA) in southern Solano County. The MHWRA lies north of the confluence of the Sacramento and San Joaquin rivers and southwest of the city of Rio Vista (Figure 1).

The proposed project would be implemented primarily on two properties, Solano 4 East and Solano 4 West, which total approximately 2,237 acres. These properties occupy 881 acres and 1,390 acres, respectively. Solano 4 East is approximately 3.5 miles southwest of Rio Vista and Solano 4 West is adjacent to the Sacramento–San Joaquin Delta near Collinsville. State Route 12 provides regional access to the study area. Montezuma Hills Road provides local access to Solano 4 East, while Collinsville Road provides local access to Solano 4 West (Figure 2).

Methods

Before the field surveys, AECOM biologists searched the California Department of Fish and Wildlife's (CDFW's) California Natural Diversity Database (CNDDB) (CDFW 2018a), California Wildlife

Habitat Relationships species range maps (CDFW 2018b), and the eBird online database of bird observations (eBird 2018) for any information on burrowing owls. The CNDDB search included a 5-mile buffer around the project footprint. The eBird database was searched by location and for selected species. In addition, the following reports from previous studies conducted in the MHWRA were reviewed: Curry and Kerlinger, L.L.C, Avian Use Study Collinsville Wind Power Project (Curry and Kerlinger, LLC 2011), and Area West Environmental, Inc. (AWE), Solano Phase 4 Wind Project, Burrowing Owl Habitat Assessment (Area West Environmental, Inc. 2017).

AECOM biologists Matthew Bettelheim and Natalie Greer conducted habitat assessments for burrowing owls on April 18, May 15, and June 28, 2018. On June 7, 2018 habitat assessments were conducted by Matthew Bettelheim and AECOM biologist Chris Beck. The study area encompasses the project footprint and a 1,884-foot buffer around the project footprint boundary (Figure 3).

The habitat assessment was performed while driving primary and secondary access roads and consisted predominantly of habitat mapping. When pedestrian surveys were performed, surveyors also noted the presence or absence of burrows, and performed an inspection of burrows for burrowing owl sign, including whitewash, pellets, and feathers. Protocol-level surveys (i.e., using methods in accordance with CDFW's *Staff Report on Burrowing Owl Mitigation* {CDFG 2012]) were not conducted.

Results

Natural History

Burrowing owls occur in dry, open habitats, such as grasslands and prairies with low-growing or no vegetation, where they occupy underground burrows, typically those of the California ground squirrel (*Spermophilus beecheyi*). Burrowing owl can also occur in open areas of farmland, levee banks, and other disturbed or managed habitats where burrows or burrow-like refuges are present, such as small-diameter pipes, rock piles with voids, or similar hollow spaces. The overriding characteristics of suitable habitat for this species are burrows or burrow surrogates for roosting and nesting, and relatively short vegetation with only sparse shrubs. Burrowing owls can be active during the day but are most active around sunrise and sunset. They eat insects and small mammals. Burrowing owls breed from April to August (CDFG 2012). Burrowing owls occur in California year-round, both during the breeding season and nonbreeding season. California is considered one of the most important over-wintering areas for burrowing owls especially within the San Francisco Bay Area region (Shuford and Gardali 2008).

Habitat and Vegetation

The landscape throughout the rolling Montezuma Hills is characterized by treeless grasslands that have been subject to dryland farming practices and livestock grazing for more than 100 years. The MHWRA consists of a series of gently rolling hills of similar texture and size. The hills crest at a relatively constant elevation, generally 150–250 feet above mean sea level. Valleys in the project area transition to sloped hillsides with relatively flat ridgelines.

Permanent and seasonal marshes occur on the project lands and adjacent to Suisun Marsh; some of the land has been reclaimed with levees. Vegetation is primarily pasture and grain crops, with intermittent riparian swales and sporadic eucalyptus windbreaks. Varied shrub vegetation is present only in the drainage swales and around existing and abandoned settlements. Native vegetation is limited; the remainder of the area is nonnative annual grassland. Some of the lowland vegetation includes native willows, blackberry, rushes, and tules. Marsh vegetation is present in some of the shallow sloughs, which drain portions of the study area into the Sacramento River to the south.

To maintain current land use to the extent practicable, land is leased to farmers for dryland farming and grazing. Dryland farming generally follows a 1- to 3-year crop rotation cycle (wheat, barley, and oats), with predominantly sheep grazing and fallow years following planting. Therefore, land use in the Montezuma Hills consists of wind energy generation along the ridgelines (supported by connecting road and utility infrastructure), dryland farming and livestock grazing along the grassland slopes, and livestock grazing in the interstitial valleys and drainages.

Under the dryland farming land use, land management practices include disking to improve water retention, minimize erosion loss, and control invasive species. Those areas not actively being farmed are grazed or otherwise managed to support fire control, and firebreaks are maintained along all fence lines and roadways. On average, any land under dryland farming is subject to crop planting, growth, and harvest within a 3-year period. Within the study area, land under dryland farming use comprises 8,752 acres or 97% of the study area.

Burrowing Owl Habitat in the Study Area

Outside of lands under dryland farming, islands of nonnative annual grassland remain in the immediate uplands surrounding aquatic features and in the interstitial valleys and drainages that are too steep to farm (or are not farmed to avoid impacts on wetlands). Ground squirrel activity was found to be scarce in the study area and the immediate vicinity; however, a limited number of small-mammal burrows were observed occasionally in the isolated patches of nonnative annual grassland. Disking activities in land under dryland farming use leave the land unavailable for ground squirrels and other small mammals, whose burrows provide habitat for burrowing owls.

Nonnative annual grasslands in the immediate uplands surrounding aquatic features, and in the interstitial valleys and drainages that are too steep to farm, provide marginal habitat due to limited ground squirrel activity and fragmented foraging habitat. Likewise, when agricultural land is left fallow or grazed, the potential exists for small mammals to recolonize the study area and burrow, which would also provide suitable nesting and wintering habitat for burrowing owls. Potential burrowing owl habitat occurs mostly along borders of access roads and fence lines and between hills within valleys and saddles where vegetation is sparse, and where erosion produces exposed soil. Such areas are very limited in extent within the study area.

Reported Occurrences

Based on a review of CDFW range maps (Figure 3), the study area occurs within the recognized year-round range of burrowing owl (CDFW 2018a). There are three records of burrowing owls in the northeast portion of the project footprint, from May 2000 and December 1999 (CDFW 2018b). The closest burrowing owl record to the project footprint is in Montezuma, approximately 1.5 miles from the project footprint (eBird 2018). This occurrence was reported in November 2014 during the nonbreeding season. SMUD staff and consultants have observed burrowing owls overwintering in the study area during the nonbreeding season; however, burrowing owls have not been seen in the study area during the breeding season (Rice, pers. comm., 2018).

Based on SMUD staff observations and protocol level surveys conducted for Solano Phase 3, overwintering burrowing owls have been observed in the Solano Wind area along Talbert Lane, Toland Lane, and using culverts along access roads on Solano Phases 1 and 2. SMUD staff has observed breeding burrowing owls south of the Sacramento River in the cities of Brentwood, Oakley, and Antioch (Rice, pers. comm., 2018). These observations are supported by eBird and CNDDB records that show occurrences of burrowing owls in April, May, and July (and during the late-fall and winter months of November, December, and January) on West Sherman Island Road, across the Sacramento River and in Brentwood, Oakley, and Antioch south of the project footprint (eBird 2018; CDFW 2018b).

Conclusion

No evidence of burrowing owls occupancy was detected during the habitat assessment. However, potential habitat for the species is present where nonnative annual grassland occurs (456 acres of the 8,997-acre study area), and where agricultural land is left fallow or grazed. Annual grassland habitat where vegetation is sparse, undisked agricultural lands, and unvegetated areas near fence lines and buildings or where erosion produces exposed soil could also potentially support burrowing owl nesting and wintering sites, although such habitat is very limited within the project area. No breeding activity by burrowing owls has been documented in the project area. These results are consistent with the burrowing owl habitat assessment and surveys conducted in 2016 in Solano 4 West (AWE 2017) and with other avian use studies in the MHWRA (Curry and Kerlinger, LLC 2011).

References

Area West Environmental, Inc. 2017 (August). Solano Phase 4 Wind Project Burrowing Owl Habitat Assessment, Solano Count, CA. Prepared for the Sacramento Municipal Utility District.

California Department of Fish and Game (CDFG). 2012. *Staff Report on Burrowing Owl Mitigation.* State of California Natural Resources Agency.

California Department of Fish and Wildlife (CDFW). 2018a. Monthly California Natural Diversity Database data download. Results of electronic records search. Sacramento: Biogeographic Data Branch. Available: https://www.wildlife.ca.gov/Data/CNDDB. Accessed April 12, 2018

———. 2018b. Species Range Maps. Available: https://map.dfg.ca.gov/imaps/cwhr/cwhrlife.html..

Curry & Kerlinger, LLC. 2011 (March). Avian Use Study, Collinsville Wind Power Project, Solano County, California. Prepared for Pacific Gas & Electric Company, San Ramon, CA. Curry & Kerlinger, McLean, VA.

eBird. 2018. eBird: An Online Database of Bird Distribution and Abundance [web application]. Ithaca, NY. Available: http://www.ebird.org. Accessed June 26, 2018.

Rice, Ammon. Environmental Specialist. Sacramento Municipal Utility District, Sacramento, CA. April 18, 2018—personal communication with Matthew Bettelheim and Natalie Greer regarding burrowing owl observations.

Shuford, W. D., and Gardali, T., editors. 2008. California Bird Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento, CA.

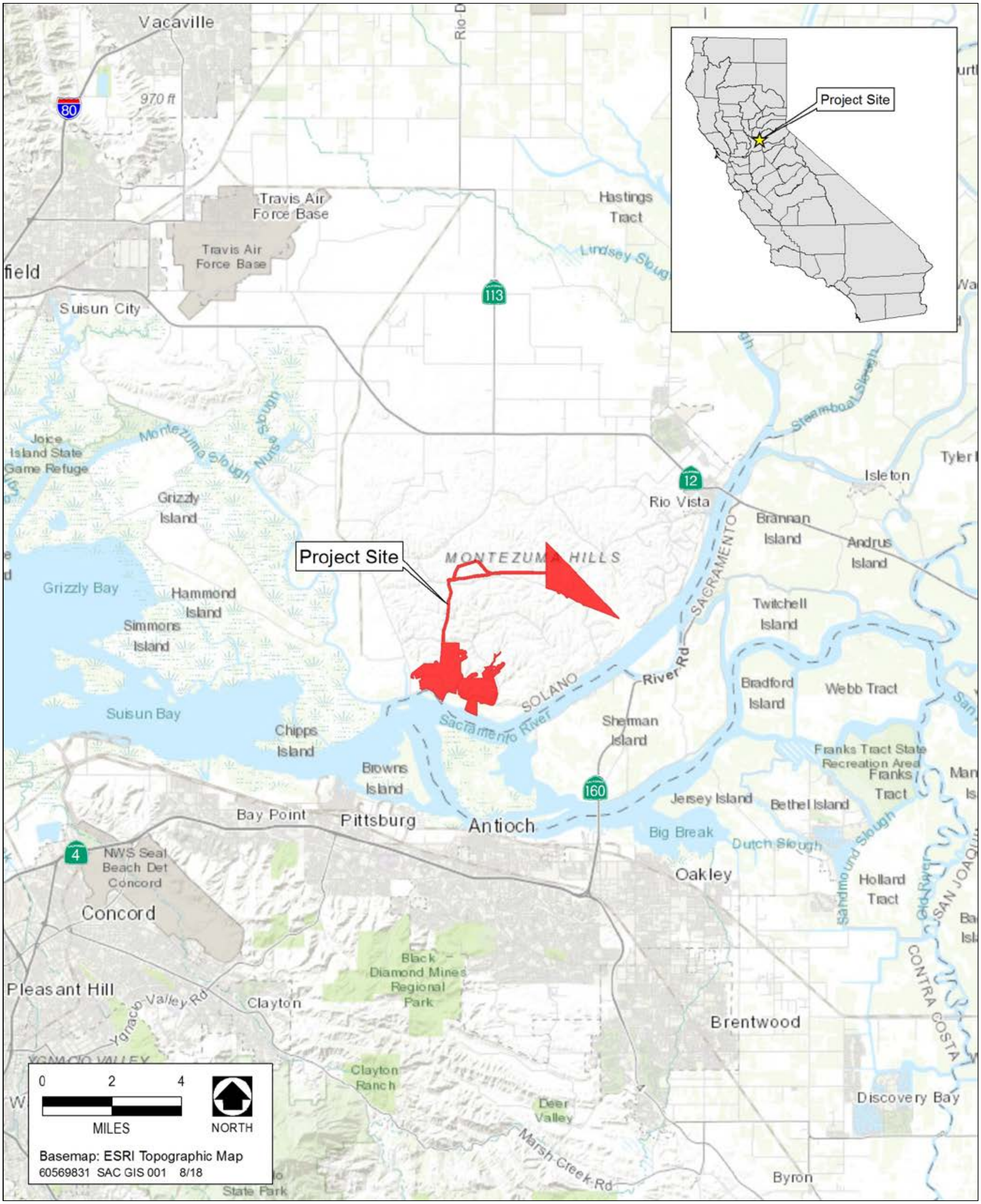

Figure 1. Regional Location Map

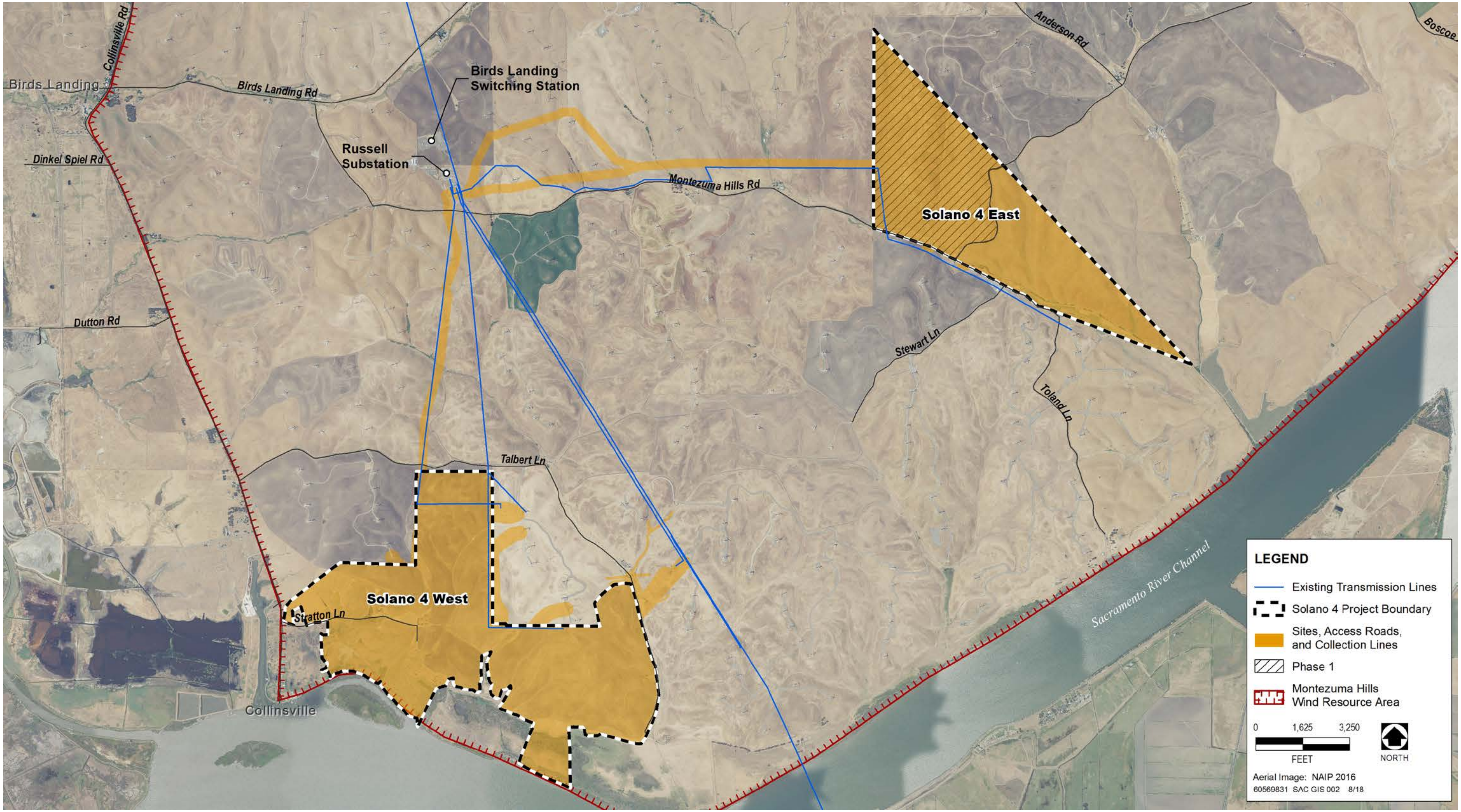

Figure 2. Project Site Map

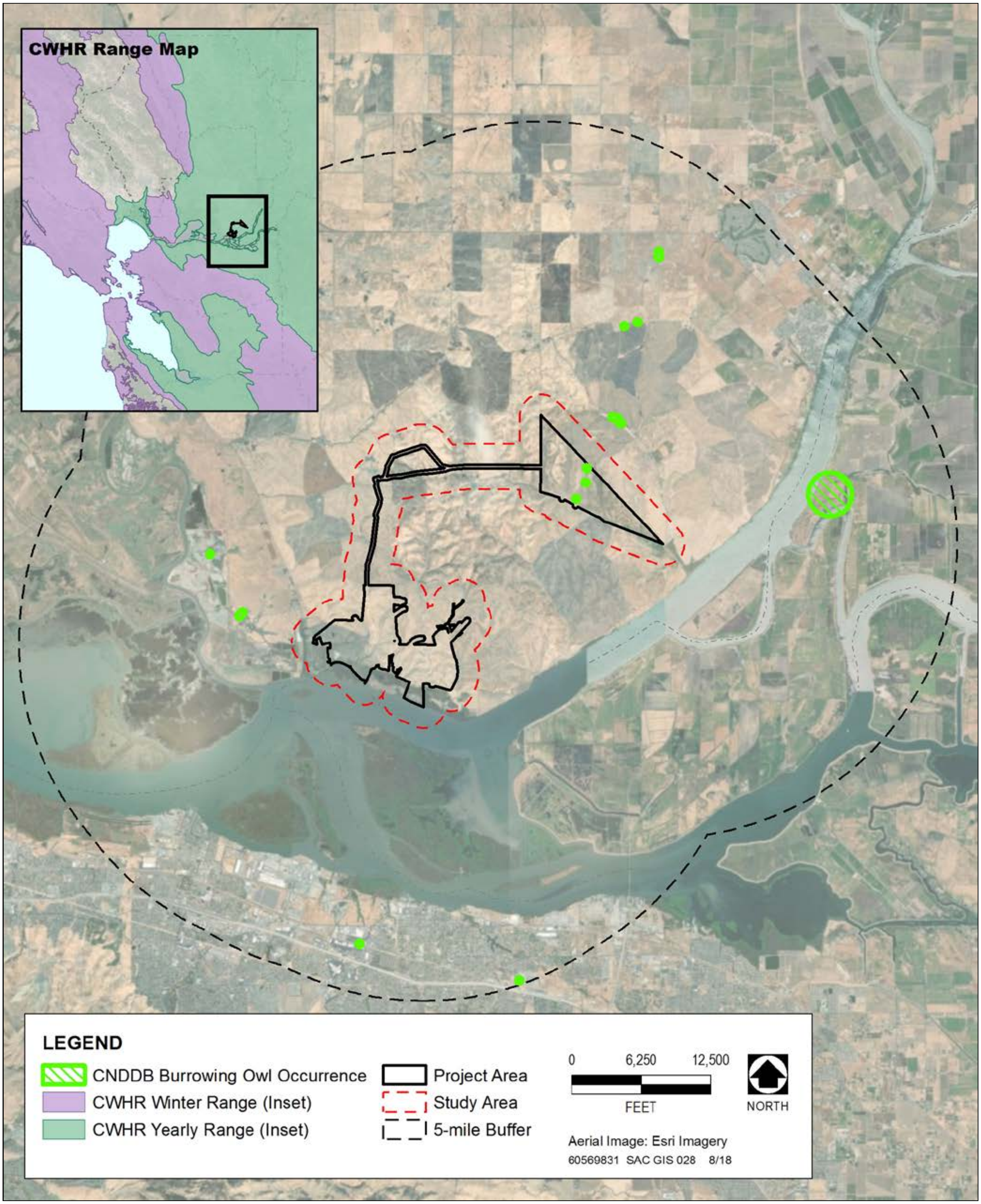

Figure 3. CNDDB Occurrences of Burrowing Owl

California Tiger Salamander Habitat Assessment (SMUD)

Sacramento Municipal Utility District
Solano Wind 4

California Tiger Salamander Habitat Assessment • September 2018

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SMUD–Environmental Management
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Acronyms and Abbreviations

CDFG	California Department of Fish and Game
CDFW	California Department of Fish and Wildlife
CNDDB	California Natural Diversity Database
eDNA	environmental DNA
MHWRA	Montezuma Hills Wind Resource Area
PCR	polymerase chain reaction
Project	Solano Wind Energy Project, Phase 4
SMUD	Sacramento Municipal Utility District
Solano 4 Project	Solano Wind Energy Project, Phase 4
USFWS	U.S. Fish and Wildlife Service
WTG	wind turbine generator

1 Introduction

Sacramento Municipal Utility District (SMUD) is proposing to develop the 92-megawatt Solano 4 Wind Project (Solano 4 Project or Project) in the Montezuma Hills Wind Resource Area (MHWRA) in Solano County, California (Figure 1). The Project would include repowering Solano Wind Phase 1 Project (Solano 4 East) and the Roberts properties, and construction of new wind turbine generators (WTGs) on the Collinsville property (collectively, Roberts and Collinsville properties are referred to as Solano 4 West). SMUD is conducting resource assessments in the Project area that will be incorporated into the environmental impact report being prepared pursuant to the California Environmental Quality Act and other related environmental documentation.

This report, one of several studies conducted on the wildlife resources of the Project area, provides a habitat assessment for California tiger salamander (*Ambystoma californiense*). In addition to the habitat assessment, this report describes the results of aquatic larval dip-netting and environmental DNA (eDNA) sampling and evaluates the suitability of the aquatic and upland habitat in the Project area for California tiger salamanders. Because the project area lies within the range of the Central California Distinct Population Segment, this report was prepared in general accordance with the California tiger salamander site assessment protocols outlined in the U.S. Fish and Wildlife Service (USFWS) and California Department of Fish and Wildlife's *Interim Guideance on Site Assessment and Field Surveys for Determining Presence or a Negative Finding of the California Tiger Salamander* (USFWS and CDFG 2003).

1.1 Environmental Setting

The MHWRA consists of a series of gently rolling hills of similar texture and size. The hills crest at a relatively constant elevation, generally 150–250 feet above mean sea level. Valleys in the Project area transition to sloped hillsides with relatively flat ridgelines.

Permanent and seasonal marshes occur on the Project lands and adjacent to Suisun Marsh; some of the land has been reclaimed with levees. Vegetation is primarily pasture and grain crops, with intermittent riparian swales and sporadic eucalyptus windbreaks. Varied shrub vegetation is present only in the drainage swales and around existing and abandoned settlements. Native vegetation is limited; the remainder of the area is annual grassland. Some of the lowland vegetation includes native willows, blackberry, rushes, and tules. Marsh vegetation is present in some of the shallow sloughs, which drain portions of the Project area into the Sacramento River to the south.

The Project area is designated for agricultural use (dryland farming and grazing) and is sparsely populated. Visible developments include electric transmission towers, and WTGs on the surrounding hilltops. Interior roads that connect these buildings and structures generally are present along the lower elevations.

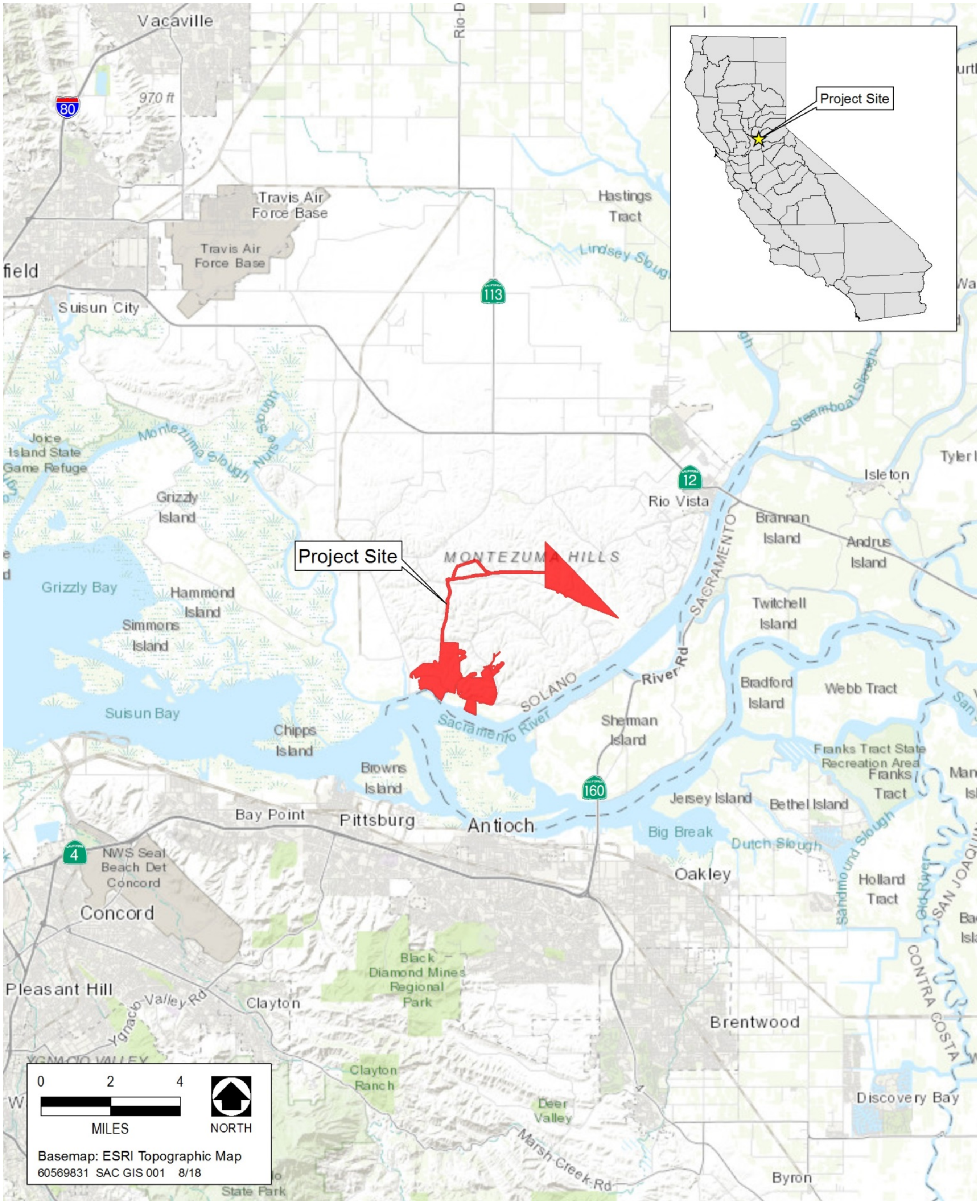

Figure 1. Regional Location Map

The Project area is owned in fee title by SMUD. The Phase 1 portion of Solano 4 East is an approximately 881-acre property owned by SMUD that is dominated by nonnative grasslands used for seasonal livestock grazing. This portion of Solano 4 East supports 23 Vestas V-47 WTGs, gravel pads and roads, underground collection lines, and pad-mounted transformers. Solano 4 West (formerly known as the Roberts and Collinsville properties) is a 1,390-acre property owned by SMUD that is dominated by nonnative grasslands. Solano 4 West supports 62 Kenetech KCS-56 WTGs owned by EDF Renewable Energy, gravel access roads, and underground collection lines.

The rolling hill landscape throughout the Montezuma Hills is characterized by treeless grasslands that have been under dryland farming practices and livestock grazing for more than 100 years. Dryland farming generally follows a 1- to 3-year crop rotation cycle (wheat, barley, and oats), with sheep grazing and fallow years following planting. Therefore, land use in the Montezuma Hills consists of wind energy generation along the ridgelines (supported by connecting road and utility infrastructure), dryland farming and livestock grazing along the grassland slopes, and livestock grazing in nonnative annual grasslands located in the interstitial valleys and drainages.

1.2 Project Description

SMUD is proposing to permit and construct the Solano 4 Project. The Project would involve the construction and operation of WTGs, an associated electricity collection system, and access roads. The Project would be implemented in the MHWRA in southern Solano County. The MHWRA lies north of the confluence of the Sacramento and San Joaquin rivers and southwest of the city of Rio Vista (Figure 1).

The Project would be implemented primarily on two properties, Solano 4 East and Solano 4 West, which total approximately 2,237 acres. These properties occupy 881 acres and 1,390 acres, respectively. Solano 4 East is approximately 3.5 miles southwest of Rio Vista and Solano 4 West is adjacent to the Sacramento–San Joaquin Delta near Collinsville. State Route 12 provides regional access to the Project area. Montezuma Hills Road provides local access to Solano 4 East, while Collinsville Road provides local access to Solano 4 West (Figure 2).

With the Solano 4 Project, SMUD would remove all 23 existing WTGs from the Phase 1 portion of Solano 4 East and all 62 WTGs from Solano 4 West. Old access roads that would no longer be needed would be reclaimed. SMUD would then construct approximately 22 new WTGs. Of these new WTGs, 10 would be constructed in the Phase 1 portion of Solano 4 East and 12 at Solano 4 West. The new facilities would generate a combined total of up to 92 megawatts of electricity. Associated access roads and collection lines would be installed to support the new WTGs. Power generated by the new WTGs would be transmitted to the existing Russell Substation on Montezuma Hills Road, where the power would be distributed via the adjacent Birds Landing Switching Station through the existing 230-kilovolt Vaca–Dixon–Contra Costa transmission line (two circuits) and 500-kilovolt Vaca-Dixon-Tesla line, which run through the MHWRA.

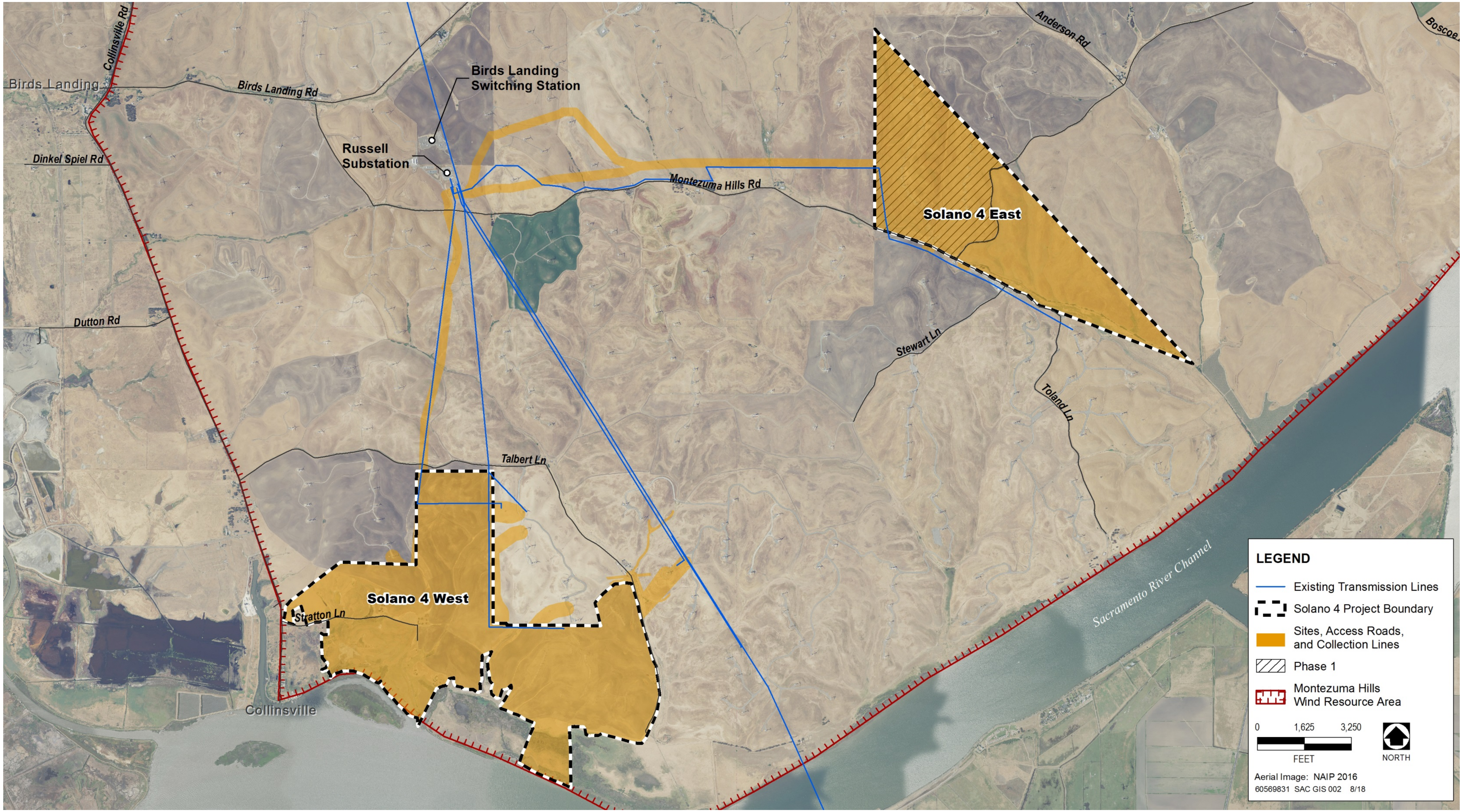

Figure 2. Project Site Map

2 Habitat Assessment

2.1 Natural History

The California tiger salamander is a large terrestrial salamander with a black body and white to yellow spots and bars (Stebbins 2003). This species' Central California Distinct Population Segment is federally listed as threatened, while the Sonoma and Santa Barbara distinct population segments are federally listed as endangered. Throughout the species' range, the California tiger salamander is a California Species of Special Concern. California tiger salamanders are distributed throughout the Central Valley and Central Coast Ranges from Colusa County south to San Luis Obispo and Kern counties, from sea level to 3,460 feet in elevation. Two disjunct populations are located in Sonoma County and Santa Barbara County, which are geographically isolated from the Central Valley population.

California tiger salamanders are at risk because of the loss of habitat caused by development of agriculture and grazing lands; habitat fragmentation; and introduction of predatory exotic species such as mosquitofish (*Gambusia affinis*), bullfrogs (*Rana catesbiena*), and Louisiana red swamp crayfish (*Procambarus clarkii*) (Collins et al. 1988; Shaffer et al. 1993; Jennings and Hayes 1994).

California tiger salamanders typically inhabit grassland and oak woodland habitats below 1,500 feet in elevation that have scattered ponds, intermittent streams, vernal pools, or artificial ponds. Breeding habitat consists of seasonal pools, low-gradient streams, and ponds that contain water for at least 12 weeks beyond the breeding season (December through January). California tiger salamanders have a typical age-to-first-reproduction of 4–5 years, experience 1.4 reproduction events in a lifetime, and have a life span of up to 10 years (USFWS 2014).

As discussed below, federally designated critical habitat for the California tiger salamander consists of three primary constituent elements that are essential to the conservation of the species: aquatic habitat, upland (refugia) habitat for refuge and foraging, and dispersal habitat (USFWS 2005).

2.1.1 Aquatic Habitat

Aquatic habitat provides space, food, and cover necessary to support reproduction and to sustain the early life stages of larval and juvenile California tiger salamanders. Such habitat consists of freshwater bodies, including natural and artificially made (e.g., stock) ponds, vernal pools, and vernal pool complexes. Aquatic and breeding habitats must be able to hold water for at least 12 weeks in the winter or spring in a year of average rainfall, the amount of time needed for salamander larvae to metamorphose into juveniles capable of surviving in upland habitats. During periods of drought or less-than-average rainfall, these sites may not hold water long enough for individuals to complete metamorphosis (Storer 1925; Barry and Shaffer 1994; Stebbins 2003).

Dispersal from upland habitat to breeding sites begins with the first rain events of the fall/winter, typically in November. Eggs are laid singly or in small clusters on the pond bottom or attached to individual strands of vegetation (Storer 1925; Shaffer and Fisher 1991; Barry and Shaffer 1994;

Jennings and Hayes 1994). Salamander larvae feed on zooplankton, small crustaceans, or small aquatic insects until they grow large enough to feed on larger food items (USFWS 2004). Metamorphosis occurs a minimum of 10 weeks after hatching, and young migrate en masse when temporary pools begin to dry up in late spring or early summer (Anderson 1968; Feaver 1971; Jennings and Hayes 1994; Stebbins 2003). After laying eggs, adults can spend several weeks actively feeding near breeding sites before returning to subterranean refuges. Aquatic habitats that dry up completely in the late summer/fall are particularly important for California tiger salamander breeding because these ponds are less likely to support breeding populations of predators such as nonnative fish or bullfrogs, which require permanent water (USFWS 2004).

2.1.2 Upland (Refugia) Habitat

Adult and juvenile California tiger salamanders are primarily terrestrial; adults enter aquatic habitats for only relatively short periods to breed. For the majority of their life cycle, through the summer and fall, juvenile and adult salamanders inhabit lowland grasslands, oak savanna, and mixed woodland habitats, where they aestivate in underground refugia in the form of small-mammal burrows (i.e., those used by California ground squirrels [*Spermophilus beecheyi*] and pocket gopher [*Thamomys* spp.]) (Shaffer et al. 1993; Barry and Shaffer 1994; Jennings and Hayes 1994; Stebbins 2003). These underground refugia provide protection from the hot, dry weather typical of California in the nonbreeding season. California tiger salamanders may also forage in the small-mammal burrows and rely on the burrows for protection from predators.

The presence of populations of small burrowing mammals is essential to constructing and maintaining burrows. Without the continuing presence of small-mammal burrows in upland habitats, California tiger salamanders would not be able to survive.

2.1.3 Dispersal Habitat

Dispersal habitat provides connectivity between the aquatic and upland habitats used by California tiger salamanders. The distance traveled by the salamanders between aquatic and upland refugia habitats varies greatly between sites. Adults have been observed migrating up to 0.7 mile from refugia sites to breeding ponds (USFWS 2004), whereas juvenile salamanders have been detected as far as 1.24 miles from breeding sites (USFWS and CDFG 2003).

In defining critical habitat for California tiger salamander, the U.S. Fish and Wildlife Service (USFWS) used a distance of 0.7 mile from known occurrences that are not isolated by barriers that the salamanders cannot cross. This distance would likely include 99 percent of the inter-pond movement of breeding adults. Salamanders can bypass many obstacles, and they do not require a particular type of habitat for dispersal; however, to function effectively, the habitats connecting essential aquatic and upland habitats need to be free of barriers (e.g., a physical or biological feature that prevents salamanders from dispersing beyond the feature). Examples of barriers are areas of steep topography devoid of soil or vegetation. Agricultural lands such as row crops, orchards, vineyards, and pastures do not constitute barriers to the dispersal of California tiger salamanders.

2.2 Methods

2.2.1 Habitat Assessment

The following permitted individual led the habitat assessment and surveys:

Matthew Bettelheim, Sr. Wildlife Biologist (Permitted Biologist) **TE-094845**

- 10(a)(1)(A) permitted biologist for California tiger salamander and California red-legged frog
- SCP-6652 for California tiger salamander and California red-legged frog

A habitat assessment of the study area was conducted on April 18, May 15, and June 28, 2018, by Matthew Bettelheim and AECOM biologist Natalie Greer, and on June 7, 2018, by Matthew Bettelheim and AECOM biologist Chris Beck. The study area encompassed the Project area and an area within 1,884 feet of the Project boundaries. This Project area buffer was selected to capture the highest-value upland habitat based on expected population density distribution modeling by Searcy and Shaffer (2011). Figure 3 depicts the boundaries of the study area.

The habitat assessment was conducted by driving the Project area's roads to evaluate and map California tiger salamander habitat. Figure 4 shows the wetland and upland habitat types with the study area. For those areas where surveyors did not have permission to enter, the habitat mapping was based on visual observation from adjacent properties and roadways, information from the *Solano Phase 4 Wind Project: Habitat Assessment and Vegetation Mapping Summary Report* (AWE 2017a), National Wetland inventory maps (NWI 2016), and review of aerial photography (Google Earth™). Freshwater aquatic features such as freshwater emergent wetlands, freshwater ponds, seasonal wetland, and wetland swales were mapped as "freshwater wetlands" on Figure 4. Brackish aquatic features such as tidal marsh wetland and emergent marsh brackish were mapped as "tidal/brackish wetlands." Surveyors searched for evidence of small-mammal activity (e.g., scat, burrows) and evaluated aquatic habitat to determine whether suitable breeding and/or upland habitat was present on or adjacent to the Project site.

2.2.2 Aquatic Sampling

Figure 5 identifies the aquatic features that were sampled during the field surveys. In total, 32 wetland features—19 on-site (Wetland Features A–S) and 13 off-site (Wetland Features 1–13)—were originally identified for review as part of this assessment (for a cross-indexed list of prior wetland feature nomenclature based on past reports, see Appendix A). Based on the results of the April 18, 2018, habitat assessment, ten wetland features (on-site Wetland Features A, B, E, I, J, L, N, P, R, and S) were identified on-site for further investigation; two additional wetland features, K and Q, were added in the field (Figure 4). Off-site, five additional wetland features (off-site Wetland Features 3, 4, 5, 6, and 13) were identified where permission to enter had been granted.

Of the 12 on-site and five off-site wetland features considered, a habitat assessment was completed for eight on-site and five off-site features (Table 2). A habitat assessment was not completed for four wetland features that were either not detectible (Wetland Feature A and S) or inaccessible (Wetland Feature C and E) during the site visit. Of the remaining wetland features, seven were dry (Wetland Features I, K, Q, 3, 4, 5, and 13), two were retaining a minimal amount of standing water (Wetland Features B and P), and four were still ponding water (Wetland Features J, L, N, and 6).

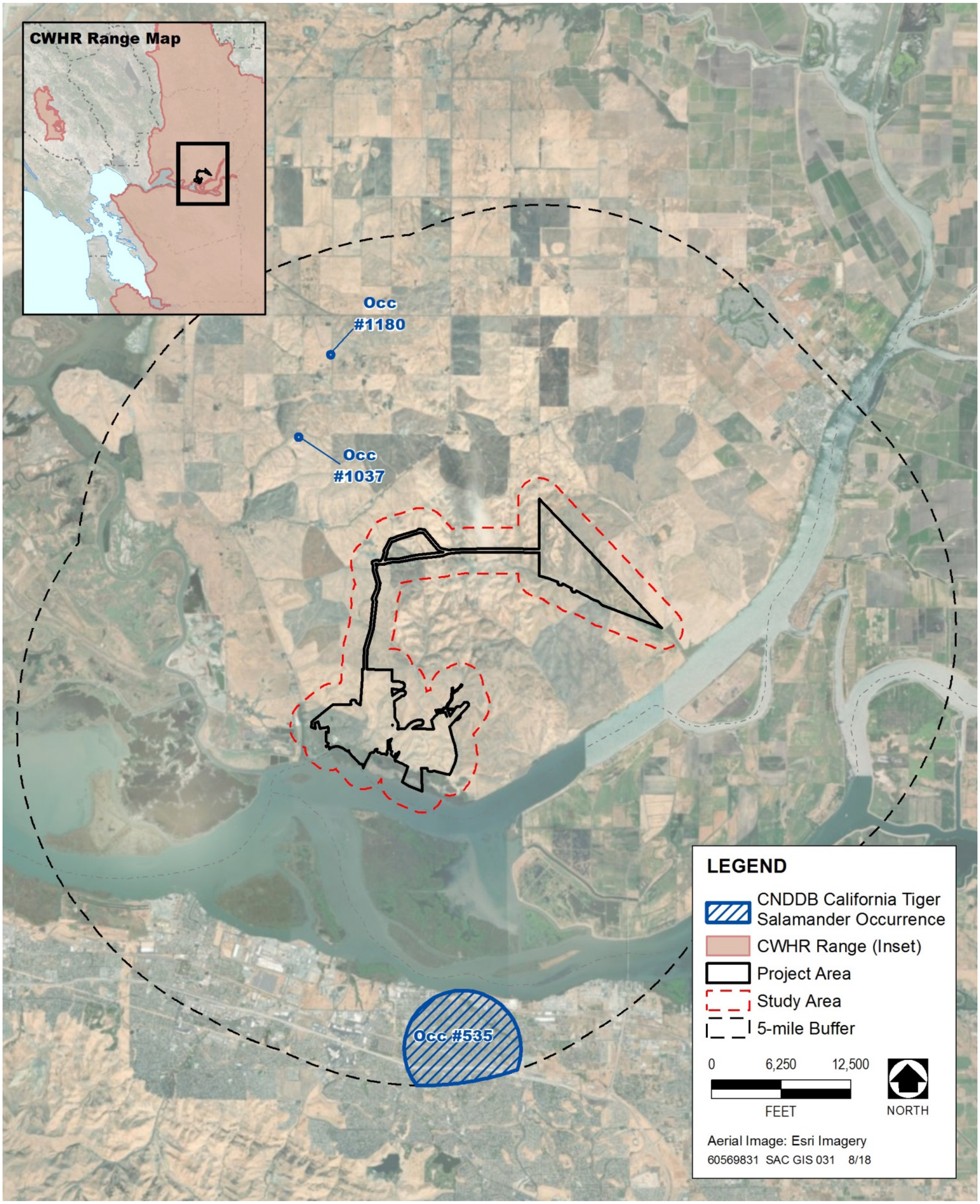

Figure 3. California Tiger Salamander CNDDB Occurrences within 5 Miles of the Project Area

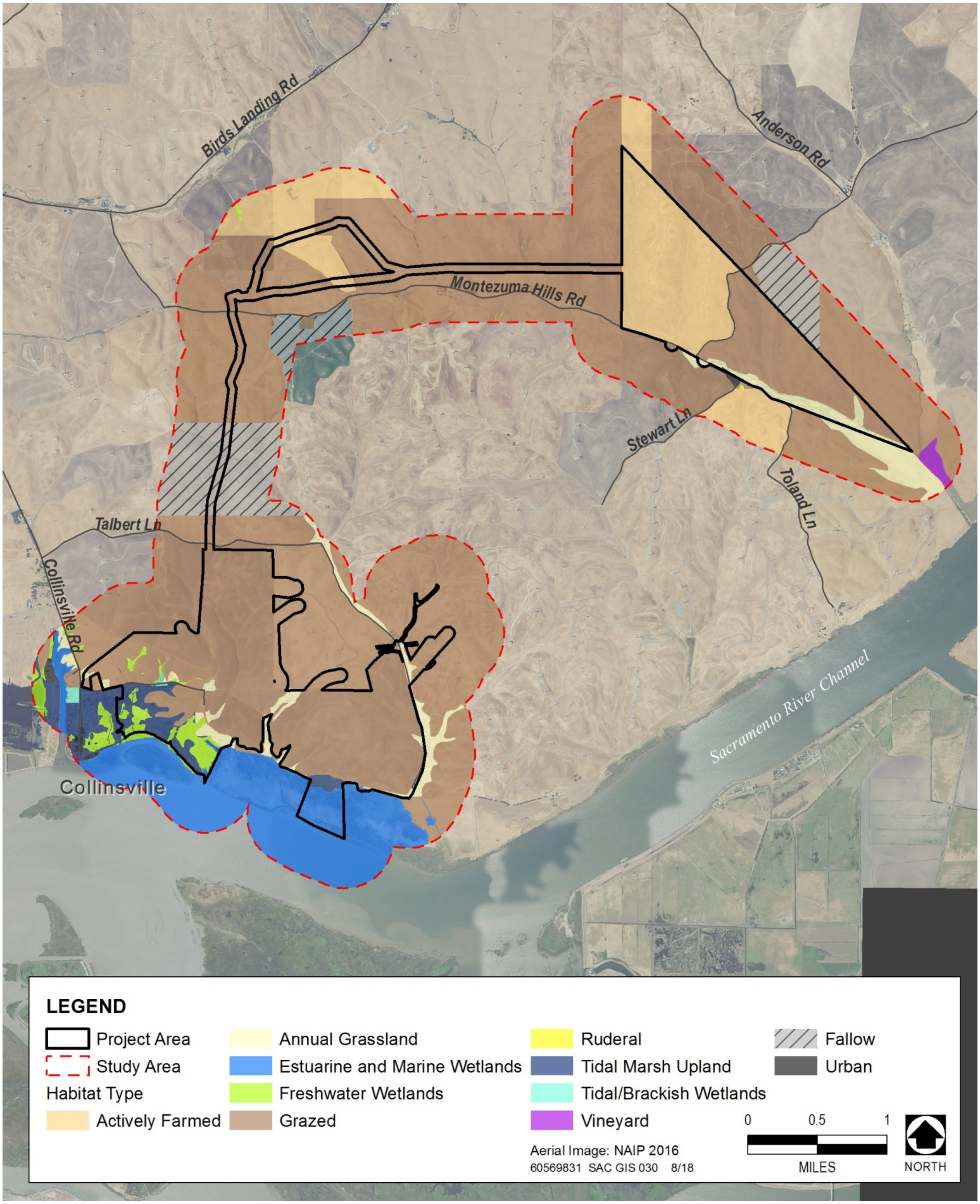

Figure 4. Habitat Types in the Solano 4 Wind Project Study Area

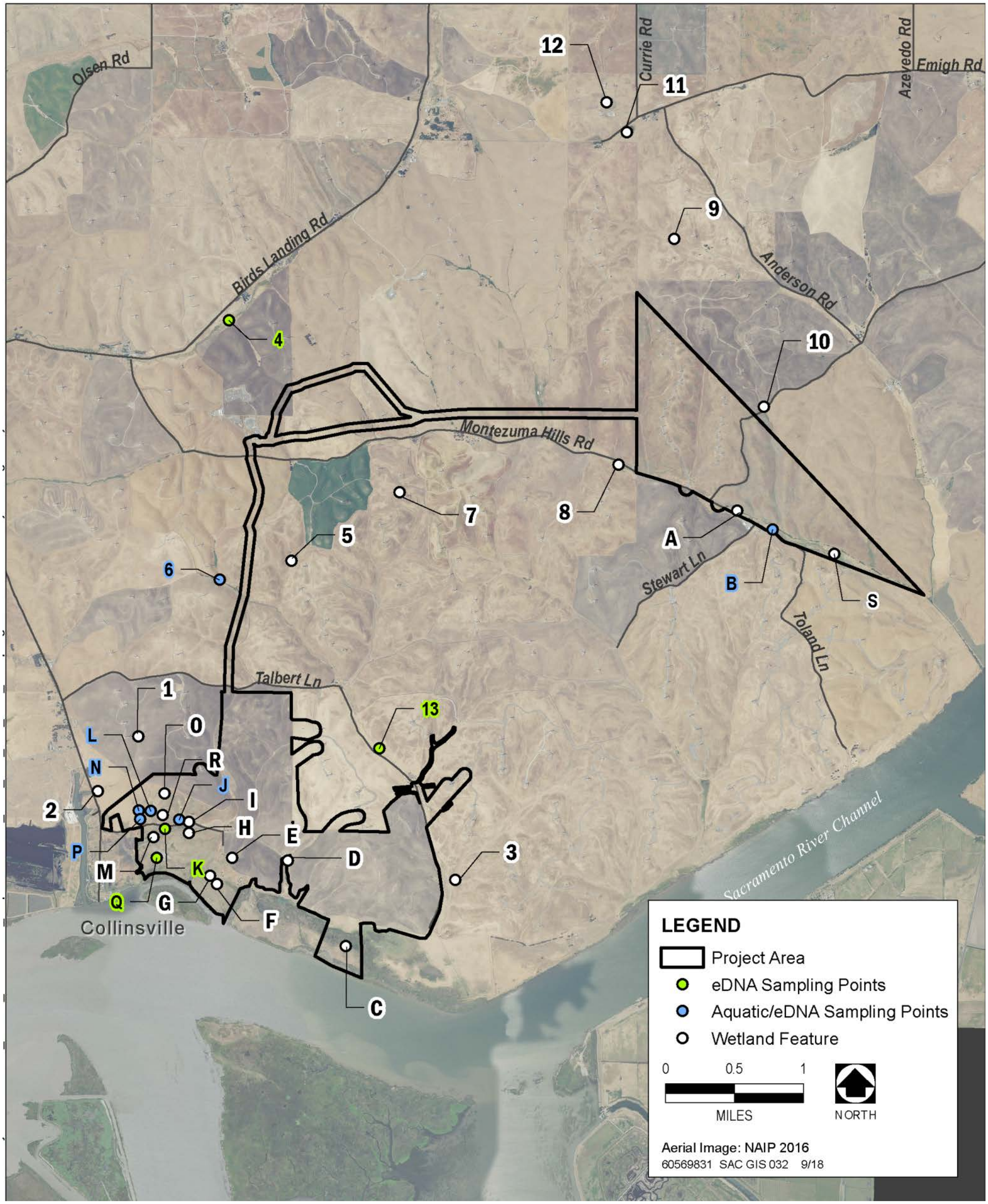

Figure 5. Aquatic Features Sampled for California Tiger Salamander Habitat Assessment

2.2.2.1 Dip-Net Sampling

Dip-net sampling was limited to wetland features within the study area where ponding water was present, and on neighboring properties where landowners granted permission to enter. AECOM biologists used a combination of visual encounter surveys and dip-net sampling of aquatic habitats. Dip-net surveys were conducted in general accordance with the USFWS and California Department of Fish and Game (CDFG) *Interim Guidance on Site Assessment and Field Surveys for Determining Presence or a Negative Finding of the California Tiger Salamander* (2003), and are described in detail below.

Aquatic sampling surveys for California tiger salamander were conducted between May 15 and June 7, 2018, during the breeding season to detect adults, subadults, larvae, and egg masses. Visual encounter surveys were performed before aquatic sampling to minimize disturbances to aquatic breeding habitat where possible. If target species were not detected, aquatic sampling was used, and consisted of the use of D-shaped, long-handled dip-nets (1/8-inch mesh). Aquatic sampling was performed only after March 15 to avoid impacts on egg masses. All surveys, equipment, and sanitation techniques were conducted in accordance with the guidelines described in survey protocols (USFWS and CDFG 2003).

On April 3, 2018, in response to a request by AECOM biologist Matthew Bettelheim (dated March 23, 2017) to conduct surveys for California tiger salamander, USFWS biologist Sarah Markegard provided e-mail authorization to perform dip-net and eDNA sampling.

2.2.2.2 eDNA Sampling

Before dip-net sampling, water samples were collected at each wetland feature with standing water. eDNA sampling was performed after visual encounter surveys, but before the aquatic sampling surveys, to prevent the introduction of foreign materials. These water samples were sent to a laboratory where they were evaluated for evidence of California tiger salamander eDNA by isolating total DNA from each water sample and analyzing them in triplicate using qualitative PCR (polymerase chain reaction).

Four additional water samples were sent to the laboratory as controls: two “off-site controls” containing tap water that were run after the field effort (Appendix B and C; SWIV X1 and SWIV X2), and two “positive controls” consisting of samples collected from water provided by the Lindsay Wildlife Museum, which was extracted from a tub in which a California tiger salamander had been partially submerged for several hours beforehand (Appendix B and C; SWIV X3 and SWIV X4).

Based on a desktop analysis of the study area, approximately 19 on-site (Wetland Features A–S) and 13 off-site (Wetland Features 1–13) wetland features were originally identified for assessment. On May 15, those on-site wetland features with standing water (Wetland Features B, J, L, N, and P) were sampled via eDNA sampling. On June 7, those off-site features with standing water (Wetland Feature 6) or signs of recent standing water (Wetland Features 4, 13, K, and Q) were sampled via eDNA sampling.

2.2.2.3 Previous Studies at MHWRA

The following reports describing California tiger salamander habitat assessments and surveys performed in or near the Project area were reviewed as part of the habitat assessment:

- Second Addendum Habitat Assessment for the California Tiger Salamander (*Ambystoma californiense*), California Red-Legged Frog (*Rana draytonii*), and Giant Garter Snake (*Thamnophis gigas*), on the Proposed Tie-In Transmission Line Substation at the Collinsville Wind Project Site, Solano County, California. Mark R. Jennings, Rana Resources for Michele Barlow, Insignia Environmental. May 2010. (Jennings 2010)
- Solano Phase 4 Wind Project: Habitat Assessment and Vegetation Mapping Summary Report, Solano County, California (Internal Review Draft). Area West Environmental, Inc. August 2017 (AWE 2017a).
- Solano Phase 4 Wind Project: California Tiger Salamander Habitat Assessment, Solano County, California. Area West Environmental, Inc. July 2017 (AWE 2017b).
- *Report on Biological Surveys, 2012–2014: Montezuma Wetlands Project, Solano County, California*. Unpublished report to Montezuma Wetlands LLC. Acta Environmental, Inc. June 2015 (Acta Environmental, Inc. 2015)

2.3 Results

2.3.1.1 Range

The Project area occurs within the recognized range of the species (USFWS and CDFG 2003; CDFW 2018b). The study area lies outside of all designated critical habitat (USFWS 2005). The closest critical habitat unit is Central Valley Region Unit 2: Solano County (USFWS 2005), which lies approximately 7 miles north of the study area.

2.3.1.2 Reported Occurrences

The June 2018 version of the California Department of Fish and Wildlife’s (CDFW’s) California Natural Diversity Database (CNDDB) (CDFW 2018a) was consulted as part of the habitat assessment to ensure that all known California tiger salamander occurrences were represented.

Based on a review of the CNDDB (CDFW 2018a), one adult California tiger salamander occurrence has been reported within 3.1 miles of the Project boundaries (Figure 3). This adult individual, the closest confirmed occurrence of an adult California tiger salamander, lies approximately 12,000 feet (2.27 miles) north of the Project area (Occurrence No. 1037). The closest confirmed breeding (larvae) occurrence of California tiger salamander lies approximately 18,890 feet (3.57 miles) north of the Project area (Occurrence No. 1180), well outside the 3.1-mile buffer recommended for habitat assessments.

2.3.2 Habitat Assessment

2.3.2.1 Upland Dispersal/Refugia Habitat

Under the dryland farming land use, land management practices include discing to improve water retention, minimize erosion loss, and control invasive species. Those areas not being actively farmed are grazed or otherwise managed to support fire control, and firebreaks are maintained along all fence lines and roadways. On average, any land under dryland farming is subject to as many as

3 years of crop planting, growth, and harvest. During this time, these lands would obstruct the movement and dispersal of California tiger salamanders, and would be unavailable to ground squirrels and other small mammals, whose burrows provide refugia for California tiger salamanders. When the land is left fallow or grazed, small-mammal burrows could provide temporary refugia if they recolonize the area, and the land would be passable for California tiger salamander movement and dispersal.

Outside of lands under dryland farming, islands of nonnative annual grassland remain in the immediate uplands surrounding wetland features and in the interstitial valleys and drainages too steep to farm (or areas that are not farmed to avoid impacts on wetlands). However, these areas provide bands of upland/refugia habitat that are too narrow (less than 1,844 feet wide) and, consequently, have too little acreage, and it is unlikely that they might support a viable population of California tiger salamander after 100 years or more of dryland farming practices.

Ground squirrel activity was scarce within and in the immediate vicinity of the Project area; however, a limited number of small-mammal burrows were observed occasionally in the isolated patches of nonnative annual grassland.

2.3.2.2 Aquatic Habitat

Table 1 summarizes the results of the aquatic habitat assessment. The only two wetland features that support suitable habitat for California tiger salamander breeding are on-site Wetland Features J and N, which were characterized as intact ponds with deep standing water and mature emergent and shoreline vegetation. These wetland features also have limited upland refugia/dispersal habitat with either infrequent (Wetland Feature N) or no (Wetland Feature J) small-mammal burrowing activity or cracks and fissures. Similarly, on-site Wetland Features B and P and off-site Wetland Features 4 and 13 support moderately suitable habitat for California tiger salamander breeding, characterized as pools or swales with recent signs of standing water, poorly developed emergent or shoreline vegetation, and limited upland refugia/dispersal habitat. Appendix D provides photos of wetland features in the study area.

2.3.3 Aquatic Sampling

2.3.3.1 Dip-Net Sampling

No California tiger salamander eggs, larvae, juveniles, or adults were detected in the study area during the 2018 aquatic sampling surveys. Additional amphibian species observed in the study area during aquatic sampling surveys included Sierra tree frog adults and tadpoles.

2.3.3.2 eDNA Sampling

No California tiger salamanders were detected in the wetland features sampled using eDNA analysis. The eDNA laboratory results for the off-site control and positive control samples were negative and positive, respectively (Appendices B and C).

Table1. California Tiger Salamander Aquatic Habitat Assessment

Wetland Feature	Survey Date/ Status*	Wetland Feature Type	Water Present (during visit)	Aquatic (A) Vegetation/Upland (U) Vegetation+	Obstructions to Upland Dispersal/ Movement	Burrow/ Refugia Type (abundance)	Habitat Suitability
On-Site							
Feature A	May 15–Not Detected	–	–	–	–	–	–
Feature B	May 15–Surveyed	Pool	Standing water (shallow)	A: Cattails U: NNAG, blackberry	Dryland Farming	None observed	Moderate
Feature C	May 15–Inaccessible	–	–	–	–	–	–
Feature D	No PTE	–	–	–	–	–	–
Feature E	June 28–Inaccessible	–	–	–	–	–	–
Feature F	No PTE	–	–	–	–	–	–
Feature G	No PTE	–	–	–	–	–	–
Feature H	Not Surveyed	–	–	–	–	–	–
Feature I	May 15–Surveyed	Depression	Dry	A: NNAG U: NNAG, mustard	Dryland Farming, Stratton Lane	None observed	Low
Feature J	May 15–Surveyed	Pond	Standing water (deep)	A: Cattails, algae U: NNAG, saltgrass	Dryland Farming, Stratton Lane	None observed	Good
Feature K	June 28–Surveyed	Depression	Dry	A: Pickleweed, NNAG U: NNAG, rabbitsfoot, pickleweed, saltgrass, alkaliweed	Dryland Farming, Stratton Lane	None observed	Low
Feature L	May 15–Surveyed	Pond (alkali pool)	Standing water (depth unknown)	A: None U: NNAG, mustard	Dryland Farming, Stratton Lane	None observed	Low
Feature M	Not Surveyed	–	–	–	–	–	–
Feature N	May 15–Surveyed	Pond	Standing water (deep)	A: Cattails, algae U: NNAG, mustard	Dryland Farming, Stratton Lane	Ground squirrel (infrequent)	Good
Feature O	Not Surveyed	–	–	–	–	–	–
Feature P	May 15–Surveyed	Pool	Standing water (shallow)	A: Cattails, algae U: NNAG, saltgrass	Dryland Farming, Stratton Lane	Ground squirrel (infrequent)	Moderate
Feature Q	June 28–Surveyed	Pool	Dry	A: Pickleweed, algae U: NNAG. Salty top soil layer.	Dryland Farming, Stratton Lane	Cracks/ fissures	None
Feature R	Not Surveyed	–	–	–	–	–	–
Feature S	May 15–Not Detected	–	–	–	–	–	–

Table1. California Tiger Salamander Aquatic Habitat Assessment

Wetland Feature	Survey Date/ Status*	Wetland Feature Type	Water Present (during visit)	Aquatic (A) Vegetation/Upland (U) Vegetation+	Obstructions to Upland Dispersal/ Movement	Burrow/ Refugia Type (abundance)	Habitat Suitability
Off-Site							
Feature 1	No PTE	–	–	–	–	–	–
Feature 2	No PTE	–	–	–	–	–	–
Feature 3	June 7 Surveyed	Depression	Dry	A: NNAG U: NNAG	Dryland Farming	None observed	None
Feature 4	June 7 Surveyed	Pool	Dry	A: NNAG, rushes U: NNAG, rushes	Dryland Farming, Birds Landing Road	Ground squirrel (infrequent)	Moderate
Feature 5	June 7 Surveyed	Pool (creek)	Dry	A: Barren U: Blackberry, NNAG	Dryland Farming	None observed	None
Feature 6	June 7 Surveyed	Pool (creek)	Standing water	A: Cattails U: NNAG, mustard, rabbitsfoot	Dryland Farming	Cracks/fissures	None
Feature 7	No PTE	–	–	–	–	–	–
Feature 8	No PTE	–	–	–	–	–	–
Feature 9	No PTE	–	–	–	–	–	–
Feature 10	No PTE	–	–	–	–	–	–
Feature 11	No PTE	–	–	–	–	–	–
Feature 12	No PTE	–	–	–	–	–	–
Feature 13	June 7 Surveyed	Swale/ depression	Dry	A: NNAG U: NNAG	Dryland Farming	Ground squirrel (infrequent), cracks/fissures	Moderate

* **Not Detected:** Wetland feature was not detectible during the on-site habitat assessment; **Inaccessible:** Vegetation/fencing prohibited access to the wetland feature; **No PTE:** Permission to Enter (PTE) was not granted by the private landowner at the time of the survey.

\+ **NNAG:** Non-Native Annual Grassland

3 Conclusions and Discussion

On-site Wetland Features J and N (Figure 5) are characterized by elements that could provide potentially suitable breeding habitat for California tiger salamander. These elements include intact ponds with deep standing water, and mature emergent and shoreline vegetation. However, upland areas adjacent to these wetland features provide only limited upland refugia/dispersal habitat, with either infrequent or no small-mammal burrowing activity or cracks and fissures. Similarly, on-site Wetland Features B and P and off-site Wetland Features 4 and 13 would be considered moderately suitable breeding habitat for California tiger salamander. These features were characterized as pools or swales with recent signs of standing water, poorly developed emergent or shoreline vegetation, and limited upland refugia/dispersal habitat. The results of the eDNA sampling show no sign of California tiger salamander presence in the wetland features sampled (Figure 5), even those features with otherwise suitable habitat.

All of the wetland features in the study area are 2.27 miles or more from the nearest known California tiger salamander occurrence (Occurrence No. 1037), and 3.57 miles or more from the nearest known California tiger salamander breeding occurrence (Occurrence No. 1180) (Figure 2). In addition, the upland habitat located between these occurrences and wetland features within the habitat assessment study area consists of fallow, grazed and dryland farm lands. These lands undergo regular disturbances as part of the active farming practices underway, making it inhospitable and impassible to dispersing salamanders for an average of 3 out of every 5 years. California tiger salamanders have a typical age-to-first-reproduction of 4–5 years, with 1.4 reproduction events in a lifetime and a life span of up to 10 years (USFWS 2014). Given these life history characteristics, the ongoing land use practices limit opportunities for California tiger salamanders to successfully migrate and disperse between upland refugia habitat and aquatic breeding habitat.

This conclusion is consistent with previous California tiger salamander habitat assessments conducted in or near portions of the Project study area. In the habitat assessment for the Solano 4 West project site, formerly the Collinsville Wind Project, Jennings (2009) determined that the absence of suitable aquatic habitat on site and the lack of nearby California tiger salamander records in both aquatic and upland habitats indicate that this species is not present. The 2017 California tiger salamander habitat assessment conducted in Solano 4 West (AWE 2017b) concluded that despite potentially suitable upland habitat present within the Project area, multiple barriers to California tiger salamander movement/dispersal exist between the nearest known occurrences and the Project area in the form of roads and developed habitat. These barriers include the multiple wind turbine access roads and Birds Landing Road which would restrict California tiger salamander movements between the nearest known CNDDB occurrences and the northernmost point of the Project area. Additional wind turbine access roads as well as Montezuma Hills Road and Talbert Lane act restrict California tiger salamander movement to the more southern portions of the Project area. The Sacramento River forms a barrier to movement from the south and east, and Suisun Marsh a barrier from the west.

Annual monitoring reports prepared for the neighboring Montezuma wetlands off-site also provide information about habitat conditions for California tiger salamanders west of Collinsville Road. The Montezuma Wetlands Restoration Project began in 2004 with the goal of converting 1,800 acres of reclaimed tidelands into tidal and seasonal wetlands along the northeastern side of Montezuma Slough over a 15-year period. Although biological monitoring efforts for special-status aquatic species include surveys for listed branchiopods and amphibians, the California tiger salamander was not included as a target species, and no evidence of recolonization by California tiger salamander has been reported to date (Acta Environmental, Inc. 2015).

Any California tiger salamanders remaining in the Montezuma Hills are unlikely to breed successfully under the adverse conditions that characterize this area. These adverse conditions include highly disturbed uplands that continue to be subject to disturbing land use practices, limited upland refugia, regular disruptions/barriers to dispersal, and habitat fragmentation. These conditions make recruitment of future generations of salamanders unlikely. This conclusion is supported by eDNA sampling, which did not detect the presence of California tiger salamanders in representative ponds in the study area. As such, based on the ongoing land use practices, the Montezuma Hills likely represents a population sink where California tiger salamander persistence is unlikely, and recolonization is unlikely to be successful. For these reasons, California tiger salamander is not expected to occur on the Project site.

