Miner Slough Bridge Project

Natural Environment Study

Caltrans District 04

State Route 84

Solano County, California

04-SOL-84 PM 12.1/12.2

EA 04-0G660/ID 0400000343

September 2015

For individuals with sensory disabilities, this document can be made available in Braille, large print, on audiocassette, or computer disk. To obtain a copy in one of these alternate formats, please call or write to Caltrans, Attn: Christopher States, District 4, 111 Grand Avenue, Oakland CA 94612; (510) 286-7185 Voice, or use the California Relay Service TTY number, (800) 735-2929.

Natural Environment Study

Miner Slough Bridge Project

Caltrans District 04

State Route 84

Solano County, California

04-SOL-084-PM 12.1/12.2

EA 04-0G660/ID 0400000343

September 2015

Prepared By: _____ Date: 9/22/2015

Chris Herbst, Biologist
(707) 287-5305
CH2M HILL, Inc.
Oakland, CA

Recommended for Approval By: _____ Date: 9/22/2015

David Lundgren
(510) 587-7663
CH2M HILL, Inc.
Oakland, CA

Approved By: _____ Date: 9.22.15

Christopher States, District Environmental Branch Chief
(510) 286-7185
Office of Biological Sciences and Permits
District 04, Oakland
California Department of Transportation

Summary

The California Department of Transportation (Caltrans) proposes to repair or replace the existing bridge on State Route (SR) 84 over Miner Slough (Miner Slough Bridge Project [Project]). The Project proposes two alternatives for the bridge based on a current planning study. The first is to build a new swing-span bridge approximately 100 feet (ft) west of the existing alignment. The second alternative is to rehabilitate the existing bridge. The bridge is approximately 30 miles southwest of Sacramento, California at post mile (PM) 12.1/12.2, connecting Ryer Island in the Sacramento-San Joaquin River Delta (Delta) to the mainland over Miner Slough. SR 84 traverses the Delta area as a levee road. It is a north-south, two-lane conventional highway that runs adjacent to agricultural, as well as limited residential, commercial, and industrial, land.

The purpose of the Project is to maintain connectivity to and from Ryer Island via the Miner Slough Bridge on SR 84. The proposed new bridge would be constructed on a new alignment, approximately 100 ft to the west of the existing bridge, with improvements such as standard width lanes and shoulders, and standard vertical clearance; also, each end of the bridge would flare out, providing extra width for truck-turning movements. Proposed construction access includes building a temporary marine trestle and permanent widening and realignment of an approximately 250-foot-long section of SR 84 north of the proposed bridge to conform to Holland Road.

The biological study area (BSA) for the Project includes the area within the project limits (Caltrans right-of-way and some adjacent private lands proposed to be used through construction easements) along SR 84 between PM 12.1 and 12.2, plus a 200-ft buffer. The BSA consists of a roughly rectangular area of approximately 33 acres associated with the slough, banks, and riparian areas, plus SR 84 and adjacent ruderal vegetation located just north of the Miner Slough Bridge. The BSA is located in the Delta subsection of the Great Valley subregion (Miles and Goudey 1997). This region is characterized by a low, level plain at the confluence of the Sacramento River and Miner Slough. Numerous levees have been constructed throughout the region to reclaim lands for agricultural production. Elevations are generally around sea level, but decomposition of organic matter has resulted in subsidence of areas within the levees.

Preliminary biological technical studies were conducted for the Project, and include the following:

- A special-status plant survey
- A tree inventory
- A preliminary determination of jurisdictional waters
- A wildlife habitat assessment
- A giant garter snake (GGS) survey
- A valley elderberry longhorn beetle (VELB) habitat assessment
- A hydro-acoustic analysis

Resource Impact Summary

The Project would result in both temporary and permanent impacts to the following resources:

- Potentially jurisdictional wetlands and other waters of the United States
- VELB (*Desmocerus californicus dimorphus*), federal threatened
- Delta smelt (*Hypomesus transpacificus),* federal threatened/state endangered
- Longfin smelt (*Spirinchus thaleichthys*), federal candidate/state threatened
- Central Valley steelhead (*Onchorhynchus mykiss*), federal threatened
- Sacramento River winter-run chinook salmon (*Oncorhynchus tshawytscha*), federal endangered/state endangered
- Central Valley spring-run chinook salmon (*Oncorhynchus tshawytscha*), federal threatened/state threatened
- Green sturgeon (*Acipenser medirostris*), federal threatened
- Giant garter snake (*Thamnophis gigas*), federal threatened/state threatened

- Swainson's hawk (*Buteo swainsonii*), state threatened
- California Native Plant Society (CNPS)-listed plant species:
  - Sanford's arrowhead (*Sagittaria sanfordii*), List 1B.2
  - Woolly rose-mallow (*Hibiscus lasiocarpus* var. *occidentalis*), List 1B.2

Table S-1 summarizes anticipated temporary and permanent impacts to these species.

Table S-1 Temporary and Permanent Impacts to Potentially Jurisdictional Features and Listed Species

Resource	Temporary Impacts (acres) Alternative 1 Replacement	Permanent Impacts (acres) Alternative 1 Replacement	Total Impacts (acres) Alternative 1 Replacement	Temporary Impacts (acres) Alternative 2 Rehabilitation	Permanent Impacts (acres) Alternative 2 Rehabilitation	Total Impacts (acres) Alternative 2 Rehabilitation
Potentially jurisdictional wetland	0.016	0.019	**0.035**	0.016	-	**0.016**
Potentially jurisdictional other waters of the United States	0.018	0.020	**0.038**	0.18	-	**0.18**
VELB	-	-	**-**	-	-	**-**
Delta smelt[a]	0.18	0.20	**0.38**	0.18	-	**0.18**
Longfin smelt[a]	0.18	0.20	**0.38**	0.18	-	**0.18**
Central Valley steelhead[b]	0.18	0.20	**0.38**	0.18	-	**0.18**
Sacramento River winter-run chinook salmon[b]	0.18	0.20	**0.38**	0.18	-	**0.18**
Central Valley spring-run chinook salmon[b]	0.18	0.20	**0.38**	0.18	-	**0.18**
Green sturgeon[b]	0.18	0.20	**0.38**	0.18	-	**0.18**
Giant garter snake	0.36	0.10	**0.46**	0.02	0.17	**0.19**
Swainson's hawk	2.40	1.10	**3.50**	1.0	0.46	**1.46**
Sanford's arrowhead[c]	0.004	-	**0.004**	0.008	-	**0.008**
Woolly rose-mallow[c]	0.004	-	**0.004**	0.008	-	**0.008**

Notes:

[a] Shading impact is a result of net increase in shade from the new bridge.

[b] Because of removal of the existing bridge, there will be a net increase of 0.12 acre of aquatic habitat.

[c] Impact resulting from direct shading from the new bridge.

As a result of project activities of Alternative 1, a total of 43 trees of various species greater than 4 inches in diameter at breast height (DBH) will be impacted (see Figure 4-17 in Section 4). Alternative 2 would require impacting a total of 28 trees of various species greater than 4 inches DBH (see Figure 4-18 in Section 4).

Table S-2 summarizes the determinations Caltrans has made for the following federal and state listed species.

Table S-2 Project Determinations to Listed Species and Critical Habitat

Resource	Status[a, b]	Determination
VELB	FT/-/CH	May affect, not likely to adversely affect. No effect to designated critical habitat.
Delta smelt	FT/SE/CH	May affect, not likely to adversely affect. Will not adversely modify or destroy designated critical habitat.
Longfin smelt	FC/ST	May affect, not likely to adversely affect.
Central Valley steelhead	FT/-/CH	Likely to adversely affect, but not jeopardize. Will not adversely modify or destroy designated critical habitat.
Sacramento River winter-run chinook salmon	FE/SE/CH/EFH	May affect, not likely to adversely affect. No effect to designated critical habitat. Temporary and minimal adverse effects to essential fish habitat.
Central Valley spring-run chinook salmon	FT/ST/CH/EFH	May affect, not likely to adversely affect. Will not adversely modify or destroy designated critical habitat. Temporary and minimal adverse effects to essential fish habitat.
Green sturgeon	FT/-/CH	Likely to adversely affect, but not jeopardize. Will not adversely modify or destroy designated critical habitat.
Giant garter snake	FT/ST	May affect, not likely to adversely affect.
Swainson's hawk	-/ST	Less than significant, with mitigation incorporated.
Tricolored blackbird	-/SE	No impact.
Sanford's arrowhead	-/-/1B.2	Less than significant impact.
Woolly rose-mallow	-/-/1B.2	Less than significant impact.