4 References

Acta Environmental, Inc. 2011 (August). *Report on Biological Surveys, 2008/2009: Montezuma Wetlands Project, Solano County, California*. Unpublished report to Montezuma Wetlands LLC.

Anderson, P. R. 1968. *The Reproductive and Developmental History of the California Tiger Salamander.* Unpublished M.A. thesis, Fresno State College, Fresno, California.

Area West Environmental, Inc. 2017a (July). Solano Phase 4 Wind Project: California Tiger Salamander Habitat Assessment, Solano County, California.

Area West Environmental, Inc. 2017b (August). Solano Phase 4 Wind Project: Habitat Assessment and Vegetation Mapping Summary Report, Solano County, California (Internal Review Draft).

Barry, S. J., and H. B. Shaffer. 1994. The Status of the California Tiger Salamander (*Ambystoma californiense*) at Lagunita: a 50-Year Update. *Journal of Herpetology* 28:159–164.

California Department of Fish and Wildlife (CDFW). 2018a (July). California Natural Diversity Database. Version 5. Database query of the Antioch North, Denverton, Birds Landing, Rio Vista, Honker Bay, Jersey Island, Clayton, Antioch South, and Brentwood 7.5-minute U.S. Geological Survey Quadrangles. Wildlife and Habitat Data Analysis Branch.

California Department of Fish and Wildlife (CDFW). 2018b. California Wildlife Habitat Relationships System, Life History Accounts and Range Maps. Available: http://www.dfg.ca.gov/biogeodata/cwhr/cawildlife.aspx.

California Department of Fish and Wildlife (CDFW). 2018c. California Tiger Salamander Predicted Habitat—CWHR A001 [ds1968]. BIOS Viewer. Available: https://www.wildlife.ca.gov/Data/CNDDB/Maps-and-Data#43018408-cnddb-in-bios.

Collins, J. P., T. R. Jones, and H. J. Beina. 1988. Conserving Genetically Distinctive Populations: The Case of the Huachuca Tiger Salamander (*Ambystoma tigrinum stebbinsi Lowe*). In *Proceedings of the Symposium on the Management of Amphibians, Reptiles, and Small Mammals in North America*, tech. coords. R. C. Szaro, K. E. Severson, and D. R. Patton, 45–53. U.S. Forest Service General Technical Report RM-166.

Feaver, P. E. 1971. *Breeding Pool Selection and Larval Mortality of Three California Amphibians:* Ambystoma tigrinum californiense *(Gray),* Hyla regilla *(Baird and Girard), and* Scaphiopus hammondi hammondi *(Girard).* M.A. thesis, Fresno State College, Fresno, CA.

Goude, Cay, Carl Wilcox, Jane Hicks, Mike Monroe, Andrew Jensen, Colleen Ferguson, Dan Schurman, Keith Kaulum, Carolyn Wasem, and Joannie Dranginis. 2005. *Santa Rosa Plain Conservation Strategy. Final.* Available:

http://www.fws.gov/sacramento/es/documents/Santa_Rosa_Final_Conservation_Strategy/Appendix_C_FWS_CTS_Survey_Protocols.pdf.

Jennings, Mark R. 2010 (May). *Second Addendum Habitat Assessment for the California Tiger Salamander (*Ambystoma californiense*), California Red-Legged Frog (*Rana draytonii*), and Giant Garter Snake (*Thamnophis gigas*), on the Proposed Tie-In Transmission Line Substation at the Collinsville Wind Project Site, Solano County, California*. Unpublished Report to Michele Barlow, Insignia Environmental.

Jennings, Mark R. and Marc P. Hayes. 1994. *Amphibian and Reptile Species of Special Concern in California.* Final Report to the California Department of Fish and Game.

Searcy, C. A., and H. B. Shaffer. 2011. Determining the Migration Distance of a Vagile Vernal Pool Specialist: How Much Land is Required for Conservation of California Tiger Salamanders? In *Research and Recovery in Vernal Pool Landscapes*, eds. D. G. Alexander and R. A. Schlising, 73–87. *Studies from the Herbarium* 16. California State University, Chico.

Shaffer, H. B., and R. Fisher. 1991. *Final Report to the California Department of Fish and Game: California Tiger Salamander Surveys, 1990*. Contract (FG 9422). Rancho Cordova: California Department of Fish and Game, Inland Fisheries Division.

Shaffer, H. B., R. N. Fisher, and S. E. Stanley. 1993. *Status Report: The California Tiger Salamander (*Ambystoma californiense*)*. Final report to the California Department of Fish and Game, Inland Fisheries Division, Rancho Cordova, under Contracts FG 9422 and FG 1383.

Stebbins, R. C. 2003. *A Field Guide to Western Reptiles and Amphibians.* 3rd Edition. New York: Houghton Mifflin Company.

Storer, Tracy I. 1925. A Synopsis of the Amphibia of California. *University of California Publications in Zoology*, Vol. 27. Berkeley: University of California Press. Pages 1–43, 231–245, 330, 331, and 336–339.

U.S. Fish and Wildlife Service (USFWS). 2004 (August 4). Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the California Tiger Salamander; and Special Rule Exemption for Existing Routine Ranching Activities; Final Rule. Federal Register 69(149): 47212-47248. August 4. http://ecos.fws.gov/docs/federal_register/fr4278.pdf.

U.S. Fish and Wildlife Service (USFWS). 2005 (August 23). Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the California Tiger Salamander, Central Population; Final Rule. 50 CFR Part 17. *Federal Register* 70 (162):49380–49458. Available: https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=D01T.

U.S. Fish and Wildlife Service (USFWS). 2014 (October 21). *California Tiger Salamander Central California Distinct Population Segment (*Ambystoma californiense*) 5-Year Review: Summary and Evaluation.* Sacramento Fish and Wildlife Office, Sacramento, CA. Available: https://ecos.fws.gov/docs/five_year_review/doc4466.pdf.

U.S. Fish and Wildlife Service and California Department of Fish and Game (USWS and CDFG). 2003 (October). *Interim Guidance on Site Assessment and Field Surveys for Determining Presence or a Negative Finding of the California Tiger Salamander*. Available: http://www.fws.gov/pacific/ecoservices/endangered/recovery/documents/CalTigerSalamander.2003.protocol.pdf.

APPENDIX A

Solano Wind 4 Pond Index

Appendix A. Solano Wind 4 Pond Index

Wetland Feature	Project Component	Jennings 2009	Area West 2016	Area West 2017
On Site				
Feature A	Phase IV-East	–	–	–
Feature B	Phase IV-East	–	–	–
Feature C	Phase IV-West	–	–	99
Feature D	Phase IV-West	"seasonal wetland"	–	32, 86, 92
Feature E	Phase IV-West	"seasonal wetland"	W-33, W-34, W-35	34, 33, 31, 19, 16, 4
Feature F	Phase IV-West	–	–	96
Feature G	Phase IV-West	–	–	96
Feature H	Phase IV-West	–	–	75
Feature I	Phase IV-West	–	W-22, W-24	22
Feature J	Phase IV-West	–	W-17, W-20, W-21	20, 21, 17, 25, 23
Feature K	Phase IV-West	–	–	74, 30, 29, 26, 27
Feature L	Phase IV-West	–	W-37	37, 15
Feature M	Phase IV-West	–	W-27	81, 82, 78, 76
Feature N	Phase IV-West	–	–	72
Feature O	Phase IV-West	–	W-15	–
Feature P	Phase IV-West	–	–	–
Feature Q	Phase IV-West	–	–	83
Feature R	Phase IV-West	–	W-18	–
Feature S	Phase IV-East	-	-	-
On Site				
Feature 1	Phase IV-West	–	–	56
Feature 2	Phase IV-West	–	–	67
Feature 3	Phase IV-West	–	–	–
Feature 4	Homerun	–	–	41
Feature 5	Homerun	–	–	–
Feature 6	Homerun	"wetland drainage"	–	52/51/1/50
Feature 7	Homerun	–	–	–
Feature 8	Phase IV-East	–	–	–
Feature 9	Phase IV-East	–	–	–
Feature 10	Phase IV-East	–	–	–
Feature 11	Phase IV-East	–	–	–
Feature 12	Phase IV-East	–	–	56
Feature 13	Phase IV-West	–	–	67

APPENDIX B

California Tiger Salamander Field Sampling Results

Appendix B. California Tiger Salamander Field Sampling Results

Sample ID	CTS Detection	Sample Date	Sample ID	CTS Detection	Sample Date
AECOM SWIV L1	ND	5/15/2018	AECOM SWIV 6A	ND	6/7/2018
AECOM SWIV L2	ND	5/15/2018	AECOM SWIV 6B	ND	6/7/2018
AECOM SWIV L3	ND	5/15/2018	AECOM SWIV 6C	ND	6/7/2018
AECOM SWIV L4	ND	5/15/2018	AECOM SWIV 6D	ND	6/7/2018
AECOM SWIV P1	ND	5/15/2018	eDNA Extraction Control 06/12/2018	ND	6/12/2018
AECOM SWIV P2	ND	5/15/2018	NTC (qPCR no Template Control)	ND	
AECOM SWIV P3	ND	5/15/2018	Positive Control	+	
AECOM SWIV P4	ND	5/15/2018	AECOM SWIV 13A	ND	6/7/2018
AECOM SWIV B1	ND	5/15/2018	AECOM SWIV 13B	ND	6/7/2018
AECOM SWIV B2	ND	5/15/2018	AECOM SWIV 4A	ND	6/7/2018
AECOM SWIV B3	ND	5/15/2018	AECOM SWIV 4B	ND	6/7/2018
AECOM SWIV B4	ND	5/15/2018	EDNA Extraction Control 06/18/2018	ND	6/18/2018
AECOM SWIV J1	ND	5/15/2018	NTC (qPCR no Template Control)	ND	
AECOM SWIV J2	ND	5/15/2018	Positive Control	+	
AECOM SWIV J3	ND	5/15/2018	AECOM SWIV K1	ND	7/3/2018
AECOM SWIV J4	ND	5/15/2018	AECOM SWIV K2	ND	7/3/2018
AECOM SWIV X1	ND	5/15/2018	AECOM SWIV Q1	ND	7/3/2018
AECOM SWIV X2	ND	5/15/2018	AECOM SWIV Q2	ND	7/3/2018
AECOM SWIV X3	+	5/15/2018	EXTRACTION CONTROL	ND	7/11/2018
AECOM SWIV X4	+	5/15/2018	NTC (qPCR no Template Control)	ND	
AECOM SWIV N1	ND	5/15/2018	Positive Control	+	
AECOM SWIV N2	ND	5/15/2018			
AECOM SWIV N3	ND	5/15/2018			
AECOM SWIV N4	ND	5/15/2018			
eDNA Extraction Control 051718	ND	5/17/2018			
eDNA Extraction Control 051818	ND	5/18/2018			
NTC (qPCR no Template Control)	ND				
Positive Control	+				

APPENDIX C

California Tiger Salamander eDNA Laboratory Metadata

Appendix C. California Tiger Salamander eDNA Laboratory Metadata

sample_id	cq_rep_1	cq_rep_2	cq_rep_3	avg_cq	Sample Location	Collection Date	CTS Positive	Sample Type
AECOM SWIV L1	0.00	0.00	0.00	0.00	L1	5/15/2018	0	Sterivex Filter
AECOM SWIV L2	0.00	0.00	0.00	0.00	L2	5/15/2018	0	Sterivex Filter
AECOM SWIV L3	0.00	0.00	0.00	0.00	L3	5/15/2018	0	Sterivex Filter
AECOM SWIV L4	0.00	0.00	0.00	0.00	L4	5/15/2018	0	Sterivex Filter
AECOM SWIV P1	0.00	0.00	0.00	0.00	P1	5/15/2018	0	Sterivex Filter
AECOM SWIV P2	0.00	0.00	0.00	0.00	P2	5/15/2018	0	Sterivex Filter
AECOM SWIV P3	0.00	0.00	0.00	0.00	P3	5/15/2018	0	Sterivex Filter
AECOM SWIV P4	0.00	0.00	0.00	0.00	P4	5/15/2018	0	Sterivex Filter
AECOM SWIV B1	0.00	0.00	0.00	0.00	B1	5/15/2018	0	Sterivex Filter
AECOM SWIV B2	0.00	0.00	0.00	0.00	B2	5/15/2018	0	Sterivex Filter
AECOM SWIV B3	0.00	0.00	0.00	0.00	B3	5/15/2018	0	Sterivex Filter
AECOM SWIV B4	0.00	0.00	0.00	0.00	B4	5/15/2018	0	Sterivex Filter
AECOM SWIV J1	0.00	0.00	0.00	0.00	J1	5/15/2018	0	Sterivex Filter
AECOM SWIV J2	0.00	0.00	0.00	0.00	J2	5/15/2018	0	Sterivex Filter
AECOM SWIV J3	0.00	0.00	0.00	0.00	J3	5/15/2018	0	Sterivex Filter
AECOM SWIV J4	0.00	0.00	0.00	0.00	J4	5/15/2018	0	Sterivex Filter
AECOM SWIV X1	0.00	0.00	0.00	0.00	X1	5/15/2018	0	Sterivex Filter
AECOM SWIV X2	0.00	0.00	0.00	0.00	X2	5/15/2018	0	Sterivex Filter
AECOM SWIV X3	35.15	35.43	35.32	35.30	X3	5/15/2018	1	Sterivex Filter
AECOM SWIV X4	33.36	34.10	33.32	33.59	X4	5/15/2018	1	Sterivex Filter
AECOM SWIV N1	0.00	0.00	0.00	0.00	N1	5/15/2018	0	Sterivex Filter
AECOM SWIV N2	0.00	0.00	0.00	0.00	N2	5/15/2018	0	Sterivex Filter
AECOM SWIV N3	0.00	0.00	0.00	0.00	N3	5/15/2018	0	Sterivex Filter
AECOM SWIV N4	0.00	0.00	0.00	0.00	N4	5/15/2018	0	Sterivex Filter
AECOM SWIV 6A	0.00	0.00	0.00	0.00	6A	6/7/2018	0	Sterivex Filter
AECOM SWIV 6B	0.00	0.00	0.00	0.00	6B	6/7/2018	0	Sterivex Filter
AECOM SWIV 6C	0.00	0.00	0.00	0.00	6C	6/7/2018	0	Sterivex Filter
AECOM SWIV 6D	0.00	0.00	0.00	0.00	6D	6/7/2018	0	Sterivex Filter
AECOM SWIV 13A	0.00	0.00	0.00	0.00	13A	6/7/2018	0	Soil
AECOM SWIV 13B	0.00	0.00	0.00	0.00	13B	6/7/2018	0	Soil
AECOM SWIV 4A	0.00	0.00	0.00	0.00	4A	6/7/2018	0	Soil
AECOM SWIV 4B	0.00	0.00	0.00	0.00	4B	6/7/2018	0	Soil
AECOM SWIV K1	0.00	0.00	0.00	0.00	K1	7/3/2018	0	Soil
AECOM SWIV K2	0.00	0.00	0.00	0.00	K2	7/3/2018	0	Soil
AECOM SWIV Q1	0.00	0.00	0.00	0.00	Q1	7/3/2018	0	Soil
AECOM SWIV Q2	0.00	0.00	0.00	0.00	Q2	7/3/2018	0	Soil

APPENDIX D

Photos of Wetland Features

Photo 1: Wetland Feature B, a pool with shallow standing water; habitat suitability Moderate.

Photo 2: Wetland Feature I, a dry depression; habitat suitability Low.

Photo 3: Wetland Feature J, a pond with deep standing water; habitat suitability Good.

Photo 4: Wetland Feature K, a dry depression; habitat suitability Low.

Photo 5: Wetland Feature L, an alkali pool with standing water; habitat suitability Low.

Photo 6: Wetland Feature N, a pond with deep standing water; habitat suitability Good.

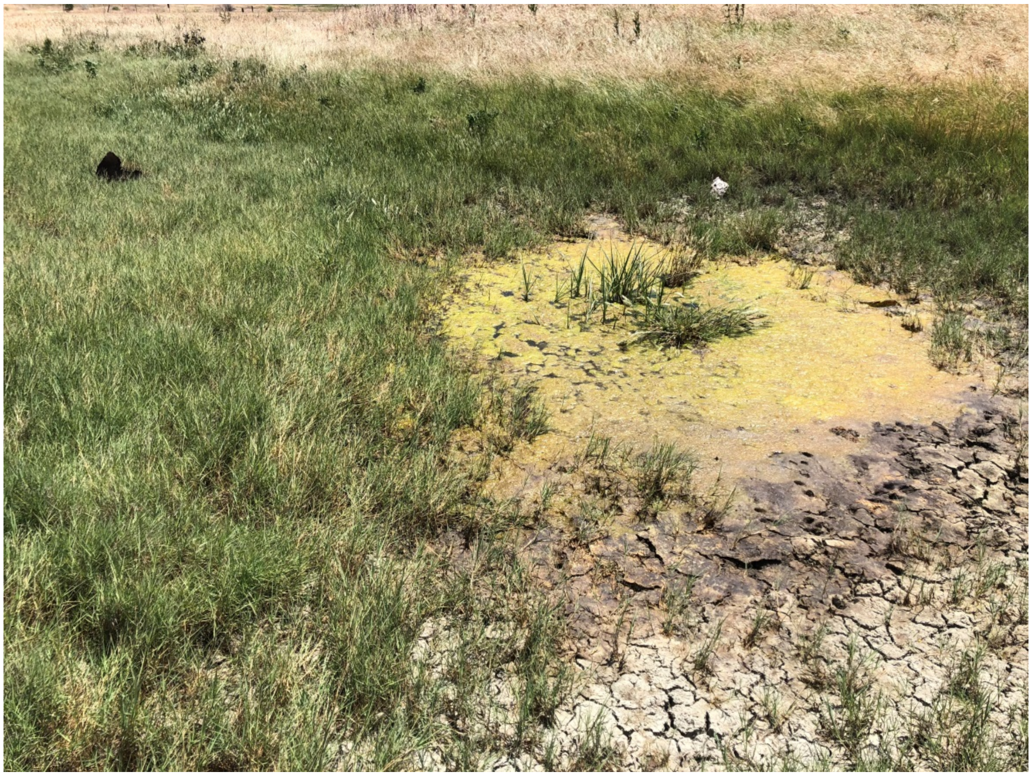

Photo 7: Wetland Feature P, a pool with shallow water, covered in algae; habitat suitability Moderate.

Photo 8: Wetland Feature Q, a dry depression with a salt layer on top of the soil; habitat suitability None.

Photo 9: Wetland Feature 4, a dry pool; habitat suitability Moderate.

Photo 10: Wetland Feature 5, a dry pool that is part of a creek; habitat suitability None.

Photo 11: Wetland Feature 6, a dry pool that is part of a creek; habitat suitability None.

Photo 12: Wetland Feature 13, a dry depression; habitat suitability Moderate.

No photo available for Wetland Feature 3

California Tiger Salamander Habitat Assessment (AWE)

SOLANO PHASE 4 WIND PROJECT

CALIFORNIA TIGER SALAMANDER HABITAT ASSESSMENT
SOLANO COUNTY, CALIFORNIA

Prepared for:

Sacramento Municipal Utility District
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Sacramento, California, 95817
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July 2017

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Table of Acronyms

AWE	Area West Environmental, Inc.
CDFW	California Department of Fish and Wildlife
CNDDB	California Natural Diversity Database
CTS	California tiger salamander
DPS	Distinct Population Segment
ESA	Endangered Species Act
GIS	Geographic Information System
GPS	Global Positioning System
MW	Megawatt
Project	Solano Phase IV Wind Project
SMUD	Sacramento Municipal Utility District
Study Area	Project area and area within a 1.2 mile buffer
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geologic Survey

1.0 Introduction

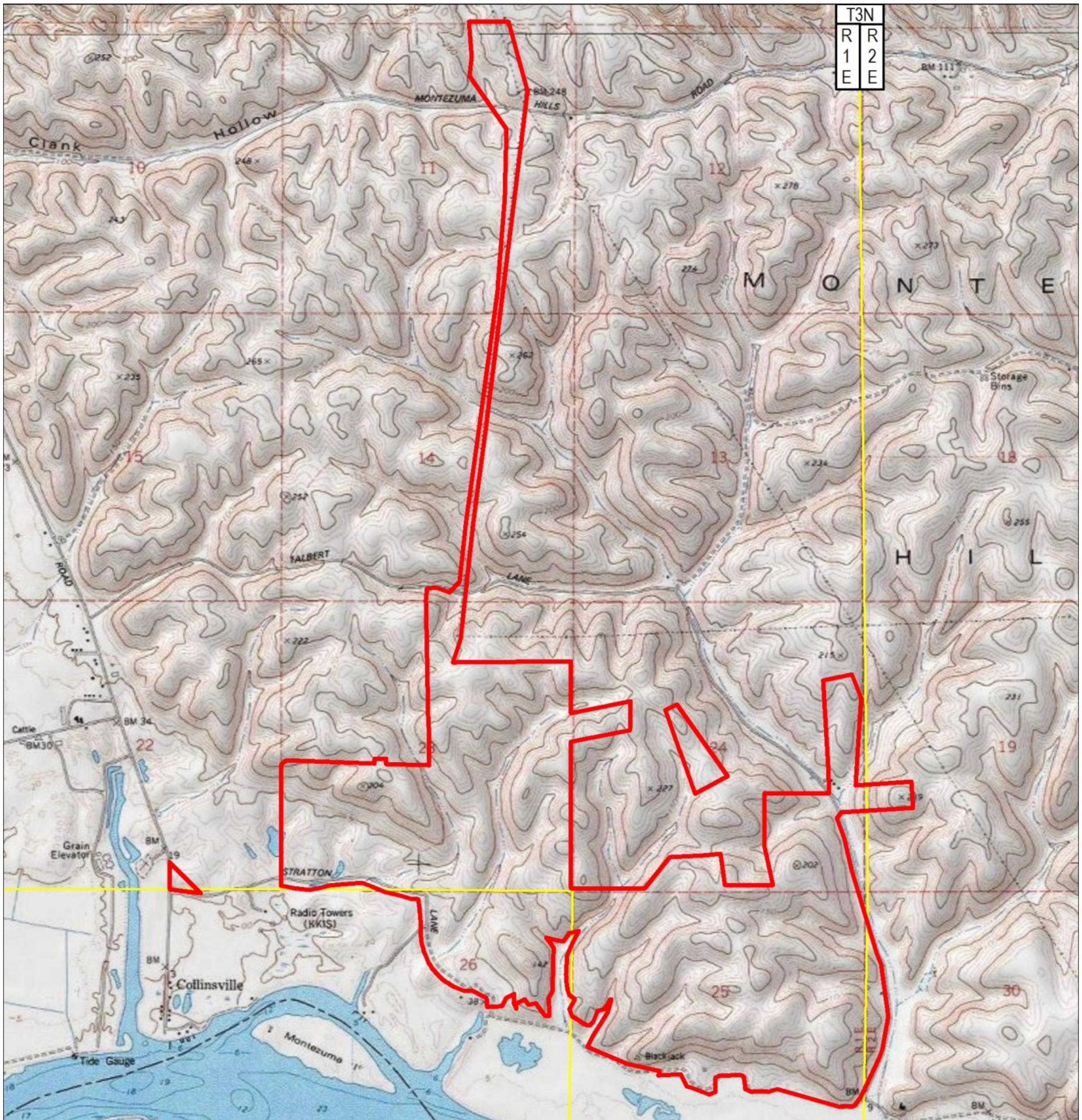
The Sacramento Municipal Utility District (SMUD) is proposing to develop the Solano Phase IV Wind Project (Project) in the Montezuma Hills in Solano County, California (Figure 1). Area West Environmental, Inc. (AWE) conducted surveys to characterize vegetation communities and aquatic habitat types to assess their potential to support California tiger salamander (*Ambystoma californiense*) (CTS).

1.1 Project Location and Description

The Project is located immediately east of the community of Collinsville in Solano County, California (Figure 1), specifically in portions of Sections 2, 22, 23, 24, 25, and 26; Township 3 North, and Range 1 East of the Antioch North and Bird's Landing U.S. Geological Survey (USGS) 7.5-minute quadrangle maps (Figure 2). Consisting of rolling hills characteristic of the Montezuma Hills area, the Project area is bordered to the south by Stratton Lane, which is just north of the Sacramento River, and to the north and east by existing SMUD wind energy generating facilities (Solano Wind Phases 1, 2, and 3). Within the 1,172-acre Project area, there are existing rows of wind turbines along the hilltops and ridgelines that are connected by gravel roads.

The Project area also includes staging areas which are located within the adjacent SMUD wind facilities, potential access road locations, energy collection systems (transmission lines), and a SMUD substation located just north of Montezuma Hills Road (Figures 1 and 2). SMUD proposes to replace existing wind turbines in the Project area. The Project would also include construction of new access roads, meteorological towers, and a power collection system, including a transmission line to the existing power substation.

Figure 1. Project Vicinity



SOLANO PHASE 4 WIND PROJECT

The Solano Phase 4 Project Area is located in the southeast portion of the County of Solano. The site encompasses approximately 1,172 acres.

The Project Area is located in the Antioch North and Birds Landing USGS 7.5-minute quadrangle map. The project occurs within Sections 2, 11, 14, 22, 23, 24, 25, and 26, Township 3 North, Range 1 East, and Section 19 and 30, Township 3 North, Range 2 East. A portion of sourthern area of the Project Area is unsectioned.

Center coordinates for the Project Area are:
WGS84 Latitude 38.080932, Longitude -121.827222
UTM Zone 10 South NAD83 Northing 4215443m, Easting 602855m

Data Source:
- Area West Environmental, Inc. 2016
- CH2MHILL, 2016
- ESRI ArcGIS Online, USGS and ©2013 National Geographic Society

Date: 12-6-16

Solano Phase IV Project Area
Township Range Boundary

0 1,000 2,000 3,000 feet
1 inch = 3,000 feet

SMUD
AREA WEST ENVIRONMENTAL, INC.

Figure 2. Project Location

2.0 Species Description

Information regarding the legal status, species description, habitat requirements, and life history of CTS is provided below.

1.1 Legal Status

Due to population declines resulting primarily from habitat loss, the Central California Distinct Population Segment (DPS) of CTS was federally listed as threatened under the federal Endangered Species Act (ESA) on August 4, 2004 (U.S. Fish and Wildlife Service [USFWS] 2004). The species was state listed as threatened under the California ESA on August 19, 2010. The USFWS published a final rule to designate Critical Habitat for the Central DPS of CTS on August 31, 2011. The nearest area of designated Critical habitat unit for CTS is located approximately 7.8 miles north of the Project area.

1.2 Geographical Distribution

CTS is endemic to California. The historic range of this species is not well known because it has been fragmented, but they were probably distributed throughout most of the Central Valley where there was suitable vernal pool and grassland habitat, from Tulare County north to at least Yolo County, and in the south coast ranges from San Luis Obispo County north to Monterey Bay east of the Bay Area (Storer 1925). Isolated populations now occur in the Sacramento Valley at Gray Lodge National Wildlife Refuge and near Dunnigan, California. Two other populations have been isolated from the general range long enough that they may constitute two unique species, one in Sonoma County near Santa Rosa, and another in Santa Barbara County (Stebbins 2003, Stebbins and McGinnis 2012).

1.3 Species Description

The CTS is a large (75-125 millimeter snout to vent length) terrestrial salamander with a black body dotted with yellow to white spots (Stebbins and McGinnis 2012). Undersurfaces are highly variable in pattern, ranging from nearly uniform white or pale yellow to variegated white or pale yellow and black (Jennings and Hayes 1994). Larval CTS are variable in coloration that ranges from dark green with black spots in aquatic habitats with clear water to light gray or pink in features with turbid water (Alvarez and Foster 2016). This appears to be an adaptation in order to camouflage larvae from predators. Larval CTS are differentiated from adults by the presence of external gills (as opposed to lungs) and a large tail fin that runs from the base of the neck to the tip of the tail. As they metamorphose into adults, the tail fin and gills are absorbed, and the larval coloration transitions to adult coloration.

1.4 Habitat Requirements and Life History

CTS require both terrestrial and aquatic habitats in order to complete its life cycle. Adult salamanders will breed within seasonal ponds and wetlands, and perennial ponds (Loredo and Van Vuren 1996, Loredo at al. 1996). The CTS larvae develop within aquatic breeding habitat and then during the dry season will move into the surrounding uplands, living underground in fossorial mammalian burrows as metamorphosed juveniles and adults. Characteristic upland habitat consists of annual grasslands, which are typically grazed by livestock. Upland habitat must also contain mammal burrows or shrink-swell cracks that provide refugia, which is used during the majority of their lifecycle (USFWS 2004).

The breeding period for CTS is generally December through February. Females lay eggs in the water and attach the eggs to vegetation, twigs, debris, or in some cases, rocks (Stebbins and McGinnis 2012). The eggs of CTS hatch in approximately 10 to 14 days. Although the larvae of CTS can overwinter in appropriate habitats, the larval stage typically lasts between 3 and 6 months, and is largely dependent on the inundation period of the wetland (Alvarez 2004). Therefore, for the purposes of this report, CTS aquatic habitat is defined as any seasonal body of freshwater deeper than 12 inches that ponds, on average, for longer than 10 weeks. Although perennial waterbodies, such as stockponds, can also contain CTS, they are also more likely to contain predators such as fish, crayfish, and bullfrogs. CTS movements have been recorded at distances of up to 1.24 miles (2 kilometers) between upland habitat and breeding ponds (USFWS 2004). However, overland movements are significantly constrained by urban development and freeways (USFWS 2003).

3.0 Methods

The habitat assessment for CTS followed USFWS and California Department of Fish and Wildlife's (CDFW) *Interim Guidance on Conducting Site Assessments and Field Surveys for Determining Presence or a Negative Finding of the California Tiger Salamander* (USFWS 2003). The habitat assessment consisted of a pre-field assessment and a field assessment, as described below.

2.1 Pre-field Analysis

Per the 2003 USFWS protocol, prior to conducting field habitat assessments, information concerning occurrences for CTS within 3.1 miles (5 kilometer) radius of the Project area were noted using information from the CDFW California Natural Diversity Data Base (CNDDB), (Figure 3). Previous habitat assessments for portions of the Project area were also reviewed (Jennings 2009a, 2009b, and 2010).

Current and historic aerial photographs (Google Earth™) were analyzed for the presence of potential aquatic features with potential to support larval CTS development. Historic images were compared with one another to determine approximate hydroperiods of aquatic features and the extent and/or presence of emergent vegetation. Aerial photographic interpretation was also used to determine the current and historic extent of land use practices in the Project area, specifically winter wheat (*Triticum aestivum*) cultivation.

2.2 Field Surveys

Biologists Mark Noyes and Jeff Alvarez conducted site visits on March 30 and 31, 2016. Offsite habitats were further characterized by Mark Noyes on July 1, 2016. During the site visits, vegetation communities within the Project area were mapped and characterized based on dominant plant species, management practices (e.g., farming and grazing), and hydrology. The Project area was investigated using meandering transects with an all-terrain vehicle, where accessible, and on foot in steep areas or locations with limited access. Aquatic areas identified during pre-field investigations including those mentioned in previous habitat assessments (Jennings 2009a, Jennings 2009b, and Jennings 2010) were visited during the field surveys to determine if they could provide potential habitat for CTS.

In addition, as part of concurrent CTS and California red-legged frog (*Rana draytonii*) habitat assessments, additional aquatic features within 1.24 miles of the Project area were also characterized (hereafter "Study area"). Off-site areas that were inaccessible where viewed with binoculars from public roads to assess habitat suitability for CTS. All vegetation communities were drawn on aerial photographs and later digitized using Geographic Information System (GIS) software to calculate acreages. For some vegetation communities dominated by hydrophytic plant species (i.e., wetlands), boundaries were mapped using Global Positioning System (GPS) units with sub-meter accuracy.

Information obtained during the field visits included the size and maximum inundation depth of aquatic features, substrate and vegetation characteristics, general hydrology, surrounding upland characteristics, species observations (including presence of predatory species), and information regarding abundance and locations of aggregations of ground squirrel (*Spermophilus beecheyi*) and Botta's pocket gopher (*Thomomys bottae*) burrows. Aquatic features that were not accessible but appeared to have sufficient hydroperiods to support CTS larvae were considered potential habitat for CTS.

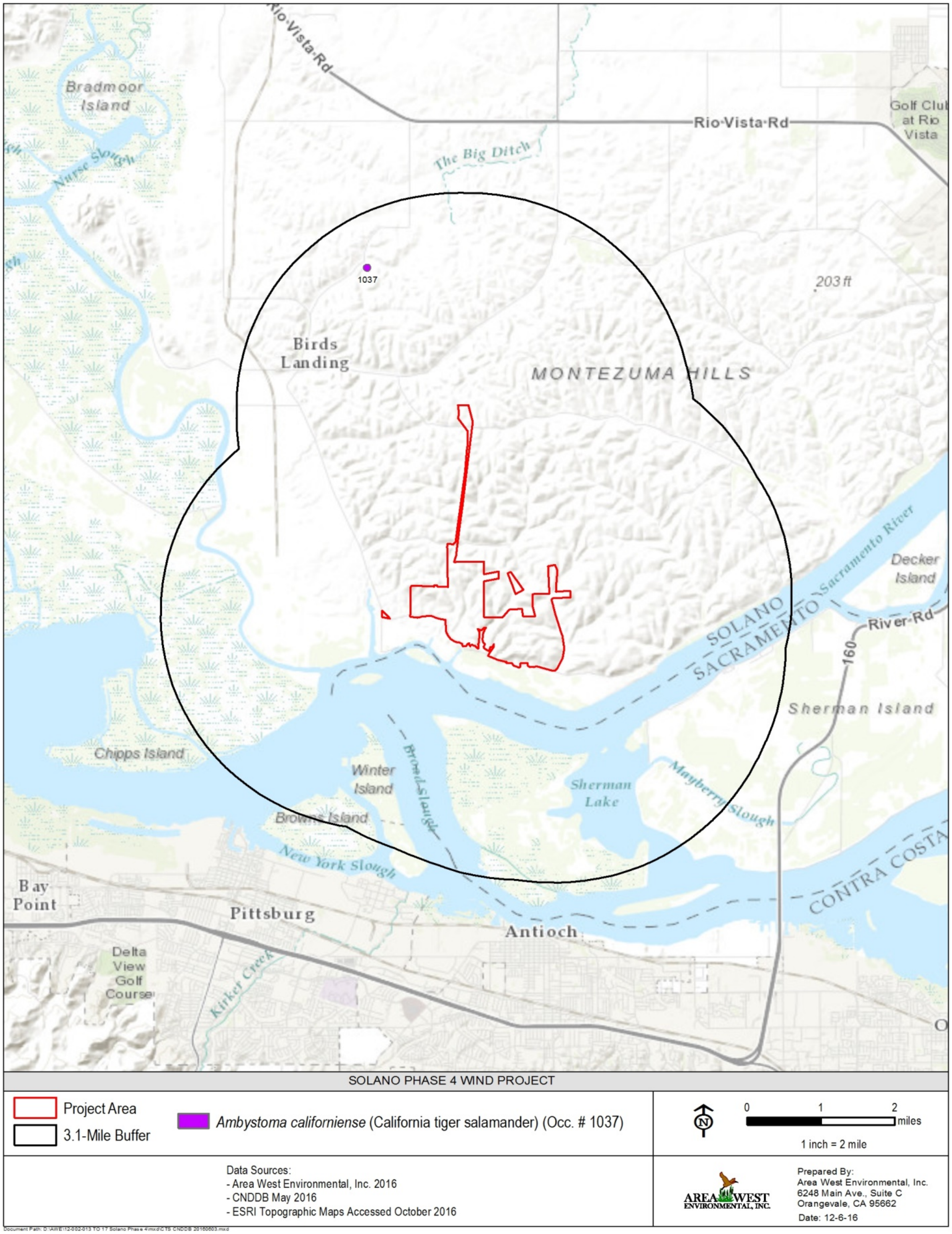


Figure 3. California Tiger Salamander CNDDB Occurrences

4.0 Results

3.1 Land Uses

The community of Collinsville is located in the southwest corner of the Study area, and low-density residential/rural development is present along the west side of Collinsville Road. Scattered residences are present throughout the Study area, typically just outside the boundaries of the large wind farms that comprise the majority of the Montezuma Hills area. The wind farms contain large wind turbines connected by graveled access roads and associated maintenance buildings and equipment yards.

Within the Project area, the open spaces between the wind turbines consist of wheat fields in various stages of production (disked, planted, and fallow). In general, a wheat crop is a 15 – 18 month process repeated every three years. For fallow wheat fields, including the eastern half of the Project area, wheat production had not occurred for at least 1 year, as evidenced by remnant stalks of wheat from previous harvests. These areas were grazed by sheep, with most grazing occurring along the hilltops and ridgelines, likely due to presence of the wind turbines, which provided shade in an area largely devoid of trees.

3.2 General Site Conditions

The majority of the Study area is characterized by rolling hills typical of the Montezuma Hills area. Bordered to the south by the Sacramento River Delta as it transitions into the Suisun Bay, the southern portion of the Project area is fringed with a mix of freshwater and brackish emergent marshes with some riparian tree cover, primarily consisting of willows (*Salix* sp.). Despite the steep terrain, relatively few drainages are present, consisting entirely of ephemeral drainages that convey water for short durations immediately following precipitation events.

3.3 CNDDB Occurrences

One CNDDB occurrence is within 3.1 miles of the Project area, CTS Occurrence #1037. Recorded in 2007, this occurrence consists of a single adult mapped at a burrow within a recently disked field for wheat production near a wind turbine. The area had until recently been fallow. (CNDDB 2017)

3.4 Aquatic Habitat

Of the 99 aquatic features assessed within the Study area, 7 aquatic features were determined to have potential to support larval CTS development (Figure 4, Table 1). Features 41, 54, 55, and 57 were inaccessible during field surveys, and are assumed to provide potential aquatic habitat to CTS based on suitable hydrology, as evidenced in aerial photographs (Figure 4).

Features 67 and 72, located just west of the Project area appeared to be seasonally-inundated (evidenced by a lack of perennial hydrophytic plant species) freshwater features that pond for sufficient durations to support larval CTS development. Feature 52, located just west of the transmission line segment of the Project area appeared to be a perennial stockpond fed by a well. Although the feature is perennial, based on the presence of willows, tules

(*Schoenoplectus acutus*), and cattails (*Typha* sp.), the likelihood of the presence of CTS predators is low due to the relative isolation of this feature.

Within the Study area, the remaining 92 features were determined to not provide potential aquatic habitat for CTS based on the presence of at least one of the following (Table 1):

- Insufficient hydroperiod (less than 10 weeks);
- Brackish water, evidenced by salt-tolerant hydrophytic plant species and/or salt crusts;
- Ponding depths too shallow (<12 inches);
- Probable presence of predators (e.g., fish), due to direct hydrologic connection to the Sacramento River.

Previous studies conducted by Mark Jennings concluded that there were no suitable CTS aquatic features within his survey area (Jennings 2009a, Jennings 2009b, Jennings 2010), which overlaps with the current Study area for this report. The Jennings investigation included extensive sampling of aquatic features along Collinsville Road and in the Montezuma Wetlands Restoration area. During the study, no CTS were found (Jennings 2009a, Jennings 2009b, Jennings 2010). The results of this report are consistent with the findings of Mark Jennings; no suitable aquatic features were found within the overlapping study areas for both reports. The features identified in this report as potential aquatic habitat are outside of the Jennings study area.

The Shiloh IV Wind Project draft Habitat Conservation Plan designates four ponds (corresponding aquatic feature 54, 55, 57, and 67 in this report) as potential aquatic habitat for CTS (ICF International 2011). The draft Habitat Conservation Plan also designates a pond just north of this report's Study area as potential aquatic habitat, though this feature was not observed or mapped for this report. The Solano Multispecies Habitat Conservation Plan designates the entire Montezuma Hills area, south to the Sacramento River, as potential range for CTS (Solano County Water Agency 2012).

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Figure 4. Potential CTS Habitat

The characteristics of each aquatic feature that was assessed for CTS habitat suitability is discussed in Table 1 below. Representative photographs are provided in Appendix A.

Table 1. Aquatic Feature Characteristics

Feature #	Suitable Habitat Characteristics[1]				Unsuitable Characteristics[1]				Potential CTS Habitat (Yes/No)
	Hydroperiod >10 weeks	Seasonally Inundated	Freshwater	Ponded Water >12 inches deep	Hydroperiod <10 weeks	Brackish	Ponded Water <12 inches deep	Connected to River	
1		X	X		X		X		No
2	X	X	X				X		No
3		X	X				X		No
4		X	X				X		No
5		X	X		X		X		No
6		X	X		X		X		No
7		X	X		X		X		No
8		X	X		X		X		No
9	X	X	X				X		No
10		X	X		X		X		No
11		X	X		X		X		No
12	X	X	X				X		No
13		X	X		X		X		No
14	X	X	X				X		No
15		X	X		X		X		No
16		X	X		X		X		No
17		X			X	X	X		No
18	X	X	X				X		No

Feature #	Suitable Habitat Characteristics[1]				Unsuitable Characteristics[1]				Potential CTS Habitat (Yes/No)
	Hydroperiod >10 weeks	Seasonally Inundated	Freshwater	Ponded Water >12 inches deep	Hydroperiod <10 weeks	Brackish	Ponded Water <12 inches deep	Connected to River	
19		X	X		X		X		No
20	X	X	X				X		No
21	X			X		X			No
22	X	X	X				X		No
23		X	X		X		X		No
24		X			X	X	X		No
25		X	X		X		X		No
26		X	X		X		X		No
27	X			X		X			No
28	X			X		X			No
29	X					X	X		No
30	X					X	X		No
31		X	X		X		X		No
32		X	X		X		X		No
33		X	X		X		X		No
34	X		X				X		No
35		X	X		X		X		No
36		X	X		X		X		No
37	X	X		X		X			No
38		X	X		X		X		No
39*	X	X	X				X		No

Feature #	Suitable Habitat Characteristics[1]				Unsuitable Characteristics[1]				Potential CTS Habitat (Yes/No)
	Hydroperiod >10 weeks	Seasonally Inundated	Freshwater	Ponded Water >12 inches deep	Hydroperiod <10 weeks	Brackish	Ponded Water <12 inches deep	Connected to River	
40	X	X	X				X		No
41	X	X	X	X					Yes
42*	X	X	X				X		No
43		X	X		X		X		No
44		X	X		X		X		No
45		X	X		X		X		No
46	X	X	X				X		No
47*	X	X	X				X		No
48	X	X	X				X		No
49*	X	X	X				X		No
50		X	X		X		X		No
51		X	X		X		X		No
52	X	X	X	X					Yes
53		X	X		X		X		No
54*	X	X	X	X					Yes
55*	X	X	X	X					Yes
56*		X	X		X		X		No
57*	X	X	X	X					Yes
58		X	X		X		X		No
59*		X	X		X		X		No
60		X	X		X		X		No

Feature #	Suitable Habitat Characteristics[1]				Unsuitable Characteristics[1]				Potential CTS Habitat (Yes/No)
	Hydroperiod >10 weeks	Seasonally Inundated	Freshwater	Ponded Water >12 inches deep	Hydroperiod <10 weeks	Brackish	Ponded Water <12 inches deep	Connected to River	
61		X	X		X		X		No
62*		X	X		X		X		No
63	X			X		X			No
64		X	X		X		X		No
65*	X	X		X		X		X	No
66	X	X	X				X		No
67	X	X	X	X					Yes
68*		X			X		X		No
69*	X	X		X		X		X	No
70*		X	X		X		X		No
71*	X	X		X		X		X	No
72	X	X	X	X					Yes
73*	X	X		X		X			No
74	X	X		X		X			No
75	X	X		X		X			No
76		X			X	X			No
77	X			X		X		X	No
78		X			X	X			No
79*		X			X			X	No
80*		X			X		X		No
81		X			X	X	X		No

Feature #	Suitable Habitat Characteristics[1]				Unsuitable Characteristics[1]				Potential CTS Habitat (Yes/No)
	Hydroperiod >10 weeks	Seasonally Inundated	Freshwater	Ponded Water >12 inches deep	Hydroperiod <10 weeks	Brackish	Ponded Water <12 inches deep	Connected to River	
82		X			X	X	X		No
83	X			X		X			No
84*		X			X	X			No
85		X			X	X			No
86		X	X		X		X		No
87*		X			X	X			No
88	X		X	X				X	No
89*		X			X	X	X		No
90*		X			X	X	X		No
91*		X			X	X	X		No
92		X	X		X	X	X		No
93*		X			X	X	X		No
94*		X			X	X	X		No
95*		X			X	X	X		No
96		X			X	X	X		No
97*		X			X	X	X		No
98	X		X	X				X	No
99		X	X		X		X	X	No

[1] See Section 2.4 for a description of CTS habitat requirements

* Feature not directly observed. Characteristics based on aerial interpretation, including water color (freshwater or brackish), hydroperiod (historic images), proximity to other features (brackish features or Sacramento River), and CNDDB records of freshwater or salt marsh dependent species (e.g. salt marsh harvest mouse [*Reithrodontomys raviventris*]).

3.5 Upland Habitats

Within the Project area, very few mammalian burrows that could provide underground refugia to CTS were observed. Despite this, upland habitat to CTS within the Project area and Study area was present in the form of soil cracks within disked and fallow wheat fields and matted emergent marsh vegetation within features 1, 34, 46, 48, 49, 50, 51, and 92 within 1.24 miles of suitable aquatic habitats (Figure 4). These features support perennial emergent marsh vegetation (i.e., cattails and tule), despite ponding for relatively short durations. As a result, adult CTS could burrow underneath the matted marsh vegetation, while the features are dry during most of the year.

5.0 Conclusions

Several aquatic features are present within the Project area and Study area that could provide aquatic breeding habitat to CTS as presented in Table 1. The surrounding uplands within 1.24 miles of these aquatic habitats consist primarily of agricultural habitat in various stages of wheat production, which may provide low quality upland habitat to CTS adults if burrows are present. While disking related to wheat production lowers the likelihood of CTS utilizing these areas, the single adult CTS was observed at a burrow site in a recently-disked field within 3.1 miles of the Project area (CNDDB 2017).

Though potentially suitable upland habitat is present within the Project area, there are multiple barriers to CTS movement/dispersal between the nearest known occurrences and the Project area in the form of roads and developed habitat. Multiple wind turbine access roads and Birds Landing Road act as barriers to movement between the nearest known CNDDB occurrence and the northernmost point of the Project area. Additional wind turbine access roads as well as Montezuma Hills Road and Talbert Lane act as barriers to movement to the more southern portions of the Project area. While CTS could disperse across these roads, it is unlikely they would disperse in numbers large enough to affect the breeding population (ICF International 2011). The Sacramento River forms a barrier to movement from the south and east, and Suisun Marsh a barrier from the west.

Given the proximity of the Project to brackish aquatic features; proximity to the Sacramento River (a presumed CTS barrier); existing barriers to movement and dispersal; and the location of the Project on the edge of the species' range, there is a low likelihood for CTS to occur within the Study area.

6.0 References

Alvarez, J. A. 2004. *Rana aurora draytonii* (California red-legged frog) Microhabitat. Herpetological Review 35:162–163.

Alvarez, J. A., and S. M. Foster. 2016. Variability in the larval coloration of the California tiger salamander. Herp Nation 19:28–30.

California Natural Diversity Data Base. 2017. Records search of the Antioch North and Surrounding Eight U.S. Geological Survey 7.5 minute topographic quadrangles. RareFind 5, April 2017 update. Sacramento, California.

CNDDB. *See* California Natural Diversity Data Base.

Jennings, Mark. 2009a. Habitat Assessment for the California Tiger Salamander (*Ambystoma californiense*), California Red-legged Frog (*Rana draytonii*), and Giant Gartersnake (*Thamnophis gigas*), on the Collinsville Wind Project Site, Solano County, California. Prepared for Insignia Environmental. July 30, 2009.

Jennings, Mark. 2009b. Addendum Habitat Assessment for the California Tiger Salamander (*Ambystoma californiense*), California Red-legged Frog (*Rana draytonii*), and Giant Gartersnake (*Thamnophis gigas*), on the Proposed Tie-In Transmission Line Substation at the Collinsville Wind Project Site, Solano County, California. Prepared for Insignia Environmental. November 30, 2009.

Jennings, Mark. 2010. Second Addendum Habitat Assessment for the California Tiger Salamander (*Ambystoma californiense*), California Red-legged Frog (*Rana draytonii*), and Giant Gartersnake (*Thamnophis gigas*), on the Proposed Tie-In Transmission Line Substation at the Collinsville Wind Project Site, Solano County, California. Prepared for Insignia Environmental. May 23, 2010.

Jennings and Hayes 1994. Amphibian and Reptile Species of Special Concern in California. Rancho Cordova, California: California Department of Fish and Game, Inland Fisheries Division.

ICF International. 2011. *Habitat Conservation Plan for the Proposed Shiloh IV Wind Project, Solano County, California.* Draft. December. (ICF 00810.10) Sacramento, CA. Prepared for Shiloh IV Wind Project, LLC, Tracy, CA.

Loredo, I., and D. Van Vuren. 1996. Reproductive ecology of a population of the California tiger salamander. Copeia 1996: 895-901.

Loredo, I., D. Van Vuren, and M. L. Morrison 1996. Habitat use and migration behavior of the California tiger salamander. Journal of Herpetology 30:282-285.

Solano County Water Agency. 2012. Public Draft Solano Multispecies Habitat Conservation Plan.

Stebbins, R. C. 2003. A Field Guide to Western Reptiles and Amphibians. Houghton Mifflin Co., Boston; New York. 336 pp.

Stebbins, R. C., and S. M. McGinnis. 2012. Field Guide to Amphibians and Reptiles of California Revised Edition. University of California Press. Berkley and Los Angeles California. 538 pp.

Storer, T. L. 1925. A synopsis of the amphibia of California. University of California. University of California Publication Zoology 27:1-342.

U.S. Fish and Wildlife Service. 2003. Interim Guidance on Site Assessment and Field Surveys for Determining Presence or a Negative Finding of the California Tiger Salamander. October.

U.S. Fish and Wildlife Service. 2004. Endangered and threatened wildlife and plants; determination of threatened status for the California tiger salamander; and special rule exemption for existing routine ranching activities; final rule. Federal Register 69:47212-47248.

USFWS. See U.S. Fish and Wildlife Service.

Appendix A. Representative Photographs

Photograph 1. Ponded portion of Aquatic Feature 10 too shallow to support CTS (facing south).
Taken on March 30, 2016.

Photograph 2. Fallow wheat fields (agricultural) in the eastern portion of the Project area, which could provide CTS upland habitat (facing south).
Taken on March 30, 2016.

Photograph 3. Aquatic Feature 99 and the Sacramento River (background) just south of the Project area (facing south).
Taken on March 30, 2016.

Photograph 4. Shallow portion of emergent marsh in Aquatic Feature 34, which is too shallow for CTS.
Taken on March 30, 2016.

Photograph 5. Emergent marsh in Aquatic Feature 92, which is too shallow to support larval CTS, but the surrounding area could provide upland habitat to adults (facing south).
Taken on March 30, 2016.

Photograph 6. Cultivated wheat fields (foreground) and Feature 37, a brackish marsh (background), which is ponded year-round and is brackish, in the southern portion of the Project area (facing west).
Taken on March 30, 2016.

 Photograph 7. Aquatic Feature 72, a seasonal freshwater pool, is considered potential aquatic CTS habitat (facing north). Taken on March 30, 2016.	 Photograph 8. Perennial swale habitat in Aquatic Feature 1 in the northern portion of the Project area is too shallow to support CTS larvae, but could support adult CTS (facing west). Taken on March 30, 2016.
 Photograph 9. Aquatic Feature 17 is too shallow and brackish to support CTS. Taken on March 30, 2016.	 Photograph 10. Although Feature 52 is perennially ponded, the relative isolation of the feature reduces the likelihood of CTS predators. Taken on July 1, 2016.
 Photograph 11. Due to its connection to the Sacramento River, Aquatic Feature 88 is not considered suitable habitat for CTS (facing southeast). Taken on March 30, 2016.	 Photograph 12. Aquatic Feature 46 flowing underneath Montezuma Hills Road is too shallow to support CTS (facing east). Taken on March 31, 2016.

	
Photograph 13. Aquatic Feature 67, a seasonal freshwater feature is considered potential aquatic CTS habitat (facing south). Taken on March 31, 2016.	Photograph 14. Aquatic Feature 63, a seasonal brackish feature (note salt-crusted soil mounds), is not considered potential aquatic CTS habitat (facing east). Taken on March 31, 2016.

California Red-Legged Frog Habitat Assessment

SOLANO PHASE 4 WIND PROJECT

CALIFORNIA RED-LEGGED FROG HABITAT ASSESSMENT
SOLANO COUNTY, CALIFORNIA

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July2017

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Table of Acronyms

AWE	Area West Environmental, Inc.
CDFW	California Department of Fish and Wildlife
CNDDB	California Natural Diversity Database
CRLF	California red-legged frog
ESA	Endangered Species Act
MW	Megawatt
ppt	parts per thousand
Project	Solano Phase IV Wind Project
SMUD	Sacramento Municipal Utility District
Study area	Project area and area within a 1 mile buffer
USFWS	U.S. Fish and Wildlife Service

1.0 Introduction

The Sacramento Municipal Utility District (SMUD) is proposing to develop the Solano Phase IV Wind Project (Project) in the Montezuma Hills in Solano County, California (Figure 1). Area West Environmental, Inc. (AWE) conducted surveys to characterize vegetation communities and aquatic habitat types to assess their potential to support California red-legged frog (*Rana draytonii*) (CRLF).

1.1 Project Location

The Project is located immediately east of the community of Collinsville in Solano County, California (Figure 1), specifically in portions of Sections 2, 22, 23, 24, 25, and 26; Township 3 North, and Range 1 East of the Antioch North and Bird's Landing U.S. Geological Survey (USGS) 7.5-minute quadrangle maps (Figure 2). Consisting of rolling hills characteristic of the Montezuma Hills, the Project area is bordered to the south by Stratton Lane, which is just north of the Sacramento River, and to the north and east by existing SMUD wind energy generating facilities (Solano Wind Phases 1, 2, and 3). Within the 1,172-acre Project area, there are existing rows of wind turbines along the hilltops and ridgelines that are connected by gravel roads.

The Project area also includes staging areas which are located within the adjacent SMUD wind facilities, potential access road locations, energy collection systems (transmission lines), and a SMUD substation located just north of Montezuma Hills Road (Figures 1 and 2). SMUD proposes to replace existing wind turbines in the Project area. The Project would also include construction of new access roads, meteorological towers, and a power collection system, including a transmission line to the existing power substation.

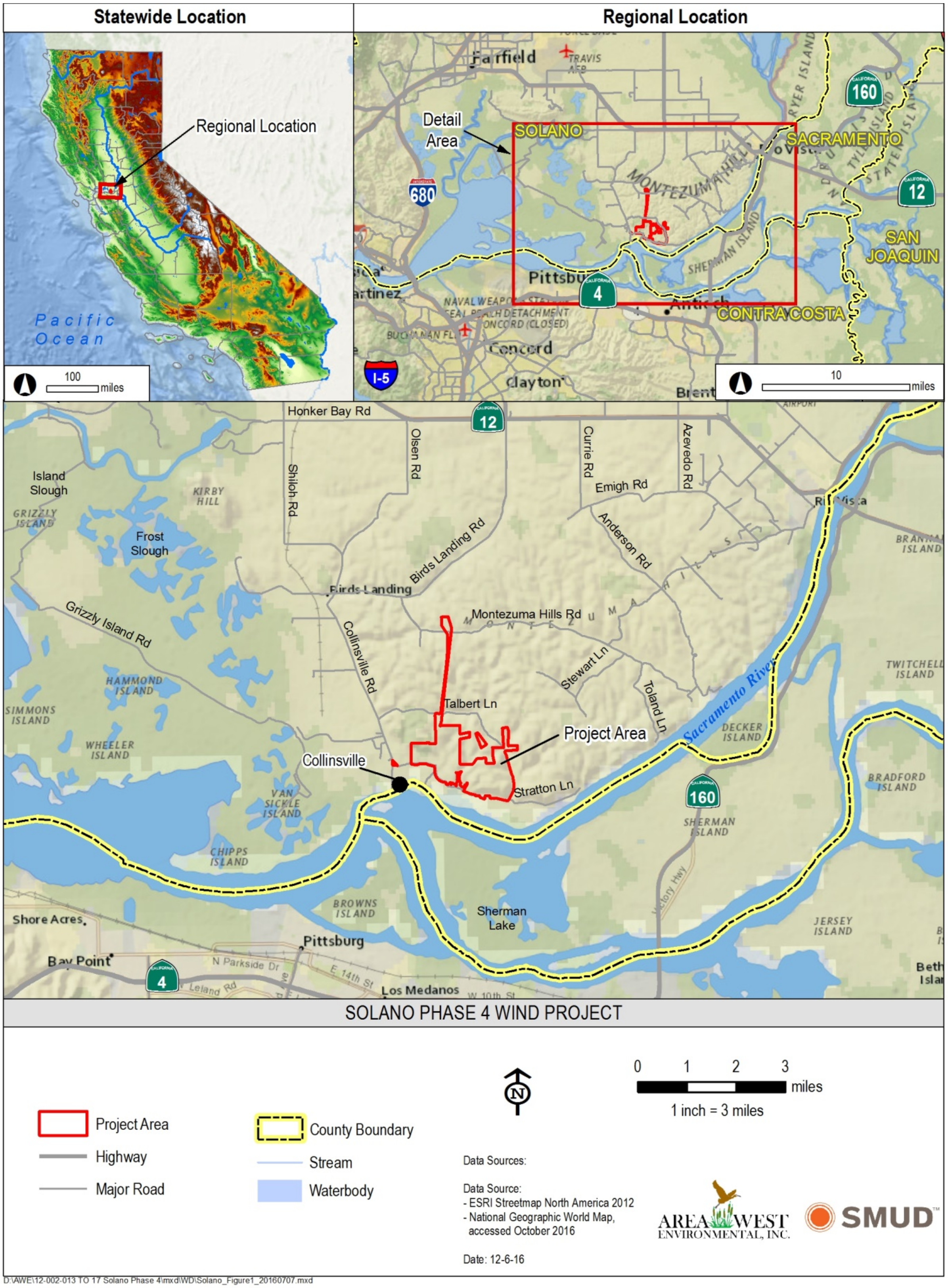
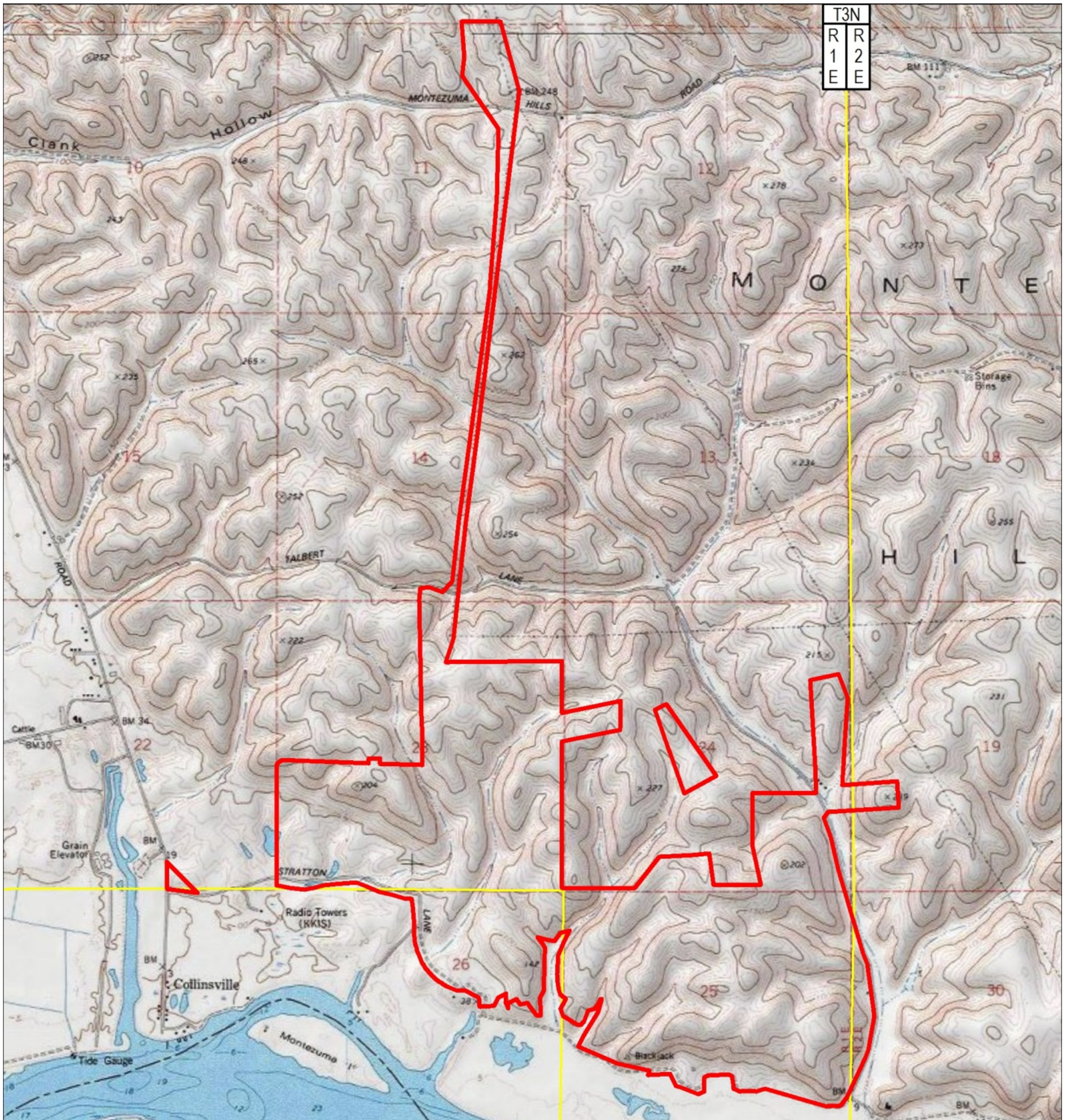


Figure 1. Project Vicinity



SOLANO PHASE 4 WIND PROJECT

The Solano Phase 4 Project Area is located in the southeast portion of the County of Solano. The site encompasses approximately 1,172 acres.

The Project Area is located in the Antioch North and Birds Landing USGS 7.5-minute quadrangle map. The project occurs within Sections 2, 11, 14, 22, 23, 24, 25, and 26, Township 3 North, Range 1 East, and Section 19 and 30, Township 3 North, Range 2 East. A portion of sourthern area of the Project Area is unsectioned.

Center coordinates for the Project Area are:
WGS84 Latitude 38.080932, Longitude -121.827222
UTM Zone 10 South NAD83 Northing 4215443m, Easting 602855m

Data Source:
- Area West Environmental, Inc. 2016
- CH2MHILL, 2016
- ESRI ArcGIS Online, USGS and ©2013 National Geographic Society

Date: 12-6-16

Solano Phase IV Project Area
Township Range Boundary

0 1,000 2,000 3,000 feet
1 inch = 3,000 feet

SMUD™ AREA WEST ENVIRONMENTAL, INC.

Figure 2. Project Location

2.0 Species Description

Information regarding the legal status, species description, habitat requirements, and life history of CRLF is provided below.

2.1 Legal Status

CRLF was listed under the federal Endangered Species Act (ESA) on June 24, 1996 (U.S. Fish and Wildlife Service [USFWS] 1996). The species is State listed as a species of special concern by California Department of Fish and Wildlife (CDFW) (Thompson et al 2016). The USFWS published a final rule to designate Critical Habitat for the CRLF on March 17, 2010. The nearest Critical habitat unit for CRLF is located approximately 15.65 miles northwest of the Project area.

2.2 Geographical Distribution

Historically, the range of CRLF extended to 46 counties throughout California, including areas of the Central Valley floor, Sierra Nevadan foothills, and Coast Ranges. Historically, the species extended as far north as Shasta County and down to Baja California in the southern end of its range. (Jennings and Hayes 1994)

CRLF is currently found in 22 counties, with significant populations found in coastal drainages between Point Reyes (Marin County) and Santa Barbara (Santa Barbara County) (Thompson et al 2016). North and west of the Napa River, Petaluma River drainage, and Sonoma Creek in Sonoma County, the species intergrades with northern red-legged frog (*Rana aurora*) in Mendocino County (Hayes and Miyamoto 1984, Shaffer et al. 2004).

In the Sierra Nevada/Cascade mountain ranges, the species ranges from Shasta County to Madera County (Jennings and Hayes 1994, Shaffer et al. 2004). They are largely absent from the California Central Valley, which separates the Sierra Nevada from the Coast Range (Storer 1925, Thompson et al. 2016).

2.3 Species Description

Among the native frog species of the western United States, CRLF is the largest (Wright and Wright 1949), measuring 1.5 to 5.1 inches in length (Stebbins 2003). Adult individuals are characterized by prominent dorsolateral folds on their back region with spots that have light centers (Stebbins 2003). Individual frogs typically have red or orange abdomens and hind legs, with small black flecks and irregular dark blotches with brown, gray, olive or reddish indistinct outlines across the dorsal surface. Larval body lengths range from 0.6 to 3.1 inches, with a body background color of dark brown or olive green, to yellow with dark spots (Storer 1925).

2.4 Habitat Requirements and Life History

CRLF habitat is characterized by riparian vegetation associated with relatively deep (>2.3 feet), slow-moving water. Emergent and riparian vegetation requirements are highly variable and include willow (*Salix* sp.), cattails (*Typha* sp.), and tules (*Schoenoplectus* sp.) providing appropriate habitat (Jennings and Hayes 1994). Adults can be found in both ephemeral and perennial streams and ponds, although stable populations require permanent freshwater (salinity ≤ 4.5%) water sources for the larval life stage (Jennings and Hayes 1994). Riparian vegetation and mammal burrows near water sources also provide refuge to estivating adults (USFWS 1996). Adults may utilize mammal burrows, desiccation cracks on pond bottoms, or dense vegetation and debris piles when aquatic breeding habitat dries (Alvarez 2004).

Adults breed from November through March, with females laying 500 to 5,000 eggs within large, gelatinous egg masses attached to submergent or emergent vegetation (Alvarez et al. 2013). Eggs hatch 6 to 14 days after deposition, with larvae undergoing metamorphosis 3.5 to 7 months after hatching, but occasionally over winter as larvae (Feller et al. 2001). Eggs and larvae are intolerant of salinity, with egg mortality reaching 100 percent in water with salinity levels greater than 4.5 parts per thousand (ppt), and larvae when exposed to salinity levels higher than 7 ppt (USFWS 1996). Despite an intolerance to salinity levels higher than 4.5 ppt, CRLF are able to utilize some brackish marshes that are not tidally-influenced (diked), when the water column becomes stratified, forming a layer of freshwater below a layer of saline water. In these instances, CRLF can lay eggs within the freshwater layer, which is subsequently used by the larvae after the eggs hatch (J. Alvarez, pers. comm.).

3.0 Methods

The habitat assessment for CRLF followed USFWS' *Revised Guidance on Site Assessments and Field Surveys for the California Red-Legged Frog* (USFWS 2005). The Habitat assessment consisted of a pre-field assessment and a field assessment, as described below.

3.1 Pre-field Analysis

Prior to conducting field habitat assessments, information concerning occurrences for CRLF near the Project area were noted using information from the CDFW California Natural Diversity Data Base (CNDDB). Previous habitat assessments for portions of the Project area were also reviewed (Jennings 2009a, 2009b, and 2010).

Per the USFWS 2005 protocol, current and historic aerial photographs (Google Earth™) were analyzed for the presence of potential aquatic features with potential to support CRLF development in the Project area and within a 1-mile buffer of the Project area (Study area). Historic images were compared with one another to determine approximate hydroperiods of aquatic features and the extent and/or presence of emergent vegetation. Aerial photographic interpretation was also used to determine the current and historic extent of land use practices in the Project area, specifically winter wheat (*Triticum aestivum*) cultivation.

3.2 Field Surveys

Biologists Mark Noyes and Jeff Alvarez conducted site visits on March 30 and 31, 2016. Offsite habitats were further characterized by Mark Noyes on July 1, 2016. During the site visits, vegetation communities within the Project area were mapped and characterized based on dominant plant species, management practices (e.g., farming and grazing), and hydrology. The Project area was investigated using meandering transects with an all-terrain vehicle, where accessible, and on foot in steep areas or locations with limited access. Aquatic areas identified during pre-field investigations including those mentioned in previous habitat assessments (Jennings 2009a, Jennings 2009b, and Jennings 2010) were also visited during the field surveys to determine if they could provide potential habitat for CRLF. For some vegetation communities dominated by hydrophytic plant species (i.e., wetlands), boundaries were mapped using Global Positioning System units with sub-meter accuracy. Although all wetlands were assessed for CRLF habitat (aquatic or dispersal), only freshwater ponds and streams within the Project area (features with potential to support CRLF aquatic habitat) were further evaluated using data forms from the 2005 USFWS as guidance.

In addition, as part of concurrent CRLF and California tiger salamander (*Ambystoma californiense*) habitat assessments, additional aquatic features within 1 mile of the Project area were also characterized. Off-site areas that were inaccessible were viewed with binoculars, where possible, from public roads to assess habitat suitability for CRLF. All vegetation communities were drawn on aerial photographs and later digitized using Geographic Information System software to calculate acreages.

Information obtained during the field visits included the size and maximum inundation depth of aquatic features, substrate and vegetation characteristics, general hydrology, surrounding upland characteristics, species observations (including presence of predatory species), and information regarding abundance and locations of aggregations of ground squirrel (*Spermophilus beecheyi*) and Botta's pocket gopher (*Thomomys bottae*) burrows. Aquatic features that were not accessible but appeared to have sufficient hydroperiods and salinity levels to support CRLF tadpoles were considered potential aquatic breeding and refuge habitat for CRLF.

4.0 Results

4.1 Land Uses

The community of Collinsville is located in the southwest corner of the Study area, and low-density residential/rural development is present along the west side of Collinsville Road. Scattered residences are present throughout the Study area, typically just outside the boundaries of the large wind farms that are present throughout the area. The wind farms contain large wind turbines connected by graveled access roads and associated maintenance buildings and equipment yards.

Within the Project area, the open spaces between wind turbines consist of wheat fields in various stages of production (disked, planted, and fallow). In general, a wheat crop is a 15 – 18 month process repeated every three years. For fallow wheat fields, including the eastern half of the Project area, wheat production had not occurred for at least 1 year, as evidenced by remnant stalks of wheat from previous harvests. These areas were grazed by sheep, with most grazing occurring along the hilltops and ridgelines, likely due to presence of the wind turbines, which provided shade in an area largely devoid of trees.

4.2 General Site Conditions

The majority of the Study area is characterized by rolling hills typical of the Montezuma Hills area. Bordered to the south by the Sacramento River Delta as it transitions into the Suisun Bay, the southern portion of the Project area is fringed with a mix of freshwater and brackish emergent marshes with some riparian tree cover, primarily consisting of willows. Despite the steep terrain, relatively few drainages are present, consisting entirely of ephemeral drainages that convey water for short durations immediately following precipitation events.

4.3 CNDDB Occurrences

There are no CRLF occurrences within dispersal range (1 mile) of the Study area. The nearest CNDDB occurrence is approximately 5.76 miles southwest of the Project area (CRLF Occurrence #531) south of the City of Antioch in Contra Costa County. Recorded in 2002, this occurrence consists of four adults observed within a shallow perennial stream. The Sacramento River, considered a dispersal barrier, separates this occurrence from the Study area. The nearest overland CNDDB occurrence is 15.65 miles northwest of the Project area (CRLF Occurrence #306). A juvenile was observed in 1996, and a single adult observed in 2005. The habitat consists of a permanent stock pond with native and introduced grazed grasses nearby. Suisun Marsh, a likely barrier to dispersal and movement for CRLF, separates this occurrence from the Study area. (CNDDB 2017)

4.4 Aquatic Habitat

Of the 99 aquatic features assessed within the Study area, 5 aquatic features were determined to have potential to support CRLF larval development (Figure 3, Table 1). Of these features, four were verified during field surveys and one was inaccessible. Of these five features, only one, Feature 21, is located within the Project area. Feature 21 is a diked brackish marsh that is likely perennial, has a maximum depth of 2.5 feet, and could have a stratified water column that could support CRLF larval development. Features 67 and 72 appear to be freshwater or slightly brackish pools that appear to be several feet deep, lack emergent vegetation, and appear to pond for at least 4 months of the year (as evidenced in Google Earth™ historic aerial photographs). Based solely on Google Earth™ aerial photographs, Feature 57 appears to be a freshwater feature that ponds long enough to provide CRLF aquatic breeding habitat. Feature 52, located just west of the transmission line segment of the Project area appeared to be a perennial stock pond fed by a well. Although the feature is perennial, as evidenced by the presence of willows, tules, and cattails, the likelihood of the presence of CRLF predators (e.g. bullfrogs [*Lithobates catesbeianus*]) is low due to the relative isolation of this feature.

An additional 48 aquatic freshwater features potentially provide dispersal habitat for CRLF when inundated with water, though the presence of water is unlikely during the dry season. Within the Study area, the remaining 46 features were determined to not provide potential aquatic habitat for CRLF based on the presence of at least one of the following (Table 1):

- Insufficient hydroperiod (less than 12 weeks);
- Brackish water, evidenced by salt-tolerant hydrophytic plant species and/or salt crusts (deeper, diked brackish features could have stratified water columns containing freshwater and would be available as CRLF aquatic habitat);
- Shallow ponding depths (<12 inches);
- Probable presence of predators (e.g., fish), due to direct hydrologic connection to the Sacramento River.

The characteristics of each aquatic feature that was assessed for CRLF habitat suitability is discussed in Table 1 below. Representative photographs are provided in Appendix A. Supplemental habitat assessment data forms are provided in Appendix B.

Previous reports conducted by Mark Jennings concluded that there were no suitable aquatic features within his survey area (Jennings 2009a, Jennings 2009b, Jennings 2010), which overlaps with the current Study area for this report. The Jennings investigation included extensive sampling of aquatic features along Collinsville Road and in the Montezuma Wetlands Restoration area. During the study, no CRLF were found (Jennings 2009a, Jennings 2009b, Jennings 2010). Jennings' survey area was smaller than the Study area for this report and did not include Feature 21 (classified as potential aquatic breeding habitat in this report).

4.5 Upland Habitats

Within the Project area, very few mammalian burrows that could provide underground refugia to CRLF were observed. Despite this, upland habitat to CRLF within the Project area and Study area was present in the form of soil cracks within disked and fallow wheat fields and matted emergent marsh vegetation present in features 81, 82, 85, and 92, which support perennial emergent marsh vegetation, despite ponding for relatively short durations. As a result, adult CRLF could burrow underneath the matted marsh vegetation when the features are dry during most of the year.

D:\AWE\12-002-013 TO 17 Solano Phase 4\mxd\CRLF_Habitat_20160603.mxd

Figure 3. Potential CRLF Habitat

Table 1. Aquatic Feature Characteristics

Feature #	Suitable Habitat Characteristics[1]				Unsuitable Characteristics[1]				Potential Dispersal Habitat (Yes/No)	Potential Aquatic Habitat (Yes/No)
	Hydroperiod >12 weeks	Freshwater or Stratified Brackish	Riparian/ Emergent Vegetation	Ponded Water >12 inches deep	Hydroperiod <12weeks	Shallow or Saline	Ponded Water <12 inches deep	Connected to River		
1		X	X		X		X		Yes	No
2	X	X					X		Yes	No
3		X					X		Yes	No
4		X					X		Yes	No
5		X			X		X		Yes	No
6		X			X		X		Yes	No
7		X			X		X		Yes	No
8		X			X		X		Yes	No
9	X	X					X		Yes	No
10		X			X		X		Yes	No
11		X			X		X		Yes	No
12	X	X					X		Yes	No
13		X			X		X		Yes	No
14	X	X					X		Yes	No
15		X			X		X		Yes	No
16		X			X		X		Yes	No
17					X	X	X		No	No
18	X	X					X		Yes	No
19		X			X		X		Yes	No
20	X	X					X		Yes	No
21	X		X	X		X			No	Yes
22	X	X					X		No	No

Feature #	Suitable Habitat Characteristics[1]				Unsuitable Characteristics[1]				Potential Dispersal Habitat (Yes/No)	Potential Aquatic Habitat (Yes/No)
	Hydroperiod >12 weeks	Freshwater or Stratified Brackish	Riparian/ Emergent Vegetation	Ponded Water >12 inches deep	Hydroperiod <12weeks	Shallow or Saline	Ponded Water <12 inches deep	Connected to River		
23		X			X		X		Yes	No
24					X	X	X		Yes	No
25		X			X		X		Yes	No
26		X			X		X		No	No
27	X			X		X			No	No
28	X			X		X			No	No
29	X					X	X		Yes	No
30	X		X			X	X		Yes	No
31		X			X		X		Yes	No
32		X			X		X		Yes	No
33		X			X		X		Yes	No
34	X	X	X				X		Yes	No
35		X			X		X		Yes	No
36		X			X		X		Yes	No
37	X			X		X			No	No
38		X			X		X		No	No
39*	X	X	X				X		Yes	No
40	X	X	X				X		Yes	No
41	X	X	X	X					Yes	No
42*	X	X	X				X		Yes	No
43		X	X		X		X		Yes	No
44		X	X		X		X		Yes	No

Feature #	Suitable Habitat Characteristics[1]				Unsuitable Characteristics[1]				Potential Dispersal Habitat (Yes/No)	Potential Aquatic Habitat (Yes/No)
	Hydroperiod >12 weeks	Freshwater or Stratified Brackish	Riparian/ Emergent Vegetation	Ponded Water >12 inches deep	Hydroperiod <12weeks	Shallow or Saline	Ponded Water <12 inches deep	Connected to River		
45		X			X		X		Yes	No
46	X	X	X				X		Yes	No
47*	X	X					X		No	No
48	X	X					X		No	No
49*	X	X					X		No	No
50		X	X		X		X		Yes	No
51		X	X		X		X		Yes	No
52	X	X	X	X					No	Yes
53		X			X		X		No	No
54*	X	X		X					No	No
55*	X	X		X					No	No
56*		X			X		X		Yes	No
57*	X	X		X					No	Yes
58		X			X		X		Yes	No
59*		X			X		X		No	No
60		X			X		X		No	No
61		X			X		X		No	No
62*		X			X		X		No	No
63	X			X		X			No	No
64		X			X		X		No	No
65*	X			X		X		X	No	No
66	X	X	X				X		Yes	No

Feature #	Suitable Habitat Characteristics[1]				Unsuitable Characteristics[1]				Potential Dispersal Habitat (Yes/No)	Potential Aquatic Habitat (Yes/No)
	Hydroperiod >12 weeks	Freshwater or Stratified Brackish	Riparian/ Emergent Vegetation	Ponded Water >12 inches deep	Hydroperiod <12weeks	Shallow or Saline	Ponded Water <12 inches deep	Connected to River		
67	X	X		X					Yes	No
68*					X		X		No	No
69*	X			X		X		X	No	No
70*		X			X		X		No	No
71*	X			X		X		X	No	No
72	X	X		X					Yes	No
73*	X			X		X			No	No
74	X			X		X			No	No
75	X			X		X			No	No
76					X	X			No	No
77	X		X	X		X		X	No	No
78					X	X			No	No
79*					X			X	Yes	No
80*					X		X		Yes	No
81					X	X	X		No	No
82					X	X	X		No	No
83	X			X		X			No	No
84*					X	X			No	No
85					X	X			No	No
86		X			X		X		Yes	No
87*					X	X			No	No
88	X	X	X	X				X	No	No

Feature #	Suitable Habitat Characteristics[1]				Unsuitable Characteristics[1]				Potential Dispersal Habitat (Yes/No)	Potential Aquatic Habitat (Yes/No)
	Hydroperiod >12 weeks	Freshwater or Stratified Brackish	Riparian/ Emergent Vegetation	Ponded Water >12 inches deep	Hydroperiod <12weeks	Shallow or Saline	Ponded Water <12 inches deep	Connected to River		
89*					X	X	X		No	No
90*					X	X	X		No	No
91*					X	X	X		No	No
92		X	X		X	X	X		Yes	No
93*					X	X	X		No	No
94*					X	X	X		No	No
95*					X	X	X		No	No
96			X		X	X	X		No	No
97*					X	X	X		No	No
98	X	X	X	X				X	No	No
99		X	X		X		X	X	No	No

[1] See Section 2.4 for a description of CRLF habitat requirements

* Feature not directly observed. Characteristics based on aerial interpretation, including water color (freshwater or brackish), hydroperiod (historic images), proximity to other features (brackish features or Sacramento River), and CNDDB records of freshwater or salt marsh dependent species (e.g. salt marsh harvest mouse [*Reithrodontomys raviventris*]).

5.0 Conclusions

Several aquatic features are present within the Project area and Study area that could provide aquatic habitat to CRLF (Table 1). The surrounding uplands within 1 mile of these aquatic habitats consist primarily of agricultural habitat in various stages of wheat production, which may provide low quality upland habitat to CRLF adults if refugia in the form of burrows, soil cracks, and rocks are present to provide aestivation locations. Disking related to wheat production lowers the likelihood of CRLF utilizing these areas, and the nearest overland CRLF occurrence is approximately 15.65 miles away, northwest of Suisun Marsh. Suisun Marsh is likely too saline for CRLF to access the Project area through and as a result may serve as a dispersal barrier (CNDDB 2017). Given the proximity of the Project to brackish aquatic features and the Sacramento River (likely CRLF barrier), and the distance from known species' occurrences, there is a low likelihood for CRLF to occur within the Project area.

6.0 References

Alvarez, J. A. 2004. *Rana aurora draytonii* (California red-legged frog) Microhabitat. Herpetological Review 35:162–163.

Alvarez, J. A., D. G. Cook, J. L. Yee, M. G. van Hattem, D. R. Fong, R. Fisher. 2013. Comparative microhabitat characteristics as oviposition sites of the California red-legged frog. Herpetological Conservation and Biology.

Alvarez, J. A. 2016. Personal Communication. Subject: California Red-legged Frog Use of Brackish Habitats. In person on September 23, 2016.

California Natural Diversity Data Base. 2016. Records search of the Antioch North and Surrounding Eight U.S. Geological Survey 7.5 minute topographic quadrangles. RareFind 5, April 2017 update. Sacramento, California.

CNDDB. *See* California Natural Diversity Data Base.

Fellers, G. M., A Launer, G. Rathbun, S. Bobzien, J. Alvarez, D. Sterner, R. Seymour, and M, Westphal. 2001. Overwintering tadpoles in the red-legged frog (*Rana aurora draytonii*). Herpetological Review 32:156–157.

Hayes, M. P. and M. M. Miyamoto. 1984. Biochemical, behavioral, and body size differences between *Rana aurora aurora* and *R. a. draytonii*. Copeia, 1984(4), pp. 1018-1022.

Jennings and Hayes 1994. Amphibian and Reptile Species of Special Concern in California. Rancho Cordova, California: California Department of Fish and Game, Inland Fisheries Division.

Jennings, M. 2009a. Habitat Assessment for the California Tiger Salamander (*Ambystoma californiense*), California Red-legged Frog (*Rana draytonii*), and Giant Gartersnake (*Thamnophis gigas*), on the Collinsville Wind Project Site, Solano County, California. Prepared for Insignia Environmental. July 30, 2009.

Jennings, M. 2009b. Addendum Habitat Assessment for the California Tiger Salamander (*Ambystoma californiense*), California Red-legged Frog (*Rana draytonii*), and Giant Gartersnake (*Thamnophis gigas*), on the Proposed Tie-In Transmission Line Substation at the Collinsville Wind Project Site, Solano County, California. Prepared for Insignia Environmental. November 30, 2009.

Jennings, M. 2010. Second Addendum Habitat Assessment for the California Tiger Salamander (*Ambystoma californiense*), California Red-legged Frog (*Rana draytonii*), and Giant Gartersnake (*Thamnophis gigas*), on the Proposed Tie-In Transmission Line Substation at the Collinsville Wind Project Site, Solano County, California. Prepared for Insignia Environmental. May 23, 2010.

Stebbins, R. C. 2003. A Field Guide to Western Reptiles and Amphibians. Houghton Mifflin Co., Boston; New York. 336 pp.

Shaffer, H. B., G. M. Fellers, S. R. Voss, J. C. Oliver, and G. B. Pauly. 2004. Species boundaries, phylogeography and conservation genetics of the red-legged frog (*Rana aurora/draytonii*) complex. Molecular Ecology 13:2667-2677.

Storer, T. L. 1925. A synopsis of the amphibia of California. University of California. University of California Publication Zoology 27:1-342.

Thompson, R. C., A. N. Wright, and H. B. Shaffer. 2016. California amphibian and reptile species of concern. University of California Press, Berkeley, California. 390 pp.

U.S. Fish and Wildlife Service. 1996. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the California Red-Legged Frog; Final Rule. Federal Register 61: 25813-25833.

U.S. Fish and Wildlife Service. 2005. Revised Guidance on Site Assessment and Field Surveys for California Red-Legged Frogs. August. Sacramento, CA: Ecological Services, Sacramento Field Office.

USFWS. See U.S. Fish and Wildlife Service.

Wright, A. H. and A. A. Wright. 1949. Handbook of Frogs and Toads of the United States and Canada. Comstock Publ. Co., Ithaca, New York. 640 pp.

Appendix A. Representative Photographs

Photograph 1. Ponded portion of Feature 10 could support CRLF dispersal habitat, but is too shallow to support CRLF larval development (facing south).
Taken on March 30, 2016.

Photograph 2. Fallow wheat fields (agricultural) in the eastern portion of the Project area, which could provide CRLF upland habitat (facing south).
Taken on March 30, 2016.

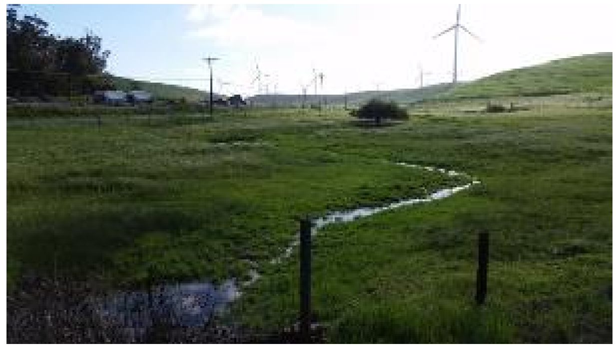
Photograph 3. Feature 99, which is connected to the Sacramento River (background) just south of the Project area (facing south).
Taken on March 30, 2016.

Photograph 4. Shallow ponded portion of Feature 34 provides potential dispersal habitat for CRLF.
Taken on March 30, 2016.

Photograph 5. Emergent vegetation in Feature 92 could provide potential dispersal habitat for CRLF, but not aquatic habitat, because it does not pond for sufficient depths or durations to support larval development (facing south).
Taken on March 30, 2016.

Photograph 6. Cultivated wheat fields (foreground) and Feature 37, a brackish marsh (background),that could support CRLF aquatic breeding habitat, in the southern portion of the Project area (facing west).
Taken on March 30, 2016.

 Photograph 7. Feature 72, a seasonal freshwater pool, is considered potential aquatic breeding habitat for CRLF (facing north). Taken on March 30, 2016.	 Photograph 8. Feature 1 in the northern portion of the Project area could support CRLF dispersal (facing west). Taken on March 30, 2016.
 Photograph 9. Feature 17, which is too shallow and brackish to support CRLF (facing west). Taken on March 30, 2016.	 Photograph 10. Feature 52 is perennially ponded, but the relative isolation of the feature reduces the likelihood of CRLF predators, increasing its suitability for CRLF aquatic breeding habitat (facing southwest). Taken on July 1, 2016.

 Photograph 11. Due to its connection to the Sacramento River, Feature 88 is not considered suitable habitat for CRLF (facing southeast). Taken on March 30, 2016.	 Photograph 12. Feature 46 flowing underneath Montezuma Hills Road could support CRLF dispersal habitat (facing east). Taken on March 31, 2016.
 Photograph 13. Feature 67, a seasonal freshwater feature is considered potential aquatic breeding habitat for CRLF (facing south). Taken on March 31, 2016.	 Photograph 14. Feature 63, a seasonal brackish feature (note salt-crusted soil mounds), is not considered potential CRLF habitat (facing east). Taken on March 31, 2016.

Appendix B. Assessment Forms

California Red-legged Frog Habitat Site Assessment Data Sheet

Site Assessment reviewed by	(FWS Field Office)	(date)	(biologist)

Date of Site Assessment: 03/30/2016
(mm/dd/yyyy)

Site Assessment Biologists:

(Last name)	(first name)	(Last name)	(first name)
Noyes	Mark		
Alvarez	Jeff		

Site Location: Solano County, east of Collinsville, center coordinates: 38.080932, -121.87222
(County, General location name, UTM Coordinates or Lat./Long. or T-R-S).

****ATTACH A MAP** (include habitat types, important features, and species locations)**

Proposed project name: Solano Phase 4 Wind Project
Brief description of proposed action:
Replacement of wind turbines at an existing wind farm.

1) Is this site within the current or historic range of the CRF (circle one)? YES NO

2) Are there known records of CRF within 1.6 km (1 mi) of the site (circle one)? YES NO
If yes, attach a list of all known CRF records with a map showing all locations.

GENERAL AQUATIC HABITAT CHARACTERIZATION

(if multiple ponds or streams are within the proposed action area, fill out one data sheet for each)

POND:

Size: ____________ Maxim um depth: ____________

Vegetation: emergent, overhanging, dominant species: ____________

Substrate: ____________

Perennial or Ephemeral *(circle one)*. If ephemeral, date it goes dry: ____________

California Red-legged Frog Habitat Site Assessment Data Sheet

STREAM: Ephmeral drainages 10 and 11

Bank full width: 24.5 feet

Depth at bank full: 5 feet

Stream gradient: 2-3%

Are there pools (circle one)? YES NO

If yes,

Size of stream pools: Approximately 1,000 sq. ft

Maximum depth of stream pools: 12 inches

Characterize non-pool habitat: run, riffle, glide, other: Run

Vegetation: emergent, overhanging, dominant species: No emergent or overhanging vegetation, dominated by annual species

Substrate: loam

Bank description: No observed burrows, between 15 and 30 percent slopes

Perennial or Ephemeral *(circle one)*. If ephemeral, date it goes dry: Mid-march

Other aquatic habitat characteristics, species observations, drawings, or comments:

Based on observations, the pool(s) within Features 10 and 11 (portions of a large ephemeral drainage connected by a culvert) are unlikely to remain ponded long enough to support CRLF larval development. The features were dry when observed in late March, and aerial photographs to not have the pools lasting later than April. The short hydroperiod of the pools was further evidenced by all the vegetation consisting of annual hydrophytic and upland plant species growing within the boundaries of the pooled areas.

Necessary Attachments:

1. All field notes and other supporting documents
2. Site photographs
3. Maps with important habitat features and species location

California Red-legged Frog Habitat Site Assessment Data Sheet

Site Assessment reviewed by ____________ ____________ ____________
(FWS Field Office) (date) (biologist)

Date of Site Assessment: 03/30/2016
(mm/dd/yyyy)

Site Assessment Biologists:

(Last name)	(first name)	(Last name)	(first name)
Noyes	Mark		
Alvarez	Jeff		

Site Location: Solano County, east of Collinsville, center coordinates: 38.080932, -121.87222
(County, General location name, UTM Coordinates or Lat./Long. or T-R-S).

****ATTACH A MAP** (include habitat types, important features, and species locations)**

Proposed project name: Solano Phase 4 Wind Project
Brief description of proposed action:
Replacement of wind turbines at an existing wind farm.

1) Is this site within the current or historic range of the CRF (circle one)? YES NO

2) Are there known records of CRF within 1.6 km (1 mi) of the site (circle one)? YES NO
If yes, attach a list of all known CRF records with a map showing all locations.

GENERAL AQUATIC HABITAT CHARACTERIZATION

(if multiple ponds or streams are within the proposed action area, fill out one data sheet for each)

POND: W-21

Size: 1.25 acres Maxim um depth: approx. 3.5 feet

Vegetation: emergent, overhanging, dominant species: Cattails (Typha spp.), tule (Schoenoplectus acutus var. occidentalis), Mexican rush (Juncus mexicanus), seaside club-rush (Bolboschoenus robustus)

Substrate: Loam

Perennial or Ephemeral *(circle one)*. If ephemeral, date it goes dry: ____________

. .
California Red-legged Frog Habitat Site Assessment Data Sheet

STREAM:

Bank full width: ________________
Depth at bank full: ______________
Stream gradient: ________________

Are there pools (circle one)? YES NO
If yes,
Size of stream pools: ________________________
Maximum depth of stream pools: _______________

Characterize non-pool habitat: run, riffle, glide, other: ____________________________

Vegetation: emergent, overhanging, dominant species: ____________________________

Substrate: ____

Bank description: ____

Perennial or Ephemeral *(circle one)*. If ephemeral, date it goes dry: ____________________

Other aquatic habitat characteristics, species observations, drawings, or comments:
This marsh, which appears to be brackish, is dominated by perennial freshwater emergent plants as well as salt-tolerant species, including pickleweed (Salicornia sp.). In addition, it is diked by Stratton Road, and is connected to an adjoining undiked brackish marsh. Based on the types of plants (freshwater perennials in middle and salt-tolerant on edges) and presence of a dike, the water column could be stratified and contain a layer of brackish/saline water above a lower layer of freshwater. Due to this stratification, there is potential for the feature to be used as CRLF aquatic habitat (similar to Abbott's Lagoon at Point Reyes).

Necessary Attachments:

1. All field notes and other supporting documents
2. Site photographs
3. Maps with important habitat features and species location

Giant Garter Snake Habitat Assessment

SOLANO PHASE 4 WIND PROJECT

GIANT GARTER SNAKE HABITAT ASSESSMENT
SOLANO COUNTY, CALIFORNIA

Prepared for:

Sacramento Municipal Utility District
6201 S Street
Sacramento, California, 95817
Contact: Jose Bodipo-Memba
916.732.6493

Prepared by:

Area West Environmental, Inc.
6248 Main Avenue, Suite C
Orangevale, California 95662
Contact: Becky Rozumowicz
916.987.3362

July 2017

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Figures

Tables

Appendices

Table of Acronyms

AWE	Area West Environmental, Inc.
CNDDB	California Natural Diversity Database
ESA	Endangered Species Act
GGS	giant garter snake (*Thamnophis gigas*)
Project	Solano Phase IV Wind Project
SMUD	Sacramento Municipal Utility District
Study area	Project area and surrounding 200-foot buffer
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

1.0 Introduction

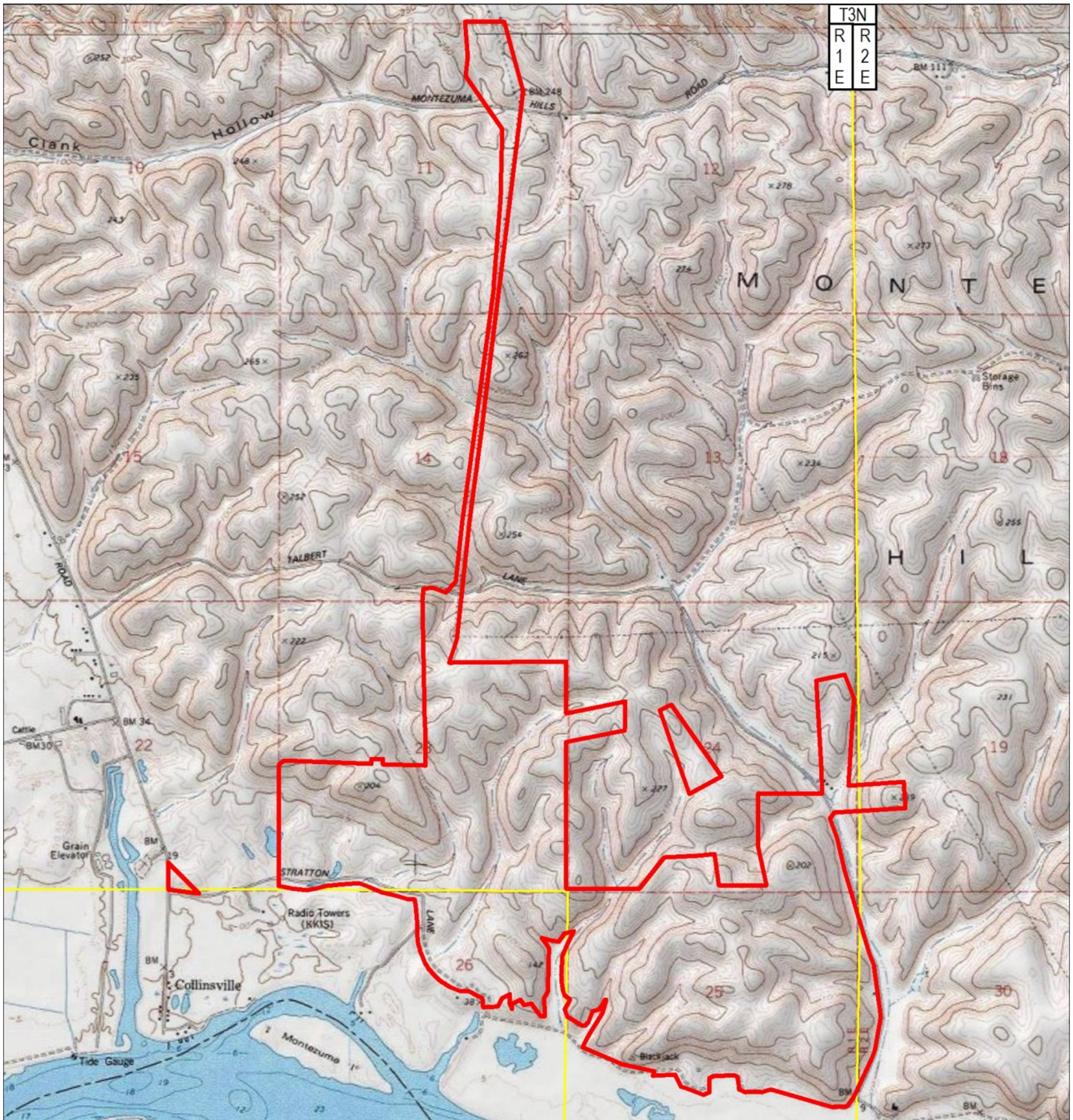
The Sacramento Municipal Utility District (SMUD) is proposing to develop the Solano Phase IV Wind Project (Project) in the Montezuma Hills in Solano County, California (Figure 1). Area West Environmental, Inc. (AWE) conducted surveys to characterize vegetation communities and aquatic habitat types to assess their potential to support giant garter snake (*Thamnophis gigas*) (GGS).

1.1 Project Location and Description

The Project is located immediately east of the community of Collinsville in Solano County, California (Figure 1), specifically in portions of Sections 2, 22, 23, 24, 25, and 26; Township 3 North, and Range 1 East of the Antioch North and Bird's Landing U.S. Geological Survey (USGS) 7.5-minute quadrangle maps (Figure 2). Consisting of rolling hills characteristic of the Montezuma Hills, the Project area is bordered to the south by Stratton Lane, which is just north of the Sacramento River, and to the north and east by existing SMUD wind energy generating facilities (Solano Wind Phases 1, 2, and 3). Within the 1,172-acre Project area, there are existing rows of wind turbines along the hilltops and ridgelines that are connected by gravel roads.

The Project area also includes staging areas which are located within the adjacent SMUD wind facilities, potential access road locations, energy collection systems (transmission lines), and a SMUD substation located just north of Montezuma Hills Road (Figures 1 and 2). SMUD proposes to replace existing wind turbines in the Project area. The Project would also include construction of new access roads, meteorological towers, and a power collection system, including a transmission line to the existing power substation.

Figure 1. Project Vicinity



SOLANO PHASE 4 WIND PROJECT

The Solano Phase 4 Project Area is located in the southeast portion of the County of Solano. The site encompasses approximately 1,172 acres.

The Project Area is located in the Antioch North and Birds Landing USGS 7.5-minute quadrangle map. The project occurs within Sections 2, 11, 14, 22, 23, 24, 25, and 26, Township 3 North, Range 1 East, and Section 19 and 30, Township 3 North, Range 2 East. A portion of southern area of the Project Area is unsectioned.

Center coordinates for the Project Area are:
WGS84 Latitude 38.080932, Longitude -121.827222
UTM Zone 10 South NAD83 Northing 4215443m, Easting 602855m

Data Source:
- Area West Environmental, Inc. 2016
- CH2MHILL, 2016
- ESRI ArcGIS Online, USGS and ©2013 National Geographic Society

Date: 12-6-16

Solano Phase IV Project Area

Township Range Boundary

0 1,000 2,000 3,000 feet

1 inch = 3,000 feet

SMUD™

AREA WEST ENVIRONMENTAL, INC.

Figure 2. Project Location

2.0 Species Description

Information regarding the legal status, species description, habitat requirements, and life history of GGS is provided below.

2.1 Legal Status

GGS was listed as threatened under the federal Endangered Species Act (ESA) on October 20, 1993 (U. S. Fish and Wildlife Service [USFWS] 1993). California listed the species as rare on June 27, 1971, and reclassified it to threatened under the California ESA on October 2, 1980 (California Department of Fish and Wildlife 2016). Critical habitat has not been designated for this species.

2.2 Geographical Distribution

GGS is a California endemic species that relies on marshes, sloughs, ponds, small lakes, mud-bottom canals adjacent to rice fields, and occasionally slow streams on the valley floors of the Sacramento and San Joaquin valleys of central California, typically below 400 feet (122 meters) in elevation (Hansen and Brode 1980; USFWS 2012). Historically, GGS was found throughout the Central Valley from Butte County south to Kern County (USFWS 2012).

The current distribution and abundance of GGS has been reduced significantly from historic levels. Current known populations are scattered within the Central Valley from near Chico in Butte County, south to the Mendota Wildlife Area in Fresno County, with a gap within the central part of the central valley from southern San Joaquin County to Merced County. Current locality records show that GGS are distributed in nine different isolated locations/populations associated with historic flood basins, marshes, wetlands, and streams; Butte Basin, Colusa Basin, Sutter Basin, American Basin, Yolo Basin, Cosumnes-Mokelumne Watershed, Delta Basin, San Joaquin Basin, and Tulare Basin (USFWS 2015). Agriculture and flood control measures have extirpated the species from the southern third of its range (USFWS 2015).

Additionally, the range of GGS in Solano County, based on only three known records (California Natural Diversity Database [CNDDB] 2017), is confined to the eastern portion of the County. The USGS conducted GGS surveys in 2004 at 15 locations most likely to support this species in Solano County but none were found (Wylie et al. 2004). Based on GGS records from Solano County and lack of recent observations it appears that GGS is very rare or possibly extirpated from Solano County (Wylie et al. 2004).

2.3 Species Description

The GGS is one of the largest garter snakes, reaching an average total length of at least 162 centimeters (63.7 inches) (USFWS 2012). Once identified as a subspecies of the western terrestrial garter snake (*Thamnophis elegans*), GGS was given the status of a full species in

1987. The giant garter snake can be distinguished from the common garter snake (*T. sirtalis*) and the western terrestrial garter snake by color pattern, scale numbers and/or size, and head shape (USFWS 2015). The dorsal background color of GGS varies from brown to olive with a cream, yellow, or orange dorsal stripe and two light-colored lateral stripes (USFWS 2015). Some individuals have a checkered pattern of black spots between the dorsal and lateral stripes. Background coloration, prominence of the checkered pattern, and the three yellow stripes are individually and geographically variable (Hansen 1980).

2.4 Habitat Requirements and Life History

GGS is closely associated with emergent wetlands in the Central Valley, occurring in marshes; sloughs; ponds; small lakes; and low-gradient waterways such as small streams, irrigation and drainage canals, and rice fields (USFWS 2012, Stebbins and McGinnis 2012). USFWS 2015 Draft Recovery Plan for GGS (USFWS 2015) identifies the following three habitat components that GGS are mostly associated with, which are further detailed below:

1) an aquatic component with protective emergent vegetative cover that will allow escape and foraging habitat;
2) an upland component (grassy banks and openings in waterside vegetation) near the aquatic habitat that can be used for basking and for summer shelter in burrows, and
3) an upland refugia component that will serve as over-wintering habitat.

Aquatic Component. GGS require aquatic habitat for foraging on prey (i.e. fish and amphibians). The following are characteristics of high-quality aquatic habitat for GGS (USFWS 2015):

- water present during the entire active season (March through November);
- slow moving or static water flow with mud substrate;
- presence of emergent and bankside vegetation that provides cover from predators and may serve in thermoregulation (i.e. basking sites);
- the absence of a continuous canopy of riparian vegetation;
- available prey in the form of small amphibians and small fish;
- the absence of large predatory fish; and
- absence of recurrent inundation or flooding, or where flooding is probable the presence of upland refugia.

Upland Component. While GGS is primarily an aquatic snake, during the active season they utilize upland areas adjacent aquatic habitat (Hansen 1988; Brode and Hansen 1992; Wylie et al. 2003, 2004). Upland habitat that is not typically inundated is used for basking, escape cover to avoid predation, and as a retreat into mammal burrows and crevices in the soil during ecdysis (shedding of skin) (Hansen and Brode 1993; Wylie et al. 2003). Wylie et. al. (1997) found that GGS primarily stayed near the marsh edge, however GGS were observed using burrows as much as 164 feet (50 meters) away as retreats from hot weather during the summer. The following are characteristics of high quality upland habitat for GGS (USFWS 2015):

- availability of bankside vegetative cover, typically tule (*Schoenoplectus* sp.) or cattail (*Typha* sp.), for cover from predators;
- availability of permanent shelter, such as bankside cracks or crevices, holes, or small mammal burrows; and
- grazed using good management practices (not too much nested thatch and not overgrazed).

Upland Winter Refugia Component. During the winter, GGS are in a lethargic state. During this period, they over-winter in small mammal burrows and other soil and rock crevices located along canal banks and marshes (Hansen and Brode 1993; Wylie et al. 1997; Wylie et al. 2003). They do not typically over-winter where flooding occurs in channels with rapidly moving water (USFWS 2015). Wylie et al. (1997) also found that over-wintering GGS are known to use burrows as far as 656 to 820 feet (200 to 250 meters) from the edge of summer aquatic habitat.

GGS begin to mate soon after emergence from overwintering sites. The breeding season lasts from March through May and resumes briefly in September (Hansen and Hansen 1990; USFWS 1999). Females give birth to live young from late July through early September. Brood size averages 23 young but can range from 10 to 46 (Hansen and Hansen 1990). GGS then remain active foraging and occasionally courting until the onset of cooler fall temperatures.

The diet of GGS consists mainly of aquatic prey such as small fish, tadpoles, and frogs (Hansen 1988; Stebbins and McGinnis 2012). Likely predators of GGS include bullfrog (*Lithobates catesbeianus*), northern harrier (*Circus cyaneus*) and other hawks, egrets (Family *Ardeidae*), great blue heron (*Ardea herodias*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), and opossum (*Didelphis virginiana*).

3.0 Methods

There is no formal guidance on performing habitat assessments for GGS. This habitat assessment consisted of pre-field assessment and field assessment components, as described below.

3.1 Pre-field Analysis

Prior to conducting field habitat assessments, information regarding occurrences for GGS near the Project area was gathered from the 2012 Giant Garter Snake 5-Year Review (USFWS 2012) and CNDDB 2017). Previous habitat assessments for portions of the Project area were also reviewed (Jennings 2009a, 2009b, and 2010).

Current and historic aerial photographs (Google Earth™) were analyzed for the presence of potential aquatic features with potential to support GGS within the Project area and surrounding 200-foot buffer. Historic images were compared with one another to determine approximate hydroperiods of aquatic features and the extent and/or presence of emergent vegetation. Aerial photographic interpretation was also used to determine the current and historic extent of land use practices in the Project area, specifically winter wheat (*Triticum aestivum*) cultivation.

The USFWS incorporated a standard of 200 feet of upland on each bank side of linear habitat as suitable upland for GGS when assessing a project's disturbance area (USFWS 1997, 2005). Therefore, the 200-foot upland buffer has become standard in subsequent Biological Opinions and impacts analyses, and is used as a standard in this assessment. Using this standard, all aquatic features within 200 feet of the Project area were also characterized. The Project area and surrounding 200-foot buffer is hereafter referred to as the Study area.

3.2 Field Surveys

AWE biologists Mark Noyes and Jeff Alvarez conducted site visits on March 30 and 31, 2016. Offsite habitats were further characterized by Mark Noyes on July 1, 2016. During the site visits, vegetation communities within the Project area were mapped and characterized based on dominant plant species, management practices (e.g., farming and grazing), and hydrology. The Study area was investigated using meandering transects with an all-terrain vehicle, where accessible, and on foot in steep areas or locations with limited access. Areas that were inaccessible where viewed with binoculars from public roads to assess habitat suitability for GGS. Areas identified during pre-field investigations including those mentioned in previous habitat assessments (Jennings 2009a, Jennings 2009b, and Jennings 2010) were visited during the field surveys to determine if they could provide habitat for GGS.

All vegetation communities were drawn on aerial photographs and later digitized using Geographic Information System software to calculate acreages. For some vegetation communities dominated by hydrophytic plant species (i.e., wetlands), boundaries were mapped using Global Positioning System units with sub-meter accuracy.

Information obtained during the field visits included the size and approximate depth of aquatic features, substrate and vegetation characteristics, general hydrology, surrounding upland characteristics, species observations (including presence of predatory species), and information regarding abundance and locations of aggregations of ground squirrel (*Spermophilus beecheyi*) and Botta's pocket gopher (*Thomomys bottae*) burrows. Aquatic features that were not accessible but appeared to have sufficient hydroperiods to support GGS were considered potential aquatic habitat.

4.0 Results

4.1 Land Uses

The community of Collinsville is located just outside the southwest corner of the Study area, and low-density residential/rural development is present along the west side of Collinsville Road. Several residences are present within the Study area, typically just outside the boundaries of the large wind farms that are present throughout the area. These areas contain large wind turbines connected by graveled access roads and associated maintenance buildings and equipment yards.

Within the Project area, the open spaces between the wind turbines consist of wheat fields in various stages of production (disked, planted, and fallow). In general, a wheat crop is 1a 5 – 18 month process repeated every three years. For fallow wheat fields, including the eastern half of the Project area, wheat production had not occurred for at least 1 year, as evidenced by remnant stalks of wheat from previous harvests. These areas were grazed by sheep, with most grazing occurring along the hilltops and ridgelines, likely due to presence of the wind turbines, which provided shade in an area largely devoid of trees.

South of Stratton Lane, which generally serves as the southern boundary of the Project area, vegetation appeared to be grazed at irregular intervals.

4.2 General Site Conditions

The majority of the Study area is characterized by rolling hills typical of the Montezuma Hills area. Bordered to the south by the Sacramento River Delta as it transitions into the Suisun Bay, the southern portion of the Project area is fringed with a mix of freshwater and brackish emergent marshes with some riparian tree cover, primarily consisting of willows (*Salix* sp.). Despite the steep terrain, relatively few drainages are present, consisting entirely of ephemeral drainages that convey water for short durations immediately following precipitation events.

4.3 CNDDB Occurrences

There are six CNDDB occurrences of GGS within 5 miles of the Study area. The nearest overland CNDDB occurrence is 2.6 miles west of the Study area (GGS Occurrence #358). Recorded in 2010, this occurrence consists of a single adult observed along a graveled access road located on the northern bank of Grizzly Slough near the junction with Montezuma Slough (CNDDB 2017). The remaining five occurrences were observed on the southern bank of the Sacramento River and on Sherman Island, across the river from the Study area (4.43 miles to the east, 3.93 miles southwest, 3.88 miles southeast, 3.40 miles southeast, and 2.56 miles southeast of the Study area).

4.4 Aquatic Habitat

Of the 48 aquatic features assessed within the Study area, two aquatic features were determined to provide potential aquatic habitat for GGS (Figure 4, Table 1). Features 46 and 47, located just south of the Project area, were identified as emergent marsh/open water vegetation communities, as evidenced by the presence of willows, tules, and cattails. The vegetation observed while in the field indicate predominantly freshwater habitat. These features are perennial estuarine wetlands and have connectivity to the Sacramento River. Therefore, there is sufficient water during the active summer season to supply cover and prey species (small fish and amphibians) to support GGS.

Within the Study area, the remaining 46 features were determined to not provide potential aquatic habitat for GGS based on the presence of at least one of the following characteristics (Table 1):

- insufficient hydroperiod (not lasting from March to November);
- saline or brackish water, evidenced by salt-tolerant hydrophytic plant species and/or salt crusts; and
- no emergent or riparian vegetation.

The characteristics of each aquatic feature that was assessed for GGS habitat suitability is discussed in Table 1 below. Representative photographs are provided in Appendix A.

4.5 Upland Habitats

Within the Study area, very few mammalian burrows were observed that could provide underground refugia to GGS. Despite this, upland habitat to GGS within the Study area was present in the form of soil cracks within disked and fallow wheat fields within 200 feet from aquatic features 46 and 47 (Figure 3). These upland areas have potential to provide upland habitat and may provide aestivation sites for GGS.

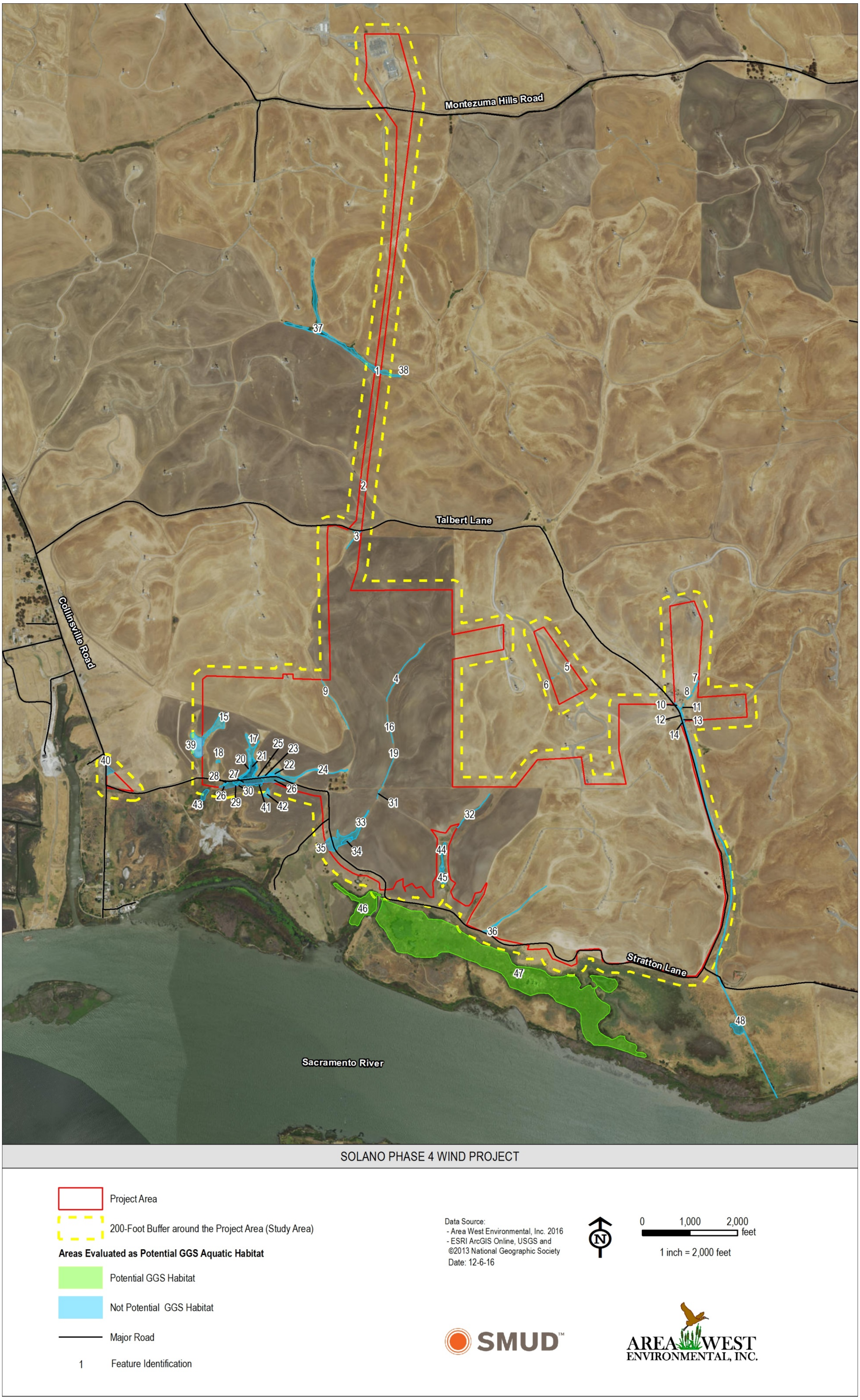


Figure 3. Potential GGS Habitat

Table 1. Aquatic Feature Characteristics

Feature #	Suitable Habitat Characteristics[1]			Unsuitable Characteristics[1]			Potential Aquatic Habitat (Yes/No
	Sufficient Hydroperiod (March to November)	Freshwater	Riparian/ Emergent Vegetation	Insufficient Hydroperiod	Saline or Brackish Water	No Riparian/Emergent Vegetation	
1		X	X	X		X	No
2		X		X		X	No
3		X		X		X	No
4		X		X		X	No
5		X		X		X	No
6		X		X		X	No
7		X		X		X	No
8		X		X		X	No
9		X		X		X	No
10		X		X		X	No
11		X		X		X	No
12		X				X	No
13		X		X		X	No
14		X		X		X	No
15		X		X		X	No
16		X		X		X	No
17				X	X	X	No
18		X		X		X	No
19		X		X	X	X	No
20		X		X		X	No
21	X		X	X	X		No
22		X		X		X	No
23		X		X		X	No
24				X	X	X	No
25		X		X		X	No
26		X		X		X	No
27	X			X	X		No
28				X	X		No
29	X			X	X	X	No
30	X		X	X	X	X	No
31		X		X		X	No
32		X		X		X	No

Feature #	Suitable Habitat Characteristics[1]			Unsuitable Characteristics[1]			Potential Aquatic Habitat (Yes/No
	Sufficient Hydroperiod (March to November)	Freshwater	Riparian/ Emergent Vegetation	Insufficient Hydroperiod	Saline or Brackish Water	No Riparian/Emergent Vegetation	
33		X		X		X	No
34	X	X	X			X	No
35		X		X		X	No
36		X		X		X	No
37		X	X	X		X	No
38		X	X	X		X	No
39	X				X		No
40		X		X		X	No
41					X		No
42				X	X		No
43				X	X		No
44		X		X		X	No
45		X	X	X	X	X	No
46	X	X	X				Yes
47	X	X	X				Yes
48				X			No

[1] See Section 2.4 for a description of GGS habitat requirements

5.0 Conclusions

No suitable GGS habitat is present within the Project area, however two aquatic features within the Study area could provide potential aquatic habitat for GGS. Although the majority of the uplands within the 200-foot buffer of these aquatic features are outside of the Project area, this buffer does extend into two small portions of the Project area along its southern boundary. GGS could occur within small portions of upland habitat near the southern boundary of the Project area.

6.0 References

Brode, J. and G. Hansen. 1992. Status and future management of the giant garter snake (Thamnophis gigas) within the southern American Basin, Sacramento and Sutter counties, California. California Department of Fish and Game, Inland Fisheries Division, January 1992.California Department of Fish and Wildlife. 2013. State and Federally Listed Endangered and Threatened Animals of California, October 2013. Sacramento: California Department of Fish and Wildlife, California Natural Diversity Database.

California Department of Fish and Wildlife. 2016. State and Federally Listed Endangered and Threatened Animals of California (Updated October 2016). https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=109405 &inline

California Natural Diversity Data Base. 2017. Records search of the Antioch North and Birds Landing, and Surrounding U.S. Geological Survey 7.5 minute topographic quadrangles. RareFind 5, April 2017 update. Sacramento, California.

CDFW. See California Department of Fish and Wildlife.

CNDDB. See California Natural Diversity Data Base.

Hansen, G. E. 1988. "Review of the Status of the Giant Garter Snake (Thamnophis couchi gigas) and its Supporting Habitat During 1986-1987." (unpublished final report for CDFW, Contract C-2060).

Hansen, G. E., and M. Brode. 1980. "Status of the Giant Garter Snake, Thamnophis couchi gigas (Fitch)." Inland Fishery Endangered Species Program Special Publication 80-5. Sacramento: California Department of Fish and Game.

Hansen, G. E., and M. Brode. 1993. Results of Relocating Canal Habitat of the Giant Garter Snake (Thamnophis gigas) during widening of SR 99/70 in Sacramento and Sutter Counties, California. Final Report for Caltrans Interagency Agreement 03E325 (FG7550) (FY 87/88-91-92). Rancho Cordova.

Hansen, R. W. 1980. Western Aquatic Garter Snakes in Central California: an Ecological and Evolutionary Perspective. Master of Arts thesis, California State University, Fresno, California, 78 pp.

Hansen, R.W., and G.E. Hansen. 1990. "Thamnophis gigas Reproduction." Herpetological Review 21(4):93-94.

Stebbins, R.C., and S.M. McGinnis. 2012. Amphibians and Reptiles of California. Berkeley: University of California Press.

Jennings, M. 2009a. Habitat Assessment for the California Tiger Salamander (*Ambystoma californiense*), California Red-legged Frog (*Rana draytonii*), and Giant Gartersnake (*Thamnophis gigas*), on the Collinsville Wind Project Site, Solano County, California. Prepared for Insignia Environmental. July 30, 2009.

Jennings, M. 2009b. Addendum Habitat Assessment for the California Tiger Salamander (*Ambystoma californiense*), California Red-legged Frog (*Rana draytonii*), and Giant Gartersnake (*Thamnophis gigas*), on the Proposed Tie-In Transmission Line Substation at the Collinsville Wind Project Site, Solano County, California. Prepared for Insignia Environmental. November 30, 2009.

Jennings, M. 2010. Second Addendum Habitat Assessment for the California Tiger Salamander (*Ambystoma californiense*), California Red-legged Frog (*Rana draytonii*), and Giant Gartersnake (*Thamnophis gigas*), on the Proposed Tie-In Transmission Line Substation at the Collinsville Wind Project Site, Solano County, California. Prepared for Insignia Environmental. May 23, 2010.

U.S. Fish and Wildlife Service. 1993. "Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Giant Garter Snake." Federal Register 58 (201): 54053-54066.

U.S. Fish and Wildlife Service. 1997. Programmatic Formal Consultation for U.S. Army Corps of Engineers 404 Permitted Project with Relatively Small Effects on the Giant Garter Snake within Butte, Colusa, Glenn, Fresno, Merced, Sacramento, San Joaquin, Solano, Stanislaus, Sutter and Yolo Counties, California. Sacramento, CA. November 13, 1997.

U.S. Fish and Wildlife Service. 1999. Draft Recovery Plan for the Giant Garter Snake (Thamnophis gigas). US Fish and Wildlife Service, Portland, Oregon. ix+192 pp.

U.S. Fish and Wildlife Service. 2005. Appendix C of the Programmatic Biological Opinion on the Effect of Small Highway Projects on the Threatened Giant Garter Snake in Butte, Colusa, Glenn, Sacramento, San Joaquin, Solano, Sutter, Yolo, and Yuba Counties, California. Sacramento, CA. January 24, 2005.

U.S. Fish and Wildlife Service. 2012. Giant Garter Snake (Thamnophis gigas) 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office, Sacramento, California. June 2012.

U.S. Fish and Wildlife Service. 2015. Draft Recovery Plan for the Giant Garter Snake (Thamnophis gigas). US Fish and Wildlife Service, Portland, Oregon. ix+192 pp.

USFWS. See U.S. Fish and Wildlife Service.

Wylie, G. D., M. L. Casazza, and J. K. Daugherty. 1997. "1996 Progress Report for the Giant Garter Snake Study." (unpublished report. USGS, Biological Resources Division, Dixon Research Station. Dixon, California).

Wylie, G. D., M. L. Casazza, and M. Carpenter. 2003. Diet of Bullfrogs in Relation to Predation on Giant Garter Snakes at Colusa National Wildlife Refuge. California Fish and Game 89 (3): 139-145.

Wylie, G. D and L. L. Martin. 2004. Survey for the Giant Garter Snakes in Solano County: 2004 Report. Prepared for US Fish and Wildlife Service. U. S. Geological Survey, Western Ecological Research Center, Dixon Field Station, Dixon, California. 20 pp.

Appendix A. Representative Photographs

<table>
<tr>
<td>
Photograph 1. Ponded portion of ephemeral drainage Feature 10, which has too short a hydroperiod to provide GGS aquatic habitat (facing south).
Taken on March 30, 2016.</td>
<td>
Photograph 2. Aquatic Feature 47 and the Sacrament River (background) just south of the Project area, which could provide GGS aquatic habitat (facing south).
Taken on March 30, 2016.</td>
</tr>
<tr>
<td>
Photograph 3. Emergent marsh vegetation in Aquatic Feature 45, which does not have a long enough hydroperiod to provide GGS aquatic habitat (facing south).
Taken on March 30, 2016.</td>
<td>
Photograph 4. Cultivated wheat fields (foreground) and brackish marsh (background), which despite being ponded year-round, is too saline to provide aquatic habitat to GGS (facing southwest).
Taken on March 30, 2016.</td>
</tr>
</table>

Eagle Survey Report

Solano 4 Wind Project
Eagle Survey Report

July 2018

Prepared for:

Sacramento Municipal Utility District

SMUD®

Prepared by:

Estep Environmental Consulting

ESTEP
Environmental Consulting

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Eagle Survey Report

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July 2018

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Executive Summary

This report was prepared to supplement the biological resources assessment for the Sacramento Municipal Utility District's (SMUD) Solano 4 Wind Project (Project) located within the Montezuma Hills Wind Resource Area (MHWRA) in Solano County. Surveys were conducted within a 10-mile radius of the Project to document bald eagle (*Haliaeetus leucocephalus*) and golden eagle (*Aquila chrysaetos*) nesting activity. The surveys, conducted over three breeding seasons between 2016 and 2018, included determining the status of previously reported eagle nest sites and nesting territories, examining other potential nesting habitat for active nests, reporting all eagle observations within the survey area, and documenting other raptor nests.

No eagles were observed at the four historic golden eagle nest sites within the MHWRA. The most recent eagle activity reported at any of these nest sites was in 2012, and three have not had reported activity since 2008. During the survey, three of the four sites were occupied by other raptor species.

Although nesting activity could not be confirmed, each of the five golden eagle nesting territories outside of the MHWRA but within the 10-mile survey radius were considered extant due to incidental eagle observations and limited ability to confirm nest occupancy. Although several juvenile bald eagles were observed in the MHWRA, no nesting bald eagles were recorded and no bald eagles were observed in the vicinity of a previously-reported possible bald eagle breeding territory on Grizzly Island.

A total of 58 active nests of other raptor species, including red-tailed hawk (*Buteo jamaicensis*), Swainson's hawk (*Buteo swainsoni*), white-tailed kite (*Elanus leucurus*), and great-horned owl (*Bubo virginianus*); and common raven (*Corvus corax*) were documented during the survey.

Introduction

The Sacramento Municipal Utility District (SMUD) is proposing to develop the Solano 4 Wind Project (Project) in the Montezuma Hills Wind Resource Area (MHWRA) in Solano County, California (Figure 1). SMUD is currently conducting resource assessments that will be incorporated into the Environmental Impact Report prepared pursuant to the California Environmental Quality Act (CEQA) and other related environmental documentation. Because they are afforded protection under the federal Bald and Golden Eagle Protection Act, among these is a survey of nesting golden eagles (*Aquila chrysaetos*) and bald eagles (*Haliaeetus leucocephalus*) in the vicinity of the Project. Surveys for nesting eagles were conducted during three breeding seasons between 2016 and 2018 following the U.S. Fish and Wildlife Service's (USFWS) *Interim Golden Eagle Technical Guidance: Inventory and Monitoring Protocols; and Other Recommendations in Support of Golden Eagle Management and Permit Issuance* (Eagle Guidance) (USFWS 2010). This report summarizes results of current nesting surveys and historical eagle nesting within the survey area. The information presented in this report will be used to assess potential eagle use of the Project area and will inform Project design to facilitate minimizing or eliminating eagle mortality during operation of the Project.

Project Location and Description

The Project includes two non-contiguous subareas and an electrical distribution corridor that connects them to the Russell Substation (Figure 2). The Solano 4 West subarea is located immediately east of the community of Collinsville, specifically in portions of Sections 2, 22, 23, 24, 25, and 26; Township 3 North, and Range 1 East of the Antioch North and Bird's Landing U.S. Geological Survey 7.5-minute quadrangle maps (Figure 2). Consisting of rolling hills characteristic of the Montezuma Hills, the Project area is bordered to the south by Stratton Lane, which is just north of the Sacramento River, and to the north and east by existing SMUD wind energy generating facilities (Solano Wind Phases 1, 2, and 3). There are 62 existing Kenetech KCS 56 turbines within the 1,390-acre subarea, which will be removed and replaced with 12 Project turbines.

The Solano 4 East subarea is located approximately 3 miles northeast of the Solano 4 West subarea in portions of Sections 4, 5, 8, and 9; Township 3 North, and Range 2 East of the Antioch North and Bird's Landing U.S. Geological Survey 7.5-minute quadrangle maps (Figure 2). Montezuma Hills Road extends north-south through the triangle-shaped subarea before turning westward along the southwestern edge of the subarea. From its southwest corner, the subarea extends for 2.2 miles southeast towards the Sacramento River. Rolling hill topography is similar to Solano 4 West and consists of annual grasses used for seasonal livestock grazing. Within the 881-acre Solano 4 East subarea there are 23 V-47 Vestas turbines, all of them west of Montezuma Hills Road, which will be removed and replaced with 10 Project turbines spaced throughout the Solano 4 East subarea.

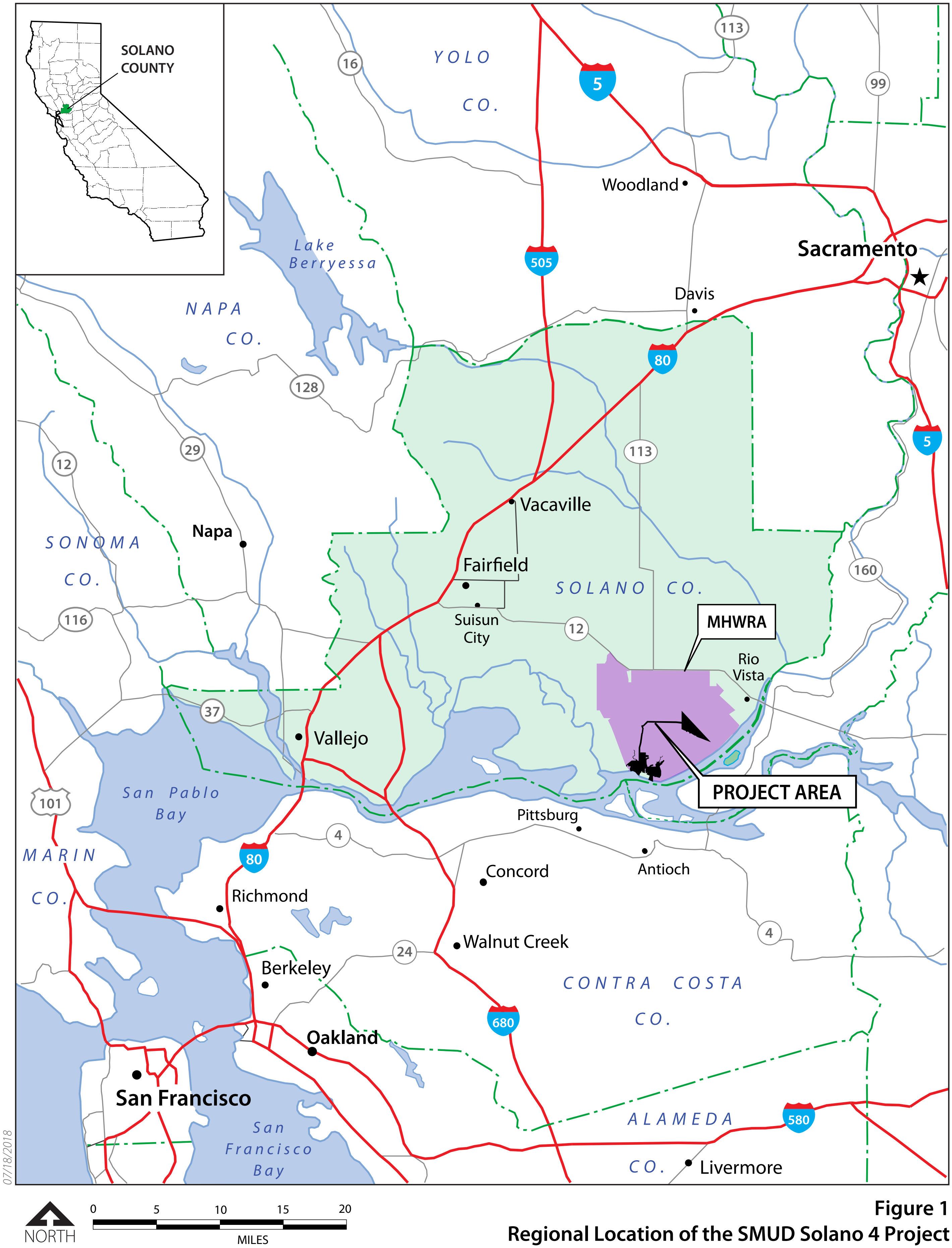

Figure 1
Regional Location of the SMUD Solano 4 Project

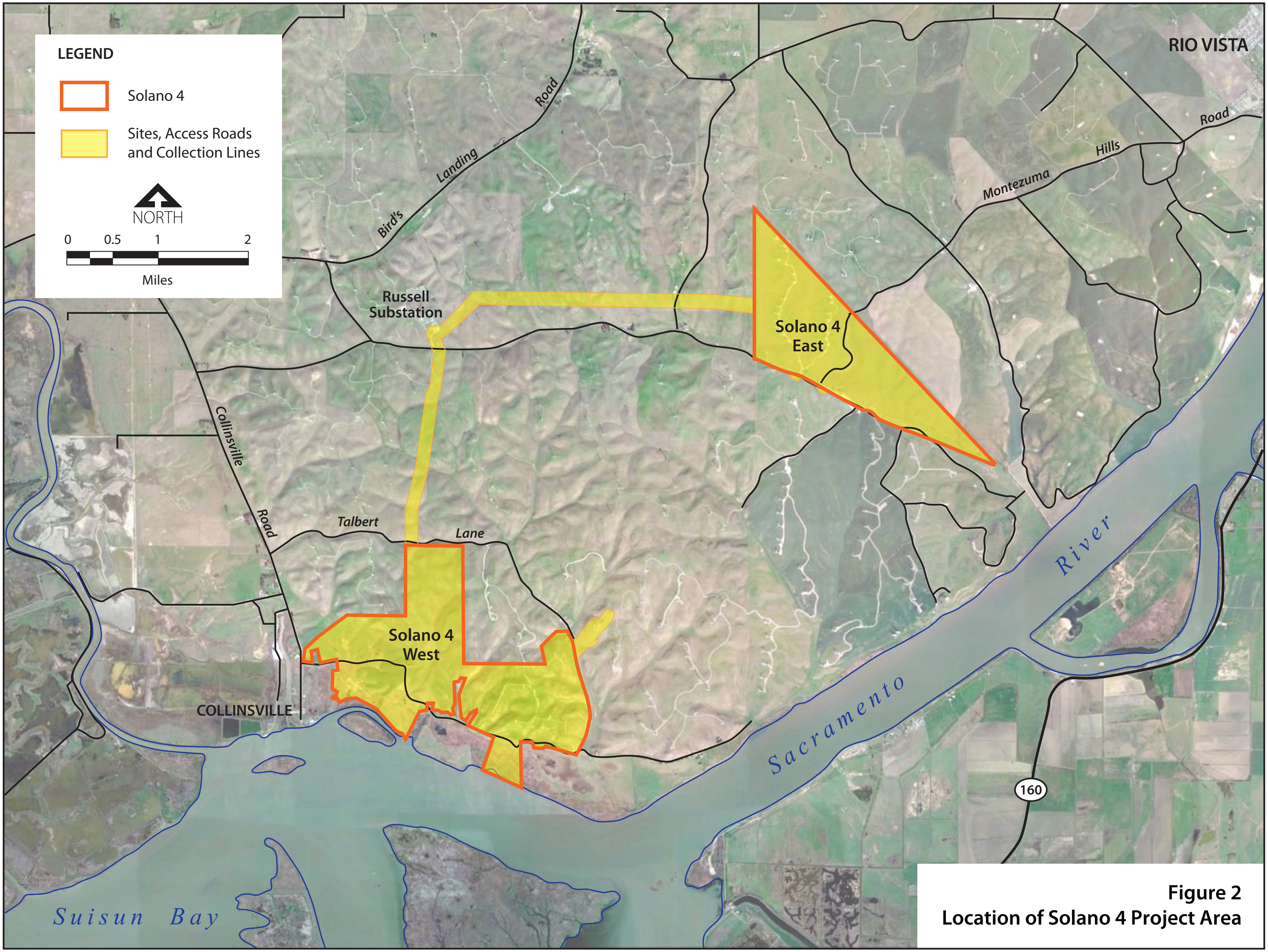

Figure 2
Location of Solano 4 Project Area

SOURCE: Sacramento Municipal Utility District 2018.

The Project area also includes staging areas, which are located within the adjacent SMUD wind facilities, meteorological towers, gravel access roads, and energy collection systems (underground distribution lines) that will connect to the Russell substation (Figure 2).