Table S-2 Project Determinations to Listed Species and Critical Habitat

Resource	Status[a, b]	Determination

Notes:
CDFW = California Department of Fish and Wildlife
NMFS = National Marine Fisheries Service
USFWS = U.S. Fish and Wildlife Service
[a] USFWS, NMFS, and CDFW designations:
C= Candidate species
CH = Critical Habitat
EFH = Essential Fish Habitat
FE = Federal Endangered
FT = Federal Threatened
SE = State Endangered
ST = State Threatened
[b] CNPS designations:
1B = Plants rate, threatened, or endangered in California or elsewhere
0.2 = Fairly threatened in California (20-80% occurrences threatened/moderate degree and immediacy of threat)

Avoidance and Minimization Measures

General and species-specific avoidance and minimization efforts will be implemented to reduce potential effects to potentially jurisdictional features and to special-status species. These measures will include minimizing the area of impact; implementing a ground disturbance work window to avoid Swainson's hawk; implementing an in-water pile-driving work window to avoid Delta and longfin smelt, steelhead, chinook salmon, and green sturgeon; implementing an environmental education program for construction personnel; conducting preconstruction surveys for special-status species and nesting birds; delineating the work area and environmentally sensitive areas (ESAs) with fencing; presence of an onsite biological monitor during designated periods; presence of hydro-acoustic monitors during designated periods; and other construction site best management practices (BMPs).

Regulatory Setting

The following permits and agreements from regulatory agencies are anticipated for this Project:

- Biological Opinion from U.S. Fish and Wildlife Service (USFWS)
- Biological Opinion from National Marine Fisheries Service (NMFS)

- Incidental Take Permit and Streambed Alteration Agreement from California Department of Fish and Wildlife (CDFW)
- Section 10 Rivers and Harbors Act Authorization and Section 404 Nationwide Permit from the U.S. Army Corps of Engineers (USACE)
- Section 401 Water Quality Certification from the Central Valley Regional Water Quality Control Board (Central Valley RWQCB)
- Bridge Permit from the U.S. Coast Guard (USCG)

Mitigation

As required by the federal Endangered Species Act (FESA), Caltrans will implement reasonable and prudent measures to minimize and avoid take of listed species. Pursuant to the procedures of the California Environmental Quality Act (CEQA), Caltrans has assessed the Project's potential to impact species designated as candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by CDFW, NMFS, or USFWS. To reduce the potential for adverse impacts, Caltrans will propose a mitigation component to offset any adverse impacts caused by the Project. Caltrans proposes that compensatory mitigation in the form of habitat restoration and preservation will be provided at a 1.1:1 ratio of mitigation acreage to impact acreage for temporary habitat impacts of 1 year, a 2:1 ratio of for impacts lasting 2 years, and a 3:1 ratio for permanent habitat impacts lasting 3 years or more to the following resources: wetlands/waters, delta and longfin smelt, giant garter snake, and Swainson's hawk. Potential mitigation opportunities include the Liberty Island Mitigation Bank, Burke Ranch Conservation Bank, and Elsie Gridley Mitigation Bank.

Mitigation for temporary impacts will be accomplished through restoration onsite. Some elements of onsite restoration include the obliteration and revegetation of the existing SR 84 pavement along the northern project limits, revegetating staging areas and temporary work areas, and removal of temporary marine trestles.

Removal of the existing bridge's in-water piers and shading would result in a net increase of 0.12 acre of aquatic habitat and will have a beneficial impact on the aquatic habitat.