Methods

Agency coordination and field surveys at the Solano 4 site were conducted by Area West Environmental, Inc. (AWE) in 2016 and 2017 (AWE 2017). In 2018 field surveys were conducted by Estep Environmental Consulting. The following section provides details on the pre-field research and survey methods conducted from 2016 through 2018.

Pre-field Assessment

Consistent with the Eagle Guidance (USFWS 2010), location data from previous eagle surveys conducted within and surrounding the MHWRA along with other information sources were reviewed for known locations of historic eagle nests, and included the following:

- Raptor Nesting Survey Related to Wind Turbine Siting, Montezuma Hills (Howell and DiDonato 1988);
- Avian Use Monitoring Related to Wind Turbine Siting, Montezuma Hills (Howell et al 1988
- Avian Use and Mortality Study, U.S. Windpower, Wind Energy Site Development, Montezuma Hills (Howell et al 1991);
- Wind turbine effects on avian activity, habitat use, and mortality in Altamont Pass and Solano County Wind Resource Areas (Orloff and Flannery 1992);
- Examination of Avian Use and Mortality at the Sacramento Municipal Utility District Proposed Wind Energy Development Site, Montezuma Hills (Howell and Noone 1992);
- Examination of Avian Use at the Sacramento Municipal Utility District Proposed Wind Energy Development Site, Montezuma Hills (Howell and Noone 1994);
- Avian Monitoring Study and Risk Assessment for the High Winds Power Project (Kerlinger et al. 2001);
- A Survey of Breeding Raptors in the Vicinity of the Montezuma Hills Wind Resource Area (Hunt et al 2008);
- Bald and Golden Eagle Survey Report for Proposed Collinsville Wind Project (Garcia and Associates [GANDA] 2011);
- Avian Use Study for the Collinsville Wind Power Project (Curry and Kerlinger, LLC 2011);
- Avian and Bat Protection Plan for the Proposed Collinsville Wind Project (ICF International 2011);
- Bird and Bat Conservation Strategy for the Shiloh 4 Wind Project (ICF International 2012;

- Final Eagle Conservation Plan (for the) Solano Wind Project Phases 1, 2, and 3 (AECOM 2014; and
- California Natural Diversity Database (CNDDB) (California Department of Fish and Wildlife [CDFW] 2018).
- eBird 2018 records (Sullivan et a. 2009) – online citizen-based bird observation network.

Eagle Guidance Survey Protocol

According to the Eagle Guidance (USFWS 2010), a 10-mile radius survey area should be established around a project site to determine presence/absence, location, and status of eagle nests. Two rounds of either aerial or ground-based surveys in a single season are required to determine the status of an occupied nest. The first survey should be conducted during the time of year when golden eagles are establishing nesting territories, which is generally during the winter months (December through early February) in California. During the first survey, all known eagle nests from previous seasons and all potential nesting locations (large trees, utility towers, and cliffs) should be surveyed for the presence of potential eagle mating pairs establishing nest territories. All previously-identified eagle nests should be surveyed for up to 4 hours at a distance (between 300 and 1600 meters) to determine the occupancy status of each site. A second round of surveys – conducted no less than 30 days after the first round and ideally when the young would be more than 51 days old but not yet fledged – would then be conducted to determine the nesting status of each occupied nesting territory.

If a nest is determined to be potentially occupied by a bald or golden eagle, the following information would be collected during each round of surveys:

- Date of observation(s);
- Time of observation(s);
- Weather during observation(s);
- Name of observer(s);
- Location of observation(s); and
- Description of observation(s).

For each potential or occupied eagle nest, the following data would be recorded:

- Status (Unknown; Vacant; Occupied-Number of eagles [laying or non-laying]; breeding successful [chick observed to be ≥51 days-fledging]; breeding unsuccessful);
- Location (decimal degree lat/long or Universal Transverse Mercator);
- Elevation
- Age class(es) of eagles observed;
- Estimated nesting chronology (date clutch complete [with incubation behavior observed], hatch date, fledge date, date failure first observed and/or confirmed, and number of young at each visit ≥51 days);

- Photographs (surrounding landscape and nest); and
- Substrate (tree species, cliff, or structure).

Additional observations could also include:

- Presence and description of bands, patagial tags, or telemetry unit;
- Forage location;
- Prey items;
- Height of nest;
- Additional nesting substrate information;
- Aspect; and
- Nearby nesting raptors.

Agency Coordination

Resource agency personnel and professionals from CDFW and USFWS were contacted with regard to special-status species occurrence within the action area.

California Department of Fish and Wildlife

On March 8, 2016, SMUD sent a letter to Craig Weightman, Region 3 Environmental Program Manager at the CDFW Bay Delta Region. The letter included a list of special-status species that have potential to occur within the Project vicinity based on species lists from CNDDB and USFWS. The letter asked if there are any additional special-status species that the CDFW believes has potential to occur within the Project vicinity, or if there are species of local concern. To date, no response has been received.

U.S. Fish and Wildlife Service

A letter was sent to Jan Knight, Deputy Field Supervisor at the USFWS Sacramento Fish & Wildlife Office on March 8, 2016. The letter included a list of special-status species that have potential to occur within the Project vicinity based on species lists from CNDDB and USFWS. The letter asked if there are any additional federally listed species that the USFWS believes has potential to occur within the Project vicinity, or if there are species of local concern. To date no response has been received.

On March 31, 2016, Jose Bodipo-Memba and Ammon Rice of SMUD, Becky Rozumowicz with AWE, and Bridget Canty with CH2M HILL had a conference call with Heather Beeler and Robert Doster of the USFWS to discuss proposed eagle survey methods. During that call Ms. Beeler stated that the USFWS would like early season surveys (December - February) to be included in the methods in order to identify whether there is eagle breeding territory within the Project area.

On April 21, 2016, Becky Rozumowicz with AWE sent a follow up email concerning the March 31 conference call to Ms. Beeler and Mr. Doster with the USFWS. The email included a letter outlining the proposed eagle survey methods for the Project. In addition, the letter requested any additional information the USFWS may have on nesting eagles and territories, and comments on the methods proposed. Resumes of proposed surveyors were also attached for the USFWS's approval. Mr. Doster responded via email on May 3, 2016 with approval of the surveyors. Regarding the request for additional eagle nest data, Mr. Doster stated that the USFWS did not have any further data beyond what was cited in the letter. He also agreed that the proposed survey methods are appropriate. However, given that it was a little late in the nesting season for 2016, Mr. Doster stated that the USFWS recommends considering doing a second round of surveys, appropriately timed during the next nesting season.

No additional follow-up with the CDFW or USFWS was made prior to the 2018 surveys to address any potential changes due to the addition of the Solano 4 East subarea because:

- the expanded 10-mile radius survey area only included 1-2 miles north and east of the Project area in the Central Valley and north Delta where there are no records of nesting golden or bald eagles and nesting is not expected to occur; and
- the 2018 surveys included an additional 3rd consecutive year survey of historic golden eagle nests and other suitable nesting habitat within the MHWRA.

Field Surveys

The survey area was established by creating a 10-mile radius polygon measured from the perimeter of the Project area (Figure 3). Surveys were conducted by driving all accessible roads and walking as needed to access potential nesting areas. Using binoculars and spotting scope, suitable nesting habitat was checked for the presence of nests and to record all observations of golden and bald eagles within the survey area. Nesting occurrences of other raptor species were also recorded.

To determine presence/absence of active eagle nests, occupied eagle breeding territories, and to record eagle occurrences within the Project area, ground-based daytime surveys were conducted within the 10-mile-radius survey area over the course of three breeding seasons from March 2016 to May 2018. Biologists Jeff Alvarez and Mark Noyes of AWE conducted surveys within 10 miles of the Solano 4 West subarea on March 30 and March 31, 2016 and continued by Jeff Alvarez on April 2, 2016 and April 11, 2016. As part of the survey round, all accessible potential nesting sites within the survey area were visited, with the exception of the portion of Contra Costa County located south of the cities of Antioch and Pittsburg, where golden eagle activity had been previously reported at three separate locations in 2011 (GANDA 2011) (Figure 3). Although nests were not confirmed, GANDA (2011) considered these to be breeding territories. Survey effort in this area focused on the locations of these previously reported territories, but all potential nesting habitat, which included large areas of oak woodland, was not

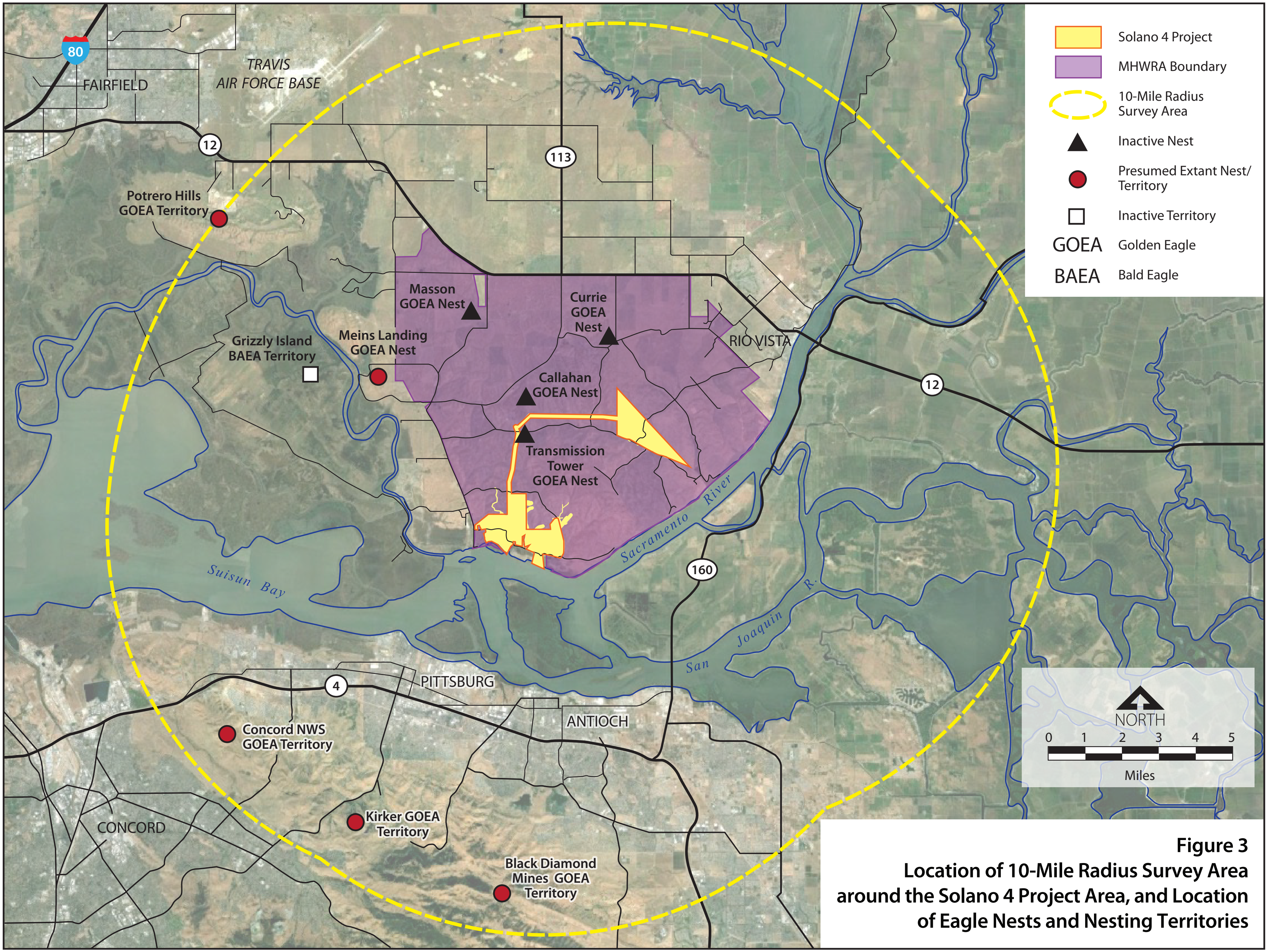

Figure 3
Location of 10-Mile Radius Survey Area around the Solano 4 Project Area, and Location of Eagle Nests and Nesting Territories

SOURCE: AWE 2017; Estep Environmental Consulting April 19 and 24, 2018 surveys; GANDA 2011; Hunt 2008; Kerlinger et. al. 2001.

surveyed. Access to the Potrero Hills nest site (Figure 3) was also limited. Surveys of this area were conducted from Grizzly Island Road.

Surveys were again conducted within 10 miles of the Solano 4 West subarea on November 29 and December 30, 2016, and February 22, 2017.

The Solano 4 East subarea was added to the Project in late 2017, necessitating an expanded 10-mile survey radius. This expansion added an additional 1 to 2 miles to the survey area east and northeast of the original 10-mile radius survey area (Figure 3). Jim Estep of Estep Environmental Consulting conducted surveys in the expanded area, rechecked activity at all historic golden eagle nest sites within the MHWRA, and re-surveyed other potential nesting habitat within the MHWRA on April 19, 24, and 26 and May 4, 2018. Other raptor nests within the survey area were also identified and mapped.

Eagles were determined to not be utilizing previously-identified nests or nesting areas if:

- The previously identified nest was no longer present and no other nest structures were present,
- The nest was present but damaged or not sufficiently intact to be used for nesting,
- The nest was unoccupied and no golden eagles were observed in the vicinity of the nest,
- A non-eagle raptor was visually observed siting on the nest,
- A non-eagle raptor was observed showing territorial behavior above the nest, or
- Calls from a non-eagle raptor were heard coming from the general nest location.

Results

Based on a review of numerous previous surveys conducted in and around the MHWRA since 1987, there are four historic golden eagle nesting territories identified from within the MHWRA. Five additional golden eagle nesting territories and one bald eagle nesting territory have been documented outside of the MHWRA but within the 10-mile survey radius (Figure 3).

Golden Eagle Activity Within the MHWRA

During the 2016 spring, 2016/17 winter, and 2018 spring surveys, no eagles were detected at any of the previously identified golden eagle nests or other potential nesting areas within the MHWRA (Table 1, Figure 3). All historic nests within the MHWRA are either no longer present or only remnants of the previously-used nests are present.

Masson Nest

The Masson nest was in a small eucalyptus grove approximately 1.2 miles south of State Route 12, just west of Olsen Road. The site, approximately 4 miles northwest of the Solano 4 East subarea, is surrounded by open grazed grassland and periodically-cultivated grain fields with other small eucalyptus groves nearby and within 500-600 feet of the nearest wind turbine. Golden eagle nesting was first reported at this site in 2001 (Kerlinger et al. 2001), but activity at this site has not been reported since then. Only remnants of the golden eagle nest are still present. Red-tailed hawks (*Buteo jamaicensis*) were reported to occur at this site in 2011 (GANDA 2011). Red-tailed hawks also occupied this site during the 2016-2018 surveys (Table 1).

Callahan Nest

First reported in 1992 (Orloff and Flannery 1992), the Callahan nest was in a small eucalyptus grove 0.5-miles southeast of Bird's Landing Road and 1.25 miles east of Montezuma Hills Road. Approximately 2.5 miles west of the Solano 4 East subarea, the site is surrounded by open grazed grassland and periodically-cultivated grain fields and is within 800 feet of the nearest wind turbine. The site was reportedly active in 2001 (Kerlinger et al. 2001) and several subsequent years with the last nesting activity reported in 2007. A subadult was observed in the area in 2010, but there were no signs of nesting activity and the golden eagle nest had deteriorated. Swainson's hawks (*Buteo swainsoni*) were reported nesting at this site from 2009 to 2011 (GANDA 2011). Swainson's hawks also occupied this site during the 2016-2018 surveys (Table 1).

Currie Nests

The Currie site included two alternate nests within the same nesting territory. Approximately 0.4 miles from each other, both were in small eucalyptus groves near the intersection of Currie and Emigh Roads. The site, approximately 1-mile northwest of the Solano 4 East subarea, is within a similar landscape of grazed grassland and periodically-cultivated grain fields and is between 1,500 and 2,000 feet from the nearest wind turbine. The last reported golden eagle nesting at this site was in 2005. GANDA (2011) reports that the golden eagle nests are no longer present and red-tailed hawks have occupied the site in years prior to 2011. Red-tailed hawks and great-horned owls (*Bubo virginianus*) occupied these sites during the 2016-2018 surveys (Table 1).

Transmission Tower Nest

Located on a transmission tower near the Russell substation just north of Montezuma Hills Road – and along the Project electrical distribution corridor – this nest was first documented in 2012 and given its close proximity may be an alternate nest within the Callahan territory. The nest failed and golden eagle activity has not been reported at the site since then. The nest is no longer present.

Although no active nests were reported within the MHWRA, several eagle observations were reported during the 2016-2018 surveys including:

- A foraging adult golden eagle approximately 0.25 miles northeast of the Solano 4 West subarea along Talbert Lane in spring 2016.
- A subadult golden eagle interacting with a Swainson's hawk above Birds Landing Road just east of Birds Landing in spring 2018.
- Juvenile bald eagles observed foraging with a group of turkey vultures (*Cathartes aura*) and common crows (*Corvus brachyrhynchos*) just west of the Solano 4 West subarea on March 31, 2016 and again on April 5, 2016.

Golden Eagle Nests/Nesting Territories Outside of the MHWRA but Within the Survey Area

Meins Landing Nest

The Meins Landing nest is in a small eucalyptus grove about 0.25 miles east of the terminus of Birds Landing Road near the east side of Grizzly Island approximately 5 miles northwest of the Solano 4 West subarea (Figure 3). The nest was initially reported active in 2011 (GANDA 2011), but activity has not been confirmed since then. Golden eagle activity was not reported at this site during the 2016-2018 surveys (Table 1). However, a nearby landowner and site supervisor of the Montezuma Wetlands Restoration Project reports regular activity at this nest site as recent as 2017 (Gollinger, Stan pers comm). Therefore, although confirmed to be inactive in 2018, this site is conservatively considered potentially extant.

Potrero Hills Nest

This golden eagle nest is in a eucalyptus grove about 1,500 feet south of the Potrero Hills landfill and approximately 10 miles northwest of the Project (Figure 3). Initially reported in 1995 (Jones & Stokes 1995), the territory was reported active in 2007 and again in 2011 (GANDA 2011) but nesting activity was not confirmed. Although no eagles were observed during 2016/17 surveys, this site is conservatively considered potentially extant because nest occupancy could not be confirmed due to limited access.

Nesting Territories South of Antioch/Pittsburg

Helicopter surveys conducted in 2011 (GANDA 2011) identified three golden eagle nesting territories in the hills south of the cities of Antioch and Pittsburg (Figure 3):

- **Concord Naval Weapons Station Territory**. The Concord Naval Weapons Station territory is centered in the hills between the City of Pittsburg and the City of Concord, approximately 9.5 miles southwest of the Solano 4 West subarea.

- **Kirker Creek Territory**. The Kirker Creek territory is centered in the hills southwest of Antioch about 9 miles south of Solano 4 West subarea.

- **Black Diamond Mines Territory**. The Black Diamond Mines territory is centered in the Black Diamond Mines Regional Preserve in the hills south of Antioch about 9 miles south of the Solano 4 West subarea.

Nests were not found for any of these territories in 2011, but the behavior of the birds indicated potential nesting (GANDA 2011). Observations of three in-flight golden eagles were recorded in this area during the 2016/17 surveys indicating potential nesting activity; however, active nests were again not located. CNDDB (2018) also reports sightings in the general area, but no information about confirmed nesting was found. With limited ability to confirm nest occupancy, but with reports of activity and breeding behavior, each of these is therefore conservatively considered an extant nesting territory.

Bald Eagle Nesting Territories Outside of the MHWRA but Within the Survey Area

GANDA (2011) reported sightings of bald eagles in 2011 in the vicinity of Bradmoor Island and Grizzly Island along the western edge and west of the MHWRA. Based on their flight pattern and behavioral observations, they considered the possibility of a bald eagle breeding territory centered on Grizzly Island approximately 4 to 5 miles west of the MHWRA and 6 to 7 miles northwest of the Solano 4 West subarea. A nest was not confirmed. Although bald eagles have been intermittently observed in and around the MHWRA, nesting has not been confirmed within the 10-mile radius area. However, because an active nest, breeding behavior, or hatching-year bald eagles have not been reported, this is considered an undetermined, unverified breeding territory. Because adult bald eagles were not observed in the vicinity of the territory location on Grizzly Island during 2016-2018 surveys, the territory is considered inactive during this timeframe (Table 1).

Table 1. Status of Golden and Bald Eagle Nesting Territories within 10-miles of the Project

Nest/Territory Location	Survey Period	Current Status	Other Species Present	Last Reported Eagle Activity
Within the MHWRA				
Masson GOEA Nest	Spring 2016	Inactive	RTHA	2001
	Winter 2016/17	Inactive	RTHA	
	Spring 2018	Inactive	RTHA	
Curry East GOEA Nest	Spring 2016	Inactive	GHOW	2005
	Winter 2016/17	Inactive	GHOW	
	Spring 2018	Inactive	RTHA	
Curry West GOEA Nest	Spring 2016	Inactive	RTHA	2005
	Winter 2016/17	Inactive	RTHA	
	Spring 2018	Inactive	RTHA	
Callahan GOEA Nest	Spring 2016	Inactive	SWHA	2007
	Winter 2016/17	Inactive	SWHA	
	Spring 2018	Inactive	SWHA	
Transmission Tower GOEA Nest	Spring 2016	Inactive	None	2012
	Winter 2016/17	Inactive	None	
	Spring 2018	Inactive	None	
Outside the MHWRA but Within the 10-Mile Radius				
Meins Landing GOEA Nest	Spring 2016	Inactive	None	2011/2017*
	Winter 2016/17	Possibly Active*		
	Spring 2018	Inactive	RTHA	
Potrero Hills GOEA Nest	Spring 2016	No obs – extant		2011
	Winter 2016/17	No obs – extant		
	Spring 2018	Not surveyed		
Concord NWS GOEA Territory	Spring 2016	Incidental obs - extant		2011
	Winter 2016/17	Incidental obs - extant		
	Spring 2018	Not surveyed		
Kirker GOEA Territory	Spring 2016	Incidental obs - extant		2011
	Winter 2016/17	Incidental obs - extant		
	Spring 2018	Not surveyed		
Black Diamond Mines GOEA Territory	Spring 2016	Incidental obs – extant		2011
	Winter 2016/17	Incidental obs – extant		
	Spring 2018	Not surveyed		
Grizzly Island BAEA Territory	Spring 2016	Inactive		2011
	Winter 2016/17	Inactive		
	Spring 2018	Inactive		

*landowner at the Meins nest reports nesting activity in 2017.

Source: AWE 2017; Estep Environmental Consulting April 19 and 24, 2018 surveys; GANDA 2011; Hunt et al. 2008; Kerlinger et al. 2001

Other Nesting Raptors Within the Survey Area

Other nesting raptors (and including common raven [*Corvus corax*]) were also recorded during 2018 surveys for nesting eagles. A total of 58 active non-eagle raptor and common raven nests were found and their activity and locations are presented in Appendix A, Table A-1 and Figure 4.

Conclusions

No active eagle nests were found within the MHWRA during the 2016 – 2018 surveys. No active eagle nests have been reported within the MHWRA since 2007 with the exception of the Transmission Tower nest, which was active only in 2012. Due to the length of time since last activity and the occupancy of the historic eagle nesting sites by other raptor species, these historic golden eagle nesting territories are considered unlikely to be occupied in the future.

No eagle activity was observed in 2016 – 2018 at the Meins Landing golden eagle nesting area. However, due to the possible recent activity reported by the landowner at the Meins Landing site, this should be considered an extant golden eagle breeding territory that could become occupied in future years.

The Potrero Hills golden eagle nesting area and the three golden eagle territories in the southern end of the survey area south of the cities of Pittsburg and Antioch (Concord NWS, Kirker Creek, and Black Diamond Mines territories) are also considered potentially extant because nest occupancy could not be confirmed due to limited survey effort in that portion of the survey area.

Finally, there were no bald eagle observations made during the 2016 – 2018 surveys and no information was found regarding possible bald eagle nesting activity at Grizzly Island. Although there continue to be occasional reported occurrences of bald eagles in the area, including at Grizzly Island in the vicinity of the presumed breeding territory (Sullivan et al 2009 – e-Bird 2018 records), bald eagle nesting activity in this area remains undetermined.

References

AECOM. 2014. Final Eagle Conservation Plan Solano Wind Project Phases 1, 2, and 3. Prepared for SMUD. August 2014.

Area West Environmental, Inc. (AWE). 2017 (May). Eagle Survey Report, Solano County, CA. Prepared for the Sacramento Municipal Utility District.

California Department of Fish and Wildlife. 2018. California Natural Diversity Database. Available at: https://www.dfg.ca.gov/ biogeodata/cnddb/mapsanddata.asp. May 22, 2018.

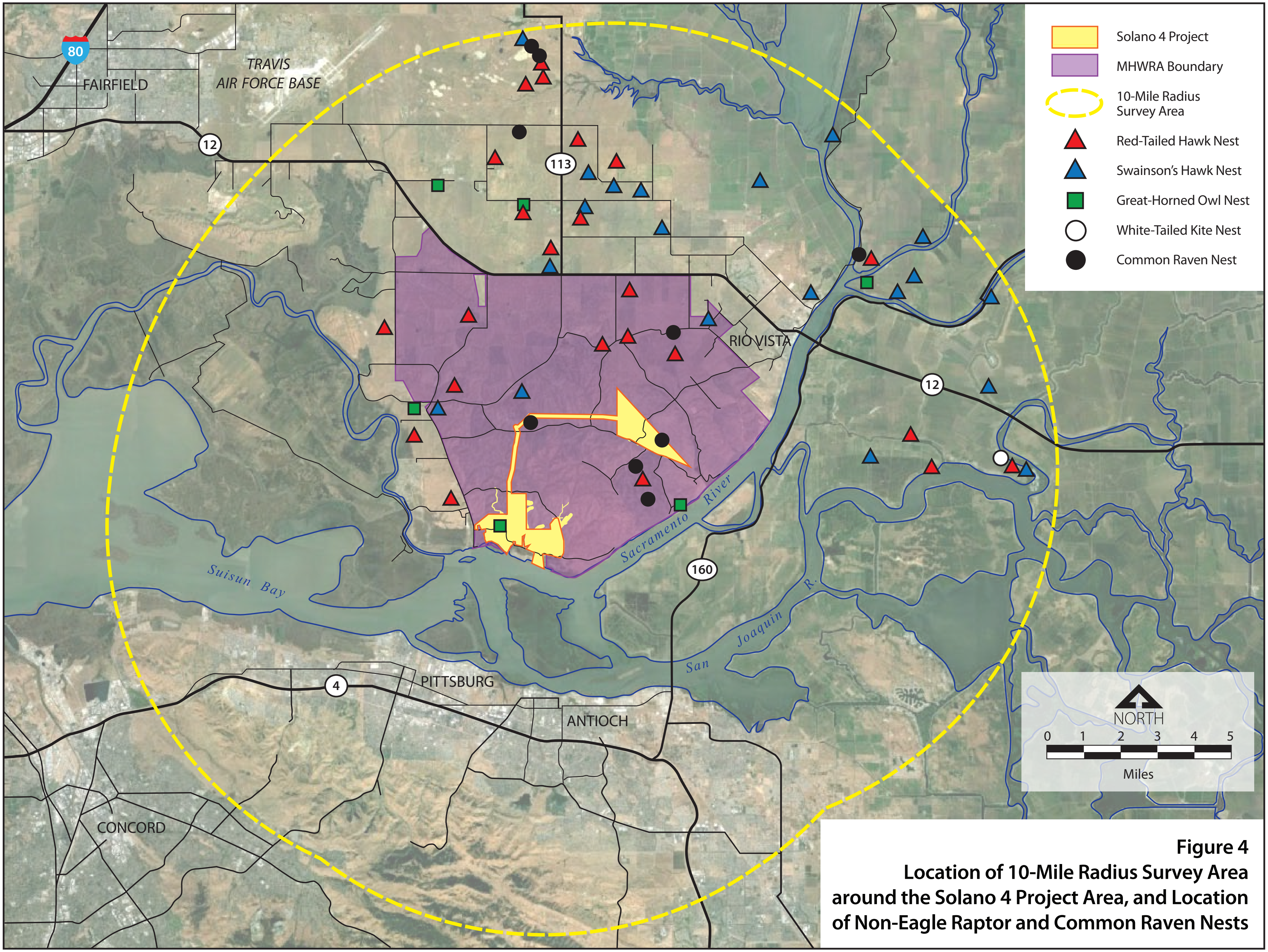

Figure 4
Location of 10-Mile Radius Survey Area around the Solano 4 Project Area, and Location of Non-Eagle Raptor and Common Raven Nests

06/05/2018

SOURCE: Estep Environmental Consulting April 19, 24, 26, and May 4, 2018 surveys.

Curry & Kerlinger, LLC. 2011. Avian Use Study Collinsville Wind Power Project, Solano County, California. Prepared for Pacific Gas & Electric Company. March 2011.

GANDA. 2011. Bald and Golden Eagle Survey Report for Proposed Collinsville Wind Project. Prepared for Pacific Gas & Electric Company. June 2011.

Gollinger, Stan. Landowner/resident, site supervisor for Montezuma Wetlands, LLC. Personal Communication. Onsite field meeting with Jim Estep on April 26, 2018.

Hunt, T.L., A.A. Hasch, C. Wilkerson, Z. Smith and B. Fischer. 2008. A survey of breeding raptors in the vicinity of the Montezuma Hills Wind Resource Area. Prepared for Curry and Kerlinger, LLC.

Howell, J. A., J. J. Keane, and J. E. DiDonato. 1988. Avian Use Monitoring Related to Wind Turbine Siting, Montezuma Hills, Solano County, CA. Prepared for Solano County Department of Environmental Management, Fairfield, CA.

Howell, J.A., J. Noone, and C. Wardner. 1991. Avian Use and Mortality Study; U.S. Windpower Wind Energy Development Site, Montezuma Hills, Solano County, CA. Post-construction Spring, 1990 to Spring 1991. Prepared for Solano County Department of Environmental Management, Fairfield, CA.

Howell, J. A. and J. Noone. 1992. Examination of Avian Use and Mortality at a U.S. Windpower Wind Energy Development Site, Montezuma Hills, Solano County, CA. Final Report. Prepared for Solano County Department of Environmental Management, Fairfield, CA.

Howell, J.A. and J.E DiDonato. 1988. Raptor Nesting Survey Related to Wind Turbine Siting, Montezuma Hills, Solano County, California, Spring 1988. Prepared for Solano County Department of Environmental Management, Fairfield, CA.

Howell, J. A., and J. Noone. 1992. Examination of Avian Use and Mortality at a U.S. Windpower Wind Energy Development Site, Montezuma Hills, Solano County, CA. Final Report. Prepared for Solano County Department of Environmental Mgmt., Fairfield, CA.

Howell, J.A. and J. Noone. 1994. Examination of Avian Use at the Sacramento Municipal Utility District Proposed Wind Energy Development Site, Montezuma Hills, Solano County, California. Prepared for Kenetech Windpower, San Francisco, CA.

Hunt, T.L., A.A. Hasch, C. Wilkerson, Z. Smith and B. Fischer. 2008. A survey of breeding raptors in the vicinity of the Montezuma Hills Wind Resource Area. Prepared for Curry and Kerlinger, LLC.

ICF International. 2011. Avian and Bat Protection Plan for the Proposed Collinsville Wind Project. Prepared for Pacific Gas & Electric Company. September 2011.

ICF International. 2012. Bird and Bat Conservation Strategy for the Shiloh 4 Wind Project. Prepared for Shiloh 4 Wind Project LLC. August 2012.

Jones & Stokes Associates, Inc. October 26, 1995. Draft Solano Garbage Company Landfill/Potrero Hills Landfill, Inc. Landfill Combined Environmental Impact Report. Prepared for Solano County Department of Environmental Management.

Kerlinger, P., R. Curry, and L. Culp. 2001. Avian Monitoring Study and Risk Assessment for the High Winds Power Project. Prepared for FPL Energy.

Orloff, S. and A. Flannery. 1992. Wind turbine effects on avian activity, habitat use, and mortality in Altamont Pass and Solano County Wind Resource Areas. California Energy Commission Report P700-92-001, Sacramento, CA.

Sullivan, B.L., C.L. Wood, M.J. Iliff, R.E. Bonney, D. Fink, and S. Kelling. 2009. eBird: a citizen-based bird observation network in the biological sciences. Biological Conservation 142: 2282-2292.

USFWS. 2010. Interim Golden Eagle Technical Guidance: Inventory and Monitoring Protocols; and Other Recommendations in Support of Golden Eagle Management and Permit Issuance. February 2010.

Appendix A. Other Nesting Raptors

Table A-2. Other Nesting Raptors within the 10-mile Radius Survey Area

Species	Location	GPS coordinates	Nesting Habitat	Nest Substrate
Red-tailed hawk	800 feet west of Toland Ln, 0.9 mi south SMUD shop	38.100989 N 121.758684W	Transmission line tower	Tower
Red-tailed hawk	Dinkel Spiel Rd, east of Collinsville Rd	38.121937 N 121/882345 W	Eucalyptus grove	Eucalyptus
Red-tailed hawk	0.5 mi So of hwy12 and 0.2 mi east of Currie Rd	38.176518 N 121.775137 W	Eucalyptus grove	Eucalyptus
Red-tailed hawk	South side of Emigh Rd, 0.3 mi SW of Currie Rd.	38.153997 N 121.783863 W	Eucalyptus grove	Eucalyptus
Red-tailed hawk	Emigh Rd, 0.15 mi east of Currie Rd.	38.157342 N 121.776079 W	Eucalyptus grove	Eucalyptus
Red-tailed hawk	0.4 mi So of Emigh Rd, 0.2 mi west of Azevedo Rd	38.156188 N 121.746541 W	Riparian	Willow
Red-tailed hawk	west side of Shiloh Rd, 1.8 mi south of Little Honker Bay Rd	38.157968 N 121.889765 W	Eucalyptus grove	Eucalyptus
Red-tailed hawk	500 ft west of W Brannan Is Rd and Jackson Slough Rd	38.118315 N 121.630008 W	Riparian	Willow
Red-tailed hawk	easternmost Twitchell Is. – seen from W Brannan Is. Rd	38.106928 N 121.614994 W	Riparian	Cottonwood
Red-tailed hawk	Korth's Marina on W Brannan Island Rd	38.100383 N 121.572003 W	Eucalyptus grove	Eucalyptus
Red-tailed hawk	0.3 mi east of Jepson Prairie Rd, 1.3 mi south of Hwy 113	38.266192 N 121.818143 W	Transmission line tower	Tower
Red-tailed hawk	0.45 mi east of Jepson Prairie Road, 1.5 mi south of Hwy 113	38.263601 N 121.815708 W	Transmission line tower	Tower
Red-tailed hawk	0.2 mi west of the south end of Jepson Prairie Rd	38.258235 N 121.828802 W	Eucalyptus tree row	Eucalyptus
Red-tailed hawk	east side of Goose Haven Rd, 1 mi south of Creek Rd	38.225095 N 121.842257 W	Eucalyptus tree row	Eucalyptus
Red-tailed hawk	south of Flannery Rd, 1 mile west of Hwy 113	38.210199 N 121.824480 W	Eucalyptus tree row	Eucalyptus
Red-tailed hawk	west side of Hwy 113, 0.25 mi south of McCormack Rd	38.194534 N 121.806589 W	Roadside tree	Eucalyptus
Red-tailed hawk	0.4 mi east of Hwy113, 0.5 mi north of McCormack Rd	38.205362 N 121.798146 W	Isolated tree	Willow
Red-tailed hawk	0.4 mi No of Robinson Rd, 0.4 mi E of homestead site	38.224606 N 121.778244 W	Eucalyptus tree row	Eucalyptus
Red-tailed hawk	southeast of Robinson Rd and Hwy 113	38.236871 N 121.797452 W	Isolated tree	Eucalyptus
Red-tailed hawk	Collinsville Rd at Fire Truck Rd, 1 mi north of Collinsville	38.090689 N 121.854554 W	Eucalyptus tree row	Eucalyptus
Red-tailed hawk	No side of Bird's Landing Rd, 0.5 mi east of Bird's Landing	38.134190 N 121.861427 W	Eucalyptus grove	Eucalyptus
Red-tailed hawk	SR84 around the bend from Ryer Island Ferry	38.184369 N 121.653810 W	Tree row	Ornamental pine
Red-tailed hawk	Masson GOEA site west of Olsen Road	38.165417 N 121.849140 W	Eucalyptus grove	Eucalyptus

Swainson's hawk	West side of Amerada Rd, 400-ft north of Emigh Rd	38.162244 N 121.731959 W	Eucalyptus grove	Eucalyptus
Swainson's hawk	Birds Landing, just south of Birds Landing Road	38.132020 N 121.868309 W	Eucalyptus	Eucalyptus
Swainson's hawk	W side of Twitchell Is. Ferry Rd, .4mi S of W Twitchell Is Rd	38.111533 N 121651476 W	Riparian	Willow
Swainson's hawk	Near Korth's Marina on W Brannan Island Rd	38.105878 N 121.575580 W	Tree row	Cottonwood
Swainson's hawk	Terminous Road, 0.4 miles from Hwy 12 intersection	38.133385 N 121.593127 W	Tree row	Cottonwood
Swainson's hawk	0.4 miles south of Hwy 113, 600 feet west of Jepson Prairie Road	38.279756 N 121.825714 W	Isolated tree	Eucalyptus
Swainson's hawk	Just north of Hwy 12 along Hwy 113	38.185593 N 121.806871 W	Eucalyptus grove	Eucalyptus
Swainson's hawk	Northwest corner of McCormack Rd and Canright Rd	38198648 N 121750957 W	Eucalyptus grove	Eucalyptus
Swainson's hawk	0.8 mi east of Liberty Island Rd, 1.3 mi north of McCormack Rd	38.216250 N 121.697977 W	Riparian	Willow
Swainson's hawk	Northwest of Airport Rd and St Francis Rd, Rio Vista	38.174114 N 121.683285 W	Riparian	Willow
Swainson's hawk	South side of Flannery Rd, 0.6 mi east of Hwy 113	38.212519 N 121.794895 W	Roadside tree	Eucalyptus
Swainson's hawk	Northwest of Flannery Rd and Robinson Rd	38.216680 N 121.762614 W	Eucalyptus grove	Eucalyptus
Swainson's hawk	South of Robinson Rd, 0.4 mi east of homestead site	38.218886 N 121.778451 W	Loose grove of eucalyptus trees	Eucalyptus
Swainson's hawk	Homestead site along Robinson Rd	38.220768 N 121.788782 W	Loose grove of eucalyptus trees	Eucalyptus
Swainson's hawk	Sacramento River, just upstream from Isleton	38.172558 N 121.592218 W	Tree row along river	Eucalyptus
Swainson's hawk	0.5 miles north of Grand Island Road	38.177934 N 121.629870 W	Isolated tree	Willow
Swainson's hawk	North side of Grand Island Road across river from Ida Island	38.173452 N 121.637519 W	Roadside tree	Valley oak
Swainson's hawk	300 feet northwest of SR84 along Minors Slough	38.233310 N 121.668987 W	Riparian	Willow
Swainson's hawk	200 feet north of SR84 (East Ryer Road)	38.195361 N 121.625159 W	Tree row	Cottonwood
Swainson's hawk	Callahan GOEA site, east of Birds Landing Road	38.133668 N 121.822520 W	Eucalyptus grove	Eucalyptus
Great-horned owl	East side of Toland Ln, 800 ft north of Sacramento River	38.090274 N 121.750286 W	Eucalyptus grove	Eucalyptus
Great-horned owl	South of Birds Landing Rd, east of Collinsville Rd	38.129472 N 121.879673 W	Isolated tree	Eucalyptus
Great-horned owl	South of Flannery Rd, 1 mile west of Hwy 113	38.212011 N 121.824463 W	Tree row	Eucalyptus
Great-horned owl	200 feet west of Grand Island Road	38.180462 N 121.648300 W	Riparian	Willow
Great-horned owl	So side of Lambie Rd, 1 mile east of SR 12	38.219053 N 121.869497 W	Eucalyptus grove	Eucalyptus
Great-horned owl	0.65 mi east of Collinsville Rd, on north side Stratton Lane	38083375 N 121.838292 W	Eucalyptus grove	Eucalyptus
White-tailed kite	West side of W Brannon Is Road near Korth's marina	38.108908 N 121580011 W	Tree row	Willow
Common Raven	North of Toland ln, east of	38.116133 N	Transmission line	Tower

	Montezuma Hills Rd	121.757845 W	tower	
Common Raven	West of Toland ln, 0.5 mi southeast of SMUD shop	38.107581 N 121.758312 W	Transmission line tower	Tower
Common Raven	West of Toland ln, 1.2 mi south of SMUD shop	38.097188 N 121.758921 W	Transmission line tower	Tower
Common Raven	0.5 mi west of Azevedo Rd, just south of Emigh Rd	38.160286 N 121.750413 W	Transmission line tower	Tower
Common Raven	Russell substation – north of Montezuma Hills Road	38.122048 N 121.827693 W	Transmission line tower	Tower
Common Raven	200 feet east of Jepson Prairie Road, 1 mile south of Hwy 113	38.271543 N 121.823248 W	Transmission line tower	Tower
Common Raven	0.24 mi west of Jepson Prairie Rd, 0.6 mi south of Hwy 113	38.276748 N 121.829742 W	Transmission line tower	Tower
Common Raven	South of Creed Road, 1 mile west of Hwy 113	38.241003 N 121.823956 W	Transmission line tower	Tower
Common Raven	200 feet east of SR84 at the Ryer Island Ferry	38.186992 N 121.657691 W	Transmission line tower	Tower

Source: Surveys conducted by Estep Environmental Consulting April 19, 24, and 26 and May 4, 2018

Avian Use Report

Solano 4 Wind Project
Avian Use Report

July 2018

Prepared for:

Sacramento Municipal Utility District

SMUD®

Prepared by:

Estep Environmental Consulting

ESTEP Environmental Consulting

Solano 4 Wind Project

Avian Use Report

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July 2018

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Acronyms and Abbreviations

BGEPA	Bald and Golden Eagle Protection Act
CDFW	California Department of Fish and Wildlife
CEC	California Energy Commission
CEQA	California Environmental Quality Act
EIR	Environmental Impact Report
kW	kilowatt
MHWRA	Montezuma Hills Wind Resource Area
MW	megawatt
PG&E	Pacific Gas and Electric Company
Project	Solano 4 Wind Project
SMUD	Sacramento Municipal Utility District

Executive Summary

This report was prepared to supplement the biological resources assessment for the Sacramento Municipal Utility District's Solano 4 Wind Project (Project), located within the Montezuma Hills Wind Resource Area (MHWRA) in Solano County. Because some bird species are susceptible to collision mortality from operating wind turbines, determining species composition, abundance, and distribution within and around a project can be useful in assessing potential risk. This summary was prepared to provide a baseline of avian use of the MHWRA in development of the impact analysis for the Project.

Since the late 1980s, avian use and abundance information has been collected from the MHWRA. Most of these studies have been related to development of individual wind energy projects and were conducted to determine potential impacts of projects and assist in the siting of wind turbines to minimize impacts. A substantial amount of avian information is available in a database for the MHWRA, some collected during the initial wind energy development from the late 1980s to mid-1990s, but mostly from more recent wind energy projects since 2000. These avian studies included two survey efforts that directly overlapped the Project area and three surveys that partially overlapped it. The database provides information on avian abundance, spatial and temporal distribution, and rates of occurrence from the entire MHWRA. These data are analyzed and summarized in this report to provide an overview of avian use and abundance in the MHWRA and the Project area.

The results of survey efforts since 2000, including overall abundance, seasonal differences, and rates of occurrence, generally have been consistent among all project surveys. Blackbird species have been by far the most abundant group, followed by a variety of other small passerines. Waterfowl, shorebirds, and other water birds have occurred infrequently because of the overall lack of water-bird habitat in the MHWRA. Water-bird detections mostly have been fly-overs as birds moved through the MHWRA to neighboring wetland habitats, such as the Suisun Marsh.

Several raptor species have occurred with regularity, but at much lower occurrence rates than blackbirds and other small passerine species. The most commonly recorded raptors have been the four year-round breeding resident species: American kestrel (*Falco sparverius*), red-tailed hawk (*Buteo jamaicensis)*, northern harrier (*Circus cyaneus*), and turkey vulture (*Cathartes aura*).

In addition to conducting standardized bird point count surveys, most of the survey efforts also have included breeding raptor surveys. Several larger regional raptors surveys have focused on golden eagles (*Aquila chrysaetos*), and this also has provided information on other nesting raptors in and around the MHWRA. Although nesting habitat for tree-nesting raptors is scarce in the MHWRA, most available habitat is occupied by red-tailed hawks, American kestrels, Swainson's hawks (*Buteo swainsoni*), and great-horned owls (*Bubo virginianus*). Four historical golden eagle nesting territories also are in the MHWRA; however, none has been occupied since 2012. These sites have become occupied by other species, particularly red-tailed hawk and great horned owl.

Seventeen special-status bird species have been recorded in the MHWRA. The most common of these is the State-listed tricolored blackbird (*Agelaius tricolor*). Otherwise, as a group, raptors are the most commonly observed special-status species, particularly golden eagle, northern harrier, and Swainson's hawk.

Generally, avian species composition and use in the Project area is expected to be consistent with the overall results from all the surveys that have been conducted in the MHWRA since 2000. The database provides sufficient information to assess relative avian abundance and use of the Project area and the MHWRA, and to evaluate potential impacts of the Project on resident and migratory birds.

Introduction

The Sacramento Municipal Utility District (SMUD) is proposing to develop the 60-megawatt (MW) Solano 4 Wind Project (Project) in the Montezuma Hills Wind Resource Area (MHWRA) in Solano County, California (Figure 1). The Project is the fourth and final phase of the Solano Wind Project, which includes the contiguous Solano 1–3 project phases. SMUD currently is conducting resource assessments that will be incorporated into the Environmental Impact Report (EIR) being prepared pursuant to the California Environmental Quality Act (CEQA), and other related environmental documentation. Operating wind turbines are a known source of collision-related avian mortality (Estep 1989; Erickson et al. 2001), and this potential impact of the Project and other wind energy projects in MHWRA initially is being assessed through the CEQA review process. This report summarizes all relevant avian resource data from the MHWRA that will be used in the EIR assessment to evaluate the potential impacts of the proposed project on birds.

Wind Energy Development in the MHWRA

The MHWRA was established on the basis of wind energy monitoring and assessment studies that were conducted by the California Energy Commission (CEC), Pacific Gas and Electric Company (PG&E), and Bureau of Reclamation during the late 1970s and 1980s. The first wind turbines, mostly Kenetech 56-100 (100 kilowatt [kW]) lattice tower turbines, were installed in the MHWRA in the late 1980s. With advances in turbine technology, these first-generation turbines rapidly became obsolete as larger turbines with substantially greater electrical generation capacity became available. The repowering of the MHWRA with new-generation turbines began in the early 2000s, as wind power companies began removing the smaller 100kW turbines and replacing them with fewer larger (up to 2.3MW) turbines. Today, it is one of the largest operating WRAs in the state and includes more than 500 utility-grade wind turbines in a landscape of dryland farming and grazing. To date, nearly all of the early-generation turbines have been removed and replaced with new-generation turbines. Full buildout of the MHWRA with new-generation turbines is expected with development of the Solano 4 Project. As of 2018, 11 operating wind facilities are in the Montezuma Hills (Table 1, Figure 2).

Table 1. Wind Energy Projects Currently Operating in the MHWRA, 2018

Project	Turbine Model	Number of Turbines	Total MW	Maximum Turbine Height (feet)	Year Operational
High Winds	Vestas V-80	90	162	330–350	2003
enXco V	GE 1.5MW	6	9	340	2006
Shiloh I	GE 1.5MW	100	150	340	2006
Shiloh II	REpower MM92	75	150	372–410	2008
Shiloh III	REpower MM92	59	102.5	409	2012
Shiloh IV	REpower MM92	50	102.5	415	2012
Montezuma I	Siemens 2.3MW	16	36.8	415	2010
Montezuma II	Siemens 2.3MW	34	78.2	415–428	2012
Solano Phase I	Vestas V-47	23	15.2	291	2004
Solano Phase II	Vestas V-90	29	87	410	2007
Solano Phase III	Vestas V-90	55	128	410	2012

Source: Solano County Department of Resource Management

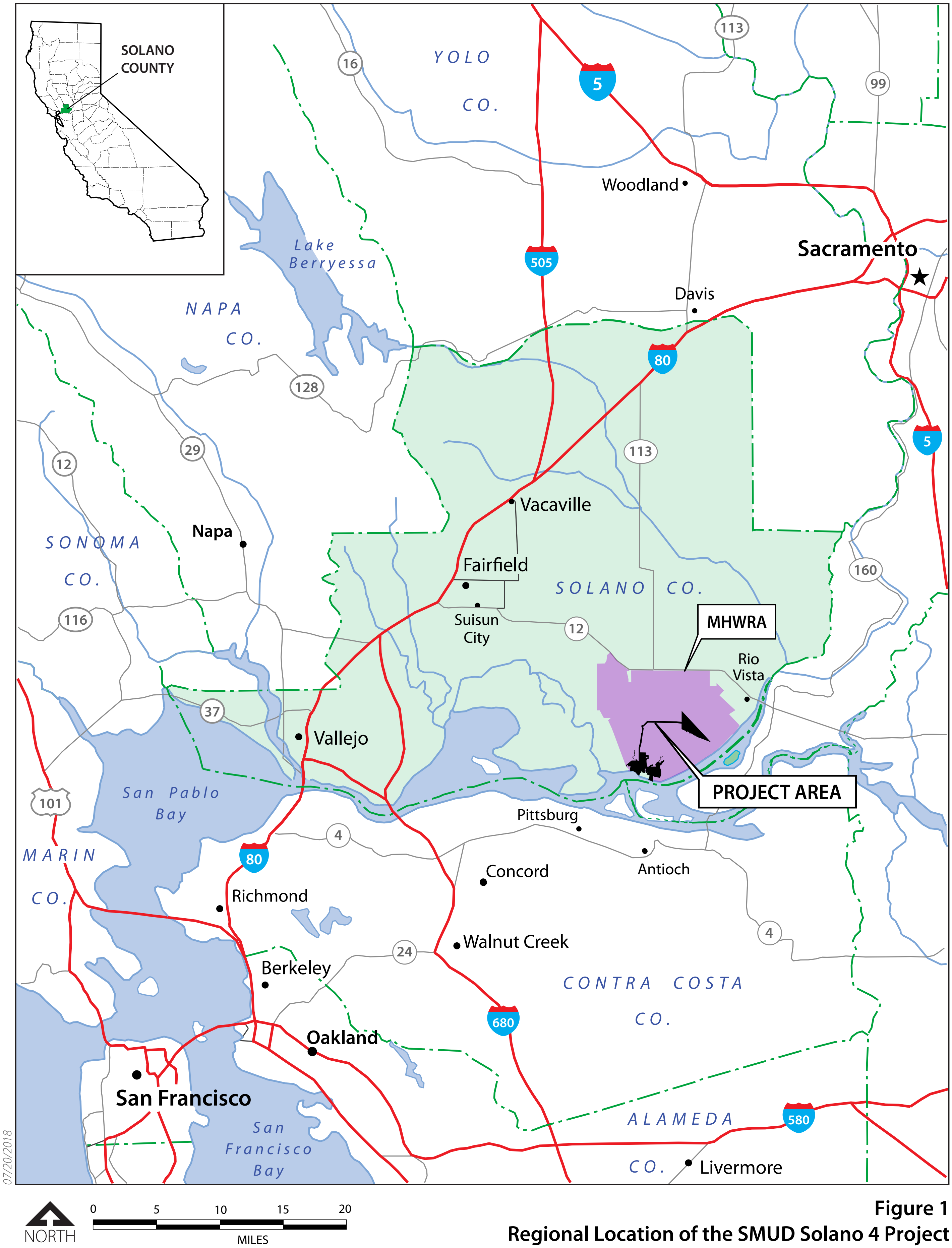
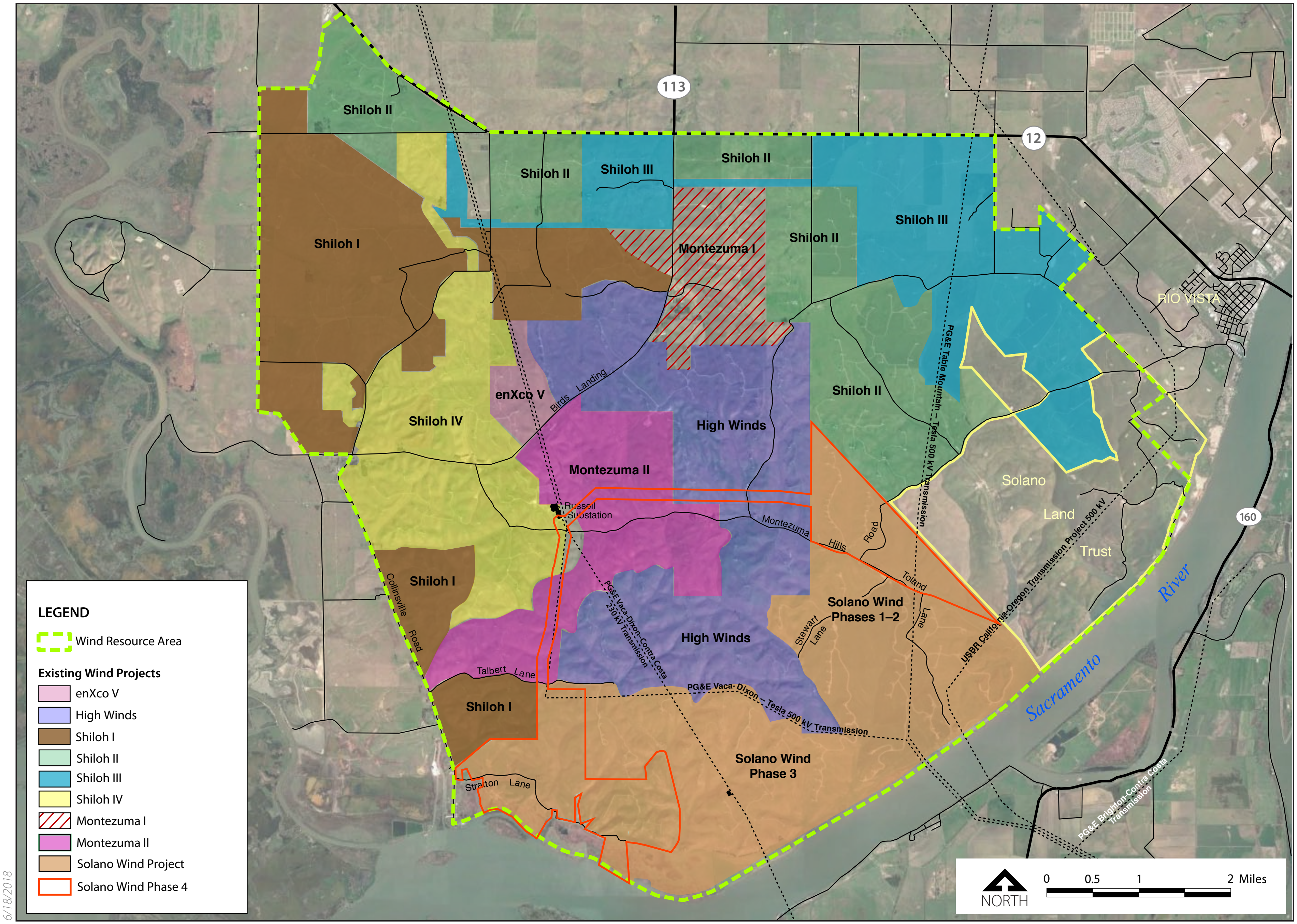


Figure 1
Regional Location of the SMUD Solano 4 Project



SOURCES: SMUD 2011, CH2MHill 2018.

Figure 2
Wind Energy Projects in the Montezuma Hills Wind Resource Area

Project Location and Description

The Project includes two non-contiguous subareas and an electrical distribution corridor that connects them to the Russell Substation (Figures 2 and 3). The Solano 4 West subarea is immediately east of the community of Collinsville, specifically in portions of Sections 2, 22, 23, 24, 25, and 26; Township 3 North, and Range 1 East of the Antioch North and Bird's Landing U.S. Geological Survey 7.5-minute quadrangle maps. Consisting of rolling hills characteristic of the Montezuma Hills, the Project area is bordered to the south by Stratton Lane, which is just north of the Sacramento River, and to the north and east by existing SMUD wind energy generating facilities (Solano Wind Phases 1, 2, and 3). A total of 62 existing Kenetech KCS 56-100 turbines are within the 1,390-acre subarea, which will be removed and replaced with 12 Project turbines.

The Solano 4 East subarea is approximately 3 miles northeast of the Solano 4 West subarea in portions of Sections 4, 5, 8, and 9; Township 3 North, and Range 2 East of the Antioch North and Bird's Landing U.S. Geological Survey 7.5-minute quadrangle maps (Figures 2 and 3). Montezuma Hills Road extends north-south through the triangle-shaped subarea before turning westward along the southwestern edge of the subarea. From its southwestern corner, the subarea extends for 2.2 miles southeast towards the Sacramento River. Its rolling hill topography is similar to Solano 4 West and consists of annual grasses, used for seasonal livestock grazing, and areas used for periodic grain crop cultivation. Phase 1 of the Solano Wind Project is within the 881-acre Solano 4 East subarea. The 23 V-47 Vestas Phase 1 turbines, all of them west of Montezuma Hills Road, will be removed and replaced with 10 Project turbines, spaced throughout the Solano 4 East subarea.

The Project would have a net energy production capacity of up to 60 MW and could be integrated with SMUD's neighboring Solano Phase 1–3 projects, which presently provide 230 MW from 107 wind turbines. The Project area also includes staging areas (which are located within the adjacent SMUD wind facilities), meteorological towers, gravel access roads, and energy collection systems (distribution lines) that will connect to the Russell substation (Figure 3).

Purpose of the Avian Use Data Review

This report summarizes existing information on avian abundance, distribution, and spatial use that can be used to evaluate potential avian impacts of the Project. These data also may be useful in identifying methods for avoiding or mitigating potential impacts related to turbine siting and operation. Because of the availability of substantial avian use data from projects in the immediate area and throughout the MHWRA, no Project-specific avian surveys were conducted. However, these data include two previous survey efforts that directly overlapped the Project area and three previous surveys that partially overlapped the Project area.

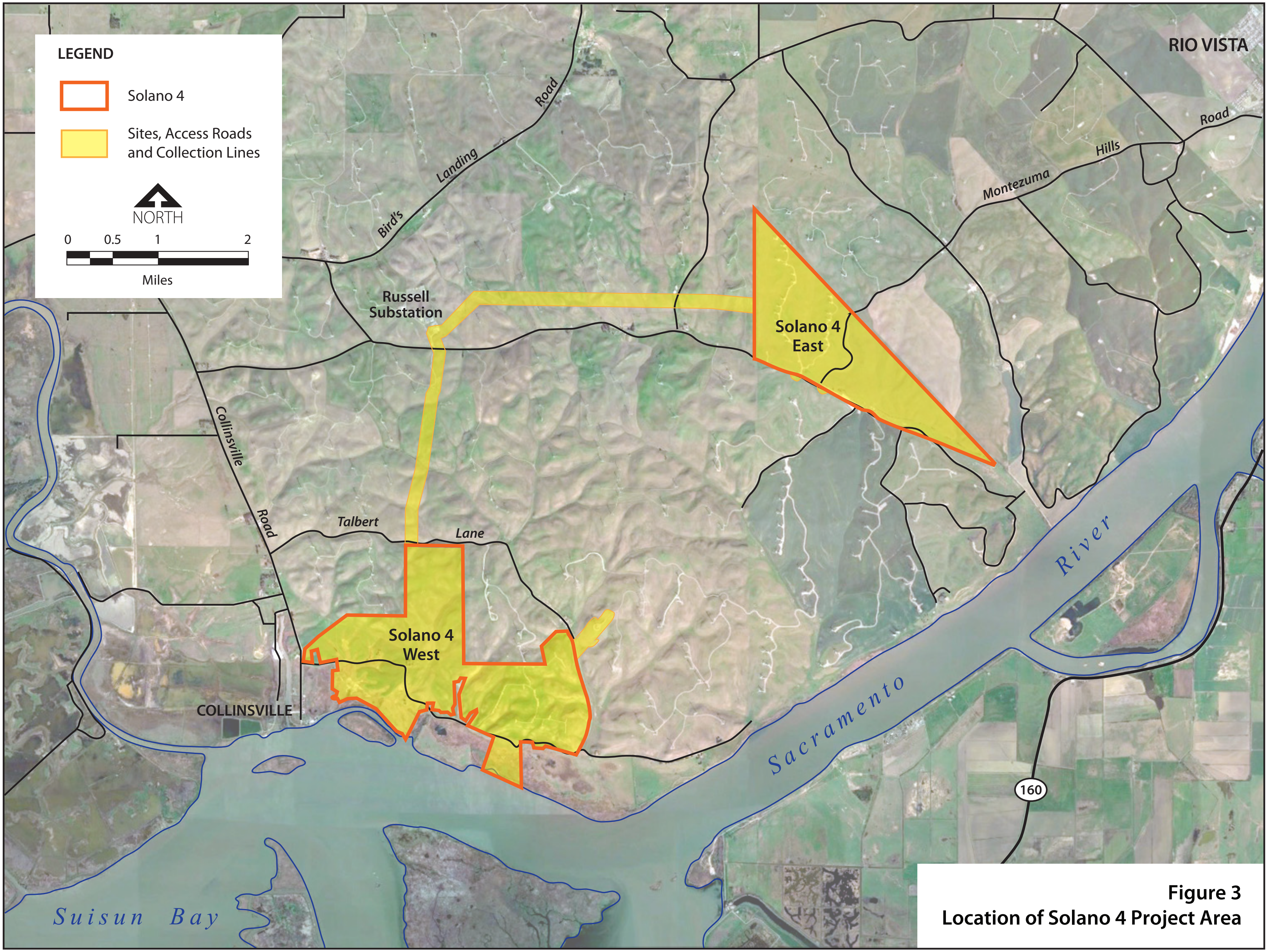


Figure 3
Location of Solano 4 Project Area

06/18/2018

SOURCE: Sacramento Municipal Utility District 2018.

Biological Setting

The following description is modified from the SMUD Avian and Bat Protection Plan (Estep 2011).

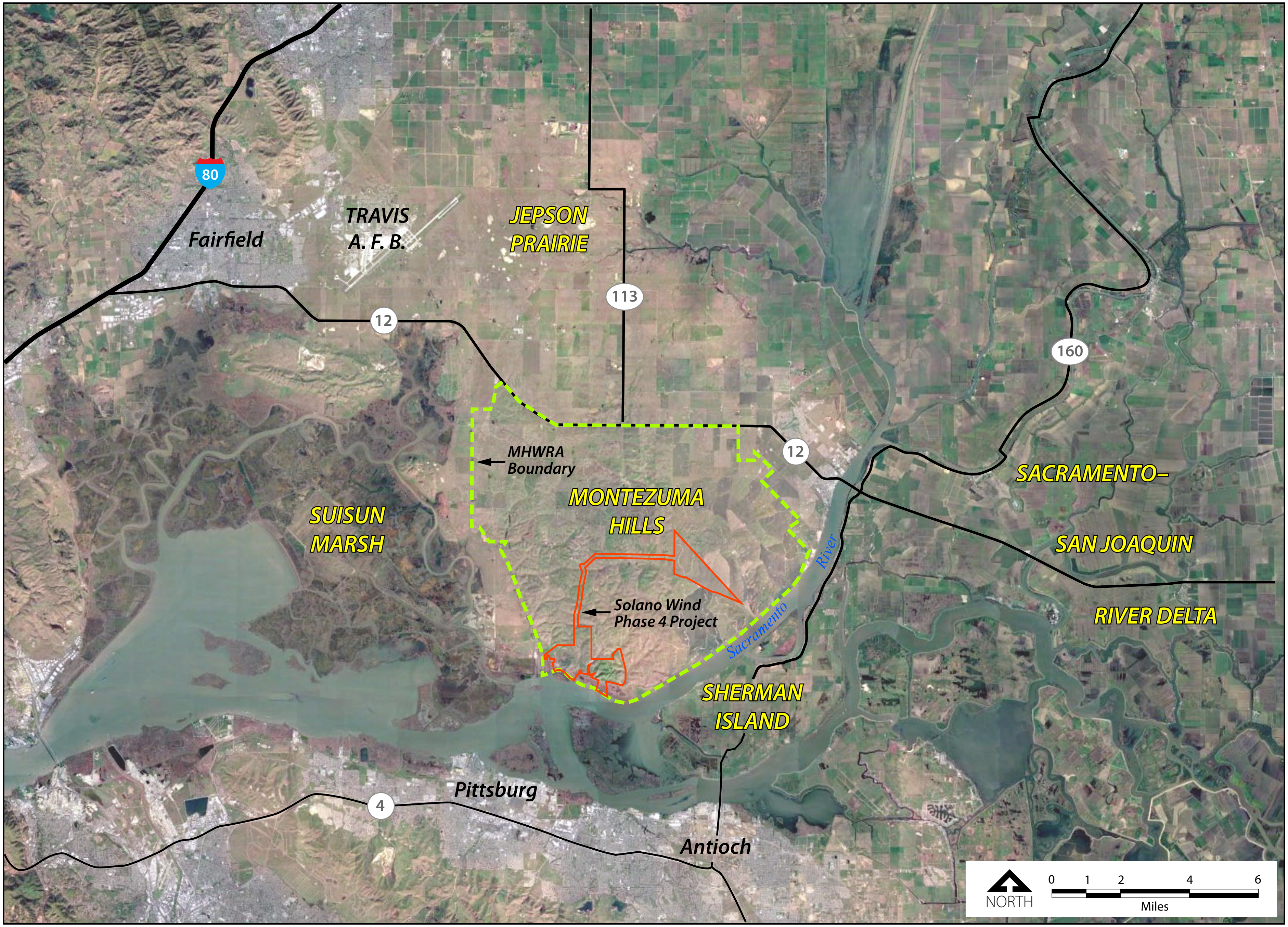
The Montezuma Hills encompass more than 40,000 acres along the western edge of the Sacramento–San Joaquin River Delta, from the vicinity of State Route 12 on the north to the Sacramento River on the south and east, and to Montezuma Slough on the west (Figure 4). Located within the Sacramento Valley geographic subregion of the California Floristic Province (Hickman 1993), which includes the San Francisco Bay area and the Sacramento-San Joaquin River Delta, this unique geologic feature lies at the western edge of the Central Valley and near the confluence of the Sacramento–San Joaquin River Delta, the San Francisco Bay estuary, and the Central Coast Ranges.

Because of previous and ongoing wind development in the Montezuma Hills as well as other projects and research conducted in or in the vicinity of the Montezuma Hills, numerous studies and environmental documents have been prepared from the late 1980s to the present that describe the habitat and landscape conditions throughout the area (Earth Metrics 1988; LSA Associates 1989; Environmental Science Associates 2002; Sacramento Municipal Utility District 1993, 2003, 2009; Jones & Stokes 2004, 2005; Ecology and Environment 2005). Collectively, these studies provide a thorough assessment and description of biological resources, vegetation communities, and wildlife habitat conditions throughout the Montezuma Hills and within the Solano 4 Project area.

Land Use and Physiography

The Montezuma Hills are composed of Quaternary-period (early Pleistocene) sediments, known as the Montezuma formation. The substrate consists of non-marine sediments, formed by inland swamps or possibly alluvial deposition (Bailey 1966), and then folded, faulted, and raised by movement in the San Andreas Fault system (Dickinson 1981; U.S. Forest Service 1998). The material primarily is poorly sorted and consolidated clayey sand, silt, and pebble gravel. The hills subsequently were shaped by fluvial erosion and are relatively smooth, rounded, and low lying. The current geomorphology generally is undisturbed and conforms to prehistoric conditions. The landscape consists of smooth, rolling hills with consistent crest elevations, ranging from 150 to 280 feet above sea level (Figures 3 and 4). The hills are arid, mostly treeless, with only seasonal and ephemeral drainages crossing the landscape, most of which connect hydrologically to the Sacramento River (U.S. Forest Service 1998).

The climate of the Montezuma Hills is temperate, with average annual temperatures fluctuating between 14° and 16°Celsius (58° and 62°Fahrenheit). Most precipitation occurs as rain; typical precipitation is 40.6–50.8 centimeters (16–20 inches) a year (U.S. Forest Service 1998). Land use in the Montezuma Hills includes dryland wheat farming, sheep and cattle grazing, and wind energy generation.



6/18/2018

SOURCE: Google Earth 2018.

Figure 4
Montezuma Hills and Surrounding Landscape

Vegetation Communities and Wildlife Associations

Historically, the dominant native vegetation in the Montezuma Hills consisted of purple needlegrass (*Nasella pulchra*) (Heady 1977). This perennial grass is the distinctive and characteristic species of the Central Valley prairie. Because plant succession cycles in the prairie tended toward perennial bunchgrasses such as purple needlegrass on all well-drained upland sites, the arid Montezuma Hills supported a quintessential California prairie plant community (Heady 1977). Over time, with the help of livestock grazing and cultivation, nonnative annual grass infestations replaced the native prairie.