Table of Contents

Summary ..... **v**
List of Abbreviated Terms ..... **xv**
Chapter 1 **Introduction** **1-1**
1.1 Purpose and Need 1-1
1.1.1 Purpose 1-1
1.1.2 Need 1-2
1.2 Project Description 1-2
1.2.1 Alternative 1- Bridge Replacement 1-7
1.2.2 Alternative 2- Bridge Rehabilitation 1-16
1.2.3 No-Build (No-Action) Alternative 1-21
1.2.4 Alternatives Considered but Eliminated from Further Discussion 1-21
Chapter 2 **Study Methods** **2-1**
2.1 Regulatory Requirements 2-1
2.2 Database and Literature Review 2-2
2.3 Technical Studies 2-5
2.3.1 Jurisdictional Wetland Delineation 2-5
2.3.2 Rare Plant Surveys 2-5
2.3.3 Valley Elderberry Longhorn Beetle Habitat Assessment 2-6
2.3.4 Giant Garter Snake Habitat Assessment 2-6
2.3.5 Swainson's Hawk Survey 2-6
2.3.6 Hydro-acoustic Modeling 2-7
2.3.7 Tree Survey 2-7
2.4 Survey Dates and Personnel 2-7
2.5 Agency Coordination and Professional Contacts 2-7
2.6 Limitations that May Influence Results 2-8
Chapter 3 **Environmental Setting** **3-1**
3.1 Biological Study Area 3-1
3.2 Physical and Biological Conditions in the Biological Study Area 3-1
3.2.1 Physical Conditions 3-1
3.2.2 Biological Conditions 3-2
3.3 Regional Species and Habitats of Concern 3-6
Chapter 4 **Results: Biological Resources, Discussion of Impacts, and Mitigation** **4-1**
4.1 General Avoidance and Minimization Measures 4-1
4.2 Natural Communities of Special Concern 4-8
4.2.1 Wetlands and Other Waters of the United States 4-8
4.3 Special-status Plant Species 4-10
4.3.1 Sanford's Arrowhead 4-13
4.3.2 Woolly Rose-mallow 4-14
4.4 Special-status Wildlife Species Occurrences 4-24
4.4.1 Delta Smelt 4-24
4.4.2 Longfin Smelt 4-39
4.4.3 Central Valley Spring-run Chinook Salmon 4-42
4.4.4 Sacramento River Winter-run Chinook Salmon 4-46
4.4.5 Central Valley Steelhead 4-49
4.4.6 Southern DPS North American Green Sturgeon 4-53
4.4.7 Giant Garter Snake 4-56
4.4.8 Swainson's Hawk 4-67

4.4.9 Migratory Birds 4-73
Chapter 5 **Permits, Laws, Regulations, and Conclusions....5-1**
5.1 Regulatory Requirements 5-1
5.2 Federal Endangered Species Act Consultation Summary 5-1
5.3 California Endangered Species Act Consultation Summary 5-1
5.4 Wetlands and Other Waters Coordination Summary 5-1
5.5 Migratory Bird Treaty Act 5-2
Chapter 6 **References....6-1**

List of Figures

Figure 1-1 Project Vicinity 1-3
Figure 1-2 Project Location 1-5
Figure 1-3 Replacement Alternative Project Components 1-9
Figure 1-4 Rehabilitation Alternative Project Components 1-17
Figure 2-1 California Natural Diversity Database (CNDDB) Occurrences Within 5 Miles of BSA 2-3
Figure 3-1 Habitat Types within the Biological Study Area 3-3
Figure 4-1 Impacts to Potential Wetlands and Other Waters Replacement Alternative 4-3
Figure 4-2 Impacts to Potential Wetlands and Other Waters Rehabilitation Alternative 4-11
Figure 4-3 Impacts to Special-status Plant Species Replacement Alternative 4-15
Figure 4-4 Impacts to Special-status Plant Species Rehabilitation Alternative 4-17
Figure 4-5 Impacts to Valley Elderberry Longhorn Beetle Replacement Alternative 4-19
Figure 4-6 Impacts to Valley Elderberry Longhorn Beetle Rehabilitation Alternative 4-21
Figure 4-7 Biological Study Area Including 183 dB Cumulative SEL Replacement Alternative 4-27
Figure 4-8 Biological Study Area Including 187 dB Cumulative SEL Replacement Alternative 4-29
Figure 4-9 Fisheries Impacts Replacement Alternative 4-35
Figure 4-10 Fisheries Impacts Rehabilitation Alternative 4-37
Figure 4-11 Giant Garter Snake Habitat Replacement Alternative 4-63
Figure 4-12 Giant Garter Snake Habitat Rehabilitation Alternative 4-65
Figure 4-13 Swainson's Hawk Habitat Impacts Replacement Alternative 4-69
Figure 4-14 Swainson's Hawk Habitat Impacts Replacement Alternative 4-71
Figure 4-15 Tree Survey and Impacts Replacement Alternative 4-75
Figure 4-16 Tree Survey and Impacts Rehabilitation Alternative 4-77

List of Tables

Table S-1 Temporary and Permanent Impacts to Potentially Jurisdictional Features and Listed Species vii
Table S-2 Project Determinations to Listed Species and Critical Habitat viii
Table 1-1 New Bridge Piers and Foundations 1-8

Table 2-1 Survey Dates and Personnel 2-7
Table 3-1 Special-Status Plant Species and Critical Habitat Potentially Occurring or Known to Occur in the Biological Study Area and Vicinity 3-7
Table 3-2 Special-Status Wildlife Species and Critical Habitat Potentially Occurring or Known to Occur in the Biological Study Area and Vicinity 3-10
Table 4-1 Results of Hydro-acoustic Analysis 4-31

List of Appendices

Appendix A Preliminary Project Construction and Drainage Plans

Appendix B USFWS, CNPS, and CNDDB Species Lists

Appendix C Delineation of Wetlands and Other Waters of the United States

Appendix D Special-Status Plant Surveys

Appendix E Valley Elderberry Longhorn Beetle Habitat Assessment

Appendix F Giant Garter Snake Survey

Appendix G Analysis of Potential Underwater Construction Noise

List of Abbreviated Terms

AC	asphalt concrete
AMM	avoidance and minimization measure
BMP	best management practice
BSA	biological study area
Caltrans	California Department of Transportation
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act of 1984
CFR	Code of Federal Regulations
CISS	cast-in-steel-shell
cm	centimeter(s)
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
CWA	Clean Water Act
dB	decibel(s)
DBH	diameter at breast height
Delta	Sacramento-San Joaquin River Delta
DPS	Distinct Population Segment
DWR	California Department of Water Resources
EFH	Essential Fish Habitat
ESA	environmentally sensitive area
ESU	Evolutionary Significant Unit
°F	degree(s) Fahrenheit
Fed. Reg.	Federal Register
FESA	federal Endangered Species Act
FE	Federal Endangered
F.G.C.	Fish and Game Code
FT	Federal Threatened

ft	foot/feet
GGS	giant garter snake
MBTA	Migratory Bird Treaty Act
NEPA	National Environmental Policy Act
NES	Natural Environment Study
NMFS	National Marine Fisheries Service
NPPA	Native Plant Protection Act of 1977
NRCS	Natural Resources Conservation Service
NWI	National Wetlands Inventory
PDT	project development team
PFMC	Pacific Fisheries Management Council
PM	post mile
ppt	part(s) per thousand
Project	Miner Slough Bridge Project
PS&E	plans, specifications, and estimates
RC	reinforced concrete
RM	river mile
RMS	root mean square
ROW	right-of-way
RSP	rock slope protection
RWQCB	Regional Water Quality Control Board
SEL	sound exposure level
SE	State Endangered
ST	State Threatened
SR	State Route
SRWRCS	Sacramento River winter-run Chinook salmon
SSC	State Species of Special Concern
SWH	shallow water habitat
SWPPP	Storm Water Pollution Prevention Plant
TMP	Traffic Management Plan

USACE	U.S. Army Corps of Engineers
U.S.C.	U.S. Code
USCG	U.S. Coast Guard
USDA	United States Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VELB	valley elderberry longhorn beetle
WRCC	Western Regional Climate Center