In part because of the transformation from native landscape to the current altered landscape, wildlife abundance and diversity are somewhat limited in the Montezuma Hills. The landscape generally is monotypic (i.e., annual grassland or dryland farming), is mostly treeless, and supports limited wetlands or other distinctive biological communities (Figures 3 and 4). The few trees in the Montezuma Hills are mostly nonnative (primarily *Eucalyptus* sp.) and are associated with rural farmsteads. Other habitats, such as wetlands, are uncommon; most of these are seasonal and highly disturbed by agricultural practices and grazing. Overall, currently very little native vegetation exists in the Montezuma Hills. Consequently, the avifauna also generally lacks the abundance and diversity of surrounding areas. For example, the Suisun Marsh and other extensive wetland communities, immediately south and west of the Montezuma Hills, support an abundant and diverse avifauna, particularly waterfowl and other water birds.

Like the Montezuma Hills in general, the Project area consists primarily of periodically cultivated land used for wheat farming with residual nonnative annual grassland that is grazed by livestock during the fall and winter months. The species composition of the annual grasslands varies with grazing intensity, aspect, soil disturbance, and soil type. In general, the annual grassland is characterized by a mix of annual grasses and weedy forbs, including ripgut brome (*Bromus diandrus*), wild oat (*Avena fatua*), wild mustard (*Hirschfeldia incana*), yellow starthistle (*Centaurea solstitialis*), several types of barley (*Hordeum* sp.), and Italian thistle (*Carduus pycnocephalus*). Other common vegetation includes Italian rye (*Lolium multiflorum*), bindweed (*Convolvulus arvensis*), medusa head (*Taeniatherum caput-medusa*), milk thistle (*Silybum marianum*), artichoke thistle (*Cynara cardunculus*), and dandelion (*Taraxacum officinale*). The landscape generally lacks other biological communities, with the exception of seasonal drainages and associated seasonal wetlands that run through portions of the Project area, and a few eucalyptus trees. The dominant plant species associated with the wetlands include narrow-leaf cattail (*Typha angustifolia*), Himalayan blackberry (*Rubus discolor*), Mexican rush (*Juncus mexicanus*), and brass buttons (*Cotula coronopifolia*) (Sacramento Municipal Utility District 2003, 2009).

The Project area and surrounding Montezuma Hills provide suitable nesting, foraging, and cover habitats—primarily for grassland-associated wildlife species, particularly small rodents, California ground squirrels (*Otospermophilus beecheyi*), pocket gophers (*Thomomys bottae*), meadow voles (*Microtus californicus*), and black-tailed jackrabbits (*Lepus californicus*)—that create foraging opportunities for several resident raptor species, including red-tailed hawk (*Buteo jamaicensis*), and American kestrel (*Falco sparverius*); passerine birds such as horned lark (*Eremophila alpestris*), western meadowlark (*Sturnella neglecta*), and savannah sparrow (*Passerculus sandwichensis*); and reptiles including gopher snake (*Pituophis catenifer*), common kingsnake (*Lampropeltis getula*), and western fence lizard (*Sceloporus occidentalis*). Wide-ranging animals, such as turkey vulture (*Cathartes aura*), golden eagle (*Aquila chrysaetos*), and coyotes (*Canis latrans*) also occur in the area. Habitat suitability for these and other species that occur in the Montezuma Hills generally is considered relatively poor because of periodic cultivation, grazing practices, and the lack of habitat diversity; however, foraging use by raptors may increase during plowing or cultivation events, which expose rodent prey. The patches of emergent wetlands also provide habitat for several nesting birds, including red-winged blackbird (*Agelaius phoeniceus*) (Curry and Kerlinger 2004; Environmental Science Associates 2002; Jones & Stokes 2004; Ecology and Environment 2005; ICF International 2010a).

Surrounding Landscape

The lack of habitat diversity in the Montezuma Hills is in stark contrast to the surrounding landscape. Lands surrounding the Montezuma Hills include a more diverse agricultural matrix, remnant native landscapes, and large wetland complexes that support abundant wildlife.

The Suisun Marsh lies immediately west and southwest of the Montezuma Hills, and extends along the western length of the Montezuma Hills north to State Route 12 (Figure 4). Historically a tidal brackish marsh, it now mostly consists of diked seasonal wetlands, managed specifically for waterfowl and other waterbirds among remaining patches of tidal wetlands. The Suisun Marsh is the largest remaining, intact brackish marsh in the western United States. It supports abundant wildlife, including several State and federally listed species, and is considered a particularly significant natural resource area in the San Francisco Bay estuary (BCDC 1976; DWR 1994; CALFED 2000).

Across the Sacramento River to the south and southeast lies the Sacramento–San Joaquin River Delta (Figure 4). Once a vast wetland complex, the Delta has been transformed into a patchwork of islands used mainly for agriculture and connected through meandering natural watercourses and canals. Sherman Island lies immediately south of the Montezuma Hills and consists of a matrix of cultivated lands, irrigated pastures, and some natural wetlands. Although mainly agricultural, this area supports abundant wildlife, including large winter concentrations of waterfowl and other water birds.

The landscape immediately north and northeast of the Montezuma Hills consist primarily of vernal pool prairies and irrigated pastures, intermixed with cultivated lands and patches of emergent wetland habitats along streams and sloughs. Jepson Prairie Preserve, the largest remaining intact, vernal pool prairie landscape associated with the Sacramento–San Joaquin River Delta region, is several miles north of the Montezuma Hills (Figure 4). This area also supports abundant wildlife, including many nesting raptors.

Avian Abundance and Use Surveys

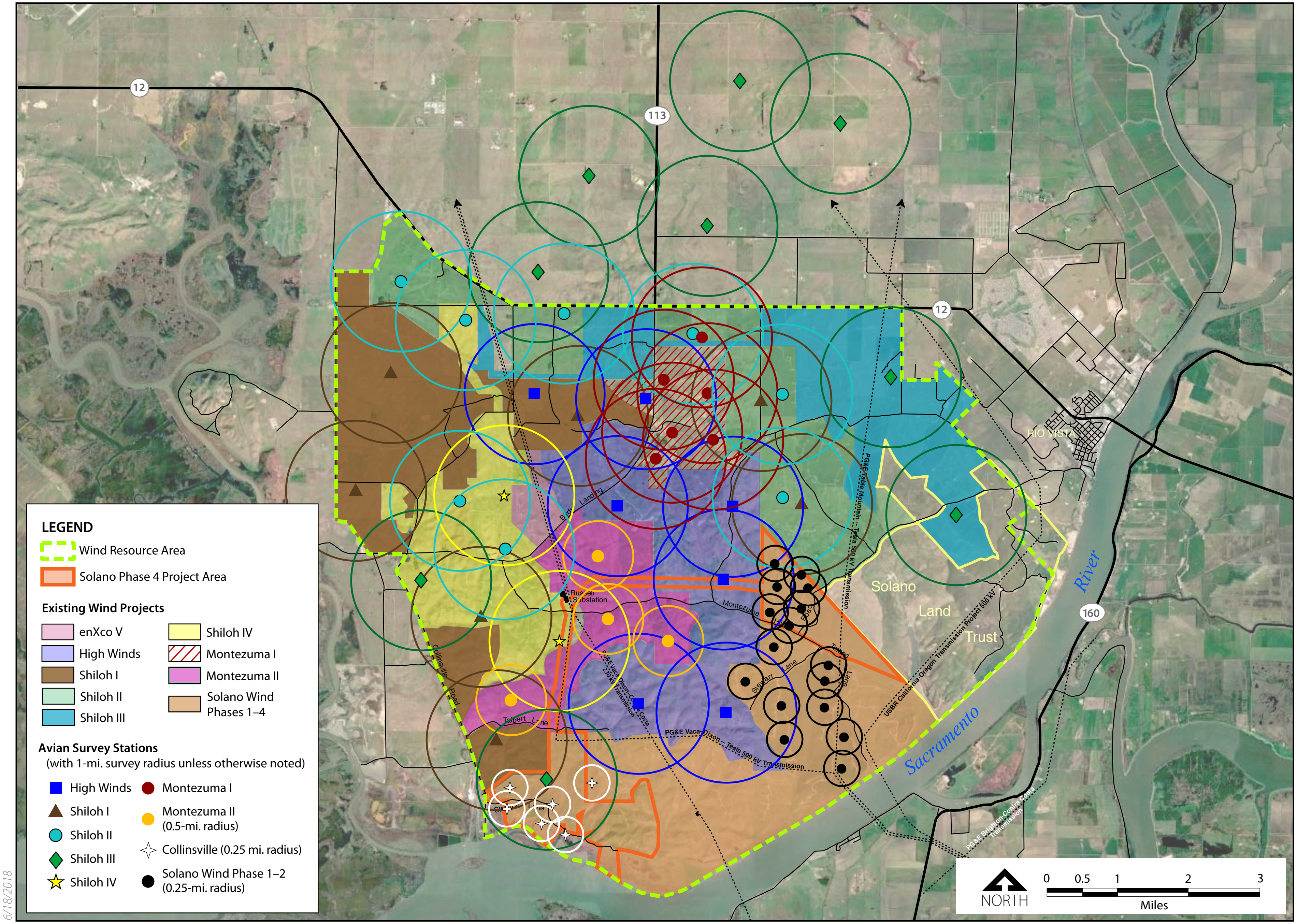
Summary of Project Surveys in the MHWRA

The abundance, diversity, and distribution of resident and migratory birds in and around the Project area have been well documented since the beginning of wind energy development in the Montezuma Hills in the mid-1980s (Howell et al. 1988; Howell and Noone 1992; Kerlinger et al. 2001, 2005, 2006a, 2006b, 2009a, 2009b, 2011; Burleson Consulting 2010; ICF International 2013; H.T. Harvey 2015). Together, these studies provide a thorough description of the distribution and abundance of bird species in the Montezuma Hills and surrounding areas.

A total of 17 separate avian abundance and use survey efforts were undertaken in the MHWRA between 1987 and 2015 (Table 2, Figure 5). These included both preconstruction and postconstruction avian abundance surveys. The primary objective of these survey efforts was to document the seasonal occurrence, relative abundance, and behavior of avian species throughout the MHWRA; and from those data, to assess the potential risk of collision with operating turbines and investigate siting or operational measures to minimize potential impacts.

Howell et al. (1988) conducted the first avian use monitoring study related to wind turbine siting in the Montezuma Hills. During this study (1987–1988), the researchers systematically surveyed portions of the Montezuma Hills that were part of the U.S. Windpower Montezuma Hills Windfarm project, the first wind power project constructed in the Montezuma Hills. Data were collected on species, species abundance, migratory use, nesting, and behavioral characteristics (e.g., flight patterns, altitudes, and perching). During this same period (October–November 1989), Orloff and Flannery (1992) also conducted surveys throughout the Montezuma Hills under contract with the CEC. These surveys were conducted to provide avian abundance and use information throughout the Montezuma Hills, in anticipation of additional wind energy development, and were not associated with any proposed projects.

From 1990 to 1991, Howell and Noone (1992) conducted additional avian surveys as part of the post-construction monitoring of the U.S. Windpower Montezuma Hills Windfarm. Additional pre- and post-construction avian abundance and use surveys were undertaken in the Montezuma Hills after initial development of the U.S. Windpower Windfarm; such efforts included several larger-scale avian surveys that were conducted in association with development of the SMUD Montezuma Project (Howell and Noone 1994), High Winds Project (Kerlinger et al. 2001, 2006a), Montezuma Winds Project (Curry and Kerlinger 2004), Shiloh I, II, III, and IV Projects (Kerlinger et al. 2005, 2006b, 2009a, 2011), Collinsville Project (Curry and Kerlinger, LLC 2011), Solano Wind Project (Burleson Consulting 2010), Montezuma I Project (ICF 2012), and Montezuma II Project (H.T. Harvey 2015). With the exception of the Solano Wind Project (Burleson Consulting 2010), each of these survey efforts employed a similar method of establishing fixed observation points across the landscape that incorporated the entire project area, in accordance with guidance from the National Wind Coordinating Committee (Erickson et al. 2001). The surveys were designed to assess avian abundance, diversity, distribution, habitat use, and behavior.



SOURCES: SMUD 2011, CH2MHill 2018.

Figure 5
Avian Survey Observation Points and Search Radii in the Montezuma Hills Wind Resource Area

Table 2. Avian Abundance and Use Survey Efforts in the MHWRA, 1987–2015

Project	Survey Dates	Number of Observation Points	Observation Point Radius (miles)	Total Observation Hours	Citation
U.S. Windpower	Oct 1987–May 1988	6	indeterminate	180	Howell et al. 1988
	Sep–Mar 1988–1992	7	indeterminate		Howell and Noone 1992
MHWRA-wide	Oct 1989–Nov 1989	20	0.50	28	Orloff and Flannery 1992
SMUD Montezuma	Aug 1992–Jul 1994	7	indeterminate	158	Howell and Noone 1994
High Winds	Aug 2000–Aug 2001	7	1	329	Kerlinger et al. 2001
	Aug 2003–Jul 2005	7	1	112	Kerlinger et al. 2006a
Montezuma Wind	Mar 2004–Jul 2004	3	1	54	Curry and Kerlinger. 2004
Shiloh I	Jan 2004–Dec 2004	7	1	31	Kerlinger et al. 2005
Shiloh II	Nov 2005–Mar 2006	8	1	104	Kerlinger et al. 2006b
	Aug–Nov, Mar–Jun, Jul, Dec–Feb 2009–2012	6	1	786	Kerlinger et al. 2013a
Shiloh III	Apr 2007–Apr 2008	9	1	333	Kerlinger et al. 2009a
	Aug–Nov, Mar–Jun, Jul, Dec–Feb 2013	4	1	182	Kerlinger et al. 2013b[2]
Collinsville	Oct 2010–Nov 2010	6	0.25	72	Curry and Kerlinger, LLC 2011
Solano Wind	Jun 2008–Apr 2010	**	indeterminate	120[3]	Burleson Consulting 2010
Shiloh IV	Jan 2011–Apr 2011	4	1	40	Kerlinger et al. 2011
Montezuma I	Mar 2011–Dec 2012	6	indeterminate	264	ICF International 2013
Montezuma II	Mar 2012–Mar 2015	4	0.50	312	H.T. Harvey 2015

Notes:
1. Orange-shaded columns represent projects with survey areas that correspond directly with the Solano Phase 4 Project; gray-shaded projects include survey areas that partially overlap the Solano Phase 4 Project.
2. These results represent only the first year of a 3-year study. Survey protocol was similar for each year, but data from years 2 and 3 were not available.
3. These surveys were conducted continuously in conjunction with fatality surveys.
Source: Individual reports listed in Citation column

In addition to avian abundance surveys, most efforts also included a survey of breeding raptors in and around each project area. In 2007, wind energy developers commissioned a raptor nesting survey that encompassed a 350-square-mile area, including the entire MHWRA and much of the surrounding lands (Hunt et al. 2008). This was followed by land and helicopter surveys for nesting golden eagles and other raptors within a 10-mile radius of the MHWRA in 2011 (GANDA 2011), and again from 2016–2018 (Estep Environmental Consulting 2018).

Together these surveys and others conducted in the MHWRA have provided data on bird use and abundance over a 30-year period. Survey efforts since 2000, totaling over 2,600 hours of observation time, have effectively and intensively covered nearly the entire MHWRA geographic area, including most of the Project area (Figure 5). The following are brief descriptions of the 10 abundance and behavior survey efforts that have been conducted for new-generation turbine projects in the MHWRA since 2000.

High Winds Project

Systematic preconstruction avian surveys were conducted for the High Winds Project between August 2000 and August 2001, and are summarized in Kerlinger et al. (2001). The survey included seven observation points with visibility radius to 1 mile. Two of the seven observation points overlap the Solano Area 4 East subarea, and one overlaps the Solano Area 4 West subarea (Figure 5). Data were collected over 98 survey days during the 1-year survey period, for a total of 329 hours of observation. A nesting raptor survey also was conducted from April to September 2001.

The High Winds Project became operational in 2003. In addition to 2 full years of post-construction avian monitoring, additional avian abundance surveys were conducted between August 2003 and July 2005, as reported in Kerlinger et al. (2006a). These surveys were conducted over a total of 48 survey days, for a total of 112 hours of observation.

Montezuma Wind Project

The Montezuma Wind Project was a precursor to the Montezuma I Project. Although much of the area was surveyed previously as part of the High Winds pre- and post-construction survey efforts and the Shiloh I preconstruction surveys, additional preconstruction surveys were conducted in the Montezuma Wind Project area between March and July 2004, as discussed by Curry and Kerlinger (2004). The survey entailed three observation points with visibility radius to 1 mile. Data were collected over 36 survey days during the 4-month survey period, for a total of 54 hours of survey time.

Shiloh I Wind Project

During the January to December 2004 avian use study of the Shiloh I project, Kerlinger et al. (2005) conducted sixty-two 30-minute point counts at seven observation points, for a total of 31 hours of observation, including one observation point with an observation radius that overlaps the Solano Phase 4 West subarea and one that overlaps the northern portion of the Phase 4 East subarea (Figure 5) (Kerlinger et al. 2005). All birds that were observed within 1 mile of the point were recorded.

The Shiloh I Wind Project became operational in 2006. Post-construction mortality monitoring surveys were conducted from April 2006 to April 2009 (Kerlinger et al. 2009b).

Shiloh II Wind Project

Preconstruction avian abundance and behavior surveys were conducted for the Shiloh II Project over a 4-month period, from November 2005 through March 2006, as described by Kerlinger et al. (2006b). The surveys consisted of 26 rounds of point counts at eight stations, each with a 1-mile search radius, one of which overlaps the Solano 4 East subarea (Figure 5). Observation time totaled 103.5 hours and covered 100% of the proposed turbine-affected area. A raptor nesting survey with a focus on identifying golden eagle nest sites was conducted in 2005, as part of the same study.

The Shiloh II Wind Project became operational in 2008. Additional avian abundance surveys were conducted during the post-construction monitoring period (Kerlinger et al. 2010, 2013a). Six observation points were located in the Shiloh II Project area (Figure 5) and were surveyed weekly or bi-weekly year-round from 2009 to 2012. The observation time totaled 786 hours. Raptor nesting surveys also were conducted each of the postconstruction monitoring years.

Shiloh III Wind Project

Preconstruction avian abundance and behavior surveys for the Shiloh III Project were conducted between April 2007 and April 2008, and are summarized in Kerlinger et al. (2009a). These surveys consisted of 74 rounds of point counts at nine stations—one of which was in the Solano Phase 4 West subarea—each with a 1-mile search radius. The observation time totaled 333 hours and covered 100% of the proposed turbine-affected area as well as other off-site areas, including north of the MHWRA (Figure 5). A raptor nesting survey with a search radius of 5 miles from the project boundary was conducted in association with the Shiloh III Wind Project in 2007 (Hunt et al. 2008).

The Shiloh III Wind Project became operational in 2012. Postconstruction mortality monitoring surveys were conducted from 2012 to 2015; however, only the first year (2012) report was available (Kerlinger et al. 2013b). Additional avian abundance surveys were conducted during the post-construction monitoring period. Four observation points were distributed in the Shiloh III project area and were surveyed weekly or bi-weekly year-round in 2012, for a total of 182 hours of observation time. Additional raptor nesting surveys also were conducted during postconstruction monitoring.

Shiloh IV Wind Project

Preconstruction avian abundance and behavior surveys in the Shiloh IV project area initially were conducted between April 2007 and April 2008, as part of the Shiloh III survey effort. Because they overlap the Shiloh IV Project area, four observation points were selected from the previous Shiloh I and Shiloh III survey effort (Figure 5). A total of 40 hours of observation time were recorded at these observation points from January to April 2011 (Kerlinger et al. 2011).

Montezuma I Project

The Montezuma I Project became operational in 2010. Additional avian abundance surveys were conducted during the 2011–2012 post-construction period for the Montezuma I Project (formerly Montezuma Wind) (ICF 2013). Six observation points were selected (Figure 5) to provide complete coverage of all available habitat types in the Project area. Using several distance ranges within an indeterminate search radius, each point was surveyed once per week for 30 minutes from March 2011 through December 2012, for a total of 264 hours of observation time.

Montezuma II Project

An avian and bat assessment was conducted for the Montezuma II Project during development of the EIR for the project (ICF 2010b). However, avian abundance surveys were not conducted at that time. The project became operational in 2012. Three years of post-construction avian abundance surveys were conducted during the 2012–2015 post-construction period (H.T. Harvey 2015). Using a search radius of 0.5 miles around each of the four observation points (Figure 5), a total of 312 observation hours were recorded from March 2012 to March 2015.

Solano Wind Project

Avian abundance surveys for the Solano Wind Project were conducted in conjunction with post-construction mortality monitoring for the Phase 1 and 2 projects (Burleson Consulting 2010). All avian observations were recorded during fatality monitoring, which were conducted between June 2008 and April 2010, and included 30 separate surveys over a 22-month period, for an estimated total of 120 hours of observation time. The search radius was indeterminate but is assumed to be at least 0.25 mile. Seven of the 16 surveyed turbines are in the Solano 4 East subarea, and the remaining nine are immediately adjacent to the Solano 4 East subarea (Figure 5).

Collinsville Wind Project

A preliminary avian risk assessment was conducted in 2009 for PG&E's Collinsville Wind Project. Never constructed, the project was proposed to consist of up to 13 wind turbines generating up to 30 MW of electricity on 953 acres. The Collinsville site represents approximately 54% of the currently proposed 1,390-acre Solano 4 West subarea.

Curry and Kerlinger, LLC (2009) conducted an avian risk assessment in 2009, based primarily on a literature review, consultations with State and federal wildlife agencies, and limited on-site observations. Two days of avian use point-counts were conducted in October 2009. Based on the results of the point-counts, some of the proposed turbines initially were recommended to be moved to decrease collision risk to three raptor species (i.e., northern harrier [*Circus cyaneus*], red-tailed hawk [*Buteo jamaicensis*], and American kestrel [*Falco sparverius*]). Because of the brief nature of these initial observations, however, a more thorough avian use and relative abundance survey also was recommended to be conducted, to provide more data to supplement the information collected over the 2-day period in October 2009 (CH2M HILL 2016).

Additional point-count surveys were conducted in October and November 2010, at six observation points, each with a 0.5-mile survey radius (Curry and Kerlinger, LLC 2011). Most of the Collinsville Wind Project area now is part of the Solano 4 West subarea. Therefore, all six observation points are within or overlap the Solano 4 West subarea (Figure 5). A total of 72 hours of observation were recorded over 24 visits from October 5 to November 27, 2010.

Summary of Survey Data

The results of the numerous avian survey efforts in the MHWRA are compiled and expressed below in two primary ways: overall species abundance (i.e., total numbers), composition, and distribution; and frequency of occurrence based on detection rates (i.e., detections per hour) and observation time (i.e., bird-minutes). Overall species abundance is used to simply describe the relative abundance and composition of species in the MHWRA. Rate of occurrence is more useful in evaluating potential collision risk, by examining how frequent and how long a species is present.

Species Abundance, Composition, and Distribution

Table 3 shows the compiled results of the most commonly observed bird species from eight bird abundance surveys conducted in the MHWRA between 2000 and 2015, for which raw data are available. Table 4 shows these same data compiled according to major bird group. These tables also highlight those projects that are most representative of the Project, including Collinsville, which gathered data entirely from the Solano 4 West subarea, and the Solano Wind project, which include data from and immediately adjacent to the Solano 4 East subarea (Figure 5).

In general, the data derived from these recent monitoring studies are consistent with regard to species distribution, relative abundance, nesting, habitat use, and flight patterns, and confirm the results of the earlier Howell et al. (1988) and Howell and Noone (1992) studies. Differences in actual abundance, as shown in the datasets in Tables 3 and 4, are attributed primarily to the amount of observation time or seasonal or annual variation in species occurrence in the MHWRA (Kerlinger et al. 2006a). For some species, such as golden eagle or raptors in general, seasonal differences also may be attributable to the activity of traditional nest sites in any given survey year with a concomitant greater number of observations of individual birds during the spring/summer breeding season.

Tables 3 and 4 show that overall, small passerines make up nearly 90% of all recorded occurrences. Over 60% of these are blackbirds and starlings, including red-winged blackbirds (*Agelaius phoeniceus*), Brewer's blackbirds (*Euphagus cyanocephalus*), and European starlings (*Sturnus vulgaris*). Tricolored blackbirds (*Agelaius tricolor*), yellow-headed blackbirds (*Xanthocephalus xanthocephalus*), and brown-headed cowbirds also are reported in some studies but occur less frequently. Approximately 52% of the blackbird occurrences are reported from mixed flocks. Over 17% of small bird occurrences are ground-dwelling passerines, primarily meadowlarks (*Sturnella neglecta*), horned larks (*Eremophila alpestris*), and American pipits (*Anthus rubescens*). Raptors (including owls and turkey vultures) make up 6.01% of all occurrences from all projects, suggesting their relatively low density in the MHWRA. Waterfowl (1.25%) and water birds/shorebirds (1.99%) also occur in relatively low numbers, and because

Table 3. Results of Avian Abundance Surveys Showing Total Bird Counts of Eight Wind Energy Projects in the MHWRA

Species	High Winds 2000–2001		Shiloh I 2004		Montezuma Wind 2004		Shiloh III 2007–2008		Solano Wind 2008–2010		Collinsville 2010		Shiloh IV 2011		Montezuma II 2014–2015		Avg %
	#	% of total	#	% of total	#	% of total	#	% of total	#	% of total	#	% of total	#	% of total	#	% of total	
American white pelican	67	0.05	120	0.67	12	0.61	117	0.28			8	0.02	12	0.41	9	0.03	0.26
American kestrel	748	0.58	340	1.89	54	2.73	318	0.76	64	0.92	53	0.16	16	0.61	106	0.40	1.01
American pipit	1241	0.97	230	1.27	216	10.9	340	0.81	702	10.1		0.00	304	11.80	967	3.66	4.94
Barn swallow	294	0.23	78	0.43			883	2.10	2	0.03	152	0.47	6	0.21	44	0.17	0.46
Brewer’s blackbird	677	0.53	476	2.64	8	0.40	2851	6.78	714	10.3		0.00	208	7.92	4622	17.49	5.76
Burrowing owl	1	0.00	2	0.01			15	0.04	5	0.07	5	0.02					.02
Common raven	760	0.59	203	1.12	23	1.16	457	1.09	105	1.51	6	0.02	31	1.18	222	0.84	0.94
European starling	128	0.10			24	1.21	1740	4.14	1581	22.8	50	0.16	26	0.99	867	3.28	4.09
Ferruginous hawk	9	0.01					18	0.04									0.01
Golden eagle	283	0.22	30	0.16	7	0.35	31	0.07	4	0.06	6	0.02	1	0.04	19	0.07	0.12
Horned lark	2729	2.13	398	2.21	20	1.01	1703	4.05	470	6.77	16	0.05	76	2.61	1429	5.41	3.07
House finch	88	0.07					88	0.21	3	0.04	796	2.47	84	2.89	610	2.31	1.00
Loggerhead shrike	141	0.11	167	0.93	7	0.35	220	0.52	93	1.34	30	0.09	2	0.07	64	0.24	0.46
Merlin	1	0.00	1	0.01			1	0.00	1	0.01					4	0.02	0.01
Mourning dove	193	0.15	17	0.09			786	1.87	29	0.42	344	1.07	14	0.48	395	1.49	0.68
Northern harrier	171	0.13	183	1.02	86	4.34	83	0.20	11	0.16	98	0.30	8	0.30	54	0.20	0.83
Red-tailed hawk	770	0.60	689	3.83	50	2.52	552	1.31	31	0.45	139	0.43	68	2.59	271	1.03	1.60
Red-winged blackbird	781	0.61	1189	6.61	934	47.2	2078	4.94	1002	14.4	1204	3.74	248	9.44	2456	9.30	12.03
Rock pigeon	408	0.32	113	0.62	4	0.20	682	1.62	10	0.14	0	0.00	102	3.88	2	0.01	0.85
Savannah sparrow	15	0.01	70	0.39			998	2.37	170	2.45	37	0.11	4	0.13	120	0.45	0.74
Swainson’s hawk	4	0.00	27	0.15	14	0.71	33	0.08					3	0.10	23	0.09	0.14
Tricolored blackbird	18	0.01	6	0.03			6	0.01							5992	22.68	2.84
Turkey vulture	1789	1.40	854	4.74	61	3.08	1199	2.85	51	0.73	33	0.10	19	0.72	942	3.57	2.15
Western meadowlark	1185	0.93	531	2.95	1	0.05	3531	8.40	483	6.96	188	0.58	137	5.22	761	2.88	3.50
White-crown sparrow	45	0.04					140	0.33	510	7.35	714	2.21	18	0.69			1.33
White-tailed kite	3	0.00	91	0.51			6	0.01			62	0.19					0.09
Waterfowl	88	0.07	188	1.05	68	3.44	544	1.29	222	3.20	50	0.16	0	0.00	186	0.70	1.24
Shorebirds/ water birds	424	0.33	180	1.00	18	0.91	2505	5.96	197	2.84	307	0.95	12	0.41	376	1.42	1.73
Other passerines	541	0.42	266	1.48	346	17.5	968	2.30	472	6.80	3043	9.44	557	19.13	721	2.73	7.35
Other raptors	313	0.24	22	0.12			54	0.13	1	0.01	9	0.03			10	0.04	0.07
Other birds	634	0.50	74	0.41	23	1.16	284	0.68	8	0.12	14	0.04	15	0.52	2637	9.98	1.68
Mixed flock blackbirds	113700	88.8	11435	63.6	0	0.00	18796	44.7			24860	77.14	940	32.29	2509	9.50	39.5
Total	**128057**	**100**	**17981**	**100**	**1976**	**100**	**42027**	**100**	**6943**	**100**	**32224**	**100**	**2911**	**100**	**26418**	**100**	**100**

Note:
Orange-shaded columns represent data that corresponds directly with the Project; gray-shaded data partially overlaps with the Project.
Source: Individual reports listed in the first row of the table and the corresponding Citation column in Table 2.

Table 4. Results of Avian Abundance Surveys Showing Total Bird Counts Compiled by Bird Group of Eight Wind Energy Projects in the MHWRA

Species	High Winds 2000–2001		Shiloh I 2004		Montezuma Wind 2004		Shiloh III 2007–2008		Solano Wind 2008–2010		Collinsville 2010		Shiloh IV 2011		Montezuma II 2014–2015		Avg %
	#	% of total	#	% of total	#	% of total	#	% of total	#	% of total	#	% of total	#	% of total	#	% of total	
Raptors	4092	3.35	2239	12.45	272	13.77	2310	5.50	168	2.42	405	1.26	115	3.95	1429	5.41	6.01
Waterfowl	88	0.07	188	1.05	68	3.44	544	1.29	222	3.20	50	0.16	0	0.00	186	0.70	1.25
Water birds/ Shorebirds	491	0.38	300	1.67	30	1.52	2622	6.25	197	2.84	315	0.98	24	0.82	385	1.46	1.99
Blackbirds/ Starlings	115286	90.00	13100	72.86	966	48.89	25465	60.59	3297	47.57	26114	81.04	1422	48.85	16446	62.25	64.00
Ground Passerines[2]	5155	4.03	1159	6.45	237	11.99	5574	13.26	1655	23.83	204	0.63	517	17.82	3157	11.95	11.25
Other Passerines	1335	1.01	587	3.26	353	17.9	4089	9.44	1279	11.1	5116	13.66	685	23.53	1559	5.90	10.73
Other Birds	1609	0.34	407	0.51	50	1.12	1423	0.68	123	0.11	20	0.04	148	5.08	3256	12.32	2.53
Total	**128057**	**100**	**17980**	**100**	**1976**	**100**	**42027**	**100**	**6943**	**100**	**32224**	**100**	**2911**	**100**	**26418**	**100**	**100**

Notes:
1. Orange- shaded columns represent data that corresponds directly with the Project; gray-shaded data partially overlaps with the Project.
2. horned lark/meadow lark/American pipit
Source: Individual reports listed in the first row of the table and the corresponding Citation column in Table 2.

habitat for these species is limited in the Montezuma Hills, many are high elevation fly-over detections.

The avian survey data from all studies indicate that the MHWRA is used by both resident and migratory birds. Although differences existed between survey efforts, overall the most common non-raptor species were horned lark, western meadowlark, American pipit, Brewer's blackbird, and red-winged blackbird. Burleson Consulting (2010) also reported European starling as the most commonly reported species in the Solano Wind Project area (Solano 4 East), and white-crowned sparrow (*Zonotrichia leucophrys*) as among the more common species. Curry and Kerlinger, LLC (2011) reported several swallow species, including barn swallow (*Hirundo rustica*), cliff swallow (*Petrochelidon pyrrhonota*), and tree swallow (*Tachycineta bicolor*), as among the most commonly reported species in the Collinsville Project area (Solano 4 West). They also reported high numbers of house finch (*Haemorhous mexicanus*) and white-crowned sparrows.

As a group across all surveys, raptors made up 6.01% of the observations (Table 4). The most common raptors were turkey vulture (*Cathartes aura*), red-tailed hawk, northern harrier, and American kestrel (Howell et al. 1988; Kerlinger et al. 2001, 2005, 2006a, 2009a; Burleson Consulting 2010; H.T. Harvey 2015). Because of the extensive wetland habitats south and west of the Montezuma Hills, waterfowl also occasionally were observed; however, typical observations were of birds or groups of birds flying above and through the area, but not using it otherwise. All waterfowl, shorebird, and other water bird species combined accounted only 3.24% of all observations across all surveys (Table 4).

Solano 4 Project (Collinsville and Solano Wind datasets)

Data for the Collinsville and Solano Wind projects, representative of Solano 4 West subarea and Solano 4 East subarea, respectively, together reveal similar results, and therefore are considered fairly representative of relative bird abundance in the MHWRA (Tables 3 and 4). A total of 6,943 observations of 46 avian species were recorded during the Solano Wind Project surveys (Burleson Consulting 2010). The most common avian species group observed were passerines, which accounted 90.9 % of all observed birds (n=6,309). Of the passerines, blackbird species (mostly European starling, red-winged blackbirds, and Brewer's blackbirds) made up 47.57% of the total number of avian observations. Ground passerines made up 23.83% of the total observations. Raptors (including owls and turkey vultures) made up 2.42%, waterfowl made up 3.20%, and other water birds and shorebirds made up 2.84%. Other small passerines (non-blackbird and non-ground-associated species) made up 17.9%, and other birds (doves, pigeons, pheasants, woodpeckers, and common raven [*Corvus corax*]) made up 2.19% of overall detections.

A total of 32,224 avian observations of 44 species were made during the Collinsville 2010 surveys (Curry and Kerlinger, LLC 2011) over just 72 hours of observation time. Of these, 30,795 (95.57%) were small passerines. This large number of observations is attributed mostly to large mixed blackbird flocks observed during the fall (October–November) survey period. Blackbird species made up 84.80% of all small passerines and made up 64.31% of all birds observed. Somewhat anomalously, ground passerines (horned lark, meadow lark, and American pipit) made up only 0.66% of the small passerine observations. Of the remaining 4,477 non-blackbird and non-ground passerines observed, 34.62% were swallows (barn swallow, tree swallow, and cliff swallow). Relatively few waterfowl (1.73%) and other water bird (1.91%) observations were recorded given the close proximity of the Solano 4 West subarea to the Suisun Marsh and Sacramento River. Species composition was similar to all other studies; however, three passerine species were unique to the Collinsville area, including ash-throated flycatcher (*Myiarchus cinerascens*), common yellowthroat (*Geothlypis trichas*), and spotted towhee (*Pipilo maculatus*).

Although the Solano Wind and Collinsville survey data generally are consistent with other survey efforts in the MHWRA (Table 3), the detection totals differ between the two subareas (Table 5). The difference is most evident in the percentage of blackbirds, where the Collinsville data indicates a substantially greater total of blackbird detections (81.04%) compared with Solano Wind (47.57%). Also, a marked difference exists in the proportion of ground passerine (e.g., horned lark, meadow lark, American pipit) between the two subareas (Table 5), with a greater proportion detected at Solano Wind (23.83%) compared with Collinsville (0.63%). These differences most likely are because of seasonal differences and site conditions during the surveys. For example, the Collinsville surveys were conducted in fall (October–November), when blackbirds are more likely to form large mixed flocks. Also, much of the landscape in the MHWRA periodically is disked or cultivated. Habitat value for grassland-associated birds, such as several blackbird species and ground passerines, may decline following disking or cultivation events, and thereby can result in fewer detections. Although the relative percentage of raptor detections is less for Collinsville because of the large number of blackbirds detected, the total number of raptors detected is more than twice that of Solano Wind. This also may be related to seasonal differences. Raptor populations in the Montezuma Hills and throughout the Central Valley can increase substantially during the fall and winter months because of an influx of wintering raptors, particularly red-tailed hawks.

Table 5. Results of Avian Abundance Surveys Showing Total Bird Counts Compiled by Bird Group at the Solano Wind and Collinsville Projects

Species	Solano Wind 2008-10 (Phase 4 East)		Collinsville 2010 (Phase 4 West)		Avg. %
	Number	% of total	Number	% of total	
Raptors	168	2.42	405	1.26	1.84
Waterfowl	222	3.20	50	0.16	1.73
Waterbirds/Shorebirds	197	2.84	315	0.98	1.91
Blackbirds/Starlings	3302	47.57	26114	81.04	64.31
Ground passerines[1]	1655	23.83	204	0.63	12.23
Other birds	1398	20.14	5136	15.94	18.04
Total	**6943**	**100**	**32224**	**100**	**100**

Note:

1. horned lark/meadow lark/American pipit

Source: Burleson Consulting 2010; Curry and Kerlinger, LLC 2011

Montezuma II Project

The results of the Montezuma II Project also are presented because this represents the most recent effort to estimate avian abundance in the MHWRA and the most comprehensive, multiyear data set from the MHWRA survey efforts. The Montezuma II Project area is immediately north of and adjacent to the Solano Area 4 West subarea, and is similar to both the Solano Area 4 West and East subareas in terms of land use, topography, and avian habitats. Abundance surveys were conducted over 3 full years, from March 2012 to March 2015. Table 6 summarizes Year 3 data (2015) from the H.T. Harvey (2015) report. Although variation in the species composition and abundance occurred between years, this 1-year dataset is the most recent example of the relative abundance based on total bird counts and frequency of occurrence of avian species in the MHWRA. Frequency of occurrence refers to the number of individual surveys during which more than one individual was seen.

Table 6. Results of Avian Abundance Surveys Showing Total Bird Counts and Frequency of Occurrence at the Montezuma II Project, March 2014 to March 2015

Species	#	% all species	F/O[1]	Species	#	% all species	F/O[1]
Raptors				**Quail & Pheasants**			
American kestrel	106	0.40	95	Ring-necked pheasant	3	0.01	3
golden eagle	19	0.07	17				
merlin	4	0.02	4	**Blackbirds & Starlings**			
northern harrier	4	0.02	45	Brewers blackbird	4,622	17.49	42
Peregrine falcon	1	0.00	1	European starling	867	3.28	44
prairie falcon	8	0.03	7	Red-winged blackbird	2,456	9.30	41
red-tailed hawk	271	1.03	212	Tricolored blackbird	5,992	22.68	18
Swainson's hawk	23	0.09	9	Unidentified blackbird	2,509	9.50	1
turkey vulture	942	3.56	196	**All Blackbirds & Starlings**	**16,446**	**62.25**	**113**
unidentified raptor	1	0.00	1				
All Raptors	**1,429**	**5.41**	**337**	**Other Small Birds**			
				American goldfinch	279	1.06	14
Waterbirds				American pipit	967	3.66	51
American coot	91	0.34	1	American robin	3	0.01	1
American white pelican	9	0.03	2	Barn swallow	44	0.17	5
Canada goose	49	0.19	7	Cliff swallow	128	0.48	17
cinnamon teal	2	0.01	1	House finch	610	2.31	46
double-crested cormorant	12	0.05	3	Horned lark	1,429	5.41	215
domestic goose	7	0.03	1	House sparrow	9	0.03	2
great blue heron	2	0.01	2	Lesser goldfinch	14	0.05	2
greater white-fronted goose	4	0.02	2	Loggerhead shrike	64	0.24	60
killdeer	344	1.30	48	Northern flicker	1	0.00	1
mallard	23	0.09	7	Northern mockingbird	7	0.03	7
northern pintail	1	0.00	1	Northern rough-winged swallow	5	0.02	1
northern shoveler	2	0.01	2	Say's phoebe	16	0.06	16
snow goose	7	0.03	1	Savannah sparrow	120	0.45	9
unidentified gull	18	0.07	6	Tree swallow	52	0.20	5
All Waterbirds	**571**	**2.16**	**77**	Western kingbird	2	0.01	1
				Western meadowlark	761	2.88	114
Crows, Ravens & Allies				White-throated swift	206	0.78	23
American crow	3	0.01	1	**All Other Small Birds**	**4,717**	**17.85**	**329**
common raven	222	0.84	121				
yellow-billed magpie	2,624	10.00	2	**Total All Species**	**26,421**		
All Crows and Ravens	**2,849**	**10.78**	**123**				
Pigeons and Doves							
Eurasian collared-dove	9	0.03	2				
mourning dove	395	1.50	68				
rock pigeon	2	0.01	108				
All Pigeons and Doves	**406**	**1.54**	148				

Note: F/O = Frequency of occurrence (number of individual surveys where ≥1 individual was seen); Source: H.T. Harvey 2015

H.T. Harvey (2015) reports that in terms of overall abundance, the 10 species with the highest total counts (in descending order) were tricolored blackbird, Brewer's blackbird, rock pigeon (*Columba livia*), red-winged blackbird, horned lark, American pipit, turkey vulture, European starling, western meadowlark, and house finch (Table 6). However, the 10 most frequently detected species based on the number of individual surveys during which ≥1 individual was observed included (in descending order) horned lark, red-tailed hawk, turkey vulture, common raven, western meadowlark, rock pigeon, American kestrel, mourning dove (*Zenaida macroura*), loggerhead shrike (*Lanius ludovicianus*), and American pipit (Table 6). This fairly predictable result most likely is a function of bird distribution and behavior. Wider ranging resident species—such as red-tailed hawk, turkey vulture, American kestrel, common raven, and loggerhead shrike—and more evenly distributed resident species—such as horned lark, and western meadowlark—are expected to be detected more frequently than species such as tricolored blackbirds and Brewer's blackbirds, which may occur in large flocks but less evenly distributed across the landscape.

In general, the results from H.T. Harvey (2015) are consistent with other avian abundance survey efforts in the MHWRA—particularly the overall abundance of raptors, waterbirds, blackbirds and starlings, and other small birds—and in general likely reflect the composition, relative abundance, and current use of the Solano 4 Project area. However, several interesting anomalies were noted that did not show up in previous data sets. These included the particularly large number of yellow-billed magpies and the relatively large number and frequency of killdeer detections. These most likely were because of nest sites occurring in the vicinity of one or more observation stations.

Avian Temporal and Spatial Distribution Patterns in the MHWRA

Temporal patterns are most evident by examining the data sets with regard to seasonal changes in species abundance and behavior. Most populations change to some extent on a seasonal basis, particularly during the transition from the spring/summer breeding season to the fall/winter migration/wintering season. Some species only occur in the MHWRA during certain times of the year. For example, Swainson's hawks (*Buteo swainsoni*), barn swallows, tree swallows, cliff swallows, violet green swallows (*Tachycineta thalassina*), and northern rough-winged swallows (*Stelgidopteryx serripennis*) migrate out of the area following the spring/summer breeding season. Populations of other species, such as white-crowned sparrow and red-tailed hawk, increase during fall/winter as migrants move into the area. Some species, such as ferruginous hawk (*Buteo regalis*), rough-legged hawk (*Buteo lagopus*), and merlin (*Falco columbarius*) only occur in the area during the fall/winter months. Understanding these patterns can be important when assessing collision risk and developing impact minimization measures.

Seasonal changes also exist related to behavior in some species that may increase their susceptibility to collision mortality. Red-winged, tricolored, and Brewers blackbirds, among the most common species in the MHWRA, form large flocks during the fall/winter months. No longer associated with breeding sites, these flocks can rapidly move through the MHWRA and surrounding area, flying at a range of altitudes and in unpredictable formations.

Among the project surveys in the MHWRA, the 2004 Shiloh 1 survey may provide the best example of temporal changes in species abundance and composition (Table 7). Surveys were conducted over one complete year, from January to December. Table 7 shows the year-round presence of common resident breeding raptors (American kestrel, northern harrier, red-tailed hawk, and turkey vulture) and several other resident species, such as common raven, golden eagle, and loggerhead shrike; and the seasonal presence of non-breeding species (rough-legged hawk, merlin, and prairie falcon) or long-distance migrants (cliff swallows, barn swallows).

Table 7. Avian Species Abundance and Composition by Month from the Shiloh 1 Wind Project, 2004

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
American crow	2	2	2	2					2	2	14	8
American kestrel	39	36	24	12	6	18	20	9	55	56	34	31
American pipit				18					12		100	100
American white pelican	16	4			10	90						
Barn swallow				18	8				52			
Bblack phoebe									1			
Brewer's blackbird		45	20				24		30	157	24	176
Burrowing owl	1											1
Canada goose		2	1				55					
Cliff swallow			50	6	28	28			71	12	32	
Common raven	27	31	8	12	10	3			3	32	17	60
Dark-eyed junco												14
Golden eagle	1	1	3	5	7		1	1		2	4	5
Great egret				2		6						
Great-horned owl				3		1						
Horned lark	60		30			22		6	64	58	118	40
Killdeer		82		2	2		11	9	18	16	23	9
Loggerhead shrike	19	9	18	8	12	15	11	9	18	16	23	9
Mallard		2	21			7						
Merlin		1										
Mourning dove	14			1	2							
Northern flicker	3	1	1								10	
Northern harrier	27	37	20	22	8	9	12	6	8	12	11	12
Northern mockingbird												1
Osprey			1									
Prairie falcon	6	1									3	1
Red-shouldered hawk											2	
Red-tailed hawk	114	111	42	43	19	26	31	15	45	99	86	58
Red-winged blackbird		700	120	188	150	20			11			
Ring-necked pheasant	2			1			4					
Rock dove				10				10	50	1	42	
Rough-legged hawk	1	1	1	1								
Savannah sparrow				4					8	38		20
Say's phoebe									1	3	5	4
Snow goose												100
Swainson's hawk			2	3	4	5	4	1	3	1	4	
Tree swallow		10										
Tricolored blackbird										6		
Turkey vulture	23	55	51	42	40	51	80	11	266	125	57	53
Western meadowlark	8							3	55	218	42	206
White-tailed kite	27	19	2				1		3	6	18	15

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Unidentified gull		1										
Unidentified buteo			1									
Mixed blackbirds	440	150							1045	2200	4150	3450
Total	**830**	**1301**	**418**	**403**	**306**	**301**	**254**	**80**	**1821**	**3060**	**4819**	**4389**

Source: Kerlinger et al. 2011

Overall avian spatial distribution patterns can be examined by reviewing all of the abundance surveys that have been undertaken throughout the MHWRA since the late 1980s. The results are fairly predictable, based on land use, topography, availability of nesting habitats, availability or proximity to wetlands or streams, and proximity to off-site habitats (e.g., Suisun Marsh). Kerlinger et al. (2009a) more fully address the distribution of species across the MHWRA landscape than other studies. During their preconstruction avian use surveys, they used nine observation points with a 1-mile observation-radii situated in the northern, southern, eastern, and western edges of the MHWRA, four of which were north of State Route 12 and therefore outside the MHWRA, and one of which overlaps most of the Solano 4 West subarea (Figure 5). Differences in species distribution and use patterns were detected for several species and species groups, which generally were correlated with habitat availability, topography, or other ecological factors. They also examined the data based on seasonal differences.

The majority of overall bird occurrences were reported north of State Route 12, attributed mainly to higher value habitat in that area for several species, including Brewer's blackbirds, European starlings, long-billed curlews (*Numenius americanus*), mourning doves, western meadowlarks, and mixed blackbird groups. Distribution in the MHWRA was relatively consistent for many species across the landscape, such as horned lark, western meadowlark, and turkey vulture; however, some interesting differences were also noted. For example, the majority of raptor detections were made in the western portion of the MHWRA. Also, as a group, waterfowl were detected north of State Route 12 and in the southwestern portion of the MHWRA, with no occurrences at any other interior locations. The relatively few waterfowl detections made across all survey efforts, particularly in light of the substantial waterfowl populations that winter in the Delta and Suisun Marsh, may be at least partially explained by the lack of waterfowl habitat in the MHWRA and flight patterns of most waterfowl that more likely follow pathways around the Montezuma Hills rather than through them.

Seasonal differences also were interesting, particularly for raptor species, and can be correlated with fatality rates. For species that do not breed in California, such as ferruginous hawk and merlin, the expected pattern indicated only non-breeding season occurrences. For other year-round resident species, such as American kestrel, red-tailed hawk, and burrowing owl (*Athene cunicularia*), the data suggested increases in local populations during the fall/winter non-breeding season. This pattern was less clear in other raptor species, including golden eagle.

Although the occurrence data indicate some local movement patterns of some species groups (e.g., waterfowl), overall the data do not suggest that the Montezuma Hills support any unique flight corridors or significant habitat use areas. As noted previously, the landscape generally is monotypic, and use patterns by many species likely are dictated more by habitat availability and quality outside the Montezuma Hills rather than in it.

Avian Distribution Patterns within the Solano 4 Project Area

The Collinsville Wind project (Curry and Kerlinger 2011) included avian occurrence data according to the six observation points used in the survey, providing some information on distribution patterns in the Solano 4 West subunit (Table 8). Among the few easily discernable patterns from this data set include the occurrences of waterfowl and waterbirds within stations 1, 2, 3, and 5 (those located closest to the wetland and aquatic habitats south and west of the Project area). Also, wide-ranging species associated with grassland landscapes were observed in most or all observation points. These include raptors—such as American kestrel, red-tailed hawk, white-tailed kite (*Elanus leucurus*), and northern harrier—and blackbird species, particularly mixed flocks. Interestingly, unlike other survey efforts, very few horned larks were observed (16) and only at one observation point (#5). Predictably, observation points 2, 3, and 5 along the southern edge of the MHWRA and overlapping the adjacent marshlands had the greatest number of overall observations. Observation points 4 and 6, the two interior sites, had the lowest number of overall observations. The relatively fewer observations in observation point 1, also along the southern edge of the MHWRA, reflect fewer detections of mixed blackbird flocks compared with the other observation points.

Table 8. Avian Species Observed by Observation Point from 2010 Surveys at the Collinsville Wind Project, Solano County, CA

Species	2010 Observation Points					
	1	2	3	4	5	6
American goldfinch	180	100	-	-	-	-
American kestrel	14	10	4	15	3	7
American white pelican	-	-	-	-	8	-
Anna's hummingbird	-	-	-	2	-	-
Ash-throated flycatcher	-	-	-	-	1	-
Barn swallow	-	36	14	60	36	6
Black phoebe	2	2	-	3	1	1
Burrowing owl	1	-	-	2	2	-
Canada goose	-	-	-	-	6	-
Cliff swallow	202	176	14	462	142	100
Common raven	-	6	-	-	-	-
Common yellowthroat	-	-	-	-	3	-
Dark-eyed junco	-	-	-	32	-	-
Double-crested cormorant	-	-	-	-	5	-
European starling	6	-	-	32	-	12
Golden eagle	-	5	-	1	-	-
Great-blue heron	-	-	-	3	-	-
Great egret	5	1	-	-	-	-
Great-horned owl	-	-	-	3	-	-
Green heron	-	-	1	-	-	-
Hermit thrush	-	1	-	-	-	-
Horned lark	-	-	-	-	16	-
House finch	610	60	-	116	10	-
Killdeer	-	-	76	12	192	-
Loggerhead shrike	14	2	1	13	-	-
Mallard	-	20	-	-	24	-
Mourning dove	64	96	72	112	-	-
Northern flicker	1	-	-	12	2	-

Species	2010 Observation Points					
	1	2	3	4	5	6
Northern harrier	27	20	17	8	21	5
Northern mockingbird	-	-	1	5	6	-
Prairie falcon	1	1	-	3	1	-
Red-tailed hawk	21	35	6	38	9	30
Red-winged blackbird	50	128	710	120	146	50
Ring-necked pheasant	-	-	-	2	-	-
Savannah sparrow	-	16	6	-	-	15
Say's phoebe	3	6	2	3	3	4
Song sparrow	16	-	-	-	14	-
Spotted towhee	5	-	-	-	1	-
Tree swallow	30	22	132	150	197	-
Turkey vulture	-	26	4	-	-	3
Western meadowlark	16	28	66	38	40	-
White-crowned sparrow	364	104	74	152	20	-
White-tailed kite	6	23	15	2	16	-
Yellow-rumped warbler	6	-	-	87	6	-
Mixed blackbirds	780	7760	8500	2000	3220	2600
Unidentified gull	-	-	-	-	6	-
Unidentified passerine	60	16	360	-	-	170
Unidentified sparrow	160	-	80	-	60	-
Unidentified tern	-	-	4	-	4	-
Total	**2,644**	**8,700**	**10,160**	**3,485**	**4,220**	**3,017**

Sources: Curry and Kerlinger, LLC 2011; CH2M HILL 2016

Occurrence Rates

Occurrence rates provide a more meaningful metric for determining the presence of species in a project area and assessing potential risk based on the frequency of occurrence. Nine of the survey efforts conducted in the MHWRA since 2000, including the Collinsville Wind Project (Solano 4 West), compiled results according to the number of observations per hour (Table 9). Averaging 258 observations per hour for all birds across all nine projects, High Winds (672.997 birds per hour) and Collinsville (447.583 birds per hour) reported the highest number of observations per hour for all birds. Excluding blackbirds, the rate dropped substantially across all projects, from 17.070 to 84.889 total birds observed per hour, with the highest rate at Collinsville (Table 9).

The most frequently observed bird group among all projects combined was blackbirds (Brewer's blackbird, red-winged blackbird, tricolored blackbird, European starling, brown-headed cowbird [*Molothrus ater*], mixed flocks) at 216.759 birds per hour (84% of the total observations). The most frequently observed species was the red-winged blackbird (13.016 birds per hour). Totals for the 10 most frequently observed non-blackbird species in descending order include horned lark (9.222 birds per hour), rock pigeon (4.068 birds per hour), western meadowlark (3.595 birds per hour), turkey vulture (3.168 birds per hour), red-tailed hawk (2.402 birds per hour), barn swallow (2.196 birds per hour), American pipit (2.177 birds per hour), house finch (1.761 birds per hour), white-crowned sparrow (1.431 birds per hour), and common raven (1.341 birds per hour).

Raptors as a group, which included 17 species (including owls and turkey vultures), were detected at a rate of 7.853 birds per hour (approximately 3% of the total observations). The three most commonly observed raptors—turkey vulture (3.168 birds per hour), red-tailed hawk (2.402 birds per hour), and American kestrel (1.052 birds per hour)—contributed to 84% of the total raptors observed (6.622 birds per minute). Raptors were observed with regularity at all observation points (see Table 8), but the rate of occurrence in terms of the number of birds per hour, was consistently low among all projects.

All waterbirds (waterfowl, shorebirds, wading birds, seabirds) combined, which included 29 species, were detected at a rate of only 2.307 birds per hour (less than 1% of the total observations). The most frequently observed species was the killdeer (0.967 birds per hour).

The three common species identified earlier as ground passerines (American pipit, horned lark, and western meadowlark) were detected at a combined rate of 14.993 birds per hour (5.8% of all observations). Excluding blackbird species, these three species combined had the highest detection rate compared to other groups (e.g., raptors, waterbirds).

Relative occurrence rates between survey efforts generally were consistent among the most commonly observed species. Although the rates are variable between surveys, species with overall high occurrence rates tend to be high across all projects. This is most pronounced in the blackbird species, mixed blackbirds, and the ground passerines (American pipit, horned lark, and western meadowlark). Common resident raptor species, including American kestrel, northern harrier, red-tailed hawk, and turkey vulture, also are similarly represented among all survey efforts. Observations of less common raptor species and those that occur seasonally in the MHWRA, including ferruginous hawk, rough-legged hawk, merlin, peregrine falcon, and prairie falcon, occurred with much less consistency between survey efforts (Table 9).

Table 9. Avian Observations per Hour from Nine Avian Abundance Surveys in the MHWRA

Species	Observations Per Hour									
	High Winds Aug 00–Aug 01	High Winds Aug 03–Aug 05	Shiloh I Jan 04–Dec 04	Shiloh II Apr 09–May12	Shiloh III Apr 07–Apr 08	Shiloh III Jan 12–Dec 12	Shiloh IV Apr 07–Apr 08	Montezuma II Mar 12–Feb 15	Collinsville	Average – All Projects
American avocet	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000
American coot	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.455	0.000	0.051
American crow	0.610	0.156	0.320	0.040	0.000	0.150	0.000	0.050	0.000	0.147
American goldfinch	0.050	0.000	0.000	0.847	0.000	1.550	0.000	2.568	3.889	0.989
American kestrel	2.270	1.532	1.470	0.570	0.840	0.850	0.590	0.612	0.736	1.052
American pipit	3.770	4.954	1.130	0.690	0.110	1.050	1.500	3.400	0.000	2.177
American robin	0.020	0.000	0.000	0.007	0.000	0.010	0.000	0.005	0.000	0.005
Am. white pelican	0.200	0.000	0.553	0.503	0.000	0.560	0.690	0.035	0.111	0.294
American wigeon	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.013	0.000	0.001
Anna’s hummingbird	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.028	0.004
Ash-throated flycatcher	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.014	0.002
Barn swallow	0.890	1.258	0.060	0.780	13.490	0.320	0.720	0.139	2.111	2.196
Black phoebe	0.020	0.000	0.000	0.013	0.000	0.000	0.000	0.018	0.125	0.020
Black swift	0.000	0.000	0.000	0.000	0.050	0.000	0.000	0.000	0.000	0.006
Brewer's blackbird	2.060	2.860	3.440	2.670	0.970	1.790	5.540	32.151	0.000	5.720
Brown-headed cowbird	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.016	0.000	0.002
Burrowing owl	0.000	0.024	0.000	0.013	0.000	0.010	0.000	0.036	0.069	0.017
California gull	0.000	0.000	0.000	0.073	0.000	0.000	0.000	0.000	0.000	0.008
Canada goose	0.220	0.743	0.890	0.640	0.000	0.020	0.000	0.554	0.083	0.350

Species	Observations Per Hour									
	High Winds Aug 00– Aug 01	**High Winds Aug 03– Aug 05**	**Shiloh I Jan 04– Dec 04**	**Shiloh II Apr 09– May12**	**Shiloh III Apr 07– Apr 08**	**Shiloh III Jan 12– Dec 12**	**Shiloh IV Apr 07– Apr 08**	**Montezuma II Mar 12– Feb 15**	**Collinsville**	**Average – All Projects**
Chipping sparrow	0.220	0.000	0.000	0.000	0.000	0.000	0.000	0.000	15.222	1.176
Chukar	0.000	0.000	0.000	0.000	0.050	0.000	0.000	0.000	0.000	0.006
Cinnamon teal	0.000	0.000	0.000	0.007	0.000	0.000	0.000	0.003	0.000	0.001
Cliff swallow	1.050	0.118	0.230	1.690	0.650	1.410	0.000	0.920	0.000	0.674
Common raven	2.310	2.289	1.020	0.787	1.490	0.690	1.150	2.246	0.083	1.341
Common yellowthroat	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.042	0.005
Cooper’s hawk	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.020	0.000	0.002
Dark-eyed junco	0.000	0.000	0.000	0.070	0.000	0.080	0.000	0.000	0.444	0.067
Domestic goose	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.120	0.000	0.013
D-c cormorant	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.399	0.069	0.052
Dunlin	0.000	0.000	0.000	0.010	0.000	0.000	0.000	0.000	0.000	0.001
Eurasian collared dove	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.001
European starling	0.390	1.469	0.000	3.273	0.220	0.140	6.840	5.428	0.694	2.050
Ferruginous hawk	0.030	0.016	0.000	0.027	0.000	0.000	0.000	0.000	0.000	0.008
Golden eagle	0.860	0.219	0.080	0.067	0.080	0.090	0.190	0.098	0.083	0.196
Golden crowed sparrow	0.000	0.039	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004
Grasshopper sparrow	0.000	0.016	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
Great blue heron	0.000	0.008	0.000	0.000	0.000	0.000	0.000	0.005	0.014	0.003
Great egret	0.030	0.016	0.030	0.030	0.030	0.030	0.010	0.013	0.083	0.030
Great horned owl	0.000	0.000	0.000	0.017	0.000	0.020	0.000	0.018	0.042	0.010
Great-tailed grackle	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Species	Observations Per Hour									
	High Winds Aug 00–Aug 01	**High Winds Aug 03–Aug 05**	**Shiloh I Jan 04–Dec 04**	**Shiloh II Apr 09–May12**	**Shiloh III Apr 07–Apr 08**	**Shiloh III Jan 12–Dec 12**	**Shiloh IV Apr 07–Apr 08**	**Montezuma II Mar 12–Feb 15**	**Collinsville**	**Average – All Projects**
Greater yellowlegs	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000
Gr. white-fronted goose	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.000	0.001
Horned lark	8.290	2.164	0.840	2.387	2.460	1.540	4.000	6.450	0.222	9.222
House finch	0.270	0.047	0.000	0.543	0.000	0.460	0.000	3.474	11.056	1.761
House sparrow	0.000	0.000	0.000	0.040	0.000	0.000	0.000	0.022	0.000	0.007
Killdeer	0.720	0.368	0.000	0.763	0.300	0.730	0.430	1.502	3.889	0.967
Lesser goldfinch	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.154	0.000	0.017
Lesser yellowlegs	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
Lincoln's sparrow	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000
Loggerhead shrike	0.430	0.391	0.760	0.303	0.160	0.430	0.230	0.339	0.417	0.384
Long-billed curlew	0.420	0.000	0.000	0.677	0.000	0.000	0.000	0.127	0.000	0.136
Long-billed dowitcher	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.057	0.000	0.006
Mallard	0.050	0.078	0.000	0.570	0.000	0.150	0.000	0.069	0.611	0.170
Merlin	0.000	0.008	0.000	0.000	0.000	0.000	0.000	0.018	0.000	0.003
Mountain bluebird	0.000	0.000	0.000	0.013	0.000	0.000	0.000	0.000	0.000	0.001
Mourning dove	0.590	0.641	0.190	0.573	0.000	0.210	0.080	1.757	4.778	0.980
Mute swan	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000
Northern flicker	0.070	0.000	0.020	0.017	0.030	0.030	0.010	0.007	0.208	0.044
Northern harrier	0.520	0.657	0.400	0.533	0.380	0.460	0.030	0.658	1.361	0.555
Northern mockingbird	0.110	0.039	0.000	0.013	0.030	0.010	0.000	0.112	0.167	0.053
Northern pintail	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000

Species	Observations Per Hour									
	High Winds Aug 00–Aug 01	**High Winds Aug 03–Aug 05**	**Shiloh I Jan 04–Dec 04**	**Shiloh II Apr 09–May12**	**Shiloh III Apr 07–Apr 08**	**Shiloh III Jan 12–Dec 12**	**Shiloh IV Apr 07–Apr 08**	**Montezuma II Mar 12–Feb 15**	**Collinsville**	**Average – All Projects**
Northern r-w swallow	0.000	0.008	0.000	0.000	0.000	0.000	0.000	0.049	0.000	0.006
Northern shoveler	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.000
Peregrine falcon	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.000	0.001
Prairie falcon	0.030	0.000	0.060	0.027	0.000	0.040	0.040	0.026	0.083	0.034
Red-shouldered hawk	0.000	0.000	0.000	0.000	0.000	0.010	0.000	0.000	0.000	0.001
Red-tailed hawk	2.340	4.047	2.560	1.410	5.190	1.490	1.280	1.370	1.931	2.402
Red-winged blackbird	2.370	33.188	13.690	7.207	4.590	3.090	9.660	26.631	16.722	13.016
Ring-necked pheasant	0.040	0.008	0.000	0.013	0.270	0.050	0.000	0.018	0.028	0.047
Rock pigeon	1.240	3.656	1.820	0.957	10.350	0.730	6.500	11.356	0.000	4.068
Rough-legged hawk	0.290	0.000	0.030	0.007	0.050	0.010	0.000	0.016	0.000	0.045
Savannah sparrow	0.050	0.227	0.000	0.663	1.350	1.080	2.030	5.818	0.514	1.304
Say's phoebe	0.120	0.039	0.050	0.090	0.030	0.050	0.070	0.107	0.292	0.106
Short-eared owl	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.001
Snow goose	0.000	0.000	0.000	0.133	0.000	0.550	0.000	0.012	0.000	0.077
Snowy egret	0.030	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003
Song sparrow	0.070	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.417	0.054
Spotted towhee	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.083	0.009
Swainson's hawk	0.010	0.008	0.320	0.127	0.080	0.050	0.230	0.079	0.000	0.100
Tree swallow	0.040	0.321	0.160	0.753	0.490	0.380	0.340	0.655	7.361	1.167
Tricolored blackbird	0.050	0.000	0.000	0.000	0.000	0.000	0.000	68.475	0.000	7.614
Tundra swan	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.029	0.000	0.003

Species	Observations Per Hour									
	High Winds Aug 00– Aug 01	High Winds Aug 03– Aug 05	Shiloh I Jan 04– Dec 04	Shiloh II Apr 09– May12	Shiloh III Apr 07– Apr 08	Shiloh III Jan 12– Dec 12	Shiloh IV Apr 07– Apr 08	Montezuma II Mar 12– Feb 15	Collinsville	Average – All Projects
Turkey vulture	5.440	3.789	4.050	0.903	4.190	1.300	4.110	4.275	0.458	3.168
Varied thrush	0.000	0.000	0.000	0.013	0.000	0.000	0.000	0.000	0.000	0.001
Violet-green swallow	0.160	0.180	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.038
Western kingbird	0.070	0.078	0.000	0.023	0.000	0.010	0.000	0.007	0.000	0.021
Western meadowlark	3.600	2.383	0.050	3.707	2.780	3.600	6.380	7.052	2.806	3.595
Western scrub-jay	0.290	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.033
Western tanager	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000
Whimbrel	0.070	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008
White-crowned sparrow	0.140	0.008	0.000	0.083	2.590	0.100	0.000	0.037	9.917	1.431
White-faced ibis	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.000	0.001
White-tailed kite	0.010	0.243	0.130	0.027	0.000	0.070	0.000	0.049	0.861	0.154
White-throated swift	0.000	0.024	0.000	0.000	0.000	0.000	0.000	0.581	0.000	0.067
Yellow-billed magpie	0.000	0.008	0.000	0.007	0.080	0.000	0.000	0.005	0.000	0.011
Yellow-rumped warbler	0.000	0.000	0.000	0.137	0.000	0.030	0.000	0.000	1.375	0.171
Mixed blackbirds	344.210	601.61	103.870	26.033	51.620	24.640	214.040	4.677	345.278	190.775
Unidentified corvid	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Unidentified duck	0.000	0.000	0.000	0.067	0.000	0.000	0.000	0.132	0.000	0.022
Unidentified goldfinch	0.000	0.000	0.000	0.013	0.000	0.000	0.000	0.000	0.000	0.001
Unidentified gull	0.000	0.000	0.000	0.287	0.000	0.140	0.000	0.377	0.083	0.099
Unidentified raptor	0.630	0.305	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.104
Unid hummingbird	0.000	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001

Species	Observations Per Hour									
	High Winds Aug 00– Aug 01	**High Winds Aug 03– Aug 05**	**Shiloh I Jan 04– Dec 04**	**Shiloh II Apr 09– May12**	**Shiloh III Apr 07– Apr 08**	**Shiloh III Jan 12– Dec 12**	**Shiloh IV Apr 07– Apr 08**	**Montezuma II Mar 12– Feb 15**	**Collinsville**	**Average – All Projects**
Unidentified songbird	0.000	0.328	0.000	0.000	0.000	0.000	0.000	0.000	8.417	0.972
Unidentified sparrow	0.000	0.008	0.000	0.000	0.270	0.000	0.000	0.006	4.167	0.495
Unidentified swallow	0.000	1.946	0.000	0.000	0.000	0.000	0.000	0.007	0.000	0.217
Unidentified tern	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.111	0.012
Unidentified bird	0.000	0.000	0.000	0.083	0.000	0.000	0.000	0.000	0.000	0.009
Total all birds	387.798	672.997	138.070	61.960	105.270	50.210	266.690	192.090	447.583	258.075
Total except blackbirds	39.110	35.340	17.070	26.050	48.090	20.690	37.450	63.156	84.889	41.316

Notes:
1. Orange-shaded columns represent data that corresponds directly with the Project; gray-shaded data partially overlaps with the Project.
Sources: H.T. Harvey 2015; CH2M HILL 2016

Another way to examine the relative frequency of bird species is to record the amount of time that each bird is observed in the survey area. This approach was used to assess bird use during the Montezuma I Project (ICF International 2013). Using six observation points, each survey measured the amount of time (in minutes) that birds spent in the survey area. These data then were tallied into the metric of bird-minutes. Of the different approaches to collecting and analyzing bird-use data, this approach may be the most useful in addressing potential risk and interpreting changes in fatality rates over time. This metric of "bird minutes" is useful as an indicator of collision risk, because the longer an individual is present in a given area, the greater the opportunity for collision incidents. For example, ICF International (2013) was able to correlate an increase in the number of loggerhead shrike fatalities between 2011 and 2012 with an increase in observed shrike bird-minutes.