Chapter 1 Introduction

The California Department of Transportation (Caltrans) proposes to repair or replace the existing Miner Slough Bridge (Bridge No. 23-0035) to address deterioration and meet design standards. The Miner Slough Bridge Project (Project) is located approximately 13 miles north of Rio Vista in Solano County, California, along State Route (SR) 84 between post mile (PM) 12.1 and 12.2, and connects Ryer Island to the mainland over Miner Slough (Figure 1-1 and Figure 1-2). Two alternatives are proposed to either repair or replace the Miner Slough Bridge. In the first alternative, Caltrans proposes to replace the existing bridge over Miner Slough with a new bridge approximately 100 feet (ft) west of the existing bridge. The second alternative is to rehabilitate the existing bridge. The bridge would have three new approach spans with new foundations, and substructure work would be done at the center swing span pier and replacement of its deck. Both alternatives would result in impacts to Miner Slough and natural habitat along SR 84.

The project limits include the Caltrans right-of-way (ROW) and the temporary construction easements for the Project. The biological study area (BSA) is the area that the proposed project's activities may directly or indirectly affect, and extends beyond the project limits where specific construction actions occur. This has been defined as a 200-ft buffer around the project limits.

The purpose of this Natural Environment Study (NES) is to provide technical information to determine the extent to which the proposed project may affect special-status species, wetlands and other waters of the United States, and protected natural plant communities. The NES presents technical information with which later decisions regarding project impacts can be made.

1.1 Purpose and Need

1.1.1 Purpose

The purpose of the Project is to repair or replace the existing deficient Miner Slough Bridge on SR 84 to and from Ryer Island in order to improve the seismic, safety, and operational designs to meet current standards; to maintain current vehicular capacity; to avoid further deterioration of the existing structure (including bridge pier footings); and to avoid maintenance efforts and costs currently associated with upkeep of the existing bridge.

In Alternative 1, the existing Miner Slough Bridge structure would be replaced with a bridge constructed on a new alignment with improvements such as standard lane and shoulder widths, standard vertical clearance, and flares at each end providing extra width to ease articulated truck-turning movements.

Alternative 2 would rehabilitate the existing bridge. The bridge would have three new approach spans with new foundations, and substructure work would be done at the center swing span pier and replacement of its deck. The load rating for the bridge, the characteristics of existing truss swing span superstructure, and the limited existing bridge width would remain unchanged. Additional ROW would be required for this alternative because of the raising of the profile of Holland Road.