Table 9 shows the 2012 bird-minute data from Montezuma I (ICF International 2013). In many respects, the data are consistent with other survey efforts. Table 10 highlights the data for resident year-round raptors, blackbirds, and starlings, and other species with higher bird-minutes. Blackbirds, including European starlings, red-winged blackbirds, Brewer's blackbirds, and tricolored blackbirds were the most abundant and had the highest number of recorded bird-minutes (82% of the total bird-minutes). Unidentified blackbirds, most likely mixed flocks, had the highest total (863.84 bird minutes), followed by European starling (244.38 bird minutes).

Consistent with other surveys, all 12 raptors combined were observed much less frequently (43.60 bird-minutes [2.7% of the total bird-minutes]). Most of these (42.05 bird-minutes [96.4%]) were observations of the four common resident, year-round species—American kestrel, red-tailed hawk, northern harrier, and turkey vulture—with the turkey vulture being the most commonly reported raptor.

Other species that occurred relatively frequently included rock pigeon, mourning dove, common raven, loggerhead shrike, and horned lark.

From this dataset (Table 10), it also is possible to detect seasonal and monthly changes in populations, which can be correlated with migratory movements and bird behavior (e.g., fall/winter flocking behavior).

Table 10. Total Number of Bird-Minutes Documented by Species at Six Observation Points at the Montezuma I Project, 2012

Common Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Average
American kestrel	5.15	6.00	5.65	2.10	0.22	0.17	1.63	1.19	0.83	1.00	3.50	2.58	30.02	2.50
Burrowing owl	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.04	0.00
Golden eagle	0.63	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.30	0.00	2.02	0.17
Red-tailed hawk	15.11	11.56	5.52	4.90	1.56	0.17	0.75	6.10	6.17	7.92	14.10	22.46	96.31	8.03
Turkey vulture	25.04	21.20	24.48	11.00	9.11	9.29	33.31	49.24	118.00	46.88	5.27	5.92	358.74	29.89
White-tailed kite	0.00	0.00	0.48	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.62	0.05
Northern harrier	0.19	0.28	2.39	4.10	3.00	2.04	1.06	1.76	3.67	0.23	0.20	0.63	19.54	1.63
Swainson’s hawk	0.00	0.00	0.00	4.38	0.17	0.00	0.19	0.52	0.25	0.15	0.00	0.00	5.66	0.47
Ferruginous hawk	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.25	0.02
Rough-legged hawk	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.46	0.46	0.04
Unidentified buteo	0.00	0.00	7.17	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.17	0.76
Peregrine falcon	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.08	0.15	0.01
Prairie falcon	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.33	0.00	0.41	0.03
Unidentified falcon	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
American white pelican	0.00	0.00	0.52	3.67	0.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.74	0.40
Greater white-fronted goose	0.00	0.00	21.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.74	1.81
Canada goose	0.59	2.64	16.78	2.81	3.83	0.08	1.69	0.43	13.33	5.92	0.20	7.75	56.06	4.67
Unidentified goose	76.67	1461	43.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1581.5	131.79
Mallard	0.00	0.08	0.61	3.48	4.22	0.75	0.00	0.00	0.00	0.00	0.00	0.00	9.14	0.76
Common goldeneye	0.00	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.04
Unidentified duck	0.00	0.08	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.02
Great egret	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.01
Great-horned owl	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.15	0.00	1.25	2.40	0.20
American coot	0.00	0.00	0.00	0.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.86	0.07
Killdeer	3.15	0.52	0.43	0.05	0.50	0.33	0.13	0.00	0.17	4.00	1.23	10.29	20.80	1.73
Rock pigeon	58.33	11.56	20.57	2.29	2.39	3.58	7.75	4.62	8.17	19.92	14.53	45.96	197.67	16.47
Mourning dove	0.15	2.40	1.30	2.38	3.67	1.58	16.31	18.71	0.25	0.23	1.37	0.38	48.73	4.06
Anna’s hummingbird	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00
Northern flicker	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.31	8.00	12.63	21.11	1.76
Black phoebe	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.08	0.01
Say’s phoebe	0.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.03	3.92	5.88	0.49
Western kingbird	0.00	0.00	0.00	0.00	0.56	0.58	0.00	0.00	0.00	0.00	0.00	0.00	1.14	0.09
Loggerhead shrike	0.89	1.68	1.09	0.57	3.94	1.29	0.19	7.67	0.33	1.42	9.93	15.13	44.13	3.68
Western scrub jay	0.11	0.00	0.00	0.19	0.39	0.17	0.13	2.86	5.17	0.27	0.17	0.46	9.90	0.83
Yellow-billed magpie	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.16	0.01
American crow	0.00	0.00	0.00	0.00	0.00	0.00	0.88	1.29	0.67	16.69	0.43	0.00	19.95	1.66
Common raven	25.70	28.67	28.57	18.14	1.89	1.67	2.31	2.10	2.83	10.12	4.47	20.92	147.47	12.29
Horned lark	5.26	0.00	0.00	1.24	0.00	0.00	0.06	0.48	0.00	1.04	13.47	10.17	31.71	2.64
Cliff swallow	0.00	0.00	0.00	0.00	0.22	1.96	0.00	3.05	0.17	0.00	0.00	0.00	5.39	0.45
Tree swallow	0.00	0.00	2.17	2.33	0.00	0.00	0.00	1.29	0.08	0.00	0.00	0.00	5.88	0.49

Common Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Average
Barn swallow	0.00	0.00	0.30	1.00	1.17	1.67	1.44	0.67	1.08	0.38	0.00	0.00	7.71	0.64
Violet green swallow	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.01
Rough-winged swallow	0.00	0.00	0.00	0.00	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.03
Unidentified swallow	0.00	0.12	1.65	38.05	0.17	1.42	3.63	34.24	20.50	0.73	0.47	0.00	100.96	8.41
House wren	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	0.08
Ruby-crowned kinglet	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.25	6.29	0.52
Western bluebird	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00
American robin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.83	3.83	0.32
Northern mockingbird	0.00	0.00	0.13	0.00	0.00	0.17	0.00	0.10	0.00	0.00	0.00	3.75	4.14	0.35
European starling	8.15	8.84	76.09	2.48	11.28	1.88	0.44	0.24	0.00	388.12	1513.90	921.21	2932.60	244.38
American pipit	40.04	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	3.38	43.93	3.66
Yellow-rumped warbler	0.07	0.00	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.63	4.89	0.41
Savannah sparrow	0.11	0.36	0.04	0.00	0.00	0.00	0.00	0.00	0.00	2.42	26.30	48.75	77.99	6.50
White-crowned sparrow	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.83	14.96	17.79	1.48
Golden-crowned sparrow	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.04	0.00
Western tanager	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
Red-winged blackbird	27.81	18.64	212.83	270.57	62.00	54.50	0.06	0.00	0.00	145.35	39.83	35.67	867.26	72.27
Tricolored blackbird	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1160	57.79	1218.76	101.56
Western meadowlark	33.85	7.24	14.09	6.05	6.50	6.25	5.94	34.48	13.17	79.85	146.17	54.79	408.36	34.03
Yellow-headed blackbird	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.04	0.07	0.01
Brewer's blackbird	149.74	22.88	5.04	1.43	0.00	0.75	0.19	0.81	0.25	42.23	288.57	81.41	539.30	49.44
Unidentified blackbird	1436.56	630.92	487.74	97.10	0.28	7.42	0.06	0.00	0.17	1732.23	4897.10	1076.50	10366.06	863.84
Brown-headed cowbird	0.00	0.00	0.00	0.00	0.56	0.21	0.00	0.00	0.00	0.00	0.20	0.00	0.96	0.08
House finch	4.63	0.00	0.00	0.14	0.44	0.96	4.19	3.05	0.00	5.77	15.60	3.38	38.15	3.18
Lesser goldfinch	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.77	0.13	0.89	0.07
American goldfinch	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.08	0.00	31.90	5.67	37.70	3.14
Total	**1918.96**	**2237.56**	**981.35**	**483.95**	**118.67**	**100.04**	**82.31**	**174.90**	**195.33**	**2512.42**	**8205.63**	**2483.58**	**19494.72**	**1624.56**

Notes:
1. Resident year-round raptors are highlighted in gray; blackbirds and starlings are highlighted in yellow; and other species with relatively high averages are highlighted in green.
Source: ICF International 2013

Special-Status Species

Special-status species are generally defined as species that are assigned a status designation indicating possible risk to the species. These designations are assigned by state and federal resource agencies (e.g., California Department of Fish and Wildlife, U.S. Fish and Wildlife Service) or by private research or conservation groups (e.g., National Audubon Society, California Native Plant Society). Assignment to a special-status designation is usually done on the basis of a declining or potentially declining population, either locally, regionally, or nationally. The extent to which a species or population is at risk usually determines the status designation. The factors that determine risk to a species or population generally fall into one of several categories, such as habitat loss or modification affecting the distribution and abundance of a species; environmental contaminants affecting the reproductive potential of a species; or a variety of mortality factors such as hunting or fishing, interference with human-made objects (e.g., collision, electrocution), invasive species, or toxins.

Although all native migratory birds are protected under the federal Migratory Bird Treaty Act, some species are afforded additional protection because of declining populations or other related risks to long-term population sustainability. Special-status birds are defined as follows:

- species that are listed, proposed, or candidates for listing under the federal Endangered Species Act (50 Code of Federal Regulations 17.11-listed; 61 Federal Register 7591, February 28, 1996-candidates);
- species that are listed or proposed for listing under the California Endangered Species Act (Fish and Game Code 1992 Sections 2050 et seq.; 14 California Code of Regulations Sections 670.1 et seq.);
- species that are designated as Species of Special Concern by the California Department of Fish and Wildlife (CDFW);
- species that are designated as Fully Protected by CDFW (Fish and Game Code, Section 3511, 4700, 5050, and 5515; and
- species protected under the federal Bald and Golden Eagle Protection Act (BGEPA).

Several special-status bird species have been reported to occupy the MHWRA or immediately surrounding area and are listed in Table 11.

Table 11. Special-Status Birds Known to Occur On or Near the MHWRA

Species	Status (State/Federal)	Habitat Associations
American white pelican *Pelecanus erythrorhynchos*	SSC/-	Open shallow water in marshes, lakes, larger watercourses
black rail *Laterallus jamaicensis coturniculus*	T/-	Salt marsh, shallow freshwater marsh
least bittern *Ixobrychus exilis*	SSC/-	Fresh/brackish water emergent wetlands
northern harrier *Circus cyaneus*	SSC/-	Grasslands, seasonal wetlands, irrigated pastures/croplands
white-tailed kite *Elanus leucurus*	FP/-	Grasslands, seasonal wetlands, irrigated pastures/croplands

Species	Status (State/Federal)	Habitat Associations
Swainson's hawk *Buteo swainsoni*	T/-	Grasslands, irrigated pastures and croplands
Ferruginous hawk *Buteo regalis*	SSC/-	Grasslands, irrigated pastures and croplands
golden eagle *Aquila chrysaetos*	FP/BGEPA	Grasslands, irrigated pastures and croplands
bald eagle *Haliaeetus leucocephalus*	-/E, BGEPA	River, lakes, reservoirs, wetlands, woodlands/forests
Peregrine falcon *Falco peregrinus*	E, FP/-	Wetlands, open water, grasslands, cliffs and outcrops
merlin *Falco columbarius*	SSC/-	Grasslands, shrublands, woodlands, wetlands
burrowing owl *Athene cunicularia*	SSC/-	Grasslands, irrigated pastures and croplands
short-eared owl *Asio flammeus*	SSC/-	Grasslands, pasturelands, wetlands, croplands
loggerhead shrike *Lanius ludovicianus*	SSC/-	Grasslands, irrigated pastures and croplands
yellow warbler *Dendroica petechia*	SSC/-	Riparian and other woodlands, wetland thickets
tricolored blackbird *Agelaius tricolor*	T/-	Wetlands, grasslands, irrigated pastures, croplands
yellow-headed blackbird *Xanthocephalus xanthocephalus*	SSC/-	Freshwater emergent wetlands

Notes:
T – threatened, E – endangered, SSC – state species of special concern, FP – state fully protected,
BGEPA – Bald and Golden Eagle Protection Act
Source: CDFW 2018

The majority of records of special-status species occurrences in the MHWRA have been compiled through surveys conducted for wind energy project development, providing important data on relative abundance of these species. Table 12 lists the number of observations of special-status species during bird abundance surveys of seven projects in the MHWRA, including the Solano Wind Project (overlaps the Solano 4 East subarea) and the Collinsville Project (overlaps Solano 4 West subarea). These results suggest differences in annual abundance in the MHWRA for some wide-ranging species, such as golden eagle and loggerhead shrike, but also suggest local differences in use patterns in the MHWRA for more localized and specialized species, such as burrowing owl and short-eared owl.

Seventeen special-status bird species have been recorded in the MHWRA. The most common of these is the State-listed threatened tricolored blackbird. Otherwise, as a group, raptors are the most commonly observed special-status species, particularly golden eagle, northern harrier, and Swainson's hawk.

Most use of the MHWRA by special-status species is for foraging; however, nest sites also have been reported for golden eagle, a State fully protected species that receives protection under the BGEPA, and the State threatened Swainson's hawk. Nest sites also have been reported for white-tailed kite, a State fully protected species, and northern harrier and burrowing owl, both State species of special concern.

Table 12. Special-Status Species Reported during Bird Abundance Surveys

Species	Status	High Winds 2000–2001	High Winds 2004–2005	Shiloh I 2004	Montezuma Wind 2004	Shiloh III 2007–2008	Solano Wind 2008–2010	Collinsville 2010	Montezuma II 2014–2015
American white pelican	CSC	67	24	120	12	117		8	9
northern harrier	CSC	171	84	184	86	83	11	98	4
Swainson’s hawk	CT	4	1	27	14	33			23
ferruginous hawk	CSC	9				18			
golden eagle	FP/BDEPA	283	28	30	7	31	4	6	19
merlin	CSC	1	1	1		1	1		4
peregrine falcon	SE								1
prairie falcon	CSC								8
white-tailed kite	CFP	3		91		6		62	
burrowing owl	CSC	1	3	2		15	5	5	
short-eared owl	CSC	2							
loggerhead shrike	CSC	141	50	167	7	220	93	30	64
tricolored blackbird	CT	18		6		6			5992

Notes:
CSC – California Species of Special Concern; CT – California Threatened; FP – California Fully Protected;
BGEPA – Bald and Golden Eagle Protection Act
1. Orange-shaded columns represent data that corresponds directly with the Project; gray-shaded columns partially overlap the Project.
Sources: CH2M HILL 2016; Burleson Consulting 2010

Nesting Raptors

Surveys for nesting birds, particularly raptors, have been conducted throughout the area (Howell et al. 1988; Howell and Noone 1992; Kerlinger et al. 2001, 2005, 2006a, 2006b; Curry and Kerlinger 2004; Hunt et al. 2008; GANDA 2011; Area West Environmental 2017; Estep Environmental Consulting 2018). Raptor nesting habitat is limited in the Montezuma Hills by the overall lack of trees. The majority of available nest sites are eucalyptus trees, planted as ornamental trees around farm residences or as wind breaks. However, much of the suitable nesting habitat is regularly occupied. Kerlinger et al. (2005) confirmed a total of 37 raptor nests (and 23 additional possible nests) in the Shiloh I survey area in 2004. The majority of these (33 of 37 confirmed nests) were of three species: red-tailed hawk, American kestrel, and great horned owl (*Bubo virginianus*). The following year, Kerlinger et al. (2006a) conducted a raptor survey for the High Winds Project that detected less nesting activity (a total of 39 confirmed and possible nests), which was attributed to severe weather conditions and an overall reduction in raptor abundance in the MHWRA in 2005. In general, these results are consistent with the results from other studies (Howell et al. 1988; Howell and Noone 1992).

In 2008, Hunt et al. (2008) conducted a comprehensive nesting raptor survey that encompassed the entire MHWRA and 3 miles beyond its border (5 miles for golden eagle). Within the 350-square-mile radius survey area, 150 breeding pairs of eight raptor species were documented (Figure 6). Of these, 137 were confirmed nests, and 13 were probable. The three most common nesting raptors, consistent with all other raptor nesting surveys of the area, made up 78% of all nesting pairs, including red-tailed hawk (n=44 pairs), American kestrel (n=43 pairs), and great-horned owls (n=30 pairs). Other species included Swainson's hawk (n=11 pairs), northern harrier (n=10 pairs), barn owl (*Tyto alba*) (n=7 pairs), white-tailed kite (n=3 pairs), and golden eagle (n=2 pairs).

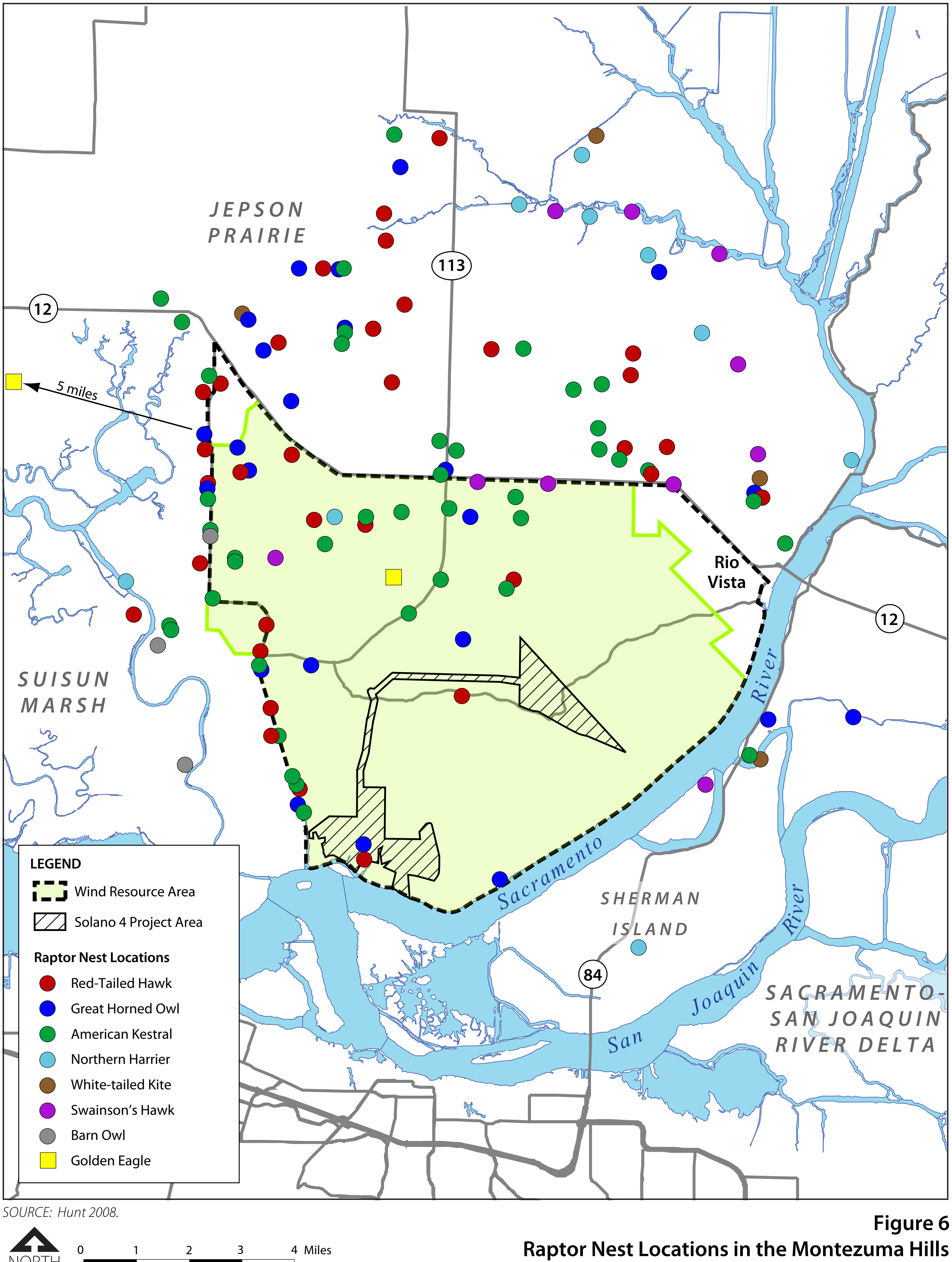
Eighty-one percent of all confirmed nest sites (n=109) in the Hunt et al. (2008) study area were in live eucalyptus trees, and the vast majority of those nests were in groves rather than single trees. Of the 29 confirmed red-tailed hawk nests, 26 (90%) were in eucalyptus, with the remaining three on electrical transmission towers. Twenty-one of 22 (95%) great-horned owl nests were in eucalyptus, as were at least 34 of 36 American kestrel nests.

As shown in Figure 6, no nests were documented in the Solano Wind Project area, with the exception of a great-horned owl nest along the southern edge of the Phase 3 area. This is primarily because of the lack of potential nesting trees in the Solano Wind Project area and throughout most of the southern and eastern portions of the MHWRA.

In conjunction with the environmental review process for the Solano 4 Project, Area West Environmental conducted surveys for golden eagles within a 10-mile radius of the Solano 4 West subarea in 2016–2017. During this survey, several other raptor nests were identified. The addition of the Solano 4 East subarea necessitated a follow-up survey in 2018, conducted by Estep Environmental Consulting, incorporating the entire MHWRA and lands within a 10-mile radius north and east of the Phase 4 East subarea. During this survey, although the focus was golden eagles, all nesting raptors and common raven nests were recorded. Figure 7 shows the composition and distribution of nesting raptors on and in a portion of the vicinity of the MHWRA in 2018. A total of 58 active non-eagle raptor and common raven nests were located, including 23 red-tailed hawk nests, 20 Swainson's hawk nests, six great-horned owl nests, one white-tailed kite nest, and nine common raven nests.

Golden Eagle

The golden eagle is a year-round resident in and around the MHWRA; however, it occurs in low breeding densities compared with Coast Range populations, in part because of the sparse nesting habitat and limited prey populations in the MHWRA (Hunt et al. 2008; Kerlinger et al. (2009a). Kerlinger et al. (2009a) reported 31 observations (0.07% of the total observations) of golden eagles during avian abundance surveys of the Shiloh III Wind Project area between April 2007 and April 2008 (Table 11). Observations were made in most months, with peaks occurring in the March–April and August–September time frames. In contrast are the earlier results from the High Winds Project, where Kerlinger et al. (2001) reported 233 observations (0.22% of the total observations) during avian abundance surveys from August 2000 to August 2001. All subsequent surveys since 2001 have documented substantially fewer golden eagle observations (Table 11).



6/30/2018

SOURCE: Hunt 2008.

Figure 6
Raptor Nest Locations in the Montezuma Hills Wind Resource Area in 2007

Relatively few golden eagle occurrences have been reported in the Solano Wind Project area (Burleson Consulting 2010). Burleson Consulting (2010) reported only four detections during its 22-month survey period. Curry and Kerlinger, LLC (2011) reported only six detections in the Collinsville Project area (Solano Area 4 West subunit). This may reflect a decline in golden eagle use of the MHWRA over time or use patterns by golden eagles in the MHWRA. Howell and Noone reported increasing golden eagle activity northward in the MHWRA, and although their survey did not include the Solano Wind Project area, Kerlinger et al. 2009a reported the majority of golden eagle detections in the far eastern or far southwestern portions of the MHWRA.

Documenting golden eagle nests in and around the MHWRA has been ongoing since the first surveys were conducted in 1987 (Howell et al. 1988). Hunt et al. (2008) conducted the first area-wide search for golden eagle and other raptor nests. Garcia & Associates (GANDA 2011) conducted the first comprehensive survey for nesting golden eagles within a 10-mile radius of the MHWRA. Both helicopter surveys and ground surveys were conducted. The most recent surveys were conducted within a 10-mile radius of the Solano 4 Wind Project area by Area West Environmental in 2016–2017 (Area West Environmental 2017) and Estep Environmental Consulting in 2018 (Estep Environmental Consulting 2018).

Four historic golden eagle nest sites are in the MHWRA, one of which was reported active in 1988, 1989, and 1991 by Howell and Noone (1992), two of which were reported active in 2004 and 2005 by Kerlinger et al. (2005, 2006a), one of which was reported active in 2007 (Hunt et al. 2008), and one that was reported active in 2012 (the only year it was reported active). None have been reported active since then. Five additional golden eagle nesting territories and one possible bald eagle nesting territory have been documented outside the MHWRA but within the 10-mile survey radius (Figure 7).

Hunt et al. (2008) reported only a few areas of suitable golden eagle habitat within the 5-mile radius area surrounding the MHWRA. Overall, suitable habitat is limited by agricultural activities that adversely affect development of a prey base, lack of nesting habitat, and lack of terrain that provides the suitable updrafts used by golden eagles. Thus, Hunt et al. (2008) reported that the low population density of golden eagles in the MHWRA appears related to the poor quality of nesting and foraging habitat, not to the more recent presence of wind turbines. Kerlinger et al. (2009a) reported that unlike areas where eagle densities are higher, the MHWRA does not have a high diversity or density of prey species, and thus it is not favored habitat for eagle nesting because ground squirrels and other prey are not very common.

The Solano 4 Eagle Report (Estep Environmental Consulting 2018) provides additional details on historic and current eagle nesting activity in and around the MHWRA.

Swainson's Hawk

The Swainson's hawk, a State threatened species, also has been reported in relatively low densities in the MHWRA; none has been reported in the Solano Wind Project area (Burleson Consulting 2010; Curry and Kerlinger, LLC 2011; Estep Environmental Consulting 2018). Earlier surveys reported Swainson's hawk nests primarily in the northern extreme of the

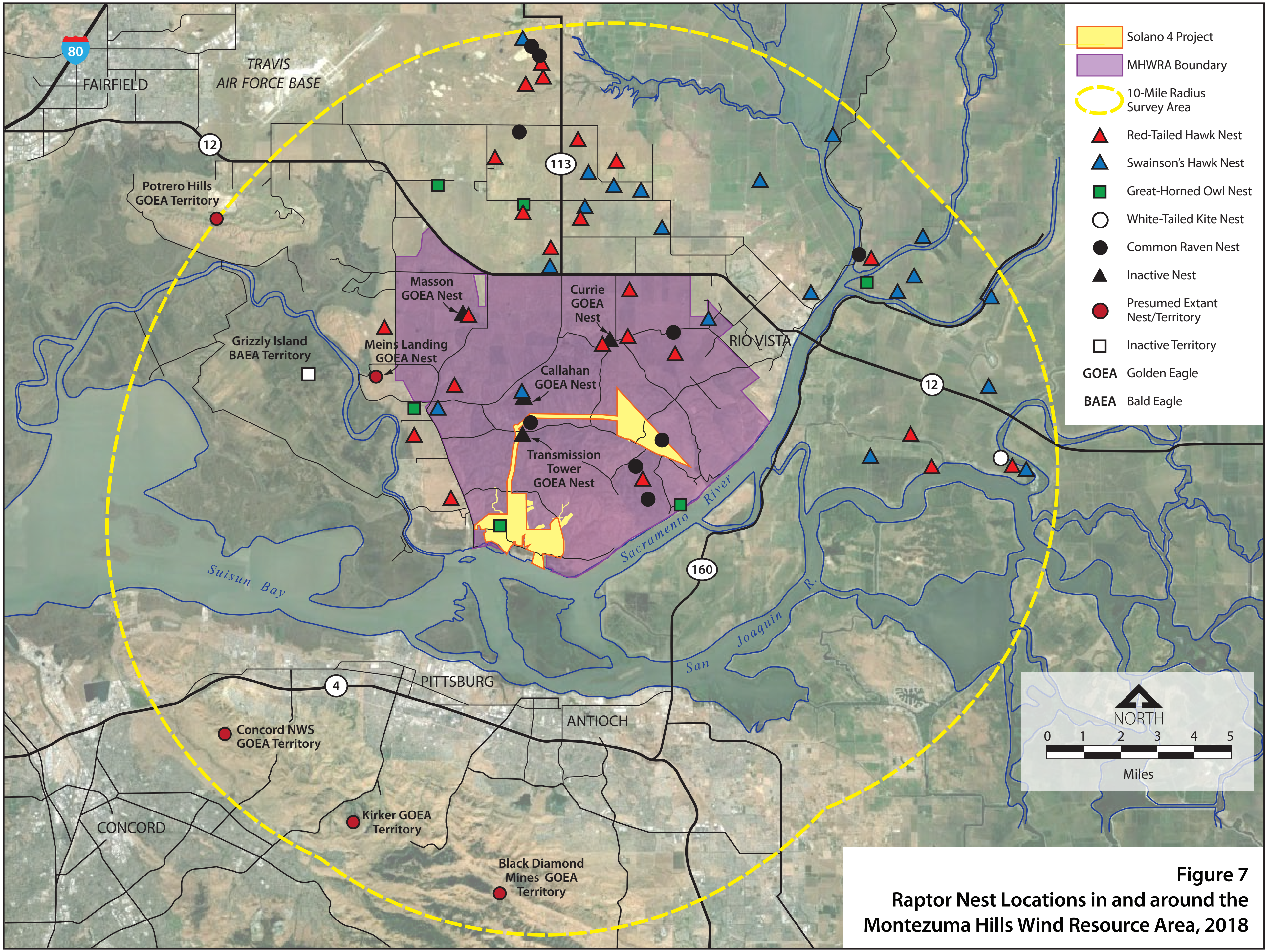


Figure 7
Raptor Nest Locations in and around the Montezuma Hills Wind Resource Area, 2018

06/30/2018

SOURCE: *Estep Environmental Consulting April 19, 24, 26, and May 4, 2018 surveys.*

MHWRA. However, more recent surveys (Hunt et al. 2008; GANDA 2011; Area West Environmental 2017; Estep Environmental Consulting 2018) have reported nesting Swainson's hawks in the hilly interior of the MHWRA. Figure 7 shows the location of four active Swainson's hawk nests in or on the edge of the MHWRA in 2018.

The quality of raptor foraging habitat in the Solano Area 4 Project area appears generally consistent with the MHWRA overall. However, the general lack of available nesting habitat in the Project area compared with neighboring lands to some extent may reduce the overall use of the area.

Conclusion

Although site-specific variability exists, all surveys generally are consistent with regard to the composition, relative abundance, seasonal variation, and occurrence rates of avian species in the MHWRA since 2000. These results also are consistent with results of earlier surveys, beginning in the late 1980s. The different ways of examining the data also result in generally consistent patterns of occurrence and frequency. Table 13 lists the avian species with the highest observed occurrence (total count) and frequency of occurrence.

Table 13. Species in the MHWRA with the Highest Overall Counts and Frequency of Occurrence

Species	Average Percent Total Count	Average Birds/Hour	Average Bird Minutes
red-winged blackbird	12.39	13.016	72.27
Brewer's blackbird	6.44	5.720	49.44
American pipit	5.08	2.177	3.66
European starling	4.21	2.050	244.38
western meadowlark	3.61	3.595	34.03
horned lark	3.28	9.222	2.64
tricolored blackbird[1]	2.84	7.614	101.56
turkey vulture	2.29	3.168	29.89
red-tailed hawk	1.64	2.402	8.03
white-crowned sparrow	1.33	1.431	1.48
American kestrel	1.02	1.052	2.50
house finch	1.00	1.761	3.18
common raven	0.94	1.341	12.29
rock pigeon	0.85	4.068	16.47
northern harrier[1]	0.83	0.555	1.63
Savannah sparrow	0.74	1.304	6.50
mourning dove	0.68	0.980	4.06
barn swallow	0.46	2.196	0.64
loggerhead shrike[1]	0.46	0.384	3.68

Note:
1. special-status species
Sources: Individual reports listed in Citation column in Table 2.

Red-winged, tricolored, and Brewer's blackbirds are the most abundant species in the MHWRA, and often occur in mixed species flocks with European starlings, another abundant species.

Ground-dwelling passerines (American pipit, western meadowlark, and horned lark) are the next most abundance species in the MHWRA.

Among the raptors, the four year-round resident breeding species (red-tailed hawk, American kestrel, northern harrier, and turkey vulture) are the most abundant but only make up a relatively small percentage of the bird use. Waterfowl, shorebirds, and other water birds occur uncommonly in the MHWRA and typically are observed as fly-over species, as they move into neighboring wetland habitats. The one exception is the killdeer (*Charadrius vociferous*), which is a fairly common species in open grassland habitats and agricultural edges. Most other passerines and other birds occur relatively infrequently; however, some surveys reported large numbers of otherwise uncommon species, such as the yellow-billed magpie (H.T. Harvey 2015).

The most commonly observed special-status species are tricolored blackbird, northern harrier, and loggerhead shrike. However, special-status raptors, including golden eagle, northern harrier, and Swainson's hawk, make up the largest proportion of individual special-status species that have been observed in the MHWRA.

Overall, the Solano Phase 4 Project supports habitat conditions and avian resources that are similar to other parts of the MHWRA. The main exception is the lack of trees, and thus the lack of tree-nesting raptors compared to other areas. However, the overall species composition and frequency of occurrence are expected to be similar in the Project area to neighboring wind energy project areas in the MHWRA.

Literature Cited

Area West Environmental, Inc. (AWE). 2017 (May). Eagle Survey Report, Solano County, CA. Prepared for the Sacramento Municipal Utility District.

Bailey, E. H. 1966. *Geology of Northern California*. California Division of Mines and Geology Bulletin 190.

Burleson Consulting, Inc. 2010. *Avian and Bat Mortality Monitoring Summary Report, Solano Wind Project, Solano County, California*. Prepared for Sacramento Municipal Utility District, Sacramento, CA.

CALFED Bay-Delta Program (CALFED). 2000. *Ecosystem Restoration Program Plan, Volume II: Ecological Management Zone Visions*. Final Programmatic ESI/EIR Technical Appendix. Available: http://www.delta.dfg.ca.gov/erp/docs/reports_docs/ERPP_Vol_2.pdf.

California Department of Fish and Wildlife (CDFW). 2018 (April). *Natural Diversity Database*. Special Animals List. Periodic Publication. Available: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=109406&inline.

California Department of Water Resources (DWR). 1994. *Summary of Sensitive Plant and Wildlife Resources in Suisun Marsh during Water Years 1984–1994*. Environmental Services Office, Sacramento, CA.

CH2M HILL. 2016. *Avian Use Regional Data Report for the Solano Phase 4 Collinsville Wind Project*. Draft Report. Prepared for Sacramento Municipal Utility District, Sacramento, CA.

Curry, R. and P. Kerlinger. 2004. *Draft Hamilton Ranch Avian Survey; Collinsville–Montezuma Hills Wind Resource Area, Solano County, California*. Prepared for FPL Energy, Livermore, CA.

Curry & Kerlinger, LLC. 2009 (October). *Post-Construction Avian Monitoring Study for the Shiloh I Wind Power Project Solano County, California*. Prepared for Iberdrola Renewables. Curry & Kerlinger, McLean, VA.

Curry & Kerlinger, LLC. 2011 (March). *Avian Use Study, Collinsville Wind Power Project, Solano County, California*. Prepared for Pacific Gas & Electric Company, San Ramon, CA. Curry & Kerlinger, McLean, VA.

Dickinson, W. R. 1981. Plate Tectonics and the Continental Margin of California. Pages 1–28 in W. G. Ernst (ed.), *The Geotectonic Development of California*. New Jersey: Prentice Hall.

Earth Metrics Incorporated. 1988. *Draft Environmental Impact Report for the Montezuma Hills Wind Park*. Prepared for Solano County Department of Environmental Management, Fairfield, CA.

Ecology and Environment, Inc. 2005. *Draft Environmental Impact Report for the Shiloh I Wind Plant Project*. Prepared for the Solano County Department of Resource Management, Fairfield, CA.

Environmental Science Associates. 2002 (June 6). *Draft Solano County High Winds Power Project Environmental Impact Report*. Prepared for Solano County Department of Environmental Management, San Francisco, CA.

Erickson, W. P., G. D. Johnson, M. D. Strickland, D. P. Young, Jr., K. J. Sernka, and R. E. Good. 2001. *Avian Collisions with Wind Turbines: a Summary of Existing Studies and Comparison of Other Sources of Avian Collision Mortality in the United States*. Prepared for the National Wind Coordinating Committee, Washington, DC.

Estep, J.A. 1989. Avian Mortality at Large Wind Energy Facilities in California: Identification of a Problem. California Energy Commission, Sacramento. P700-89-001. 30 pp.

Estep Environmental Consulting. 2011. *Sacramento Municipal Utility District Solano Wind Project Avian and Bat Protection Plan*. Prepared for the Sacramento Municipal Utility District, Sacramento, CA.

Estep Environmental Consulting. 2018. *Solano Phase 4 Wind Project, Eagle Survey Report*. Prepared for the Sacramento Municipal Utility District, Sacramento, CA.

Garcia and Associates (GANDA). 2011 (June). *Bald and Golden Eagle Survey Report for Proposed Collinsville Wind Project*. Prepared for Pacific Gas & Electric Company.

Heady, H. F. 1977. *Valley Grassland. In Terrestrial Vegetation of California*. M. G. Barbour and J. Major, editors, pp. 491–514. John Wiley and Sons, NY.

Hickman, James C. (ed.). 1993. *The Jepson Manual*. Berkeley, CA: University of California Press.

Howell, J. A., J. J. Keane, and J. E. DiDonato. 1988. *Avian Use Monitoring Related to Wind Turbine Siting, Montezuma Hills, Solano County, CA*. Prepared for Solano County Department of Environmental Management, Fairfield, CA.

Howell, J. A., and J. Noone. 1992. *Examination of Avian Use and Mortality at a U.S. Windpower Wind Energy Development Site, Montezuma Hills, Solano County, CA*. Final Report. Prepared for Solano County Department of Environmental Management, Fairfield, CA.

Howell, J.A., and J. Noone. 1994. *Examination of Avian Use at the Sacramento Municipal Utility District Proposed Wind Energy Development Site, Montezuma Hills, Solano County, California*. Prepared for Kenetech Windpower, San Francisco, CA.

H.T. Harvey & Associates. 2015. *Montezuma II Wind Energy Center Post-Construction Monitoring Final Report*. Prepared for NextEra Energy Montezuma II Wind, LLC, Birds Landing, CA.

Hunt, T.L., A.A. Hasch, C. Wilkerson, Z. Smith, and B. Fischer. 2008. *A Survey of Breeding Raptors in the Vicinity of the Montezuma Hills Wind Resource Area*. Prepared for Curry and Kerlinger, LLC.

ICF International. 2010a (October). *Draft Habitat Conservation Plan for the Proposed Shiloh III Wind Plant Project, Solano County, CA*. ICF 00263.09, Sacramento, CA. Prepared for enXco, Tracy, CA.

ICF International. 2010b (November). *Revised Avian and Bat Risk Assessment for the Montezuma II Wind Project, Solano County, California*. Prepared for NextEra. Sacramento, CA.

ICF International. 2012 (January). *Altamont Pass Wind Resource Area Bird Fatality Study*. ICF 00904.08, Sacramento, CA. Prepared for Alameda County Community Development Agency, Hayward, CA.

ICF International. 2013. *Montezuma Wind LLC (Montezuma I) 2012 Avian and Bat Fatality Monitoring Report*. Prepared for NextEra Energy Resources.

Jones & Stokes. 2004 (September). Biological Resources Report and Evaluation for the Proposed Shiloh Wind Plant Project, Solano County, California. J&S 03214.03. Sacramento, CA.

Jones & Stokes. 2005 (June). *Initial Study/Mitigated Negative Declaration for the enXco V Turbine Replacement Project*. J&S 04215.04. Sacramento, CA.

Kerlinger, P., R. Curry, and L. Culp. 2001. *Avian Monitoring Study and Risk Assessment for the High Winds Power Project, Solano County, California*. Prepared for FPL Energy. Livermore, CA.

Kerlinger, P.R., R. Curry, and A. Hasch. 2005. *Avian Monitoring Study and Risk Assessment of the Shiloh I Wind Power Project, Solano County, California*. Final Report. Prepared for enXco, Inc., Tracy, CA.

Kerlinger, P., R. Curry, L. Culp, A. Jain, C. Wilkerson, B. Fischer, and A. Hasch. 2006a. *Post-Construction Avian and Bat Fatality Monitoring Study for the High Winds Wind Power*

Project, Solano County, California–Two Year Report. Prepared for High Winds, LLC and FPL Energy.

Kerlinger, P. R., R. Curry, and L. Culp. 2006b. *Avian Monitoring Study and Risk Assessment of the Shiloh II Wind Power Project, Solano County, California–Final Report*. Prepared for enXco, Inc., Tracy, CA.

Kerlinger, P., R. Curry, C. Wilkerson, L. Culp, A. Hasch, and A. Jain. 2009a. *Avian Monitoring Study and Risk Assessment of the Shiloh III Wind Power Project, Solano County, California*. Prepared for enXco, Inc. Tracy, CA.

Kerlinger, P., R. Curry, L. Culp, A. Hasch, and A. Jain. 2009b. *Post-Construction Avian Monitoring Study for the Shiloh I Wind Power Project Solano County, California–Final Report*. Prepared for Iberdrola Renewables.

Kerlinger, P., R. Curry, L. Culp, A. Hasch, and A. Jain. 2010. Post-Construction Avian Monitoring Study for the Shiloh II Wind Power Project Solano County, California, Year One Report. Prepared for enXco Development, Inc.

Kerlinger, P., R. Curry, and A. Hasch. 2011. *Avian Use Study and Risk Assessment of the Shiloh IV Wind Project, Solano County, California*. Prepared for: enXco, San Ramon, CA.

Kerlinger, P., R. Curry, A. Hasch, J. Guarnaccia, D. Riser-Espinoza. 2013a. *Post-Construction Bird and Bat Studies at the Shiloh II Wind Project, LLC, Solano County, California*. Prepared for EDF Renewable Energy.

Kerlinger, P., R. Curry, A. Hasch, J. Guarnaccia, D. Riser-Espinoza. 2013b. *Post-Construction Bird and Bat Studies at the Shiloh III Wind Project, LLC, Solano County, California*. Prepared for EDF Renewable Energy.

LSA Associates. 1989. *Draft Environmental Impact Report, Montezuma Hills Windfarm Project*. Prepared for Solano County Department of Environmental Management, Fairfield, CA.

Orloff, S., and A. Flannery. 1992. *Wind Turbine Effects on Avian Activity, Habitat Use, and Mortality in Altamont Pass and Solano County WRAs*. Prepared for the California Energy Commission, Sacramento, CA. Tiburon, CA: BioSystems Analysis, Inc.

Sacramento Municipal Utility District. 1993. *Draft Environmental Impact Report for the SMUD-Solano Wind Project*. Sacramento, CA.

Sacramento Municipal Utility District. 2003. *Draft Supplemental Environmental Impact Report No. 2 for the SMUD-Solano Wind Project*. Sacramento, CA.

Sacramento Municipal Utility District. 2009 (October). *SMUD Solano Wind Project Phase 3 Environmental Impact Report, Recirculated Draft*. Prepared by URS Corporation, Sacramento, CA.

San Francisco Bay Conservation and Development Commission (BCDC). 1976. *Suisun Marsh Protection Plan*.

U.S. Forest Service. 1998. *Ecological Subregions of California*. Available: http://www.r5.fs.fed.us/ecoregions/title_page.html.

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Appendices

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Acronyms and Abbreviations

amsl	above mean sea level
AWE	Area West Environmental, Inc.
Cal-IPC	California Invasive Plant Council
CDFW	California Department of Fish and Wildlife
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
EO	Element Occurrence
FAC	Facultative
FACU	Facultative Upland
FACW	Facultative Wetland
OBL	Obligate Wetland
Project	Solano 4 Wind Project
SMUD	Sacramento Municipal Utility District
Solano 4 East	Solano Wind Project Phase 1 Project
SRA	State Recreation Area
USFWS	U.S. Fish and Wildlife Service

1 Introduction and Background

Sacramento Municipal Utility District (SMUD) is proposing to permit and construct the Solano 4 Wind Project (Project) in the Montezuma Hills Wind Resource Area of southern Solano County. The Montezuma Hills Wind Resource Area lies north of the confluence of the Sacramento and San Joaquin rivers and southwest of the city of Rio Vista (Figure 1).

The Project site comprises two geographically distinct areas owned by SMUD, Solano 4 East and Solano 4 West, which total 2,237 acres (Figure 2). Facilities are proposed to be repowered in both areas. The Project would also involve constructing and operating wind turbine generators, an associated electricity collection system, and access roads, and completing minor upgrades to the existing Russell Substation.

SMUD is conducting biological resource assessments in the Project area that will be incorporated into the environmental impact report being prepared pursuant to the California Environmental Quality Act, and into other related environmental documentation. In 2017, Area West Environmental, Inc. (AWE) completed botanical surveys for the Solano 4 West property and associated homerun corridor (AWE 2017). In 2018, AECOM conducted a botanical survey for several areas: the Solano 4 East property; the electrical collection system and homerun corridor that connects Solano 4 East to the Russell Substation; and portions of the Solano 4 West property that had not been surveyed by AWE.

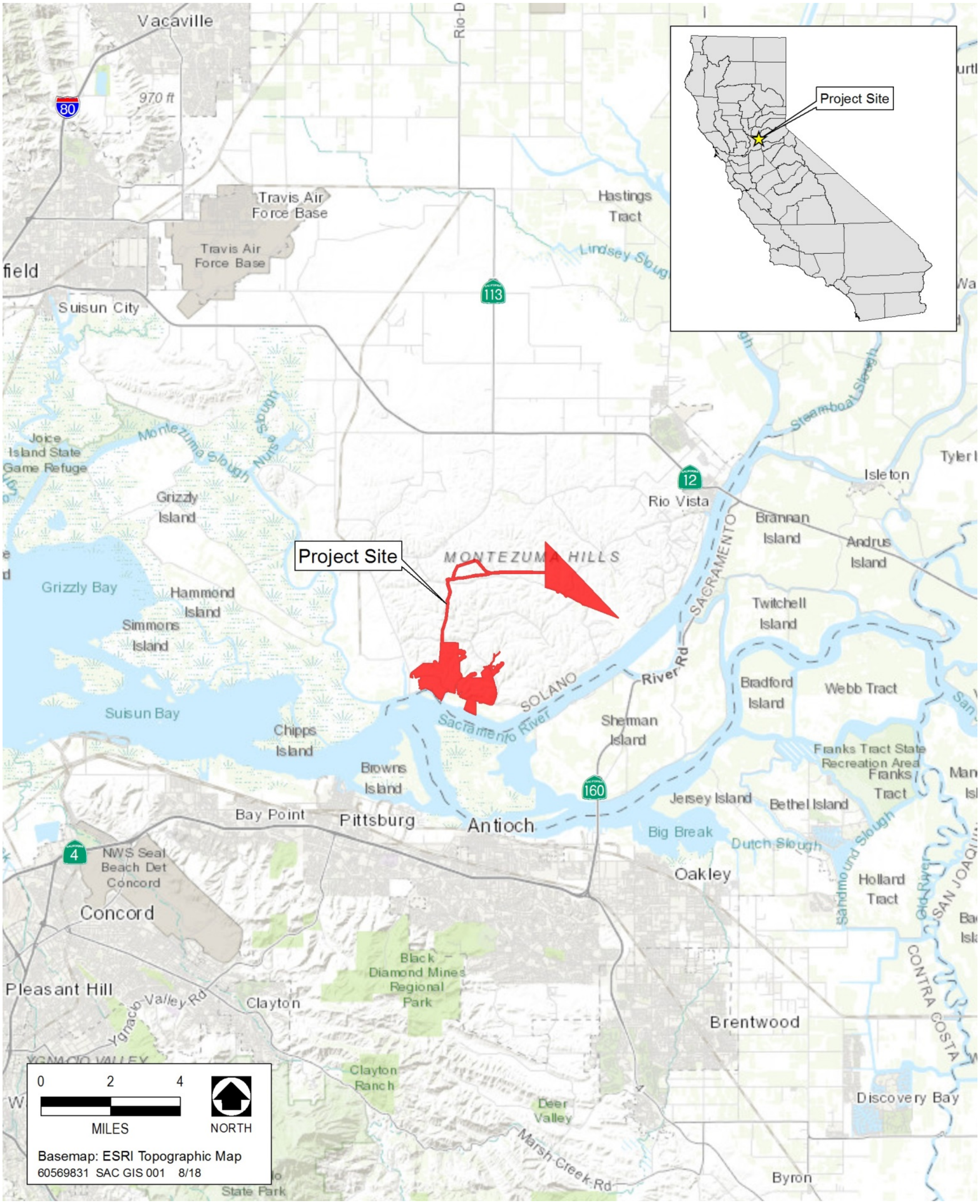

Figure 1. Regional Location Map

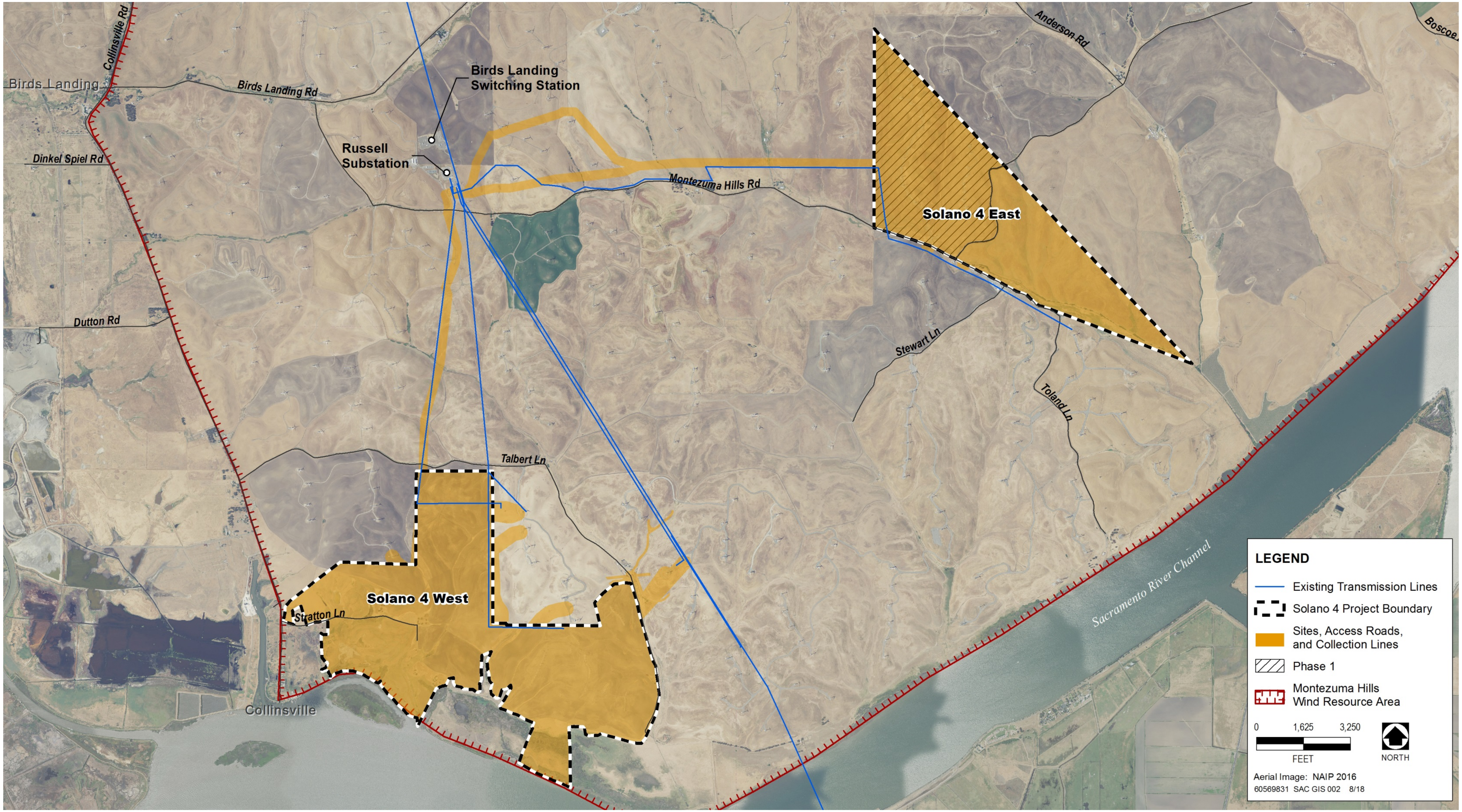

Figure 2. Project Site Map

2 Setting

2.1 Study Area

The study area consists of portions of the Solano 4 East and Solano 4 West properties; the homerun corridor that runs west from Solano 4 East and terminates at the existing Russell Substation; and buffers extending 500 feet beyond the locations of the proposed wind turbine generators and 250 feet beyond roadways (Figure 3). The study area also covers 307 acres in Solano 4 West that had not been included in AWE's 2017 botanical surveys (Figure 4).

Elevations in the study area range from approximately 0 feet above mean sea level (amsl) in the southeast corner to 250 feet amsl at the western terminus near the Russell Substation. The site's topography is characterized by gently rolling hills and shallow drainages. Hilltops generally crest between 150 and 250 feet amsl, with relatively flat ridgelines oriented predominantly north-south. Rows of wind turbines line the study area's hilltops and ridgelines, which are connected by gravel roads. Staging areas, transmission lines, and the existing Russell Substation also characterize the study area. Additional land uses include dryland wheat cultivation and livestock grazing. Farming is conducted on a 3-year rotational basis in a network of fenced pastures, with most of the study area disked on semiannually.

2.2 Vegetation Communities

Vegetation communities identified in the study area consist primarily of agricultural land (i.e., pasture and grain crops); grazed nonnative annual grasslands; and patches of ruderal vegetation along roadsides, wind turbines, and other facilities. Sporadic seasonal wetland and riparian vegetation is present along intermittent drainages and swales.

2.2.1 Agricultural

Agricultural land in the study area consists of dryland farming and livestock grazing along grassland slopes, and livestock grazing in interstitial valleys and drainages. Agricultural practices generally follow a 1- to 3-year crop rotation cycle (wheat [*Triticum asestivum*], barley [*Hordeum vulgare*], and oats [*Avena sativa*]), with predominantly sheep grazing and fallow years following planting. The fields that are dryland farmed are densely planted, and little to no other vegetation is present.

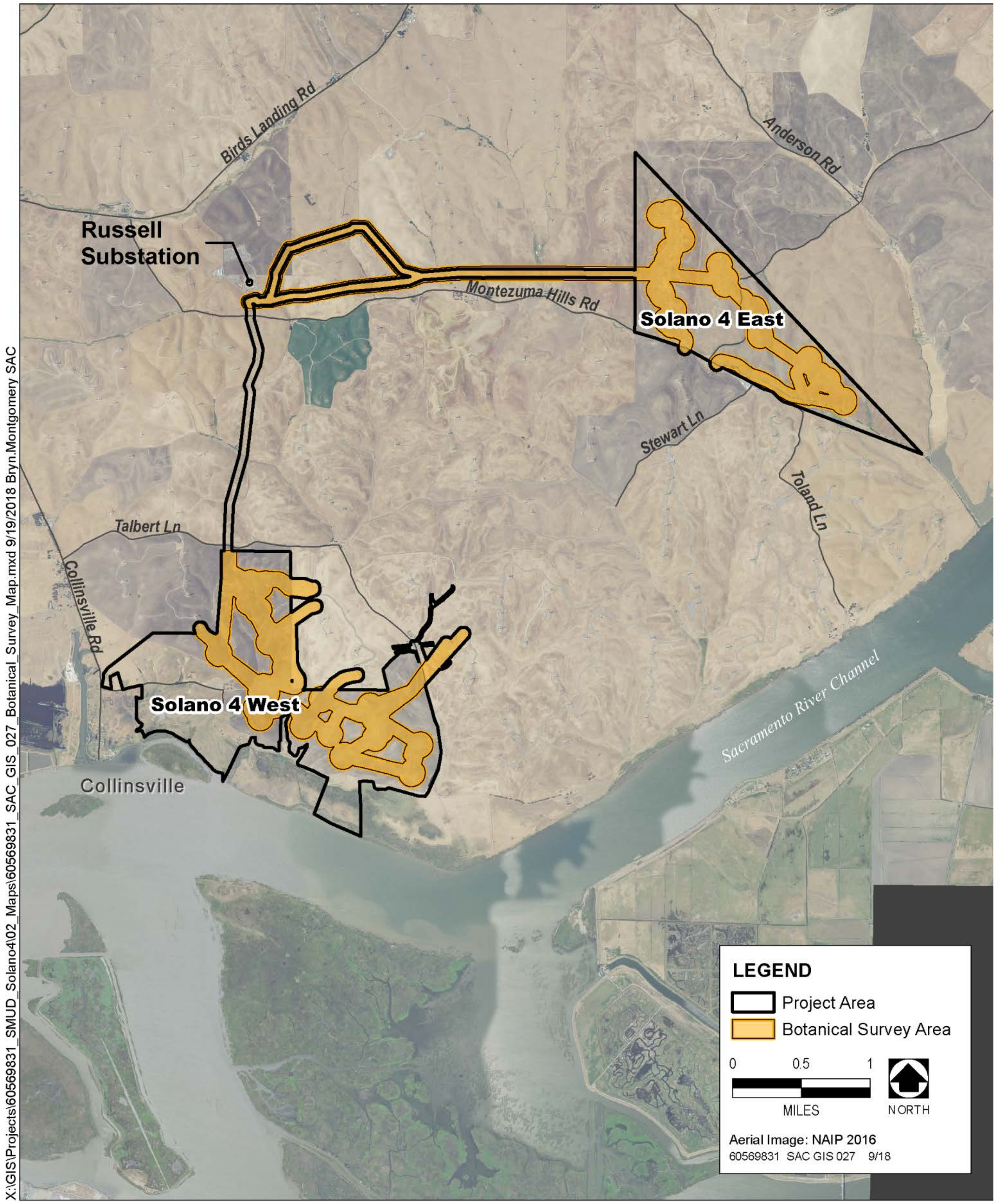

Figure 3. Botanical Survey Area

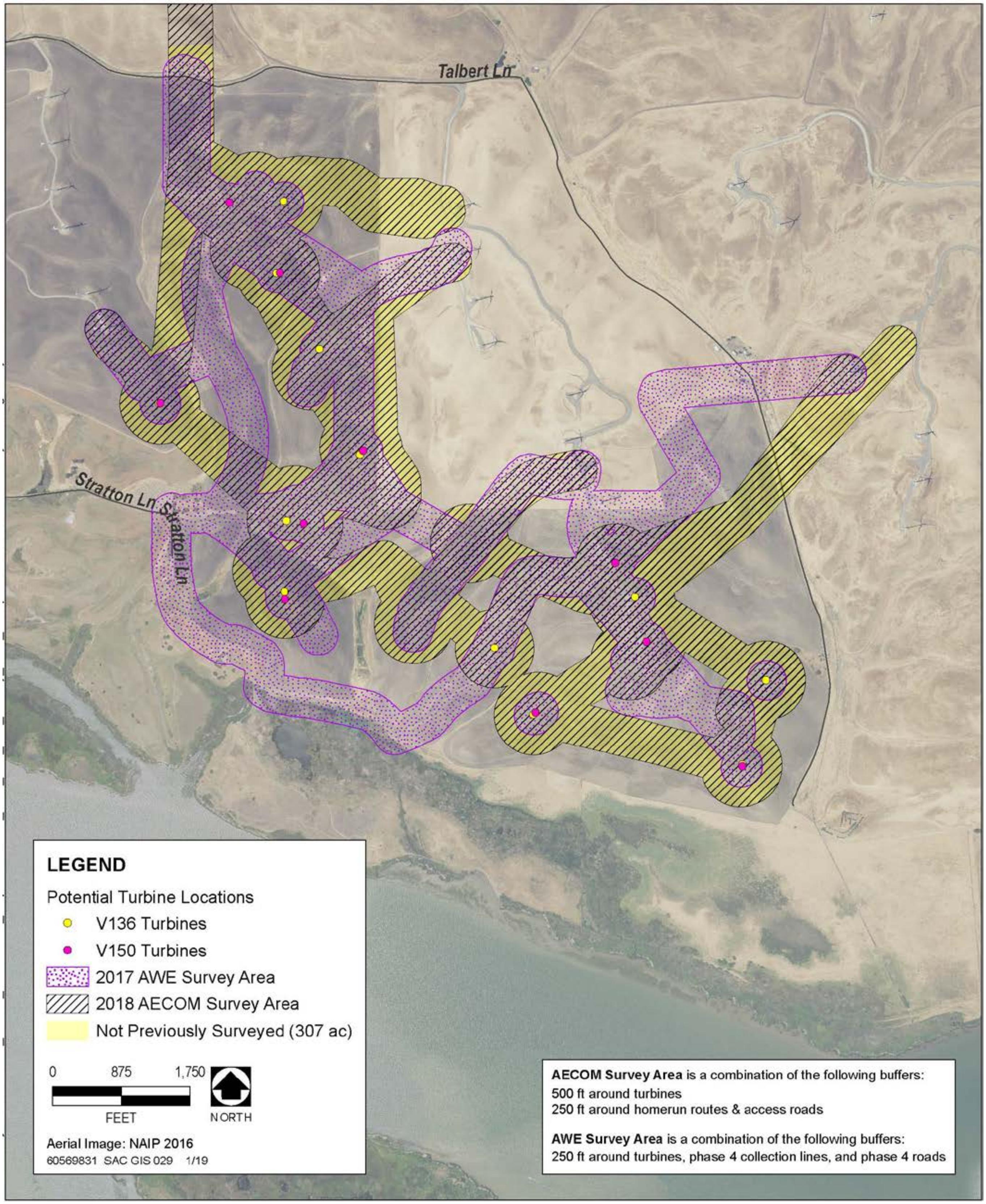

Figure 4. Comparison of Areas Surveyed by AECOM in 2018 and by Area West Environmental in 2017

2.2.2 Annual Grassland

Annual grasslands in the study area consist of fallow agricultural fields and grazed grasslands. Dominant species include nonnative grasses such as wild oats (*Avena barbata*), ripgut brome (*Bromus diandrus*), soft chess (*B. hordeaceus*), and Mediterranean barley (*Hordeum marinum* ssp. *gussoneanum*). These grasslands generally do not conform to any specific vegetation alliances as classified in A Manual of California Vegetation, Second Edition (Sawyer et al. 2009), although some patches, depending on the dominant species, may meet criteria for annual brome grasslands or wild oats grasslands. Scattered native and nonnative forbs grow among these grasses. Common forbs include blow wives (*Achyrachaena mollis*), Mediterranean linseed (*Bellardia trixago*), and scarlet pimpernel (*Lysimachia arvensis*).

2.2.3 Riparian

Drainages in the study area support scattered patches of riparian vegetation. The swale along the southeastern edge of Solano 4 East contains a small thicket of arroyo willow (*Salix lasiolepis*). A small thicket of tamarisk (*Tamarix* sp.) also occurs in a drainage just south of the homerun corridor.

2.2.4 Ruderal

Ruderal vegetation in the study area includes areas dominated by weedy species (with minimal grass cover) that colonize disturbed areas, such as roadsides and the graded areas that surround the existing wind turbines and the Russell Substation. Dominant ruderal species include black mustard (*Brassica nigra*), fennel (*Foeniculum vulgare*), and bristly ox-tongue (*Helminthotheca echioides*). Ruderal vegetation in the study area generally does not conform to any specific vegetation alliances, although some patches may meet the criteria for fennel patches or upland mustard alliances (Sawyer et al. 2009).

2.2.5 Seasonal Wetland

Several seasonal wetlands occur in the study area along the bottoms of seasonally flooded drainages. These wetlands are in a fenced drainage along the southeastern edge of Solano 4 East, and in two flat drainage bottoms adjacent to this swale. These drainage bottoms show no evidence of regular disking. Vegetation alliances in these seasonal wetlands are typical wetland alliances such as California bulrush (*Schoenoplectus californicus*) marsh, or alliances that are less readily identifiable as seasonal wetlands such as fields of perennial rye grass (*Festuca perrenis*). Associated species include Mediterranean barley, Mexican rush (*Juncus mexicanus*), and hyssop loosestrife (*Lythrum hyssopifolia*).

3 Survey Methodology

3.1 Background Research

AECOM reviewed existing databases and developed a list of special-status plants and sensitive natural communities that have the potential to occur in the vicinity of the study area. For this report, special-status plants are defined as species that are listed by the federal or state government (or both) as threatened or endangered, and California Native Plant Society (CNPS) rank 1 and 2 species (CDFW 2018a). The following data sources were used to generate a list of special-status plants with potential to occur in the study area:

- U.S. Fish and Wildlife Service (USFWS) Sacramento Field Office Web Site: An official list of plant species with the potential to occur in the study area that are federally listed as endangered or threatened, or are proposed or candidates for listing (USFWS 2018).
- California Natural Diversity Database (CNDDB): A list of plant species designated by the federal and state governments as special-status, listed as threatened or endangered, or proposed for listing; sensitive natural communities as designated by the California Department of Fish and Wildlife (CDFW); and CNPS-listed special-status plant species (CDFW 2018b). The list was generated using a 5-mile radius buffer around the study area.
- CNPS Online Inventory of Rare and Endangered Plants of California: A search of all rare and endangered plants within the Antioch North and Birds Landing U.S. Geological Survey 7.5-minute quadrangle maps and surrounding quadrangles (CNPS 2018).

Based on these database searches, 72 special-status species, consisting of both vascular and nonvascular plants, were assessed for their potential to occur in the study area. Of these, 19 were found to have the potential to occur based on suitable habitat and elevation. Appendix A provides the list of species with potential to occur in the study area. The CNDDB search indicated the presence of one sensitive natural community, coastal brackish marsh, within 5 miles of the study area boundaries.

3.2 Field Survey Methodology

AECOM botanists Joe Broberg and Kristin Asmus performed botanical surveys of the Solano 4 East parcel and homerun corridor connecting Solano 4 East to the Russell Substation on April 24 and April 25, 2018. Surveys were conducted using the methods described in CDFW's Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities (CDFW 2018c). Access was not granted to the homerun corridor; AECOM botanists instead surveyed from the SMUD right-of-way underneath the existing power lines that run from Solano 4 East to the Russell substation. The SMUD right-of-way either coincides with the homerun corridor or is close enough to allow views of the vegetation within the homerun corridor. On May 10, 2018, Joe Broberg and Kristin Asmus performed botanical surveys of previously unsurveyed portions of the Solano 4 West parcel.

The AECOM botanists followed CNPS and CDFW botanical survey protocols (CNPS 2001; CDFW 2018c), identifying all vascular plant species encountered and searching for sensitive natural communities. Plants not readily identifiable in the field were identified using Jepson eFlora (Baldwin et al. 2018). AECOM botanists determined that one survey replicate in spring was sufficient to determine whether any of the special-status plant species listed in Appendix A would occur in the study area. They made this determination based on the absence of suitable habitat for many of the target species and the high level of disturbance of the study area. The majority of the 19 species with potential to occur in the study area would have been blooming during the April and May surveys, and those that were not spring-blooming species, such as Carquinez goldenbush (*Isocoma arguta*), would have been identifiable based on their vegetative characteristics.

Much of the area surrounding the Project area is private land, and the majority of special-status plant reference populations could not be accessed. However, the botanists visited several nearby and accessible reference populations. Site visits to nearby reference populations of target plant species were visited, if available, to confirm the species were evident and identifiable in suitable habitats in the area. Table 1 summarizes the results of the reference population visits.

Table 1. Results of Visits to Reference Populations

Date	Species	Occurrence	Location	Results
4/25/2018	Mason's lilaeopsis (*Lilaeopsis masonii*)	CNDDB EO #37	Brannan Island SRA. Growing on banks of 7-mile slough, near confluence of 3-mile slough and 7-mile slough.	Identifiable; more than 1,000 plants, 50% blooming and 50% vegetative.
4/25/2018	Antioch Dunes evening primrose (*Oenothera deltoides* ssp. *howellii*)	CNDDB EO #5	Brannan Island SRA. Growing on sandy dunes near confluence of 7-mile slough and 3-mile slough.	Identifiable; 10 plants, 70% blooming, 30% vegetative.
4/25/2018	Suisun marsh aster (*Symphyotrichum lentum*)	CNDDB EO #32	Brannan Island SRA. Growing along bank of 7-mile slough at northern end of SRA, near a pier.	Identifiable; approximately 20 plants, 100% vegetative. Not blooming at this time, but identifiable vegetatively.
4/25/2018	Delta mudwort (*Limosella australis*)	CNDDB EO #57	Brannan Island SRA. Growing on banks of 7-mile slough, near confluence of 3-mile slough and 7-mile slough.	Not found; either no longer present or not blooming at this time.
5/2/2018	Keck's checkermallow (*Sidalcea keckii*)	Near CNDDB EO #9	Northwest of Birds Landing. Growing in a gently sloping field composed of annual grassland.	Identifiable; approximately 400 plants, 80% flowering, 10% fruiting, 10% vegetative.