1.1.2 Need

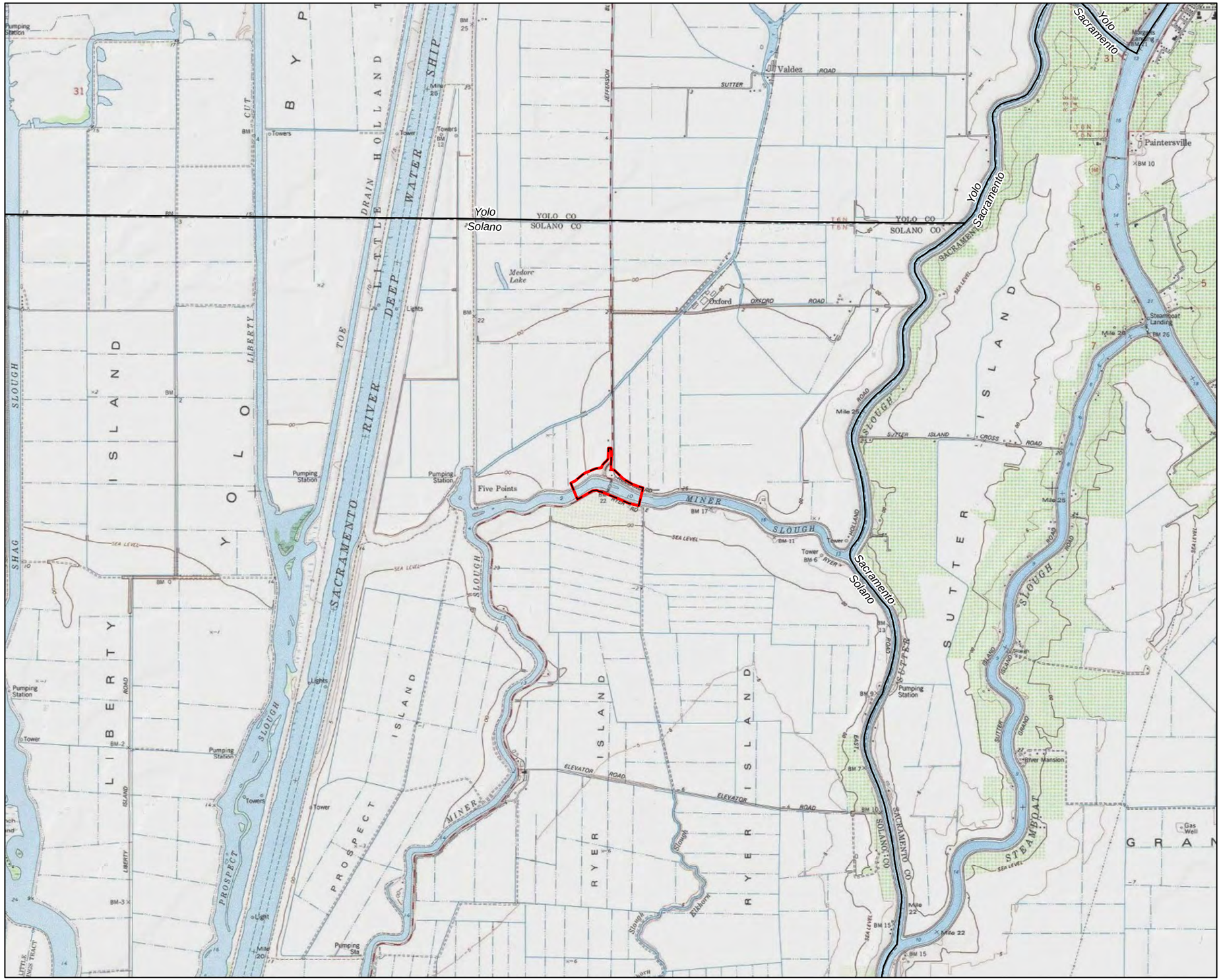
The Project is needed to remedy the following deficiencies:

- The deck surface in all spans exhibits extensive cracks caused by the differential deflection (change in elevation from one framing member to the adjacent one) of its parallel wooden planks, which deteriorate into spalls (fragments or chips) that create voids in the pavement.
- All spans contain checks (cracks in wood caused by tension) and other cracks that may decrease the weight-carrying capability of the bridge as they expand.
- The levee and roadway fill material are slumping near Abutment 12, exposing timber piles and resulting in roadway settlement.

The 2007 STRAIN Report (Caltrans 2007) recommended replacement of the bridge superstructure, including replacing the entire timber deck and timber stringers.

1.2 Project Description

The existing bridge, No. 23-0035 on SR 84 in Solano County, was built in 1933 and is a swing bridge with nonstandard features and very low existing annual average daily traffic (440 vehicles). The existing bridge is 367 ft long and is composed of three sections with timber plank decks and a 2-inch-thick asphalt concrete (AC) wearing surface. The 191-ft center steel truss swing span is on a reinforced concrete (RC) cylindrical swing pier, with RC rest piers. The two approach spans are made of timber stringers on timber cap-and-pile bents with abutments of RC on timber piles.



VICINITY MAP

LEGEND

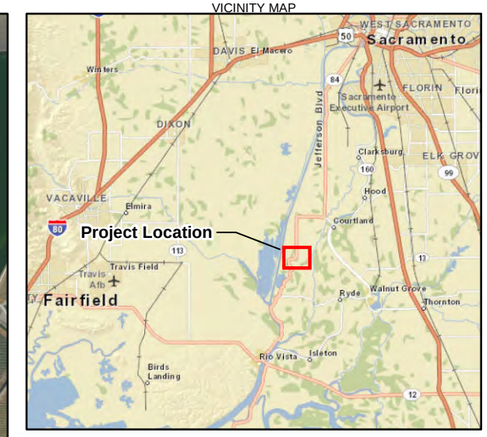
- Project Study Area
- County Boundary

N

0 3,000 6,000 Feet

FIGURE 1-1
Project Vicinity
Miner Slough Bridge Replacement Project
EA 04-0G660, State Route 84 Post Mile 12.1/12.2
Solano County, California