Notes: CNDDB = California Natural Diversity Database; EO = Element Occurrence; SRA = State Recreation Area
Source: Data compiled by AECOM in 2018

4 Survey Results

Sixty-four taxa were identified in the study area during the botanical surveys for the study area conducted in April and May 2018. Appendix B lists all species observed and identified in the study area. No special-status plants or sensitive natural communities were observed in the study area.

5 Discussion and Conclusions

Of the 67 plants identified in the study area, 46 (68.7%) were nonnative and 21 (31.3%) were native. This is a much higher ratio of nonnative to native plants than in the rest of California, which has about 25% nonnative and 75% native plants (Baldwin et al. 2012), indicating that the study area offers poor quality native plant habitat. The frequent tilling, agricultural planting, and grazing of the study area's grasslands make them unsuitable habitat for rare plants. The remaining roadsides and drainage bottoms, which are not tilled regularly, are also heavily disturbed and dominated by nonnative species. Appendix C presents representative photographs of the study area.

Based on the poor quality of the habitat and the high levels of disturbance in the study area, and on the negative findings of both this 2018 survey and the 2017 floristic surveys (AWE 2017), no special-status plant species are expected to occur in the study area.

6 References

Area West Environmental, Inc. (AWE). 2017 (July). Solano Phase 4 Wind Project Preliminary Jurisdictional Determination, Solano County, California. Prepared for Sacramento Municipal Utility District.

Baldwin, B., D. H. Goldman, D. J. Keil, R. Patterson, and T. J. Rosatti. 2012. The Jepson Manual, 2nd Edition. Berkeley: University of California Press.

Baldwin, B. G., D. H. Goldman, D. J. Keil, R. Patterson, T. J. Rosatti, and D. H. Wilken (eds.). 2018. Jepson eFlora. The Jepson Herbarium, University of California, Berkeley. Available: http://ucjeps.berkeley.edu/eflora/. Accessed July 25, 2018.

Calflora. 2018. Calflora: Information on California Plants for Education, Research and Conservation, with Data Contributed by Public and Private Institutions and Individuals, including the Consortium of California Herbaria. Web application. Berkeley, CA: The Calflora Database. Available: http://www.calflora.org/. Accessed July 25, 2018.

California Native Plant Society (CNPS). 2001. CNPS Botanical Survey Guidelines. Initially published December 9, 1983; revised June 2, 2001.

———. 2018. Inventory of Rare and Endangered Plants of California (online edition, v8-03 0.39). CNPS Rare Plant Program. Available: http://www.rareplants.cnps.org. Accessed April 6, 2018.

California Department of Fish and Wildlife (CDFW). 2018a (March 20). Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Sensitive Natural Communities. State of California Natural Resources Agency.

———. 2018b. California Natural Diversity Database. Commercial Version, dated April 6, 2018. CDFW Biogeographic Data Branch.

———. 2018c. Natural Communities List Arranged Alphabetically by Life Form. Available: https://wildlife.ca.gov/Data/VegCAMP/Natural-communities/List. Accessed August 6, 2018.

Sawyer, J. O., T. Keeler-Wolf, and J. Evans. 2009. A Manual of California Vegetation. Second Edition. Sacramento: California Native Plant Society.

U.S. Fish and Wildlife Service (USFWS). 2018 (July 25). SMUD Solano 4 Project: List of Threatened and Endangered Species that May Occur in Your Proposed Project Location, and/or May Be Affected by Your Proposed Project. Sacramento Field Office, Sacramento, CA.

APPENDIX A

Special-Status Plant Species with Potential to Occur in the Study Area

Table A-1. Special-Status Plant Species with Potential to Occur in the Study Area

Scientific Name	Common Name	Status (Federal/ State/CNPS)	Habitat	Blooming Period	Potential to Occur	Survey Results
Amsinckia grandiflora	Large-flowered fiddleneck	FE/SE/1B.1	Cismontane woodland, valley and foothill grassland. 270–550 meters.	April–May	**Low;** marginally suitable grassland habitat present in the Project area. However, the majority of the Project area is regularly disked for agricultural planting. No CNDDB occurrences within 5 miles. The nearest CNDDB occurrence is approximately 8 miles south of the Project area.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Arctostaphylos auriculata	Mt. Diablo manzanita	–/–/1B.3	Chaparral (sandstone) and cismontane woodland. 135–650 meters.	January–March	**None;** no suitable habitat, and elevations in the Project area are too low for this species. No nearby occurrences.	This species is a shrub that would be detectable year round. No Arctostaphylos were observed by AECOM in 2018 or by AWE in 2017.
Arctostaphylos manzanita ssp. *Laevigata*	Contra Costa manzanita	–/–/1B.2	Chaparral (rocky). 430–1,100 meters.	January–April	**None;** no suitable habitat, and elevations in the Project area are too low for this species. No nearby occurrences.	This species is a shrub that would be detectable year round. No Arctostaphylos were observed by AECOM in 2018 or by AWE in 2017.
Astragalus tener var. *tener*	Alkali milk-vetch	–/–/1B.2	Alkaline and adobe clay soils in playas, valley and foothill grassland, and vernal pools. 1–60 meters.	March–June	**Low;** marginally suitable grassland habitat present in the Project area, but no playas or vernal pools are present. One CNDDB occurrence approximately 2.5 miles west of the Project area.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Atriplex cordulata var. *cordulata*	Heartscale	–/–/1B.2	Saline or alkaline soils in chenopod scrub, meadows and seeps, valley and foothill grassland. Prefers sandy areas. 0–560 meters.	April–October	**Low;** marginally suitable grassland habitat present in the Project area. However, the majority of the Project area is regularly disked for agricultural planting. One CNDDB occurrence approximately 3.2 miles northwest of the Project area.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.

Table A-1. Special-Status Plant Species with Potential to Occur in the Study Area

Scientific Name	Common Name	Status (Federal/ State/CNPS)	Habitat	Blooming Period	Potential to Occur	Survey Results
Atriplex depressa	Brittlescale	–/–/1B.2	Alkaline clay soils in chenopod scrub, meadows and seeps, playas, valley and foothill grassland, and vernal pools. 1–320 meters.	April–October	**Low;** marginally suitable grassland habitat present in the Project area. However, the majority of the Project area is regularly disked for agricultural planting. One CNDDB occurrence approximately 3.5 miles west of the Project area.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Blepharizonia plumosa	Big tarplant	–/–/1B.1	Valley and foothill grassland, generally in clay soils. 30–505 meters.	July–October	**Low;** Marginally suitable grassland habitat present in the Project area. However, the majority of the Project area is regularly disked for agricultural planting. Three CNDDB occurrences approximately 5 miles to the south, across the San Francisco Bay/Sacramento–San Joaquin Delta, but these occurrences are from the 1920s and 1930s. The nearest more recent occurrence, from 1991, is approximately 8 miles away.	Surveys by AECOM in 2018 did not coincide with the bloom time of this species. However, this species is not expected to occur in the Project area due to lack of habitat and regular disturbance. Surveys by AWE in 2017 were conducted during the bloom time and did not detect this species.
Calochortus pulchellus	Mt. Diablo fairy-lantern	–/–/1B.2	Generally wooded slopes, rarely in chaparral, and valley and foothill grassland. Generally on slopes with a north-facing aspect. 30–840 meters.	April–June	**None;** no wooded slopes in the Project area, and the grassland habitat is too disturbed to support this species. No CNDDB occurrences in Solano County; the nearest CNDDB occurrence is approximately 9 miles southeast of the Project area.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Campanula exigua	Chaparral harebell	–/–/1B.2	Chaparral (rocky, usually serpentinite). 275–1,250 meters.	May–June	**None;** no chaparral or serpentinite soils in the Project area, and no CNDDB occurrences of this species within 5 miles.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.

Table A-1. Special-Status Plant Species with Potential to Occur in the Study Area

Scientific Name	Common Name	Status (Federal/ State/CNPS)	Habitat	Blooming Period	Potential to Occur	Survey Results
Centromadia parryi ssp. *congdonii*	Congdon's tarplant	–/–/1B.1	Alkaline soils in valley and foothill grassland. Terraces, swales, and floodplains, disturbed sites. 0–300 meters.	May–November	**Low;** marginally suitable grassland habitat present in the Project area. However, the majority of the Project area is regularly disked for agricultural planting. No CNDDB occurrences within 5 miles.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Centromadia parryi ssp. *parryi*	Pappose tarplant	–/–/1B.2	Often in alkaline soils in grassland, chaparral, coastal prairie, coastal salt marshes, and alkaline springs and seeps. 0–420 meters.	May–November	**Low;** marginally suitable grassland habitat present in the Project area. However, the majority of the Project area is disked regularly for agricultural planting. No CNDDB occurrences within 5 miles.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Chloropyron molle ssp. *hispidum*	Hispid bird's-beak	–/–/1B.1	Alkaline and saline areas in playas, meadows, marshes, and seeps. 1–155 meters.	June–September	**None;** no playas, meadows, seeps, or marshes in the Project area, and no CNDDB occurrences within 5 miles.	Not observed during surveys by AECOM in 2018 or by AWE in 2017. No suitable habitat.
Chloropyron molle ssp. *molle*	Soft bird's-beak	FE/SR/1B.2	Coastal salt marshes and swamps. 0–10 meters.	July–November	**None;** no coastal salt marshes or swamps in the Project area. One CNDDB occurrence approximately 4 miles to the northwest.	Not observed during surveys by AECOM in 2018 or by AWE in 2017. No suitable habitat.
Cicuta maculata var. *bolanderi*	Bolander's water-hemlock	–/–/2B.1	Coastal marshes and swamps. 0–200 meters.	July–September	**None;** no marshes or swamps in the Project area. Two CNDDB occurrences within 5 miles, one of which is less than a mile to the southwest. However, these occur in marsh habitat along the Sacramento River.	Not observed during surveys by AECOM in 2018 or by AWE in 2017. No suitable habitat.
Cirsium hydrophilum var. *hydrophilum*	Suisun thistle	FE/–/1B.1	Salt marshes and swamps. 0–1 meter.	June–September	**None;** no salt marshes or swamps in the Project area, and no CNDDB occurrences within 5 miles.	Not observed during surveys by AECOM in 2018 or by AWE in 2017. No suitable habitat.

Table A-1. Special-Status Plant Species with Potential to Occur in the Study Area

Scientific Name	Common Name	Status (Federal/ State/CNPS)	Habitat	Blooming Period	Potential to Occur	Survey Results
Cordylanthus nidularius	Mt. Diablo bird's-beak	–/SR/1B.1	Serpentinite chaparral. 600–800 meters.	June–August	**None;** no chaparral or serpentinite soils in the Project area, and no CNDDB occurrences within 5 miles.	Not observed during surveys by AECOM in 2018 or by AWE in 2017. No suitable habitat.
Cryptantha hooveri	Hoover's cryptantha	–/–/1A	Inland dunes and sandy areas in valley and foothill grassland. 9–150 meters.	April–May	**None;** no dunes or sandy soils in the Project area. One CNDDB occurrence approximately 3.7 miles to the south.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Delphinium californicum ssp. *interius*	Hospital Canyon larkspur	–/–/1B.2	Openings in chaparral, coastal scrub, and cismontane woodland. Mesic. 195–1,095 meters.	April–June	**None;** no chaparral, scrub, or woodland in the Project area, and no CNDDB occurrences within 5 miles.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Delphinium recurvatum	Recurved larkspur	–/–/1B.2	Alkaline soils in chenopod scrub, cismontane woodland, and valley and foothill grassland. 3–790 meters.	March–June	**None;** no chenopod scrub or woodland in the Project area. Grasslands are regularly disked for agricultural planting and would not support this species. No CNDDB occurrences within 5 miles of the Project area.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Downingia pusilla	Dwarf downingia	–/–/2B.2	Vernal pools in valley and foothill grasslands. 1–445 meters.	March–May	**None;** no vernal pools in the Project area. Two CNDDB occurrences within 5 miles, the closest approximately 1.7 miles to the northwest.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Eriastrum ertterae	Lime Ridge eriastrum	–/–/1B.1	Sandy, alkaline soils. Opening or edges in chaparral. 200–290 meters.	June–July	**None;** no sandy soils or chaparral habitats in the Project area, and no CNDDB occurrences within 5 miles.	Not observed during surveys by AECOM in 2018 or by AWE in 2017. No suitable habitat.

Table A-1. Special-Status Plant Species with Potential to Occur in the Study Area

Scientific Name	Common Name	Status (Federal/ State/CNPS)	Habitat	Blooming Period	Potential to Occur	Survey Results
Eriogonum nudum var. *psychicola*	Antioch Dunes buckwheat	–/–/1B.1	Inland dunes. 0–20 meters.	July–October	**None;** no inland dunes in the Project area. One CNDDB occurrence approximately 3.7 miles to the south.	Not observed during surveys by AECOM in 2018 or by AWE in 2017. No suitable habitat.
Eriogonum truncatum	Mt. Diablo buckwheat	–/–/1B.1	Sandy soils in chaparral, coastal scrub, and valley and foothill grassland. 200–400 meters.	April–December	**None;** no sandy soils, chaparral, or coastal scrub in the Project area. Grasslands are regularly disked for agricultural planting and would not support this species. One CNDDB occurrence approximately 3.7 miles south of the Project area.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Erysimum capitatum var. *angustatum*	Contra Costa wallflower	FE/SE/1B.1	Inland dunes. 3–20 meters.	March–July	**None;** no inland dunes in the Project area. Four CNDDB occurrences within 5 miles, the closest 2.5 miles to the southwest.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Eschscholzia rhombipetala	Diamond petaled California poppy	–/–/1B.1	Alkaline, clay soils in valley and foothill grassland. 0–975 meters.	March–April	**Low;** marginally suitable grassland habitat present in the Project area. However, the majority of the Project area is regularly disked for agricultural planting. One CNDDB occurrence approximately 3.7 miles to the south.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Etriplex joaquinana	San Joaquin spearscale	–/–/1B.2	Alkaline soils in chenopod scrub, meadows and seeps, playas, and valley and foothill grassland. 0–840 meters.	April–October	**Low;** Marginally suitable habitat present in the Project area. However, the majority of the Project area is regularly disked for agricultural planting. One CNDDB occurrence approximately 2.5 miles to the west.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.

Table A-1. Special-Status Plant Species with Potential to Occur in the Study Area

Scientific Name	Common Name	Status (Federal/ State/CNPS)	Habitat	Blooming Period	Potential to Occur	Survey Results
Fritillaria liliacea	Fragrant fritillary	–/–/1B.2	Often serpentinite soils in cismontane woodland, coastal prairie, coastal scrub, and valley and foothill grassland. 0–200 meters.	February–April	**None;** no serpentinite soils in the Project area. Additionally, grasslands are regularly disked for agricultural planting and would not support this species. One CNDDB occurrence approximately 2.3 miles west of the Project area.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Fritillaria pluriflora	Adobe-lily	–/–/1B.2	Adobe clay soils in chaparral, cismontane woodland, and valley and foothill grassland. 60–705 meters.	February–April	**Low;** marginally suitable grassland habitat present in the Project area. However, the majority of the Project area is regularly disked for agricultural planting. No CNDDB occurrences within 5 miles.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Gratiola heterosepala	Boggs Lake hedge-hyssop	–/SE/1B.2	Clay soil in marshes, swamps, vernal pools, and lake margins. 10–2,375 meters.	April–August	**None;** no marshes, swamps, vernal pools, or lake margins in the Project area. The nearest CNDDB occurrence is 9 miles from the Project area.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Grimmia torenii	Toren's grimmia	–/–/1B.3	Chaparral, cismontane woodland, and lower montane coniferous forest. 325–1,160 meters.	Year-round	**None;** no chaparral, woodland, or coniferous forest in the Project area, which is also outside the known elevation range for this species. No CNDDB occurrences within 5 miles.	Not observed during surveys by AECOM in 2018 and by AWE in 2017. No suitable habitat.
Helianthella castanea	Diablo helianthella	–/–/1B.2	Open , grassy sites in broadleaf upland forest, chaparral, cismontane woodland, coastal scrub, riparian woodland, and valley and foothill grassland. 60–1,300 meters.	March–June	**Low;** marginally suitable grassland habitat present in the Project area. However, the majority of the Project area is regularly disked for agricultural planting. No CNDDB occurrences within 5 miles.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.

Table A-1. Special-Status Plant Species with Potential to Occur in the Study Area

Scientific Name	Common Name	Status (Federal/ State/CNPS)	Habitat	Blooming Period	Potential to Occur	Survey Results
Hesperolinon breweri	Brewer's western flax	–/–/1B.2	Chaparral, cismontane woodland, and valley and foothill grassland. Occasionally on serpentine 30–945 meters.	May–July	**Low;** marginally suitable grassland habitat present in the Project area. However, the majority of the Project area is regularly disked for agricultural planting. No CNDDB occurrences within 5 miles.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Hibiscus lasiocarpos var. *occidentalis*	Woolly rosemallow	–/–/1B.2	Freshwater wetlands, wet banks, marshes. Often in riprap on sides of levees. 0–120 meters.	June–September	**None;** no freshwater wetlands or marshes present in the Project area, and no CNDDB occurrences within 5 miles.	Not observed during surveys by AECOM in 2018 and by AWE in 2017. No suitable habitat.
Isocoma arguta	Carquinez goldenbush	–/–/1B.1	Alkaline soils and flats, valley and foothill grassland. 0–20 meters.	August–December	**Low;** marginally suitable grassland habitat present in the Project area. However, the majority of the Project area is regularly disked for agricultural planting. Two CNDDB occurrences within 5 miles, the closest 4 miles to the north.	This species is a shrub that would be detectable year round. No Isocoma were observed by AECOM in 2018 or by AWE in 2017.
Juglans hindsii	Northern California black walnut	–/–/1B.1	Riparian forest and riparian woodland. 0–440 meters.	April–May	**None**; no riparian forest or woodland in the Project area. One CNDDB occurrence 4.75 miles to the northeast.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Lasthenia conjugens	Contra Costa goldfields	FE/–/1B.1	Mesic soils in cismontane woodland, alkaline playas, valley and foothill grassland, and vernal pools. 0–100 meters.	March–June	**Low;** marginally suitable mesic grassland habitat present in some parts of the Project area. However, the majority of grasslands in the Project area are regularly disked for agricultural planting and grazed. One CNDDB occurrence 5 miles to the south.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.

Table A-1. Special-Status Plant Species with Potential to Occur in the Study Area

Scientific Name	Common Name	Status (Federal/ State/CNPS)	Habitat	Blooming Period	Potential to Occur	Survey Results
Lathyrus jepsonii var. *jepsonii*	Delta tule pea	–/–/1B.2	Marshes and swamps, both freshwater and brackish. 0–30 meters.	May–September	**None;** no marshes or swamps in the Project area. A total of 24 CNDDB occurrences within 5 miles, the closest 0.2 mile to the southwest.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Legenere limosa	Legenere	–/–/1B.1	Wet areas, vernal pools, ponds. 1–880 meters.	April–June	**None;** no vernal pools or ponds in the Project area, and no CNDDB occurrences within 5 miles.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Lepidium latipes var. *heckardii*	Heckard's pepper-grass	–/–/1B.2	Alkaline flats in valley and foothill grassland. 2–200 meters.	March–May	**Low;** marginally suitable grassland habitat present in the Project area. However, the majority of the Project area is regularly disked for agricultural planting. No CNDDB occurrences within 5 miles.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Lilaeopsis masonii	Mason's lilaeopsis	–/SR/1B.1	Freshwater or brackish marshes and swamps, riparian scrub. 0–36 meters.	April–November	**None;** no marshes or swamps in the Project area. A total of 34 CNDDB occurrences within 5 miles, the closest 0.2 mile to the southwest.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Limosella australis	Delta mudwort	–/–/2B.1	Muddy or sandy intertidal flats, mud banks in marshes and swamps (freshwater or brackish), and riparian scrub. 0–10 meters.	April–August	**None;** no intertidal flats, marshes, or swamps in the Project area. A total of 11 CNDDB occurrences within 5 miles, the closest 0.2 mile to the southwest.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.

Table A-1. Special-Status Plant Species with Potential to Occur in the Study Area

Scientific Name	Common Name	Status (Federal/ State/CNPS)	Habitat	Blooming Period	Potential to Occur	Survey Results
Madia radiata	Showy golden madia	–/–/1B.1	Grassy or open slopes, vertic clay, rarely serpentine. Cismontane woodland and valley and foothill grassland. 25–1,215 meters.	March–May	**Low;** marginally suitable grassland habitat present in the Project area. However, the majority of the Project area is regularly disked for agricultural planting. No CNDDB occurrences within 5 miles.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Malacothamnus hallii	Hall's bush-mallow	–/–/1B.2	Open chaparral, coastal scrub. 10–760 meters.	May–October	**None;** no chaparral or coastal scrub in the Project area, and no CNDDB occurrences within 5 miles.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Microseris paludosa	Marsh microseris	–/–/1B.2	Moist grassland and open woodland in closed-cone coniferous forest, cismontane woodland, coastal scrub, and valley and foothill grassland. 5–300 meters.	April–July	**Low;** marginally suitable grassland habitat present in the Project area. However, the majority of the Project area is regularly disked for agricultural planting. No CNDDB occurrences within 5 miles.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Monolopia gracilens	Woodland woolythreads	–/–/1B.2	Serpentine grassland, open chaparral, oak woodland, and openings in North Coast coniferous forest. 100–1,200 meters.	February–July	**None;** no serpentine soils, chaparral, oak woodland, or North Coast coniferous forest in the Project area. No CNDDB occurrences within 5 miles.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Navarretia gowenii	Lime Ridge navarretia	–/–/1B.1	Clay, serpentine soils. Chaparral. 180–305 meters.	May–June	**None;** no chaparral or serpentine soil in the Project area, and no CNDDB occurrences within 5 miles.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.

Table A-1. Special-Status Plant Species with Potential to Occur in the Study Area

Scientific Name	Common Name	Status (Federal/ State/CNPS)	Habitat	Blooming Period	Potential to Occur	Survey Results
Navarretia leucocephala ssp. *bakeri*	Baker's navarretia	–/–/1B.1	Cismontane woodland, meadows and seeps, vernal pools, valley and foothill grasslands, and lower montane coniferous forest. 5–1,740 meters.	April–July	**None;** no meadows, seeps, vernal pools, or forest habitats in the Project area, and no CNDDB occurrences within 5 miles.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Navarretia nigelliformis ssp. *radians*	Shining navarretia	–/–/1B.2	Vernal pools, clay depressions in cismontane woodland, valley and foothill grassland. 76–1,000 meters.	April–July	**None;** no vernal pools or clay depressions in the Project area, and no CNDDB occurrences within 5 miles.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Neostapfia colusana	Colusa grass	FT/SE/1B.1	Large vernal pools in adobe clay. 5–200 meters.	May–August	**None;** no vernal pools in the Project area, and no CNDDB occurrences within 5 miles.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Oenothera deltoides ssp. *howellii*	Antioch Dunes evening-primrose	FE/SE/1B.1	Inland dunes. 0–30 meters.	March–September	**None;** no inland dunes in the Project area. Four CNDDB occurrences within 5 miles, the closest 4 miles to the southwest.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Orcuttia inaequalis	San Joaquin Valley Orcutt grass	FT/SE/1B.1	Vernal pools. 10–755 meters.	April–September	**None;** no vernal pools in the Project area, and no CNDDB occurrences within 5 miles.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.

Table A-1. Special-Status Plant Species with Potential to Occur in the Study Area

Scientific Name	Common Name	Status (Federal/ State/CNPS)	Habitat	Blooming Period	Potential to Occur	Survey Results
Phacelia phacelioides	Mt. Diablo phacelia	–/–/1B.2	Rocky soils in chaparral and cismontane woodland. 500–1,370 meters.	April–May	**None;** no chaparral or woodland in the Project area, and no CNDDB occurrences within 5 miles.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Plagiobothrys hystriculus	Bearded popcorn-flower	–/–/1B.1	Margins of vernal pools, mesic grasslands, often in vernal swales. 0–274 meters.	April–May	**Low;** some mesic grasslands and swales are present in the Project area. However, the majority of grasslands in the Project area are regularly disked for agricultural planting and grazed. Four CNDDB occurrences within 5 miles; the population polygon for the closest CNDDB occurrence overlaps the northern boundary of the Project area. This overlapping occurrence is a large polygon that encompasses the entire Birds Landing quadrangle.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Potamogeton zosteriformis	Eel-grass pondweed	–/–/2B.2	Freshwater marshes and swamps. 0–1,860 meters.	June–July	**None;** no marshes or swamps in the Project area, and no CNDDB occurrences within 5 miles.	Not observed during surveys by AECOM in 2018 and by AWE in 2017. No suitable habitat.
Puccinellia simplex	California alkali grass	–/–/1B.2	Alkaline soil in vernally mesic areas such as sinks, flats, and lake margins. Chenopod scrub, valley and foothill grassland, and vernal pools. 2–930 meters.	March–May	**None;** no alkaline seeps, lake margins, chenopod scrub, or vernal pools in the Project area, and no CNDDB occurrences within 5 miles.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.

Table A-1. Special-Status Plant Species with Potential to Occur in the Study Area

Scientific Name	Common Name	Status (Federal/ State/CNPS)	Habitat	Blooming Period	Potential to Occur	Survey Results
Sagittaria sanfordii	Sanford's arrowhead	–/–/1B.2	Shallow freshwater marshes and swamps. 0–650 meters.	May–November	**None;** no marshes or swamps in the Project area, and no CNDDB occurrences within 5 miles.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Sanicula saxatilis	Rock sanicle	–/SR/1B.2	Rocky soils in broadleafed upland forest, chaparral, and valley and foothill grassland. 620–1,175 meters.	April–May	**None;** no rocky soils or forest, and the listed elevation for this species is higher than the Project area. No CNDDB occurrences within 5 miles.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Senecio aphanactis	Chaparral ragwort	–/–/2B.2	Chaparral, cismontane woodland, and coastal scrub. Sometimes on alkaline soil. 15–800 meters.	January–April	**None;** no chaparral, woodland, or scrub in the Project area, and no CNDDB occurrences within 5 miles.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Sidalcea keckii	Keck's checkerbloom	FE/–/1B.1	Grassy slopes in clay soil, sometimes serpentinite.	April–June	**Low;** marginally suitable grassland habitat present in the Project area, but no serpentine. The majority of grasslands in the Project area are regularly disked for agricultural planting and grazed. One CNDDB occurrence 0.8 mile west of the Project area.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Streptanthus albidus ssp. *peramoenus*	Most beautiful jewel-flower	–/–/1B.2	Serpentine soils in chaparral, cismontane woodland, and valley and foothill grassland. 5–1,000 meters.	March–October	**None;** no serpentine soils in the Project area, and no CNDDB occurrences within 5 miles.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.

Table A-1. Special-Status Plant Species with Potential to Occur in the Study Area

Scientific Name	Common Name	Status (Federal/ State/CNPS)	Habitat	Blooming Period	Potential to Occur	Survey Results
Streptanthus hispidus	Mt. Diablo jewel-flower	–/–/1B.3	Rocky soils in chaparral and valley and foothill grassland. 365–1,200 meters.	March–June	**None;** no rocky soils in the Project area, and no CNDDB occurrences within 5 miles.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Stuckenia filiformis ssp. *alpina*	Slender-leaved pondweed	–/–/2B.2	Shallow freshwater marshes and swamps. 300–2,150 meters.	May–July	**None;** no marshes or swamps in the Project area, and no CNDDB occurrences within 5 miles.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Symphyotrichum lentum	Suisun Marsh aster	–/–/1B.2	Brackish and freshwater marshes and swamps. 0–300 meters.	May–November	**None;** no marshes or swamps in the Project area, and no CNDDB occurrences within 5 miles.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Trifolium amoenum	Two-fork clover	FE/–/1B.1	Coastal bluff scrub and valley and foothill grassland. Sometimes serpentinite soils. 5–415 meters.	April–June	**None;** no serpentine soils, and the majority of grasslands in the Project area are regularly disked for agricultural planting and grazed. No CNDDB occurrences within 5 miles.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Trifolium hydrophilum	Saline clover	–/–/1B.2	Marshes and swamps. Valley and foothill grassland (mesic, alkaline) and vernal pools. 0–300 meters.	April–June	**None;** no marshes and swamps, vernal pools, or mesic alkaline areas in the Project area, and no CNDDB occurrences within 5 miles.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Triquetrella californica	Coastal triquetrella	–/–/1B.2	Coastal bluff scrub, coastal scrub. 10–100 meters.	Year-round	**None;** no coastal scrub habitat in the Project area, and no CNDDB occurrences within 5 miles.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.

Table A-1. Special-Status Plant Species with Potential to Occur in the Study Area

Scientific Name	Common Name	Status (Federal/ State/CNPS)	Habitat	Blooming Period	Potential to Occur	Survey Results
Tropidocarpum capparideum	Caper-fruited tropidocarpum	–/–/1B.1	Alkaline hills in valley and foothill grassland. 1–455 meters.	March–April	**Low;** marginally suitable grassland habitat present in the Project area. However, the majority of the Project area is regularly disked for agricultural planting. No CNDDB occurrences within 5 miles.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Tuctoria mucronata	Crampton's tuctoria	FE/CE/1B.1	Vernal pools and mesic areas in valley and foothill grassland with Pescadero clay soil. 5–10 meters.	April–August	**None;** no vernal pools in the Project area. No CNDDB occurrences within 5 miles.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.
Viburnum ellipticum	Oval-leaved viburnum	–/–/2B.3	Chaparral, cismontane woodland, and lower montane coniferous forest. 215–1,400 meters.	May–June	**None;** no chaparral, woodland, or coniferous forest in the Project area.	Not observed during surveys conducted during the appropriate bloom time by AECOM in 2018 and by AWE in 2017.

Notes:

CNDDB = California Natural Diversity Database; CNPS = California Native Plant Society; Project = Solano 4 Wind Project

Ranking Status explanations:

– = no listing.

Federal

FE = listed as endangered under the federal Endangered Species Act

FT = listed as threatened under the federal Endangered Species Act

State

SE = listed as endangered under the California Endangered Species Act

SR = listed as rare under the California Endangered Species Act

California Native Plant Society

1B = Rank 1B species: rare, threatened, or endangered in California and elsewhere

2B = Rank 2B species: rare, threatened, or endangered in California but more common elsewhere

0.1 = Seriously threatened in California (more than 80% of occurrences threatened/high degree and immediacy of threat)

0.2 = Moderately threatened in California (20% to 80% occurrences threatened/moderate degree and immediacy of threat)

Source: Data compiled by AECOM in 2018

APPENDIX B

Plant Species Observed in the Study Area

Table B-1. Plant Species Observed in the Study Area

Scientific Name	Common Name	Family	Native/ Nonnative	Cal-IPC Status	Wetland Indicator Status
Achyrachaena mollis	blow wives	Asteraceae	native		FAC
Amsinckia intermedia	common fiddleneck	Boraginaceae	native		
Asclepias fascicularis	narrow-leaf milkweed	Apocynaceae	native		FAC
Avena barbata	slender wild oat	Poaceae	nonnative	Moderate	
Bellardia trixago	Mediterranean linseed	Orobanchaceae	nonnative	Limited	
Brassica nigra	black mustard	Brassicaceae	nonnative	Moderate	
Bromus diandrus	ripgut grass	Poaceae	nonnative	Moderate	
Bromus hordeaceus	soft chess	Poaceae	nonnative	Limited	FACU
Bromus madritensis ssp. *rubens*	red brome	Poaceae	nonnative		UPL
Calandrinia menziesii	red maids	Montiaceae	native		
Capsella bursa-pastoris	shepherd's purse	Brassicaceae	nonnative		FACU
Carduus pycnocephalus	Italian thistle	Asteraceae	nonnative	Moderate	
Castilleja exserta ssp. *exserta*	purple owl's clover	Orobanchaceae	native		
Centaurea calcitrapa	purple star-thistle	Asteraceae	nonnative	Moderate	
Centaurea solstitialis	yellow star-thistle	Asteraceae	nonnative	High	
Chenopodium sp.	chenopodium	Chenopodiaceae			
Cirsium vulgare	bull thistle	Asteraceae	nonnative	Moderate	FACU
Convolvulus arvensis	field bindweed	Convolvulaceae	nonnative		
Cotula coronopifolia	brass-buttons	Asteraceae	nonnative	Limited	OBL
Cynara cardunculus	cardoon	Asteraceae	nonnative	Moderate	
Distichlis spicata	salt grass	Poaceae	native		FAC
Elymus caput-medusae	medusa head	Poaceae	nonnative	High	
Elymus glaucus	blue wildrye	Poaceae	native		FACU
Erodium cicutarium	redstem filaree	Geraniaceae	nonnative	Limited	
Erodium moschatum	greenstem filaree	Geraniaceae	nonnative		
Eschscholzia californica	California poppy	Papaveraceae	native		
Eucalyptus sp.	eucalyptus	Myrtaceae	nonnative		
Festuca perennis	rye grass	Poaceae	nonnative	Moderate	
Ficus carica	edible fig	Moraceae	nonnative	Moderate	FACU
Foeniculum vulgare	fennel	Apiaceae	nonnative	Moderate	
Frankenia salina	alkali heath	Frankeniaceae	native		FACW
Geranium dissectum	wild geranium	Geraniaceae	nonnative	Limited	
Helminthotheca echioides	bristly ox-tongue	Asteraceae	nonnative	Limited	FAC
Hirschfeldia incana	mustard	Brassicaceae	nonnative	Moderate	
Hordeum brachyantherum	meadow barley	Poaceae	native		FACW
Hordeum jubatum ssp. *jubatum*	foxtail barley	Poaceae	native		FAC

Scientific Name	Common Name	Family	Native/ Nonnative	Cal-IPC Status	Wetland Indicator Status
Hordeum marinum ssp. *gussoneanum*	Mediterranean barley	Poaceae	nonnative		FAC
Hordeum murinum ssp. *leporinum*	hare barley	Poaceae	nonnative		FACU
Juncus mexicanus	Mexican rush	Juncaceae	native		FACW
Lactuca serriola	prickly lettuce	Asteraceae	nonnative		FACU
Lepidium latifolium	perennial pepperweed	Brassicaceae	nonnative	High	FAC
Lysimachia arvensis	scarlet pimpernel	Myrsinaceae	nonnative		FAC
Lythrum hyssopifolia	hyssop loosestrife	Lythraceae	nonnative		
Malva nicaeensis	bull mallow	Malvaceae	nonnative		
Malva parviflora	cheeseweed	Malvaceae	nonnative		
Malvella leprosa	alkali mallow	Malvaceae	native		FACU
Marah sp.	man root	Cucurbitaceae	native		
Medicago polymorpha	California burclover	Fabaceae	nonnative	Limited	FACU
Melilotus indicus	sourclover	Fabaceae	nonnative		FACU
Microseris sp.	microseris	Asteraceae			
Phacelia cf. ciliata	Great Valley phacelia	Boraginaceae	native		
Plantago lanceolata	English plantain	Plantaginaceae	nonnative	Limited	FAC
Polygonum aviculare ssp. *depressum*	prostrate knotweed	Polygonaceae	nonnative		FAC
Prunus sp.	plum	Rosaceae	nonnative		
Rubus armeniacus	Himalayan blackberry	Rosaceae	nonnative	High	FAC
Rumex crispus	curly dock	Polygonaceae	nonnative	Limited	FAC
Salix lasiolepis	arroyo willow	Salicaceae	native		FACW
Schoenoplectus californicus	southern bulrush	Cyperaceae	native		OBL
Silybum marianum	milk thistle	Asteraceae	nonnative	Limited	
Tamarix sp.	tamarisk	Tamaricaceae	nonnative		
Torilis nodosa	short sock-destroyer	Apiaceae	nonnative		
Tragopogon porrifolius	salsify, oyster plant	Asteraceae	nonnative		
Triteleia laxa	Ithuriel's spear	Themidaceae	native		
Triticum aestivum	common wheat	Poaceae	nonnative		
Veronica persica	Persian speedwell	Plantaginaceae	nonnative		
Vicia sativa	spring vetch	Fabaceae	nonnative		FACU
Xanthium sp.	cocklebur	Asteraceae	native		

Notes:

Cal-IPC = California Invasive Plant Council; FAC = Facultative; FACU = Facultative Upland; FACW = Facultative Wetland; OBL = Obligate Wetland

Source: Data compiled by AECOM in 2018

APPENDIX C

Representative Photographs

Photo 1: Slopes within the Solano 4 East parcel were disked prior to the April 2018 survey. Annual grassland and ruderal vegetation occupied roadsides and un-disked areas.

Photo 2: A seasonal wetland occupying a flat, un-disked area at Solano 4 East.

Preliminary Delineation of Waters of the United States, Including Wetlands

Preliminary Delineation of Waters of the United States, Including Wetlands

SMUD Solano 4 Wind Project

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ACRONYMS AND OTHER ABBREVIATIONS

amsl	above mean sea level
Arid West Supplement	*Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)*
CIMIS	California Irrigation Management Information System
CWA	Clean Water Act
ED	Ephemeral Drainages
EPA	U.S. Environmental Protection Agency
FAC	facultative
FACU	facultative upland
FACW	facultative wetland
GPS	Global Positioning System
ID	intermittent drainage
MCVII	*A Manual of California Vegetation, Second Edition*
MHWRA	Montezuma Hills Wind Resource Area
NL	not listed
NRCS	U.S. Natural Resources Conservation Service
NWI	National Wetlands Inventory
OBL	obligate
OHWM	ordinary high-water mark
Project	Solano 4 Wind Project
PS1	perennial swale 1
PS2	perennial swale 2
SMUD	Sacramento Municipal Utility District
SW1	seasonal wetland 1
TNW	traditional navigable water
UPL	upland
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
Wetlands Delineation Manual	*Corps of Engineers Wetlands Delineation Manual*

1 INTRODUCTION

Sacramento Municipal Utility District's (SMUD's) Solano Wind Project is located in the southern portion of Solano County, California, in the Montezuma Hills Wind Resource Area (MHWRA) (Exhibit 1). Currently, the Solano Wind Project consists of three phases developed between 2003 and 2012. To improve wind resources in the MHWRA and deliver more renewable energy to its customers, SMUD proposes to develop the Solano 4 Wind Project (Project). The Project would involve removing existing wind turbine generators; constructing new wind turbine generators; constructing associated new access roads, staging areas, meteorological towers, and an energy collection system; and completing minor upgrades to the existing Russell Substation.

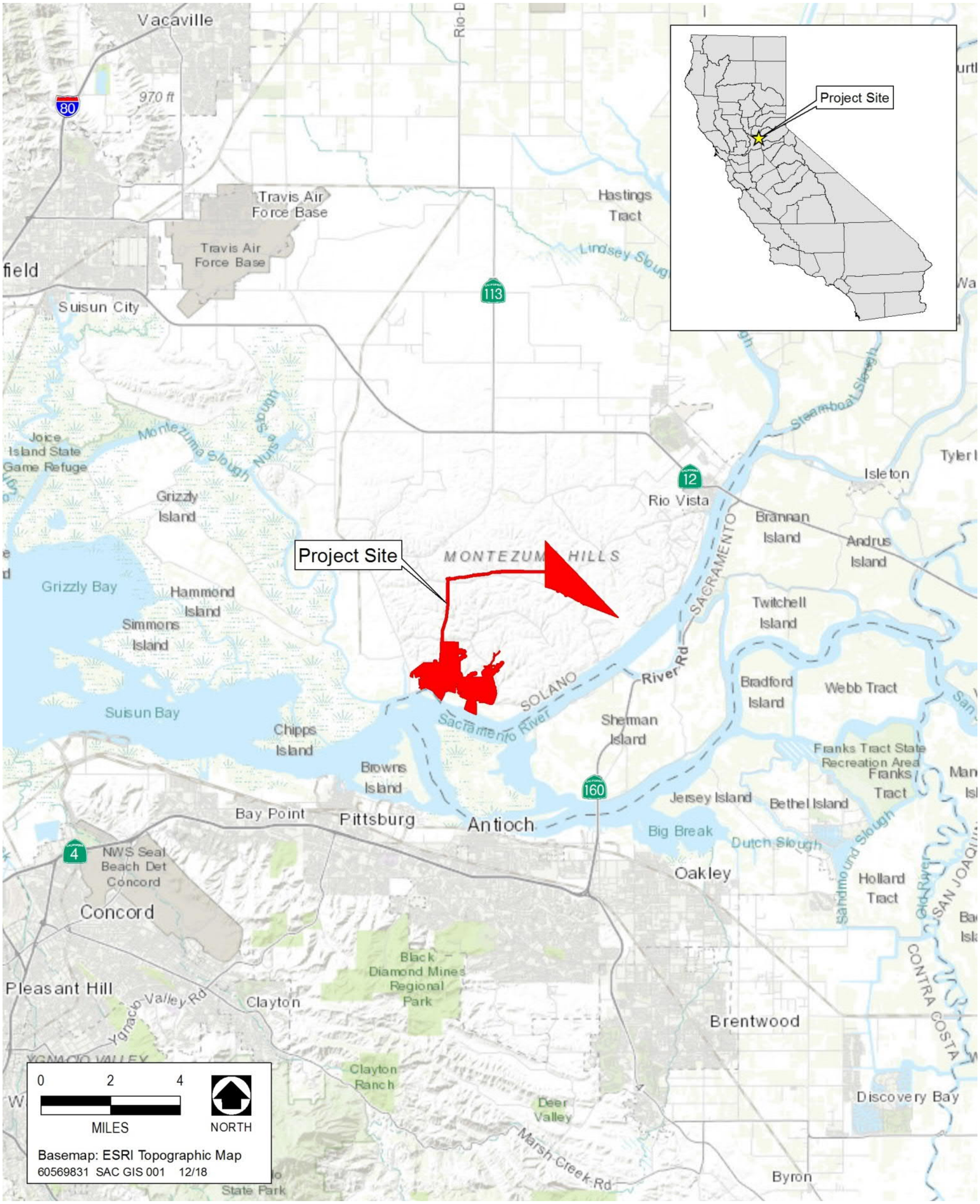
The Project area encompasses two locations: Solano 4 West, and Solano 4 East. Solano 4 East occupies 881 acres and Solano 4 West occupies 1,390 acres. The Project area is generally bounded by the community of Collinsville to the west, the confluence of the Sacramento and San Joaquin rivers to the south, and the city of Rio Vista to the northeast (Exhibit 2). In July 2017, Area West Environmental, Inc., completed a preliminary jurisdictional wetland determination for the Solano 4 West property and associated transmission lines (AWE 2017).

AECOM recently conducted a wetland delineation survey for Solano 4 East and the electrical collection system homerun corridor (homerun corridor) that connects Solano 4 East to the Russell Substation; Solano 4 East and the homerun corridor are referred to collectively in this report as the "study area" (Exhibits 3). The study area is located in portions of Sections 1, 2, 11, and 12 of Township 3 North, Range 1 East; and Sections 4, 5, 6, 7, 8, and 9 as well as unsectioned portions of Township 3 North, Range 2 East of the Birds Landing, Antioch North, and Jersey Island U.S. Geological Survey (USGS) 7.5-minute quadrangle maps (Exhibit 4).

This report presents the results of the delineation of waters of the United States, including wetlands, as defined in 33 CFR 328. It is considered a draft until verified by the U.S. Army Corps of Engineers (USACE) Sacramento District.

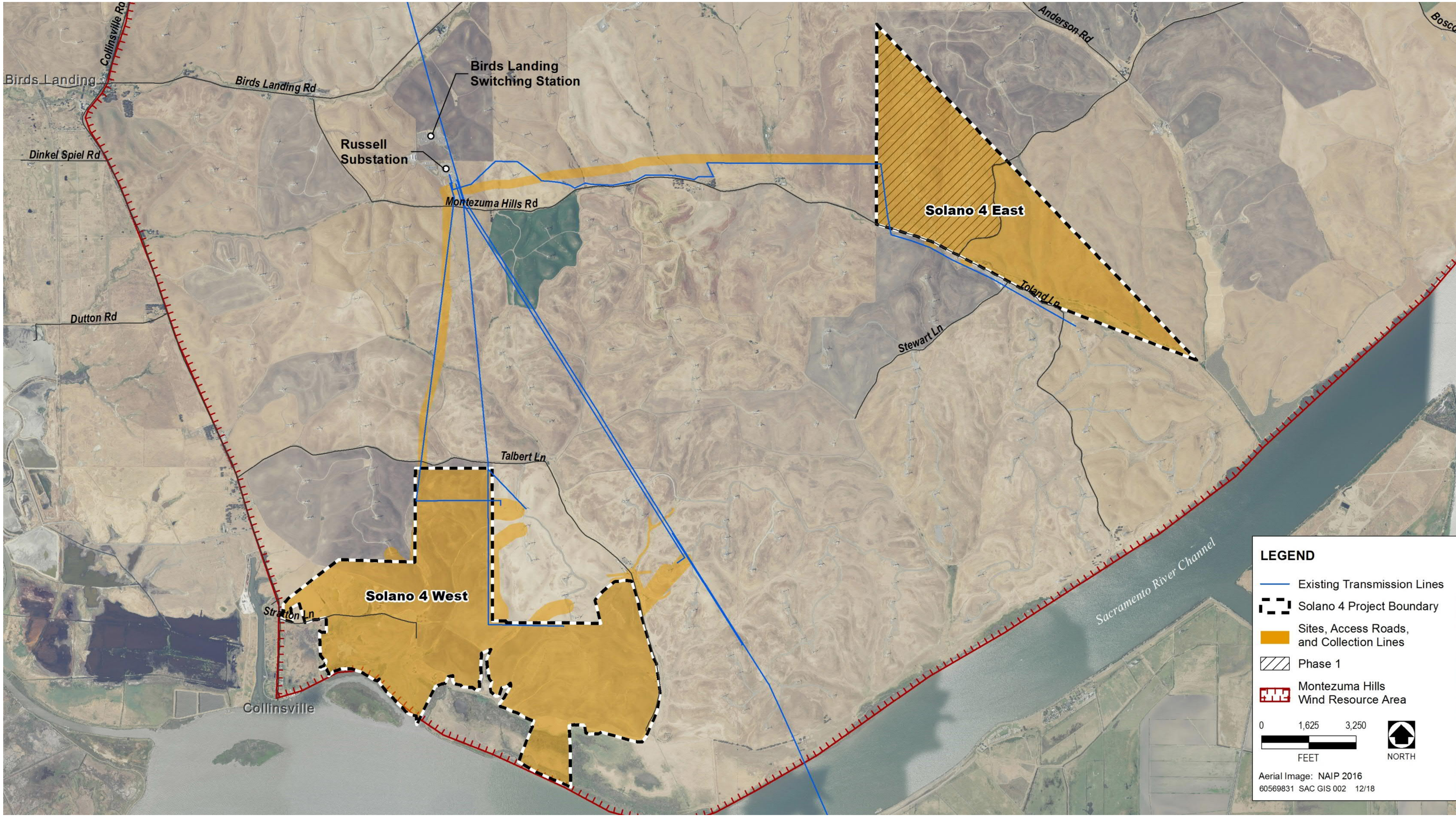
2 DELINEATION METHODS

Before conducting the wetland delineation, an AECOM wetland ecologist reviewed recent color aerial photographs of the study area (Google 2018) to identify areas of potential USACE jurisdiction. Other materials reviewed include prior delineations conducted in the vicinity, online geospatial wetlands information provided by the U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) (USFWS 2018), the Birds Landing and Antioch North USGS 7.5-minute topographic quadrangle maps, the National Map Viewer Hydrography dataset (USGS 2018a), and the U.S. Natural Resources Conservation Service (NRCS) Web Soil Survey (NRCS 2017a).



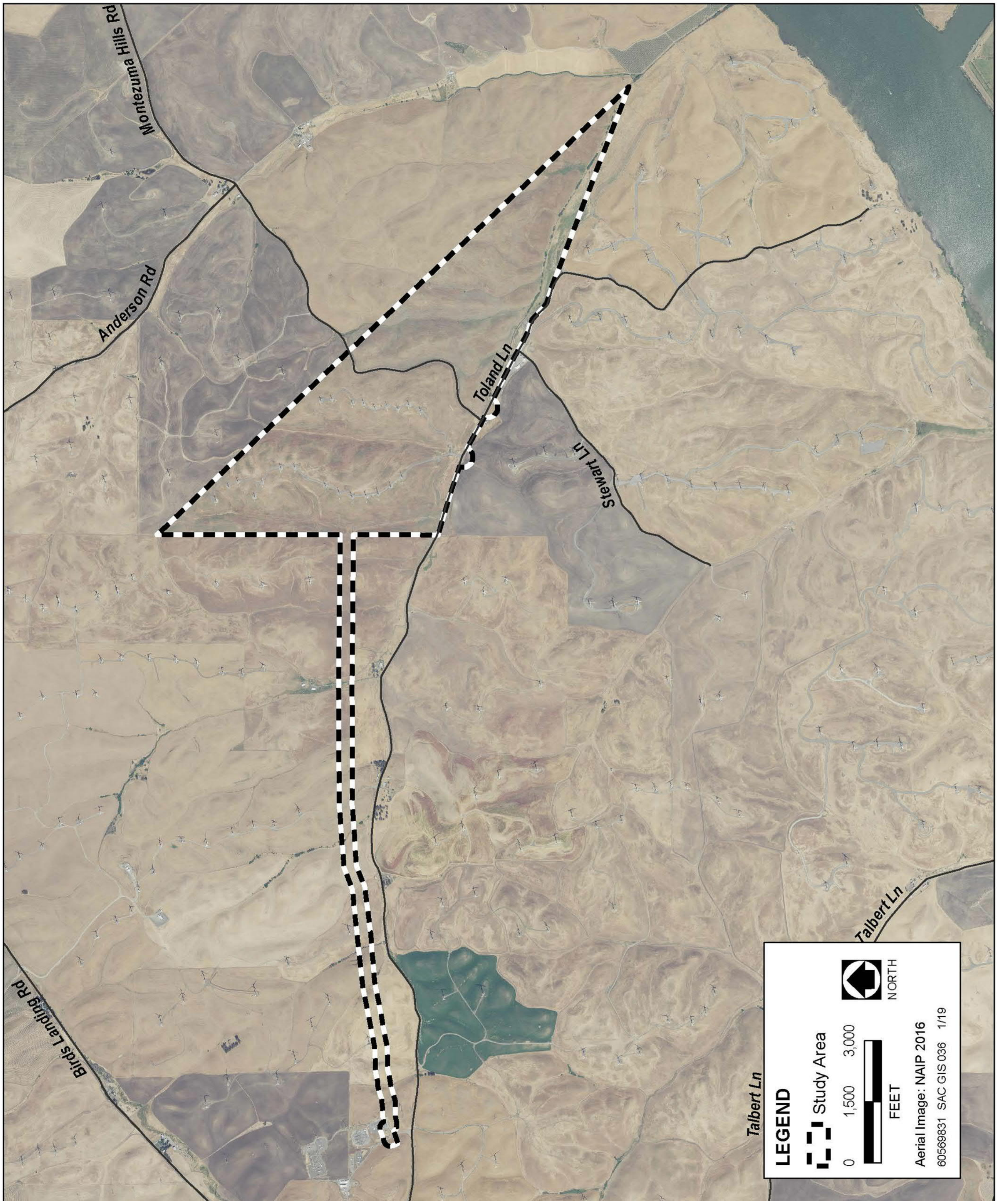
Source: Data compiled by AECOM in 2018

Exhibit 1. Regional Location



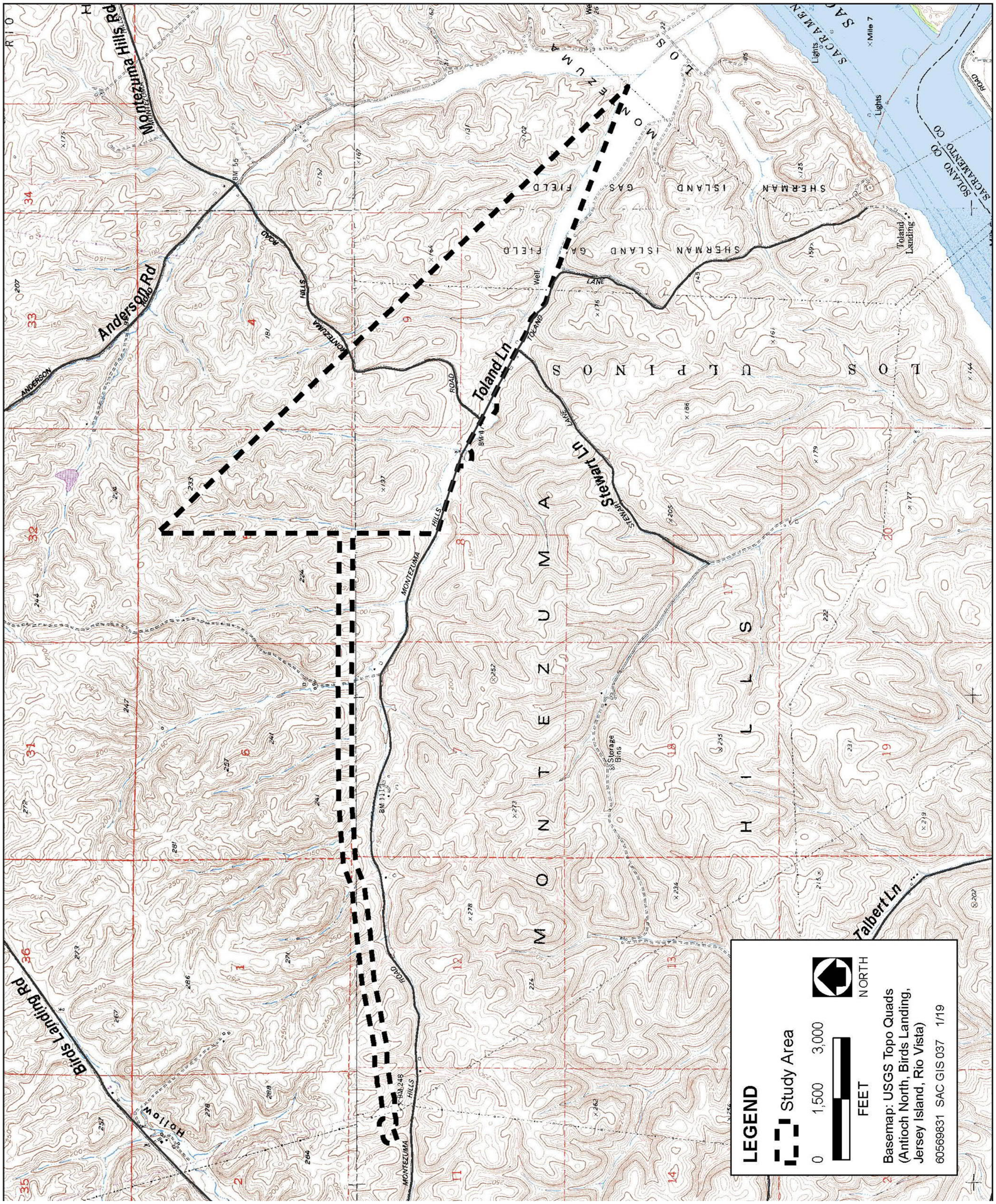
Source: Data compiled by AECOM in 2018

Exhibit 2. Project Site Map



Source: Data compiled by AECOM in 2018

Exhibit 3. Site Location



Source: Data compiled by AECOM in 2018

Exhibit 4. Site Topographic Location

The wetland delineation was conducted by AECOM biologists Kristin Asmus and Joseph Broberg on April 24–26, 2018. A routine wetland delineation was performed in accordance with the procedures outlined in the *Corps of Engineers Wetlands Delineation Manual* (Wetlands Delineation Manual) (Environmental Laboratory 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)* (Arid West Supplement) (USACE 2008a). The Wetlands Delineation Manual and Arid West Supplement provide technical guidelines and methods for identifying wetlands that may be subject to USACE jurisdiction under Section 404 of the CWA.

Under this approach, an area must support positive indicators of hydrophytic vegetation, hydric soils, and wetland hydrology to be considered a jurisdictional wetland. Routine wetland determination data forms were completed for four sample points and are provided in Appendix A. Potentially jurisdictional areas were identified and mapped in the field. Most areas and all sample point locations were recorded digitally using a Global Positioning System (GPS) data logger (Trimble Juno®) and imported onto an electronic version of an aerial photograph of the study area. Hand-mapped areas were later digitized onto the aerial photograph. GPS data were recorded in North American Datum of 1983 (feet).

Botanical nomenclature in this report follows *The Jepson Manual: Vascular Plants of California, Second Edition* (Baldwin et al. 2012). Plant community names are crosswalked to *A Manual of California Vegetation: Second Edition* (Sawyer et al. 2009) where applicable. This report also provides wetland community names that conform to the *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979).

To determine whether hydrophytic vegetation dominated an area, plant species at sample points were listed on data forms, and the wetland indicator status was recorded for each dominant species using the National Wetland Plant List website (USACE 2016). Hydrophytic species are those listed as obligate (OBL), facultative wetland (FACW), or facultative (FAC). A species' designation corresponds to the probability that the species will occur in a wetland habitat. A sample site was considered dominated by hydrophytic vegetation if more than 50% of the dominant species had an indicator status of FAC or wetter. Table 1 presents definitions of the indicator categories.

Table 1. Wetland Indicator Categories

Indicator Category	Wetland Occurrence
Obligate (OBL)	Almost always occur in wetlands.
Facultative wetland (FACW)	Usually occur in wetlands, but may occur in non-wetlands.
Facultative (FAC)	Occur in wetlands and non-wetlands.
Facultative upland (FACU)	Usually occur in non-wetlands, but may occur in wetlands.
Upland (UPL)	Almost never occur in wetlands.[1]

Note:
[1] Plants not listed on the 2016 National Wetland Plant List are listed on the data forms as NL and assumed to be UPL consistent with standard protocol.
NL = not listed
Source: Lichvar et al. 2012

Soils were examined by digging soil test pits to determine whether hydric soils exist in a sampling location. Soils were described in terms of depth, matrix color, redoxymorphic color (when present), and moisture status at each sampling location. Other diagnostic features indicative of hydric soils, such as the presence of concretions and oxidized rhizospheres (a redoximorphic feature, according to Vepraskas [1992]), were also recorded on data forms. Hydric soil determinations were based on the indicators provided by the 1987 Wetlands Delineation Manual, 2008 Arid West Supplement, *Field Indicators of Hydric Soils in the United States: A Guide for Identifying and Delineating Hydric Soils* (NRCS 2017b), and *Redoximorphic Features for Identifying Aquic Conditions* (Vepraskas 1992). Soil units mapped for the study area as part of the soil survey were cross-referenced with the National Hydric Soils List (NRCS 2018a) to determine whether the soils are listed as a hydric map unit.

Wetland hydrology was assessed by recording observations of drainage patterns, watermarks, flooded or saturated soil conditions, and other indicators. In addition, potentially jurisdictional areas were evaluated in terms of their status as navigable waterways or their adjacency or hydrologic connections to navigable waterways. Other waters were delineated based on the presence of an ordinary high-water mark (OHWM). A drainage feature's OHWM is typically defined by characteristics such as shelving, scour lines, and other natural linear features that define the bed-and-bank portion of the channel that floods under normal conditions (USACE 2008b).

The *U.S. Army Corps of Engineers Jurisdictional Determination Form Instructional Guidebook* (USACE 2007) and the *Technical Support Document for the Clean Water Rule: Definition of Waters of the United States* (U.S. Environmental Protection Agency and U.S. Department of the Army 2015) were consulted to aid the preliminary determination that a feature would be subject to USACE jurisdiction under CWA Section 404. The "significant nexus" test—outlined in a memorandum jointly authored by the U.S. Environmental Protection Agency (EPA) and USACE—was applied to each potentially jurisdictional feature (Grumbles and Woodley 2008). To facilitate jurisdictional determination consistent with the guidance, each water body delineated was evaluated as a Traditional Navigable Water (TNW), Tributaries, or Adjacent Waters based on the following definitions:

- *TNWs*—all waters subject to the ebb and flow of the tide, or waters that are presently used, have been used in the past, or may be used in the future to transport interstate or foreign commerce, and all waters that are navigable in fact under federal law for any purpose.

- *Tributaries*—waters that contribute flow either directly or through another water, including an impoundment, to a TNW, interstate waters or wetlands, or a territorial sea, and that are characterized by the presence of the physical indicators of a bed and bank and an OHWM.

- *Adjacent Waters*—waters bordering, contiguous with, or neighboring jurisdictional waters, including waters separated by constructed dikes or barriers, natural river berms, beach dunes, and the like. Adjacent waters also include all waters that connect segments of jurisdictional waters or are located at the head of a jurisdictional water and are bordering, contiguous with, or neighboring such water.

The following types of water bodies are subject to CWA jurisdiction:

- TNWs, tributaries of TNWs, and all impoundments of these types of waters;

- all waters adjacent to a TNW or tributary including wetlands, ponds, lakes, oxbows, impoundments, and similar waters; and

- all waters located within the 100-year floodplain of a TNW and all waters located within 4,000 feet of the high-tide line or OHWM of a TNW, impoundment, or tributary where they are determined on a case-specific basis to have a significant nexus to a TNW. For waters determined to have a significant nexus, the entire water is a water of the United States if a portion is located within the 100-year floodplain of a TNW or within 4,000 feet of the high-tide line or OHWM of a TNW or tributary.

The conclusions of this report are consistent with the 2015 Final Rule and are considered preliminary until verified by the Sacramento District of the USACE.

3 SETTING

3.1 STUDY AREA

The study area consists of the Solano 4 East property and the homerun corridor (collection line) that runs west toward and terminates at the existing Russell Substation. Montezuma Hills Road bisects the study area's Solano East property where it runs north-south and borders the western portion's southern boundary where it turns and runs east-west. The remainder of the study area is partially bounded on the south by Toland Lane and existing wind farm facilities, the Russell Substation to the west, existing wind energy farm facilities to the north, and the Sacramento River to the east (Exhibit 2). Montezuma Hills Road provides local access to Solano 4 East.

Elevations range from approximately 0 feet above mean sea level (amsl) in the southeast corner of the study area to 250 feet amsl at the western terminus near the Russell Substation (Exhibit 3). Site topography is characterized by gently rolling hills and shallow drainages. Hilltops generally crest between 150 and 250 feet amsl, with relatively flat ridgelines oriented predominantly north-south. Rows of wind turbines line the study area's hilltops and ridgelines, which are connected by gravel roads. Staging areas, transmission lines, and the existing Russell Substation also characterize the study area (Exhibit 2). Additional land uses in the study area include dryland wheat cultivation and livestock grazing. Farming is conducted on a 3-year rotational basis in a network of fenced pastures, with most of the study area disked semiannually.

3.2 VEGETATION COMMUNITIES

Vegetation communities identified in the study area consist primarily of agricultural land (pasture and grain crops) and nonnative annual grasslands. Sporadic shrub and riparian vegetation is present along intermittent drainage swales. Appendix B presents a habitat map and Appendix C presents a list of plants observed at the time of the field surveys.

3.2.1 AGRICULTURAL

Agricultural land in the study area consists of dryland farming and livestock grazing along grassland slopes, and livestock grazing in interstitial valleys and drainages. Agricultural practices generally follow a 1- to 3-year crop rotation cycle (wheat [*Triticum asestivum*], barley [*Hordeum vulgare*], and oats [*Avena sativa*]), with predominantly sheep grazing and fallow years following planting. The fields that are dryland farmed are densely planted, and little to no other vegetation is present. A total of 503.39acres of actively farmed land and 425.75 acres of grazed land are mapped in the study area. These vegetation communities would be considered upland following Cowardin et al. (1979).

3.2.2 NONNATIVE ANNUAL GRASSLAND

A total of 31.16 acres of nonnative annual grassland are mapped in the study area. Annual grasslands in the study area consist of fallow agricultural fields and grazed grasslands. Dominant species include nonnative grasses such as wild oats (*Avena barbata*), ripgut brome (*Bromus diandrus*), soft chess (*B. hordeaceus*), and Mediterranean barley (*Hordeum marinum* ssp. *gussoneanum*). These grasslands generally do not conform to any specific vegetation alliances as classified in *A Manual of California Vegetation, Second Edition* (MCVII) (Sawyer et al. 2009), although some patches, depending on the dominant species, may meet criteria for annual brome grasslands or wild oats grasslands. Scattered native and nonnative forbs grow among these grasses. Common forbs include blow wives (*Achyrachaena mollis*), Mediterranean linseed (*Bellardia trixago*), and scarlet pimpernel (*Lysimachia arvensis*). This vegetation community would be considered upland following Cowardin et al. (1979).

3.2.3 RIPARIAN

Drainages in the study area support scattered patches of riparian vegetation. A total of 0.11 acre of riparian vegetation are mapped in the study area. The swale along the southeastern edge of Solano 4 East contains a small thicket of arroyo willow (*Salix lasiolepis*). A small thicket of tamarisk (*Tamarix* sp.) also occurs in a drainage just south of the homerun corridor. These areas of riparian vegetation conform to Arroyo willow thickets and Tamarisk thickets as described in MCVII and would be considered upland following Cowardin et al. (1979).

3.2.4 RUDERAL

Ruderal vegetation in the study area includes areas dominated by weedy species (with minimal grass cover) that colonize disturbed areas, such as roadsides and the graded areas that surround the existing wind turbines and the Russell Substation. A total of 1.13 acres of ruderal vegetation are mapped in the study area. Dominant ruderal species include black mustard (*Brassica nigra*), fennel (*Foeniculum vulgare*), and bristly ox-tongue (*Helminthotheca echioides*). Ruderal vegetation in the study area generally does not conform to any specific vegetation alliances, although some patches may meet the criteria for fennel patches or upland mustard alliances as described in MCVII. This vegetation community would be considered upland following Cowardin et al. (1979).

3.2.5 SEASONAL WETLAND

Seasonal wetlands support annual and perennial native and nonnative wetland plant species. This habitat type typically resembles a wetland community only during and following the wet season; it dries up rapidly with the onset of summer. During the dry season, such sites may not be readily recognizable as wetland species go to seed and typical upland grasses and forbs become established. A total of 33.55 acres of seasonal wetland are mapped in the study area.

Several seasonal wetlands occur in the study area along the bottoms of seasonally flooded drainages. These drainage bottoms show no evidence of regular disking. A large wetland area in the southeastern portion of the study area that is part of the primary tributary that flows into the Sacramento River is entirely fenced and would be excluded from Project construction impacts[1]. Vegetation alliances in the large southeastern seasonal wetland are typical wetland alliances such as California bulrush (*Schoenoplectus californicus*) marsh, hardstem bulrush (*S. acutus*) marsh, and cattail (*Typha angustifolia, domingensis, latifolia*) marshes, with smaller areas of alliances that are less readily identifiable as seasonal wetlands, such as fields of perennial rye grass (*Festuca perrenis*). The three smaller, adjacent seasonal wetlands are composed primarily of perennial rye grass. Associated species include Mediterranean barley, Mexican rush (*Juncus mexicanus*), and hyssop loosestrife (*Lythrum hyssopifolia*). All seasonal wetlands would be classified as palustrine seasonally flooded wetland following Cowardin et al. (1979).

3.3 SOILS

According to the NRCS *Soil Survey of Solano County, California* as accessed through the online Web Soil Survey (NRCS 2017a), five soil map units occur in the study area: Diablo-Ayar clays, 9 to 30 percent slopes, eroded; Diablo-Ayar clays, 2 to 9 percent slopes; Valdez silt loam, drained, 0 to 2 percent slopes, Major Land Resource Area (MLRA) 16; Omni clay loam; and Antioch–San Ysidro complex, 2 to 9 percent slopes (Table 2). Two of these soil map units, Valdez silt loam and Omni clay loam, are listed on the *National Hydric Soils List* (NRCS 2018a) and all are described in further detail below. Appendix D provides a soils map showing the locations of soils in the study area.

Table 2. Soil Types in the Study Area

Soil Map Unit	Acres in Study Area	Hydric Soils List
Diablo-Ayar clays, 9 to 30 percent slopes, eroded	960.07	No
Diablo-Ayar clays, 2 to 9 percent slopes	0.19	No
Valdez silt loam, drained, 0 to 2 percent slopes, MLRA 16	34.19	Yes
Omni clay loam	32.72	Yes
Antioch–San Ysidro complex, 2 to 9 percent slopes	23.91	No

Note: MLRA = Major Land Resource Area
Source: Data compiled by AECOM in 2018

3.3.1 Diablo-Ayar Clays, 9 to 30 Percent Slopes, Eroded, and 2 to 9 Percent Slopes

Diablo-Ayar clays, 9 to 30 percent slopes, are mapped over most of the study area. The southern boundary intersects a sliver of the map unit for Diablo-Ayar clays, 2 to 9 percent slopes. These two map units do not differ substantially from each other; therefore, they are treated together here. This soil complex is approximately 60 percent Diablo clay and 30 percent Ayar clay, with 5 percent each Altamont and San Benito series inclusions.

Diablo series soils formed in residuum weathered from shale, sandstone, and consolidated sediments with minor areas of tuffaceous material. Runoff is slow when the soil is dry and medium to rapid when soils are moist; permeability is slow; and soils are well drained. Most horizons have 45–60 percent clay and slickensides are present in the Bss horizon. The depth to weathered bedrock is in the range of 40–80 inches. In dry soils, cracks

[1] Please note that throughout this document, the primary tributary is denoted with the number 1 (various segments may be ephemeral drainages (ED), intermittent drainages (ID), etc. Other drainages in the study area are identified 2-9, starting at the eastern portion of the study area, increasing farther west.

that measure 0.5 inch to 2 inches wide form from the surface to depths of 20–40 inches; the cracks close as soils become wet in late October to late November and remain closed until the soils dry up in April to early June. The Diablo series is taxonomically classified as fine, smectitic, thermic Aridic Haploxererts (NRCS 2018b).

Ayar series soils formed in material weathered from alkaline shales and sandstone that range from hard to soft and include minor beds of impure limestone. Runoff is very high, permeability is slow when cracks are closed, and the soils are well drained. Most horizons have 35–55 percent clay. Depth to shale or sandstone ranges from 40 to 80 inches. Deep, wide cracks open up from June to November for 150–180 days and remain closed the rest of the time. The Ayar series is taxonomically classified as fine, smectitic, thermic Typic Haploxererts (NRCS 2018b).

3.3.2 Valdez Silt Loam, Drained, 0 to 2 Percent Slopes, MLRA 16

Valdez silt loam is mapped in a broad valley along the southeastern edge of the study area. These soils are typically associated with river deltas and floodplains near rivers, sloughs, and old stream channels. The map unit consists of fine-silty alluvium derived from igneous, metamorphic, and sedimentary rock. Runoff is slow to very slow, permeability is moderately slow, and soils are poorly drained under natural conditions. Unless drained and not irrigated, the upper 20 inches of the soil usually does not become dry. This soil typically has a silt loam surface layer approximately 14 inches thick, and in the section ranging from 10 to 40 inches, the soil is about 18–35 percent clay and less than 15 percent fine or coarser sand. The depth to a restrictive layer is more than 80 inches.

This map unit has inclusions of Columbia soils (9 percent) and less than 1 percent each of Sacramento, Sycamore, Lang, Maria, Tyndall, and Laugenour. The Valdez series is taxonomically classified as fine-silty, mixed, superactive, nonacid, thermic Aeric Fluvaquents (NRCS 2018b).

3.3.3 Omni Clay Loam

Omni clay loam is mapped in various low-lying portions of the study area, typically along drainages that exist between adjacent hillsides (Appendix D). These soils are associated with nearly level concave basin floors at elevations of 5–150 feet. The sediments in these soils are of mixed origin. Runoff is very slow to slow, permeability is slow, and the soils are poorly drained. Omni series soils are usually moist throughout unless drained and not irrigated, and are generally calcareous in all parts. Depth to a restrictive feature is more than 80 inches. This map unit has inclusions of 5 percent each Clear Lake, Solano, and Rincon soils (NRCS 2018b).

3.3.4 Antioch–San Ysidro Complex, 2 to 9 Percent Slopes

Antioch–San Ysidro complex is mapped in the southeast corner of the study area. This complex is approximately 45 percent Antioch and 45 percent San Ysidro, with 10 percent Solano series inclusion. Antioch series soils are found on nearly level to strongly sloping alluvial fans and terraces at elevations of less than 1,100 feet. Slopes are usually less than 3 percent. These alluvial soils are derived from sedimentary rock. Runoff is slow to medium, permeability is very slow, and soils are moderately well to somewhat poorly drained. Antioch soils become moist in some or all parts at depths of 4–12 inches in about late November, and usually remain moist until late May or early June. The soils are dry the rest of the time. The San Ysidro series is taxonomically classified as fine, smectitic, thermic Natric Palexeralfs.

San Ysidro soils are found on fan remnants and stream terraces at elevations of less than 1,500 feet and slopes ranging from 0 to 9 percent. These soils are formed in alluvium from sedimentary rocks. Soils are usually moist in some or all parts at depths of 5–15 inches from late November or early December until May, and are usually dry the rest of the time. Runoff is slow to medium, permeability is very slow, and soils are moderately well drained. The San Ysidro series is taxonomically classified as fine, smectitic, thermic Natric Palexeralfs.

3.4 HYDROLOGY

The study area is primarily within the boundary of the Lower Sacramento watershed (USGS Hydrologic Unit Code 180201630703, Threemile Slough–Sacramento River). A small segment of the western end, at the Russell Substation, overlays the Suisun Bay watershed (Hydrologic Unit Code 180500010106, Lucol Hollow–Frontal Suisun Bay Estuaries).

Natural hydrology in the study area is a combination of direct precipitation and runoff from adjacent areas. The study area receives an average of approximately 16.6 inches of rainfall each year, with most low- to moderate-intensity rainstorms occurring during the winter months (WRCC 2018). The nearest weather station is a California Irrigation Management Information System (CIMIS) automated weather station at Hastings Cut, along Hastings Island Road in Solano County (CIMIS #212, Hastings Tract East), approximately 10 miles north of the study area (UCIPM 2018). At the time of the field investigation, 12.55 inches of precipitation (below average) had been recorded for the 2018 water year, which began on October 1, 2017. No rain was recorded on either the April 24 or May 10 survey dates. The last measurable precipitation event before the field survey was recorded on April 17, 2018, measuring 0.01 inch of rainfall. A total of approximately 0.29 inch of rain was recorded in the 10 days before and through the April 24 period of the field investigation; no measurable precipitation was recorded in the 10 days before and through the May 10 survey date. Two precipitation events occurred within 2 weeks after the field survey (on May 16 and May 25), totaling another 0.07 inch of rainfall. No additional precipitation was recorded before the 2018 water year ended on September 30, 2018, bringing the total for the water year to 12.62 inches of rainfall.

Precipitation runoff drains into draws and narrow valleys between rolling hills and flows generally in an easterly and southerly direction across the study area toward the Sacramento River channel. The Sacramento River, a TNW, flows southwest toward its confluence with the San Joaquin River and eventually drains west to Suisun Bay, a tidally influenced brackish estuary.

NATIONAL WETLANDS INVENTORY

The USFWS NWI was queried to gather information on any wetlands previously mapped in the study area. The NWI identifies 10 distinct features in the study area, including three classifications of freshwater emergent wetland and two classifications of riverine wetland (USFWS 2018). Except for the primary tributary, which flows southeast into the Sacramento River, all of these features are generally oriented in north-south directions in narrow valleys between hillsides. Two freshwater emergent features and one riverine feature intersect in a low-lying area in the southeast corner of the Solano 4 East property. The large freshwater emergent feature in this area is classified as PEM1C (palustrine, emergent, persistent, seasonally flooded) and the primary drainage in this area is classified as PEM1Fx (palustrine, emergent, persistent, semipermanently flooded, excavated). The riverine habitat enters the study area from the north and is classified as R4SBC (riverine, intermittent, streambed, seasonally flooded). In the higher-elevation areas of the western portion of the Solano 4 East property, two narrow freshwater emergent habitats classified as PEM1A (palustrine, emergent, persistent, temporarily flooded) and one riverine feature classified as RS4BA (riverine, intermittent, streambed) are mapped parallel to each other along the bases of adjacent hillsides. The proposed collection lines extending to the west are intersected by another four linear freshwater emergent wetlands (all classified PEM1A) and four riverine wetlands (two classified RS4BC and two classified RS4BA) that run north-south in draws and narrow valleys between adjoining hillsides.

4 DELINEATION RESULTS

This section of the report presents the results of the delineation of waters of the United States for the study area. The wetland delineation maps, provided as Exhibits 5a-5e, were prepared in accordance with the *Final Map and Drawing Standards for the South Pacific Regulatory Program* (USACE 2012) and are at a scale of 1 inch = 200 feet. All features that exhibited the three wetland parameters or an OHWM were mapped on the exhibits.

The wetland delineation maps (Exhibits 5a–5e) show the delineation sample sites in the study area, which are cross-referenced to the wetland determination data forms (Appendix A). Appendix B presents a detailed habitat map and Appendix C contains a list of plant species observed during the field survey. Appendix D presents a soils map and Appendix E provides representative photographs of the study area.

4.1 POTENTIALLY JURISDICTIONAL FEATURES

Potential waters of the United States in the study area consist of five tributaries, five adjacent swales, and seven adjacent seasonal wetlands. The location and acreages of potentially jurisdictional features are shown in Exhibits 5a-5e and summarized in Table 3.

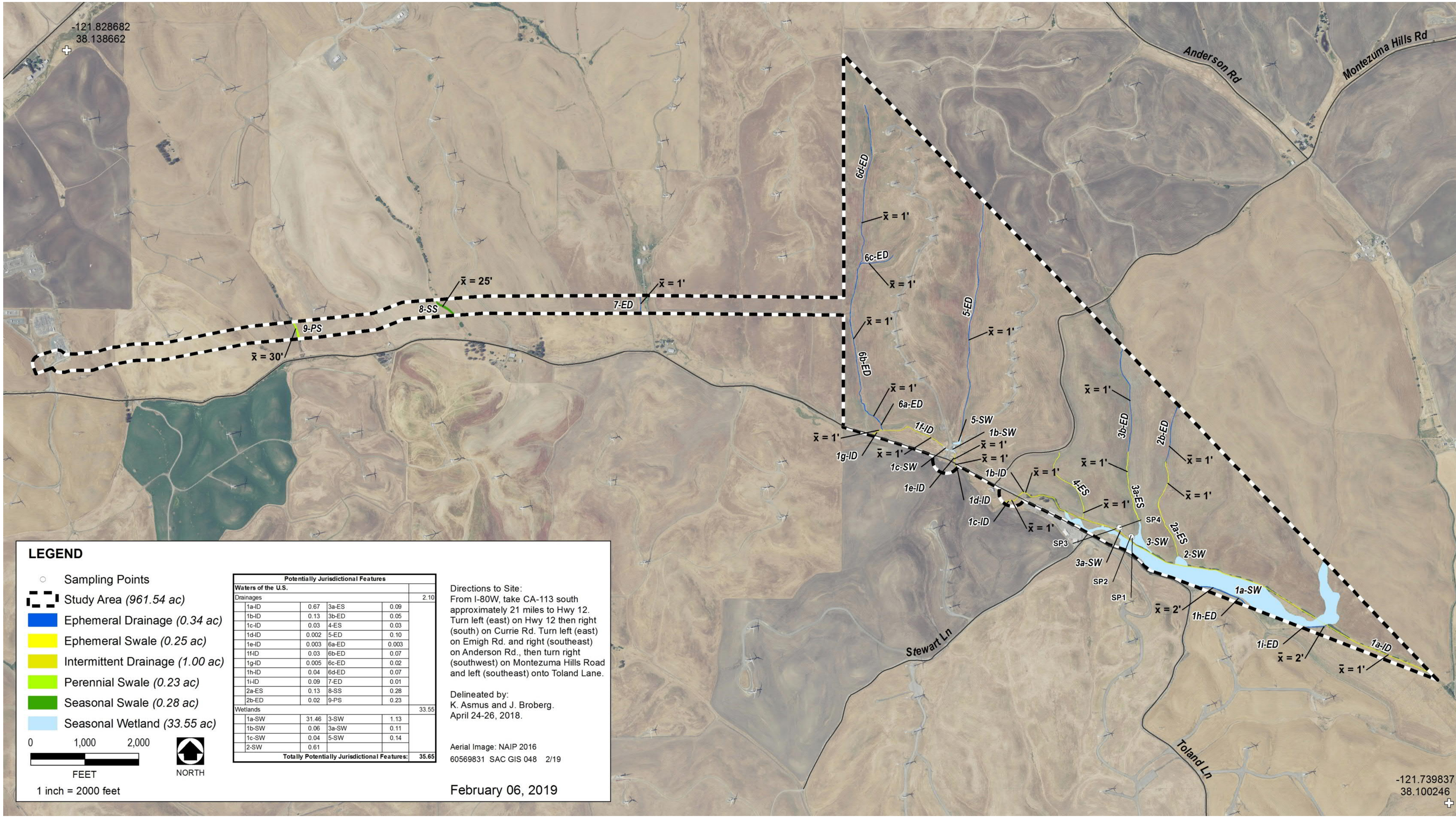
Table 3. Potentially Jurisdictional Features

Feature	Acreage
TRIBUTARIES:	**1.34**
Intermittent Drainage	1.00
Ephemeral Drainage	0.34
ADJACENT WATERS:	**34.31**
Perennial Swale	0.23
Seasonal Swale	0.28
Ephemeral Swale	0.25
Seasonal Wetland	33.55
TOTAL POTENTIALLY JURISDICTIONAL FEATURES	**35.65**
Source: Data compiled by AECOM in 2018	

Nine drainages were delineated in the study area, including the primary tributary (intermittent drainage 1 [1-ID]) into which the other eight drainages flow. The primary tributary is an unnamed intermittent drainage that runs west to southeast, generally paralleling Montezuma Hills Road in the west and then Toland Lane, before continuing southeast down the valley to Chinese Cut in the Sacramento River. The Sacramento River is tidally influenced and qualifies as a traditionally navigable water of the United States. In addition, the USACE Sacramento District identifies the Sacramento River as a navigable waterway of the United States. As such, the

Sacramento River is subject to USACE jurisdiction pursuant to Section 404 of the CWA and Section 10 of the Rivers and Harbors Act.

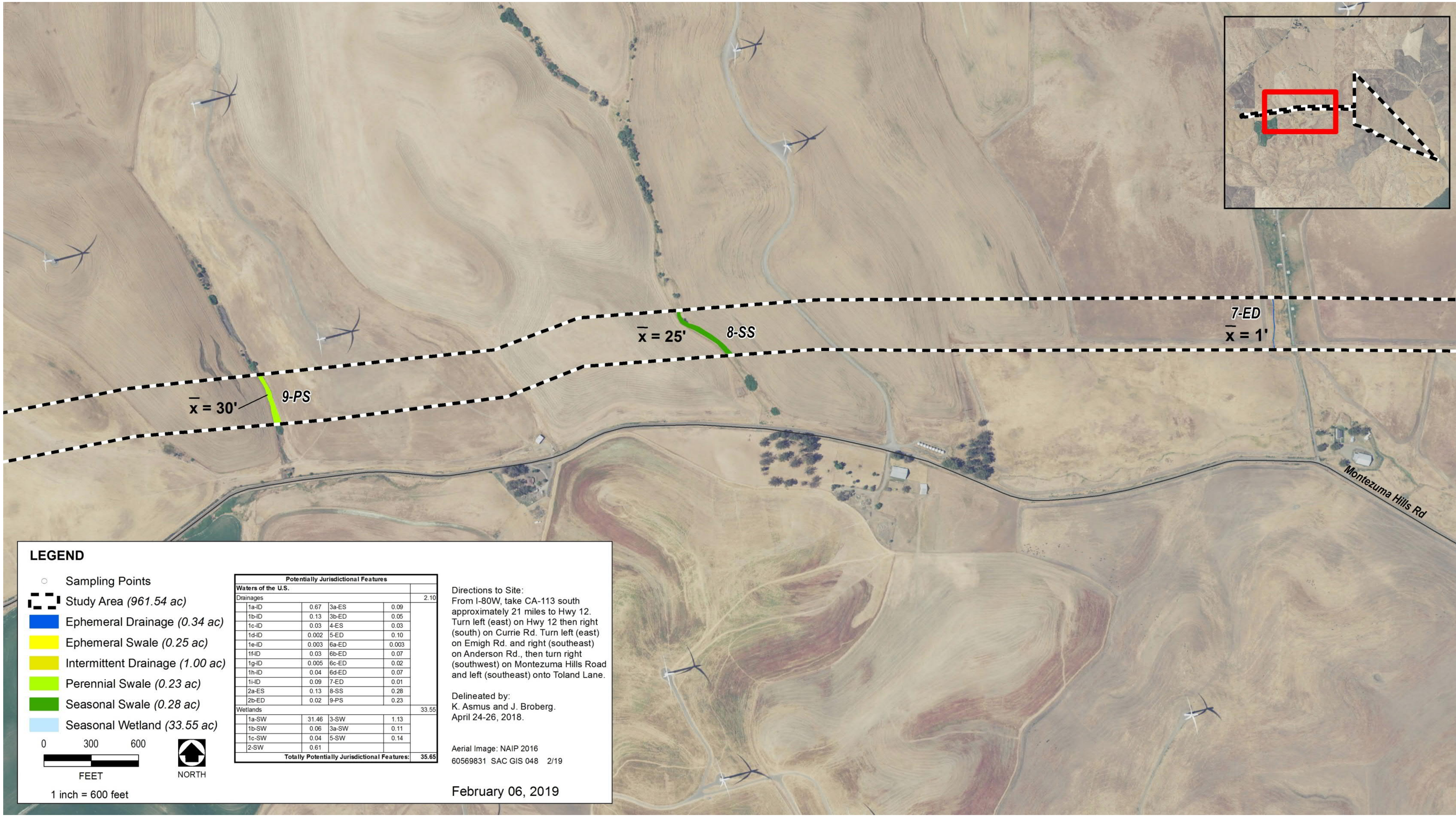
Each of the other eight drainages that cross the study area generally originate at the tops of draws in the hillsides to the north, then flow south into the primary tributary valley. These drainages are numbered 2 through 9 from east to west (Exhibits 5a–5e). There is one perennial swale, one seasonal swale, five ephemeral drainages, and one



Potentially Jurisdictional Features				
Waters of the U.S.				
Drainages				2.10
1a-ID	0.67	3a-ES	0.09	
1b-ID	0.13	3b-ED	0.05	
1c-ID	0.03	4-ES	0.03	
1d-ID	0.002	5-ED	0.10	
1e-ID	0.003	6a-ED	0.003	
1f-ID	0.03	6b-ED	0.07	
1g-ID	0.005	6c-ED	0.02	
1h-ID	0.04	6d-ED	0.07	
1i-ID	0.09	7-ED	0.01	
2a-ES	0.13	8-SS	0.28	
2b-ED	0.02	9-PS	0.23	
Wetlands				33.55
1a-SW	31.46	3-SW	1.13	
1b-SW	0.06	3a-SW	0.11	
1c-SW	0.04	5-SW	0.14	
2-SW	0.61			
Totally Potentially Jurisdictional Features:				**35.65**

Source: Data compiled by AECOM in 2018

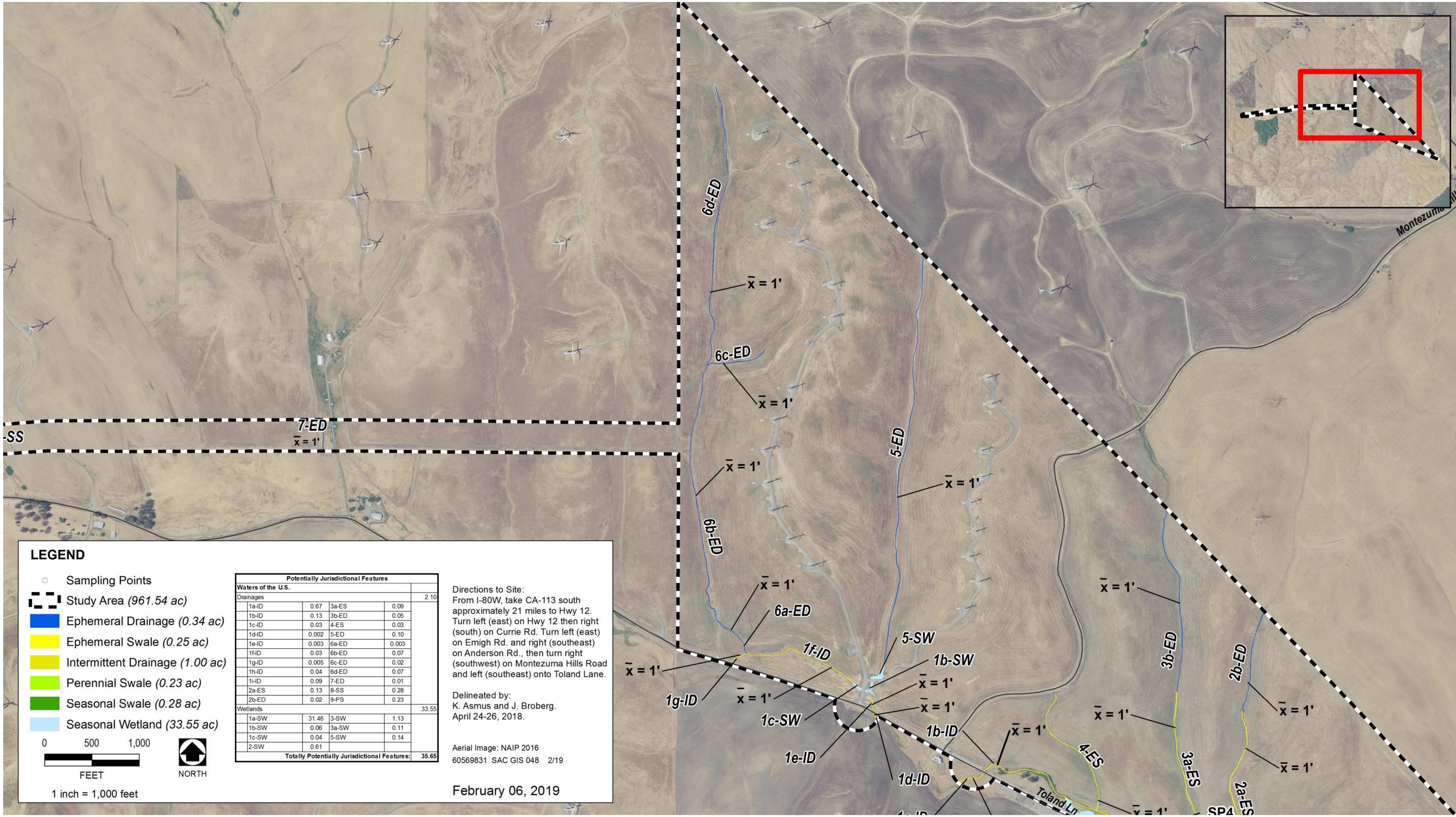
Exhibit 5a. Wetland Delineation Map



Potentially Jurisdictional Features					
Waters of the U.S.					
Drainages					2.10
	1a-ID	0.67	3a-ES	0.09	
	1b-ID	0.13	3b-ED	0.05	
	1c-ID	0.03	4-ES	0.03	
	1d-ID	0.002	5-ED	0.10	
	1e-ID	0.003	6a-ED	0.003	
	1f-ID	0.03	6b-ED	0.07	
	1g-ID	0.005	6c-ED	0.02	
	1h-ID	0.04	6d-ED	0.07	
	1i-ID	0.09	7-ED	0.01	
	2a-ES	0.13	8-SS	0.28	
	2b-ED	0.02	9-PS	0.23	
Wetlands					33.55
	1a-SW	31.46	3-SW	1.13	
	1b-SW	0.06	3a-SW	0.11	
	1c-SW	0.04	5-SW	0.14	
	2-SW	0.61			
Totally Potentially Jurisdictional Features:					**35.65**

Source: Data compiled by AECOM in 2015

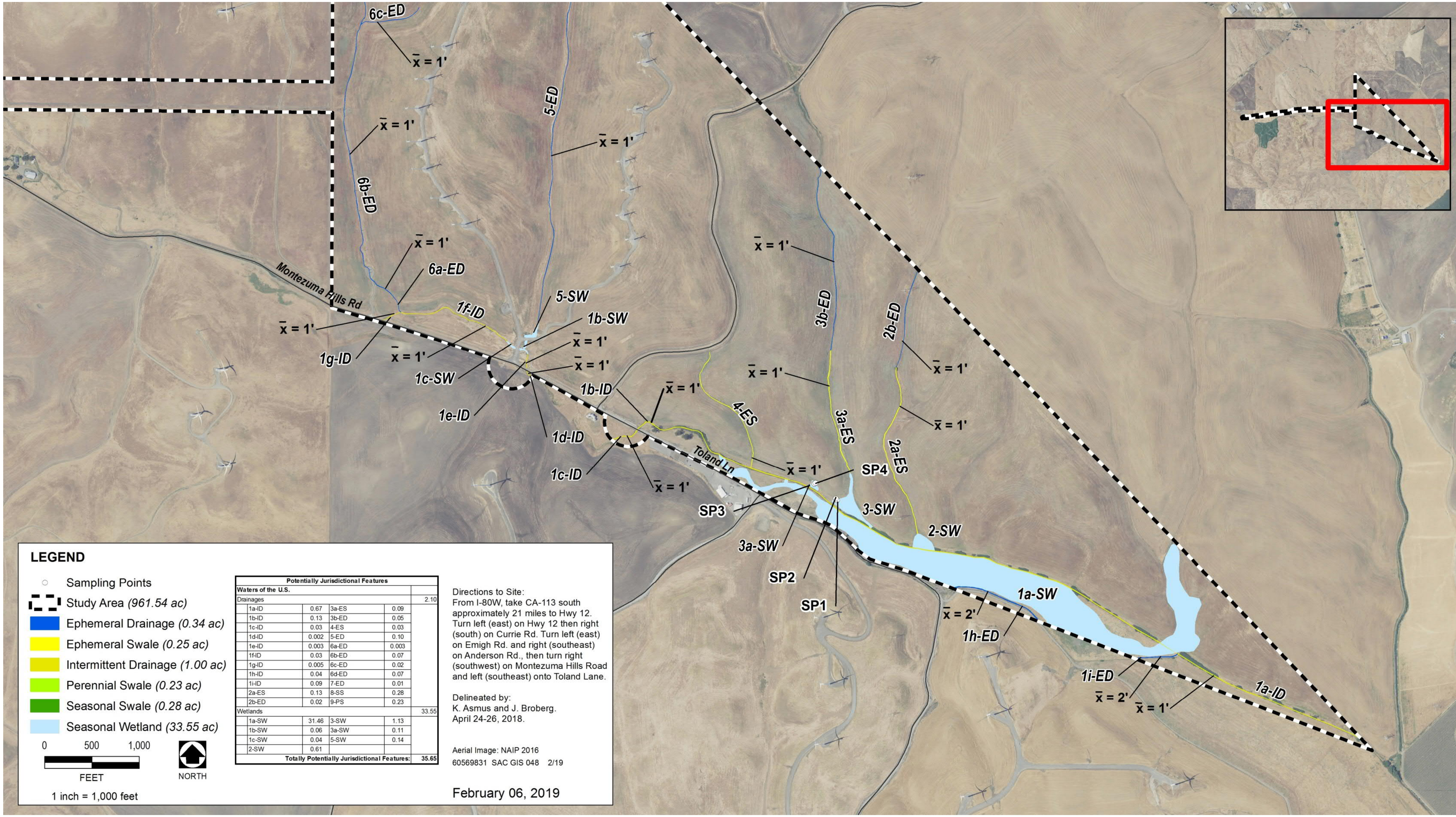
Exhibit 5b. Wetland Delineation Map



Potentially Jurisdictional Features					
Waters of the U.S.					
Drainages					2.10
	1a-ID	0.67	3a-ES	0.09	
	1b-ID	0.13	3b-ED	0.05	
	1c-ID	0.03	4-ES	0.03	
	1d-ID	0.002	5-ED	0.10	
	1e-ID	0.003	6a-ED	0.003	
	1f-ID	0.03	6b-ED	0.07	
	1g-ID	0.005	6c-ED	0.02	
	1h-ID	0.04	6d-ED	0.07	
	1i-ID	0.09	7-ED	0.01	
	2a-ES	0.13	8-SS	0.28	
	2b-ED	0.02	9-PS	0.23	
Wetlands					33.55
	1a-SW	31.46	3-SW	1.13	
	1b-SW	0.06	3a-SW	0.11	
	1c-SW	0.04	5-SW	0.14	
	2-SW	0.61			
Totally Potentially Jurisdictional Features:					**35.65**

Source: Data compiled by AECOM in 2018

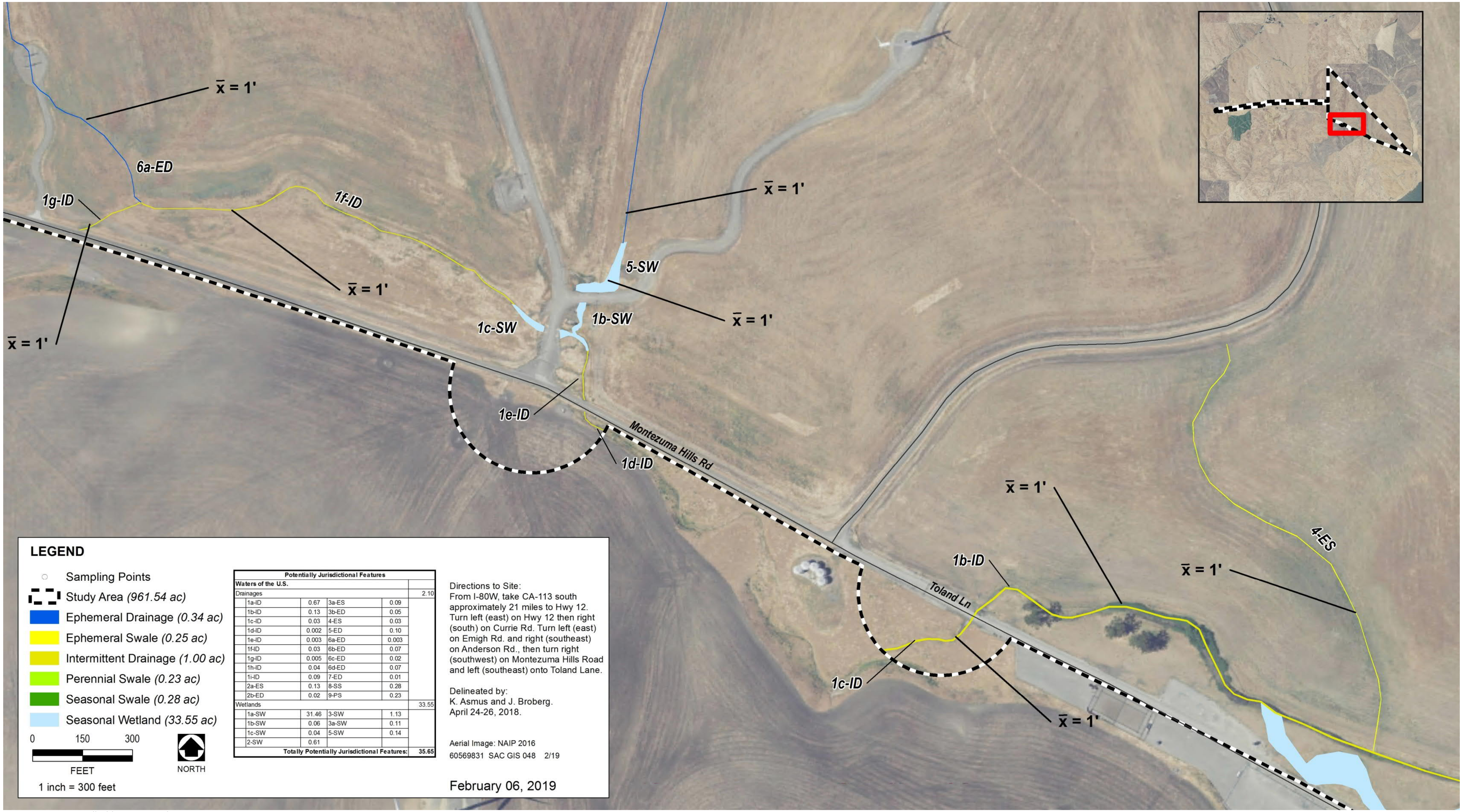
Exhibit 5c. Wetland Delineation Map



Potentially Jurisdictional Features					
Waters of the U.S.					
Drainages					2.10
	1a-ID	0.67	3a-ES	0.09	
	1b-ID	0.13	3b-ED	0.05	
	1c-ID	0.03	4-ES	0.03	
	1d-ID	0.002	5-ED	0.10	
	1e-ID	0.003	6a-ED	0.003	
	1f-ID	0.03	6b-ED	0.07	
	1g-ID	0.005	6c-ED	0.02	
	1h-ID	0.04	6d-ED	0.07	
	1i-ID	0.09	7-ED	0.01	
	2a-ES	0.13	8-SS	0.28	
	2b-ED	0.02	9-PS	0.23	
Wetlands					33.55
	1a-SW	31.46	3-SW	1.13	
	1b-SW	0.06	3a-SW	0.11	
	1c-SW	0.04	5-SW	0.14	
	2-SW	0.61			
Totally Potentially Jurisdictional Features:					35.65

Source: Data compiled by AECOM in 2018

Exhibit 5d. Wetland Delineation Map



Potentially Jurisdictional Features					
Waters of the U.S.					
Drainages					2.10
	1a-ID	0.67	3a-ES	0.09	
	1b-ID	0.13	3b-ED	0.05	
	1c-ID	0.03	4-ES	0.03	
	1d-ID	0.002	5-ED	0.10	
	1e-ID	0.003	6a-ED	0.003	
	1f-ID	0.03	6b-ED	0.07	
	1g-ID	0.005	6c-ED	0.02	
	1h-ID	0.04	6d-ED	0.07	
	1i-ID	0.09	7-ED	0.01	
	2a-ES	0.13	8-SS	0.28	
	2b-ED	0.02	9-PS	0.23	
Wetlands					33.55
	1a-SW	31.46	3-SW	1.13	
	1b-SW	0.06	3a-SW	0.11	
	1c-SW	0.04	5-SW	0.14	
	2-SW	0.61			
Totally Potentially Jurisdictional Features:					**35.65**

Source: Data compiled by AECOM in 2018

Exhibit 5e. Wetland Delineation Map

ephemeral swale that connect to the primary tributary. Two of the drainages originate as ephemeral drainages, become seasonal swales where the topography breaks and the gradient decreases, and then flow into seasonal wetlands in the flats adjacent to the primary tributary. All of these features meet the definition of tributaries or adjacent waters, or connect tributaries, and are connected by direct surface flow or adjacency to the primary tributary, which is connected by direct surface flow to the TNW Sacramento River; therefore, all tributaries and the adjacent waters delineated in the study area are considered potentially jurisdictional features pursuant to Section 404 of the CWA. These features are discussed in more detail below.

4.1.1 TRIBUTARIES

INTERMITTENT DRAINAGE

1-ID (1.00 acre, 13,842.62 linear feet) is the primary tributary flowing west to southeast through the main valley of the study area. This unnamed tributary is low gradient and is the tributary to which all others in the study area connect. 1-ID corresponds to an NWI mapped riverine feature (R4SB) in its upper reach; at the downstream end of this feature in the southeast of the study area it is classified as PEM1Fx (Palustrine Emergent, persistent, semipermanently flooded, excavated). A review of the USGS historical topographic map collection (USGS 2018b) shows on the Jersey 1910 map that the drainage extended to the mouth of the valley and dissipated into wet meadow/seasonal wetland, which transitioned into tidal marsh that extended to the east side of current day Decker Island (the west bank of Horseshoe Bend). In 1910 this stretch of the lower Sacramento River was dredged, Horseshoe Bend was cutoff and the excavated material placed to create Decker Island (Lund et al. 2007). The Jersey Island 1952 map shows the drainage channelized along the north side of the valley and extending to the Sacramento River.

The feature has a defined bed and bank and a clear OHWM, and is primarily unconsolidated bottom. It ranges in width from as narrow as 2 feet to 6 feet or wider; it retains enough water in depressional stretches to support patches of tule, cattails, and rushes, among other hydrophytic plants. In the southern portion of the study area, this feature is connected to a large floodplain seasonal wetland and swale complex (seasonal wetland 1a [1a-SW]). This drainage is a tributary with direct surface connection to the TNW Sacramento River and is therefore considered to be subject to USACE jurisdiction under Section 404 of the CWA.

EPHEMERAL DRAINAGES

Ephemeral drainages (Table 4) are present in the study area in steep areas at the tops of draws, where the water that collects moves downslope with enough erosive force that a defined bed and bank have developed. In the study area, the entirety of tributary 7-ED, and portions of 5-ED and 6-ED are mapped as wetland features (PEM1A) in the NWI. The two remaining ephemeral drainage features are not mapped in the NWI. All of these features have an average width of one foot at the OHWM, with an unconsolidated bottom. They are typically more sparsely vegetated than surrounding annual grasslands but contain similar species, and there are some short, mostly unvegetated stretches. Two of the drainages, 6-ED and 7-ED, flow continuously to the primary tributary, while drainages 2b-ED, 3b-ED, and 5-ED flow into ephemeral swales 2a-ES, 3a-ES, and seasonal wetland 5-SW, respectively, before reaching 1-ID. 1h-ED and 1i-ED are segments of an ephemeral drainage on the southeastern boundary of the study area that appears to capture runoff from the roads and hillsides on the south side of the primary tributary valley. These segments have an average width of two feet at the OHWM and unconsolidated bottoms; they are not mapped on the NWI. Segment 1i-ED appears to be channelized where it turns and crosses the study area in a straight line below seasonal wetland 1a-SW and connects to the primary tributary 1-ID.These features are directly tributary or adjacent to the primary tributary (1-ID), and all or most of the reaches' length is within 4,000 feet of the OHWM of the primary tributary, which is a tributary water of the United States. Therefore, these features are considered potentially subject to USACE jurisdiction under Section 404 of the CWA.

Table 4. Ephemeral Drainages

Feature	Acreage	Linear Feet
2b-ED	0.02	1,070.66
3b-ED	0.05	2,047.14
5-ED	0.10	8,804.21
6a-ED	0.003	136.22
6b-ED	0.07	3,147.38
6c-ED	0.02	674.01
6d-ED	0.07	3,039.96
7-ED	0.01	336.33
TOTAL	**0.343**	**19,255.91**
Source: Data compiled by AECOM in 2018		

4.1.2 ADJACENT WATERS

PERENNIAL SWALE

Perennial swale 9-PS (0.23 acre,748.21 linear feet) is the drainage farthest to the west that crosses the proposed collection line corridor. This drainage swale is relatively low gradient and wide, averaging 30 feet where it crosses the study area, and retains enough water throughout the year to support a prevalence of perennial hyrdophytic monocots such as tule, cattails, and rushes. 9-PS corresponds to a mapped wetland feature (PEM1A) in the NWI and occurs on soils mapped as hydric. 9-PS has a direct hydrological connection with and functions as a tributary to 1-ID, which is a tributary to the TNW Sacramento River, and is therefore considered an adjacent waters potentially subject to USACE jurisdiction under Section 404 of the CWA.

SEASONAL SWALE

Seasonal swale 8-SS (0.28 acre, 975.00 linear feet) crosses the collection line corridor in the west of the study area. Similar to 9-PS this drainage swale is relatively low gradient and wide, averaging 25 feet where it crosses the study area. This feature retains enough water to support hydrophytic vegetation at least seasonally, primarily facultative grasses and some sedges and rushes. 8-SS corresponds to a mapped wetland feature (PEM1A) in the NWI and occurs on soils mapped as hydric. 8-SS has a direct hydrological connection with and functions as a tributary to 1-ID, which is a tributary to the TNW Sacramento River, and is therefore considered an adjacent waters potentially subject to USACE jurisdiction under Section 404 of the CWA.

EPHEMERAL SWALES

Ephemeral swales (Table 5) are present in the study area at the bottom of draws, along slope breaks that are too steep to be disked or farmed, and at the bases of hills as they transition into the floodplain of the primary tributary. These features are not mapped in the NWI. These swales average one foot wide and are demarcated by a slope and vegetation break, but do not possess a defined bed and bank. 2a-ES and 3a-ES connect potentially jurisdictional ephemeral drainages arising at the tops of draws (in the case of 3a-ES, the ephemeral drainage originates outside the study area) to seasonal wetlands 2-SW and 3-SW, respectively. 2-SW, 3-SW, and 4-ES have a direct surface connection to the primary tributary 1-ID, which is a tributary to the TNW Sacramento River. Therefore, these ephemeral swales are considered adjacent waters potentially subject to USACE jurisdiction under Section 404 of the CWA.

Table 5. Ephemeral Swales

Feature	Acreage	Linear Feet
2a-ES	0.13	1,894.30
3a-ES	0.09	1,340.30
4-ES	0.03	1,500.03
TOTAL	**0.25**	**4,734.63**
Source: Data compiled by AECOM in 2018		

SEASONAL WETLANDS

Seven seasonal wetlands were identified in the study area (Table 6). The hydrophytic vegetation in these wetlands is described in more detail in Section 3.2.5. For seasonal wetlands where no soil pits were dug, hydric soils were assumed; the soils mapped in all of these wetland areas are listed as hydric. Data forms SP1 and SP3 in Appendix B provide additional information about these seasonal wetland habitats present in the study area. 1a-SW is a large wetland and swale complex in the floodplain of the primary tributary (1-ID), located in the southeastern portion of the study area. Some of the deeper depressional areas supporting obligate species such as cattails and hardstem bulrush still held water at the time of the survey. 2-SW, 3-SW, and 3a-SW were mostly dry at the time of the survey. These wetland features are dominated by facultative perennial rye grass and are situated on flats adjacent to and north of the primary tributary. 3a-SW is located along the toe of a slope adjacent to drainage 3. 2-SW and 3-SW are at drainage bottoms and receive flows from 2a-ES and 3a-ES, respectively. 1b-SW, 1c-SW, and 5-SW are located on a flat at the confluence of 5-ED with 1-ID, and are separated by culverted road crossings. These wetlands were also mostly dry at the time of the survey and are dominated by facultative grasses perennial rye grass and Mediterranean barley.

Table 6. Seasonal Wetlands

Feature	Acreage
1a-SW	31.46
1b-SW	0.06
1c-SW	0.04
2-SW	0.61
3-SW	1.13
3a-SW	0.11
5-SW	0.14
TOTAL	**33.55**
Source: Data compiled by AECOM in 2018	

All of the seasonal wetlands meet the three-parameter criteria of wetlands and all abut or are adjacent to the primary tributary (PS1), which is tributary to the TNW Sacramento River, and are therefore considered adjacent waters. In addition, all of the seasonal wetlands are within 4,000 feet of the OHWM of the primary tributary, a tributary water of the United States, and therefore, all are potentially subject to USACE jurisdiction under Section 404 of the CWA.

4.2 UPLAND FEATURES

Of the 997.19-acre study area, approximately 961.54 acres are composed of potentially nonjurisdictional features (Table 7). These features are likely nonjurisdictional under CWA Section 404 because they are located above the OHWM and lack one or more of the three criteria defining wetlands. The nonjurisdictional habitats are described above in Section 3.2, "Vegetation Communities."

Table 7. Upland Features

Habitats	Acres
Actively Farmed	503.39
Grazed	425.75
Nonnative Annual Grassland	31.16
Riparian	0.11
Ruderal	1.13
TOTAL	**961.54**
Source: Data compiled by AECOM in 2018	

5 JURISDICTIONAL DETERMINATION

The 997.19-acre study area contains a total of approximately 35.65 acres of wetlands and other waters potentially subject to jurisdiction pursuant to Section 404 of the CWA. These comprise approximately 1.00 acre of intermittent drainage tributary, 0.34 acre of ephemeral drainage tributaries, 0.23 acre of perennial swale adjacent waters, 0.28 acre of seasonal swale adjacent waters, 0,25 acre of ephemeral swale and 33.55 acres of seasonal wetland adjacent waters. Approximately 961.54 acres of nonjurisdictional habitats are present in the study area. The results of this delineation of waters of the United States are contingent upon verification by the USACE Sacramento District.

6 REFERENCES

Area West Environmental, Inc. 2017 (July). *Solano Phase 4 Wind Project Preliminary Jurisdictional Determination, Solano County, California*. Prepared for Sacramento Municipal Utility District, Sacramento, CA.

AWE. *See* Area West Environmental, Inc.

Baldwin, B. G., D. H. Goldman, D. J. Keil, R. Patterson, T. J. Rosatti, and D. H. Wilken (eds.). 2012. *The Jepson Manual: Vascular Plants of California, Second Edition.* Berkeley: University of California Press.

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. *Classification of Wetlands and Deepwater Habitats of the United States*. Washington, DC: U.S. Department of the Interior, Fish and Wildlife Service.

Environmental Laboratory. 1987. *Corps of Engineers Wetlands Delineation Manual.* Technical Report Y-87-1. Vicksburg, MS: U.S. Army Engineer Waterways Experiment Station.

EPA. *See* U.S. Environmental Protection Agency.

Google Inc. 2018. Google Earth Pro (Version 7.3). Aerial imagery of Montezuma Hills and Solano Wind Farm, centered at approximately 38.129306, -121.778183 WGS, from June 11, 1993 to February 5, 2018. Mountain View, CA.

Grumbles, B. H., and J. P. Woodley Jr. 2008 (December 2). *Clean Water Act Jurisdiction Following the U.S. Supreme Court's Decision in* Rapanos v. United States *and* Carabell v. United States. Memorandum to U.S. Environmental Protection Agency regions and U.S. Army Corps of Engineers districts. Washington, DC.

Lichvar, R. W., N. C. Melvin, M. L. Butterwick, and W. N. Kirchner. 2012 (July). *National Wetland Plant List Indicator Rating Definitions*. ERDC/CRREL TR-12-1. Hanover, NH: U.S. Army Corps of Engineers, Engineer Research and Development Center, Cold Regions Research and Engineering Laboratory.

Lund, J., Hanak, E, Fleenor, W., Howitt, R., Mount, J., Moyle, P. 2007. *Envisioning Futures for the Sacramento-San Joaquin Delta*. Public Policy Institute of California. San Francisco, CA. Available: https://www.ppic.org/publication/envisioning-futures-for-the-sacramento-san-joaquin-delta/

NRCS. *See* U.S. Natural Resources Conservation Service.

Sawyer, J. O., T. Keeler-Wolf, and J. M. Evens. 2009. *A Manual of California Vegetation, Second Edition*. Sacramento: California Native Plant Society Press.

UCIPM. *See* University of California Statewide Integrated Pest Management Program.

University of California Statewide Integrated Pest Management Program. 2018. California Weather Data, Hastings Cut Station. University of California Agriculture and Natural Resources. Available: http://www.ipm.ucdavis.edu/WEATHER/index.html. Accessed July 24, 2018.

USACE. *See* U.S. Army Corps of Engineers.

U.S. Army Corps of Engineers. 2005 (December 7). *Ordinary High Water Mark Identification*. Regulatory Guidance Letter No. 05-05. Washington, DC.

———. 2007. *U.S. Army Corps of Engineers Jurisdictional Determination Form Instructional Guidebook.* Washington, DC.

———. 2008a. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)*. Ed. J. S. Wakeley, R. W. Lichvar, and C. V. Noble. ERDC/EL TR-08-28. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

______. 2008b. *A Field Guide to the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States. A Delineation Manual* Robert W. Lichvar and Shawn M. McColley. U.S. Army Engineer Research and Development Center.

———. 2012 (August 6). *Final Map and Drawing Standards for the South Pacific Regulatory Program.* Special public notice. Sacramento District. Sacramento, CA.

———. 2016. National Wetland Plant List, Version 3.3. U.S. Army Corps of Engineers, Engineer Research and Development Center, Cold Regions Research and Engineering Laboratory, Hanover, NH. Available: http://wetland-plants.usace.army.mil/. Accessed July 2018.

U.S. Environmental Protection Agency and U.S. Department of the Army. 2015. *Technical Support Document for the Clean Water Rule: Definition of Waters of the United States*. May 27. Available: https://www.epa.gov/sites/production/files/2015-05/documents/technical_support_document_for_the_clean_water_rule_1.pdf.

U.S. Fish and Wildlife Service. 2018. Wetlands Mapper. Available: http://www.fws.gov/wetlands/Data/Mapper.html. Last updated May 1, 2018. Accessed July 24, 2018.

USFWS. *See* U.S. Fish and Wildlife Service.

U.S. Geological Survey. 2018a. The National Map, TNM Viewer. Hydrography and Watershed Boundary data sets. U. S. Department of the Interior. Available: https://viewer.nationalmap.gov/advanced-viewer. Last updated June 26, 2018. Accessed in July 2018.

———. 2018b. USGS Historical Topographic Map Explorer. Jersey 1910, Jersey Island 1952, and Sacramento 1947. Available: http://historicalmaps.arcgis.com/usgs/ Accessed in October 2018.

USGS. *See* U.S. Geological Survey

U.S. Natural Resources Conservation Service. 2017a. Web Soil Survey (Version 3.3). Available: http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm. Accessed July 24, 2018.

———. 2017b. *Field Indicators of Hydric Soils in the United States: A Guide for Identifying and Delineating Hydric Soils*, Version 8.1. In cooperation with the National Technical Committee for Hydric Soils. Washington, DC.

———. 2018a. National Hydric Soils List. Query by Soil Survey Area: Solano County. Available: http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/use/hydric/. Accessed July 24, 2018.

———. 2018b. Official Soil Series Descriptions. Available: http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/soils/survey/class/data/?cid=nrcs142p2_053587. Accessed July 24, 2018.

Vepraskas, M. J. 1992. *Redoximorphic Features for Identifying Aquic Conditions.* Technical Bulletin 301. Raleigh: North Carolina State University, North Carolina Agricultural Research Service.

Western Regional Climate Center. 2018. Climatological Summary. Station: Rio Vista, Rio Vista, CA. Period of Record: February 1, 1893, to May 31, 1977. Available: https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca7446. Accessed July 24, 2018.

WRCC. *See* Western Regional Climate Center.

APPENDIX A

Wetland Delineation Data Forms

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Solano Wind Farm Phase IV, West | City/County: Solano County | Sampling Date: 4/24/18

Applicant/Owner: Sacramento Municipal Utility District | State: CA | Sampling Point: SP1

Investigator(s): K. Asmus and J. Broberg | Section, Township, Range: Unsectioned, Range 2E, Township 3N

Landform (hillslope, terrace, etc.): Valley flat | Local relief (concave, convex, none): None | Slope (%): 2%

Subregion (LRR): C - Mediterranean California | Lat: 38.113751 | Long: -121.760212 | Datum: WGS84

Soil Map Unit Name: Diablo-Ayar clays, 9 to 30 percent slopes, eroded | 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:

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	%		
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:	%		
Herb Stratum			
1. *Horduem marinum ssp. gussoneanum*	40	Yes	FAC
2. *Festuca perennis*	26	Yes	FAC
3. *Rumes pulcher*	3	No	FAC
4. *Lythrum hyssopifolium*	1	No	OBL
5.			
6.			
7.			
8.			
Total Cover:	70 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum 30 % | % Cover of Biotic Crust %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	2	(A)
Total Number of Dominant Species Across All Strata:	2	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100.0 %	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	1	x 1 =	1
FACW species		x 2 =	0
FAC species	69	x 3 =	207
FACU species		x 4 =	0
UPL species		x 5 =	0
Column Totals:	70 (A)		208 (B)

Prevalence Index = B/A = 2.97

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.

Hydrophytic Vegetation Present? Yes (●) No ( )

Remarks: Wetland is where a draw between hills flattens and widens to meet valley. Sample point is on edge of wetland and area appears to have been tilled periodically in the past though was too wet and was avoided this year.

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SOIL

Sampling Point: SP1

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[3]	Remarks
0-12"	10YR 3/1	98	10YR 5/6	2%	C	PL	clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.
[3]Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

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[4]:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? **Yes** ◉ **No** ○

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ 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 Plowed Soils (C6)
- ☐ 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)
- ☐ Thin Muck Surface (C7)
- ☐ 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:

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WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Solano Wind Farm Phase IV, West City/County: Solano County Sampling Date: 4/24/18

Applicant/Owner: Sacramento Municipal Utility District State: CA Sampling Point: SP2

Investigator(s): K. Asmus and J. Broberg Section, Township, Range: Unsectioned, Range 2E, Township 3N

Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): none Slope (%): 5%

Subregion (LRR): C - Mediterranean California Lat: 38.113804 Long: -121.760258 Datum: WGS84

Soil Map Unit Name: Diablo, Ayar clays, 9 to 30 percent slopes, eroded 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:

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	%		
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:	%		
Herb Stratum			
1. *Festuca perennis*	55	Yes	FAC
2. *Hordeum marinum ssp. gussoneanum*	15	No	FAC
3. *Erodium moschatum*	2	No	Not Listed
4. *Lepidium latifolium*	5	No	FAC
5. *Lactuca seriola*	3	No	FACU
6. *Medicago polymorpha*	5	No	FACU
7.			
8.			
Total Cover:	85 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum 15 % % Cover of Biotic Crust %

Remarks:

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: 100.0 % (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species		x 2 =	0
FAC species	75	x 3 =	225
FACU species	8	x 4 =	32
UPL species	2	x 5 =	10
Column Totals:	85 (A)		267 (B)

Prevalence Index = B/A = 3.14

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.

Hydrophytic Vegetation Present? Yes (●) No ( )

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Arid West - Version 11-1-2006

SOIL

Sampling Point: SP2

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[3]	Remarks
0-12	10YR 3/1	98	10YR 3/2	2%	C	M	silty clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.
[3]Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

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[4]:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? **Yes** ◉ **No** ○

Remarks: Sample point soil fits indicator F6 and is within and near the edge of the area regularly tilled for dryland farming. Redox features here are spotty, not diffuse, while soils in location closer to the untilled low areas show hydrology indicator C6.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ 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 Plowed Soils (C6)
- ☐ 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)
- ☐ Thin Muck Surface (C7)
- ☐ 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 paired upland to SP1. Point is upslope of the edge of the wetland.

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Arid West - Version 11-1-2006

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Solano Wind Farm Phase IV, West | City/County: Solano County | Sampling Date: 4/24/18

Applicant/Owner: Sacramento Municipal Utility District | State: CA | Sampling Point: SP3

Investigator(s): K. Asmus and J. Broberg | Section, Township, Range: Unsectioned, Range 2E, Township 3N

Landform (hillslope, terrace, etc.): Valley flat | Local relief (concave, convex, none): None | Slope (%): 2%

Subregion (LRR): C - Mediterranean California | Lat: 38.114228 | Long: -121.761049 | Datum: WGS84

Soil Map Unit Name: Diablo, Ayar clays, 9 to 30 percent slopes, eroded | 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:

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	%		
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:	%		
Herb Stratum			
1. *Festuca perennis*	70	Yes	FAC
2. *Hordeum marinum ssp. gussoneanum*	10	No	FAC
3. *Polygonum aviculare*	7	No	FAC
4. *Medicago polymorpha*	3	No	FACU
5.			
6.			
7.			
8.			
Total Cover:	90 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum 10 % | % Cover of Biotic Crust %

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: 100.0 % (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 = 0
FACW species		x 2 = 0
FAC species	87	x 3 = 261
FACU species	3	x 4 = 12
UPL species		x 5 = 0
Column Totals:	90 (A)	273 (B)

Prevalence Index = B/A = 3.03

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.

Hydrophytic Vegetation Present? **Yes** (●) **No** ( )

Remarks: Wetland is in relatively flat area at base of hill and adjacent to RPW in valley bottom.

US Army Corps of Engineers

Arid West - Version 11-1-2006

SOIL

Sampling Point: SP3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture[3]	Remarks
0-12	10YR3/1	98	10YR/5/6	2	C	PL	Clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.
[3]Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

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[4]:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):
Type:
Depth (inches):

Hydric Soil Present? **Yes** ◉ **No** ○

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ 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 Plowed Soils (C6)
- ☐ 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)
- ☐ Thin Muck Surface (C7)
- ☐ 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 low part of flat at toe of a slope, outside of tilled area.

US Army Corps of Engineers

Arid West - Version 11-1-2006

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Solano Wind Farm Phase IV City/County: Solano County Sampling Date: 04/24/2018

Applicant/Owner: Sacramento Municipal Utility District State: CA Sampling Point: SP4

Investigator(s): K. Asmus and J. Broberg Section, Township, Range: Unsectioned, Range 2E, Township 3N

Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): None Slope (%): 3%

Subregion (LRR): C - Mediterranean California Lat: 38.114257 Long: -121.761002 Datum: WGS84

Soil Map Unit Name: Diablo, Ayar clays, 9 to 30 percent slopes, eroded 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:

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	%		
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:	%		
Herb Stratum			
1. *Festuca perennis*	50	Yes	FAC
2. *Hordeum marinum ssp. gussoneanum*	20	Yes	FAC
3. *Convolvulus arvensis*	10	No	Not Listed
4. *Medicago polymorpha*	5	No	FACU
5.			
6.			
7.			
8.			
Total Cover:	85 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum 15 % % Cover of Biotic Crust %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0 % (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species		x 2 =	0
FAC species	70	x 3 =	210
FACU species	5	x 4 =	20
UPL species	10	x 5 =	50
Column Totals:	85 (A)		280 (B)

Prevalence Index = B/A = 3.29

Hydrophytic Vegetation Indicators:

- [x] 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.

Hydrophytic Vegetation Present? Yes (●) No ( )

Remarks:

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SOIL

Sampling Point: SP4

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[3]	Remarks
0-10	10YR 3/1	99	10YR 3/2	1	C	M	silty clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.
[3]Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

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[4]:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? **Yes** ○ **No** ◉

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ 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 Plowed Soils (C6)
- ☐ 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)
- ☐ Thin Muck Surface (C7)
- ☐ 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):

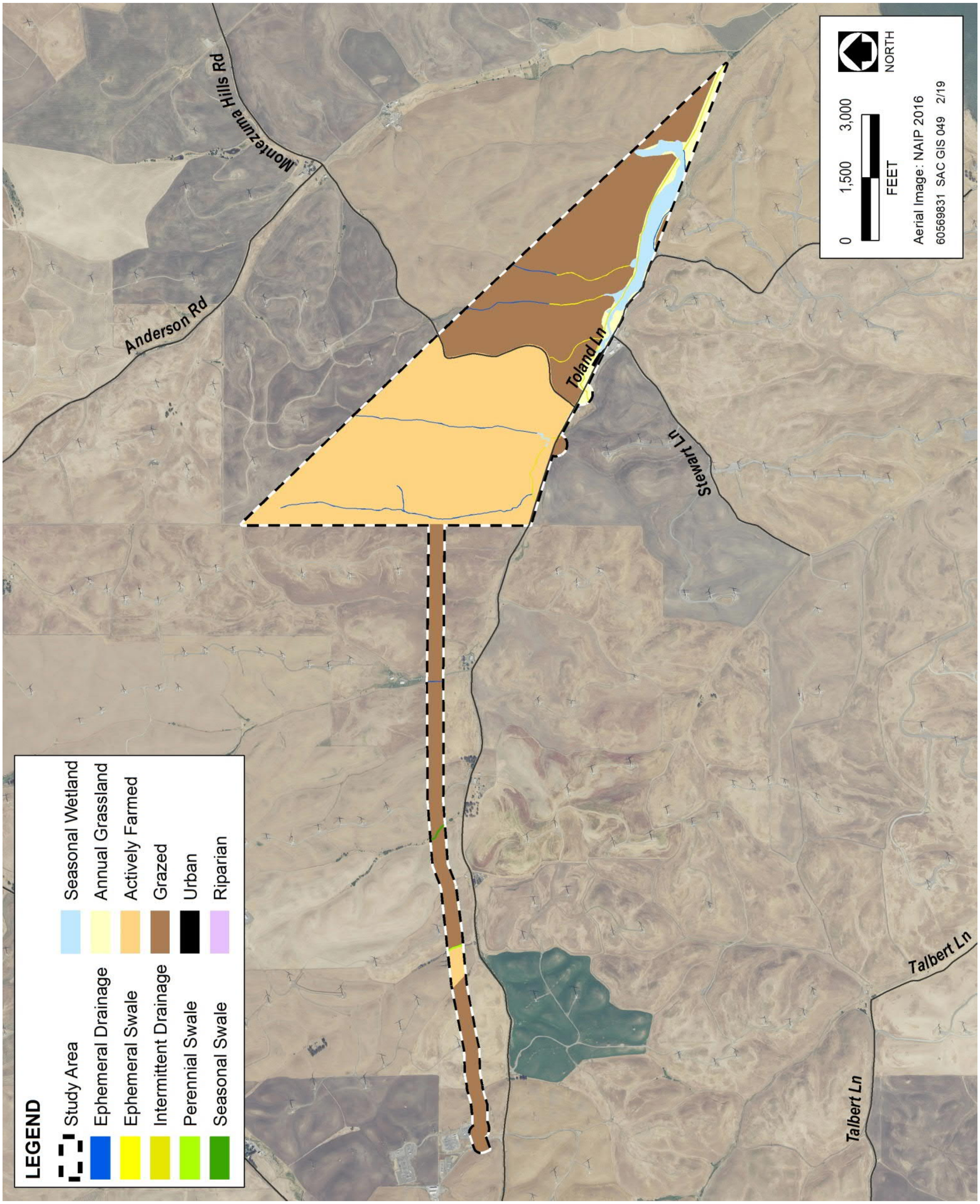
Wetland Hydrology Present? **Yes** ○ **No** ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Sample point is paired upland to SP3. Point is upslope of the edge of the wetland.

APPENDIX B

Habitat Map



Appendix B Habitat Map

APPENDIX C

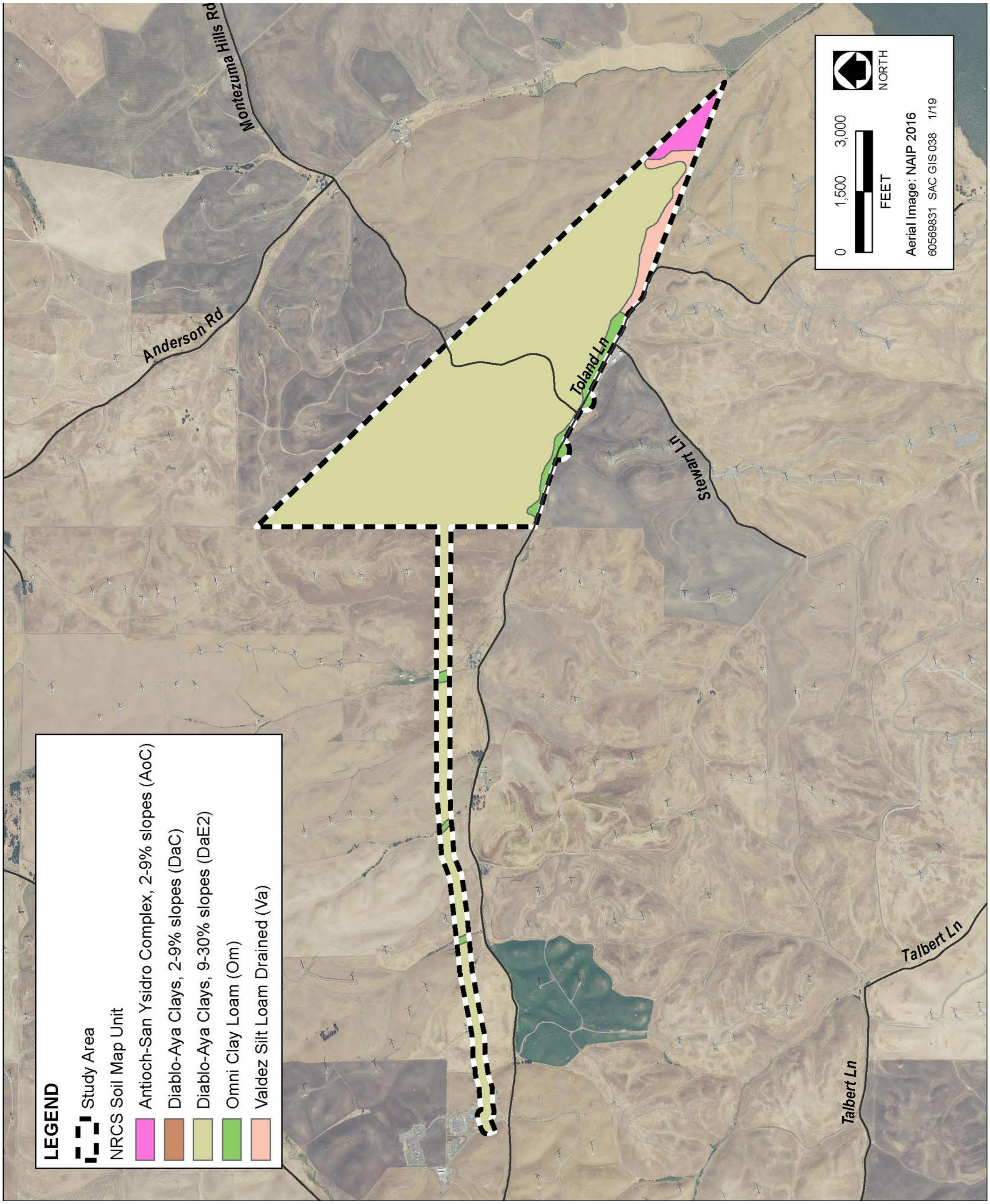
Plant Species Observed

Scientific Name (=NWPL)	Common Name	Wetland Indicator Status
Achyrachaena mollis	blow wives	FAC
Amsinckia intermedia	common fiddleneck	NL
Asclepias fascicularis	narrow-leaf milkweed	FAC
Avena barbata	slender wild oat	NL
Bellardia trixago	Mediterranean linseed	NL
Brassica nigra	black mustard	NL
Bromus diandrus	ripgut grass	NL
Bromus hordeaceus	soft chess	FACU
Bromus madritensis ssp. *rubens*	red brome	UPL
Calandrinia menziesii (=C. ciliata)	red maids	FACU
Capsella bursa-pastoris	shepherd's purse	FACU
Carduus pycnocephalus	Italian thistle	NL
Castilleja exserta ssp. *exserta*	purple owl's clover	NL
Centaurea calcitrapa	purple star-thistle	NL
Centaurea solstitialis	yellow star-thistle	NL
Chenopodium sp.	chenopodium	NL
Cirsium vulgare	bull thistle	FACU
Convolvulus arvensis	field bindweed	NL
Cotula coronopifolia	brass-buttons	OBL
Cynara cardunculus	cardoon	NL
Distichlis spicata	salt grass	FAC
Elymus caput-medusae	medusa head	NL
Elymus glaucus	blue wildrye	FACU
Erodium cicutarium	redstem filaree	NL
Erodium moschatum	greenstem filaree	NL
Eschscholzia californica	California poppy	NL
Eucalyptus sp.	eucalyptus	NL
Festuca perennis (=Lolium perenne)	rye grass	FAC
Ficus carica	edible fig	FACU
Foeniculum vulgare	fennel	NL
Frankenia salina	alkali heath	FACW
Geranium dissectum	wild geranium	NL
Helminthotheca echioides	bristly ox-tongue	FAC
Hirschfeldia incana	mustard	NL
Hordeum brachyantherum	meadow barley	FACW
Hordeum jubatum ssp. *jubatum*	foxtail barley	FAC
Hordeum marinum ssp. *gussoneanum*	Mediterranean barley	FAC
Hordeum murinum ssp. *leporinum*	hare barley	FACU
Juncus mexicanus	Mexican rush	FACW
Lactuca serriola	prickly lettuce	FACU
Lepidium latifolium	perennial pepperweed	FAC
Lysimachia arvensis	scarlet pimpernel	FAC
Lythrum hyssopifolia	hyssop loosestrife	OBL

Scientific Name (=NWPL)	Common Name	Wetland Indicator Status
Malva nicaeensis	bull mallow	NL
Malva parviflora	cheeseweed	NL
Malvella leprosa	alkali mallow	FACU
Marah sp.	man root	NL
Medicago polymorpha	California burclover	FACU
Melilotus indicus	sourclover	FACU
Microseris sp.	microseris	NL
Phacelia cf. *ciliata*	Great Valley phacelia	NL
Plantago lanceolata	English plantain	FAC
Polygonum aviculare ssp. *depressum*	prostrate knotweed	FAC
Prunus sp.	plum	NL
Rubus armeniacus	Himalayan blackberry	FAC
Rumex crispus	curly dock	FAC
Rumex pulcher	fiddle dock	FAC
Salix lasiolepis	arroyo willow	FACW
Schoenoplectus californicus	southern bulrush	OBL
Silybum marianum	milk thistle	NL
Tamarix sp.	tamarisk	FAC
Torilis nodosa	short sock-destroyer	NL
Tragopogon porrifolius	salsify, oyster plant	NL
Triteleia laxa	Ithuriel's spear	NL
Triticum aestivum	common wheat	NL
Veronica persica	Persian speedwell	NL
Vicia sativa	spring vetch	FACU
Xanthium strumarium	cocklebur	FAC

APPENDIX D

Soils Map



Compiled by: AECOM 2018

Appendix D Soils Map

APPENDIX E

Representative Photographs

Photo 1: Slopes within the Solano 4 East parcel were disked prior to the April 2018 survey. Annual grassland and ruderal vegetation occupied roadsides and un-disked areas.

Photo 2: View northeast of seasonal wetland (SW) 2 occupying a flat at the bottom of drainage 2.

Photo 3: View west of SW1c. Vegetation break is visible in center of photo.

Photo 4: View southeast of SW1c as it narrows and transitions to 1e-ID in upper left of photo.

Photo 5:. View of typical ephemeral drainage as it transitions to ephemeral swale in upper right of photo.

Photo 6: View north of 9-PS from south of the study area boundary.

Photo 7: View west along 1a-ID.

Photo 8:. View east along 1a-ID.