VICINITY MAP



LEGEND

- Project Limits
- Project Study Area

N

0 1,000 2,000 Feet

Caltrans

FIGURE 1-2
Project Location
Miner Slough Bridge Replacement Project
EA 04-0G660, State Route 84 Post Mile 12.1/12.2
Solano County, California

The Project proposes two alternatives for the bridge based on a current planning study.

1.2.1 Alternative 1- Bridge Replacement

The first alternative is to build a new swing span bridge approximately 100 ft west of the existing alignment. The new bridge would have standard features with a 12-ft-wide lane and 8-ft-wide shoulder in each direction. This alternative would require construction of temporary trestles to be used during construction. There would be a control house structure on the levee to house operating equipment and provide parking for maintenance personnel. SR 84 would also be realigned by shifting it to the east to align with the new bridge, for a length of approximately 900 ft north of Holland Road. Project components are shown on Figure 1-3, and preliminary plans are provided in Appendix A.

1.2.1.1 PROJECT COMPONENTS- REPLACEMENT ALTERNATIVE

Temporary Trestles

Two temporary trestles would be installed to facilitate bridge construction, one next to each end of the bridge. The one on the south end would be approximately 86 ft long, and the one on the north end would be approximately 204 ft long. This would leave an opening of about 85 ft for marine (boat) traffic to navigate between the two trestles. Each trestle would be 35 to 40 ft wide with a superstructure of timber decking, steel stringers, and prefabricated steel bents, as well as a safety railing. The bents would be spaced approximately 25 to 40 ft apart and would be supported on piles varying from 15 to 36 inches in diameter. The piles may be driven by an impact hammer or a vibratory hammer and would be spaced 5 to 10 ft apart. The number of piles is estimated to be 125. Each pile will be approximately 50 to 75 ft long. The elevation of the trestles would be below the soffit of the new bridge at about 18 ft. After construction of the new bridge and demolition of the existing bridge are complete, the trestle superstructures would be removed by crane and the piles would be removed by a vibratory extraction method or cut 3 ft below the mudline.

New Piers with Foundations

The Project would construct three steel-reinforced cast concrete piers to support the bridge: one central pivot pier (Pier 3) and two independent piers (Pier 2 and Pier 4) that would support the approach spans and the swing span when the bridge is not in operation. Each pier would be supported through cap-on cast-in-steel-shell (CISS) piles. The cap would be constructed of steel-reinforced cast concrete over a group of CISS piles as summarized in Table 1-1.

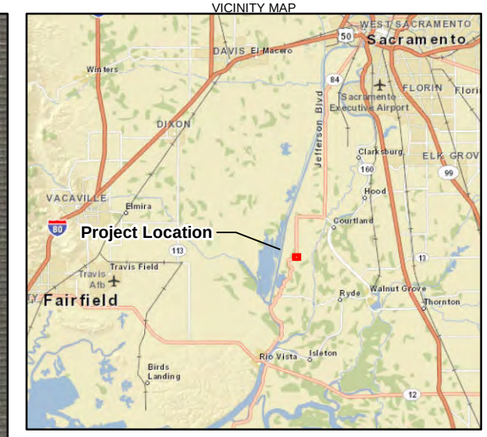
Table 1-1 New Bridge Piers and Foundations

	Pier 3	Piers 2 and 4
Number of piles	42	4
Depth of piles	40 ft	40 ft
Diameter of pile	2 ft	5 ft
Diameter of pier	18 ft	5 ft
Diameter of caps	32 ft	8 ft
Height of caps	8 ft	5 ft
Height of pier	18 ft	18 ft
Elevation of top of pier	24 ft	24 ft

For Pier 3, a 44-by-44-ft cofferdam would be constructed to facilitate the pile driving and the construction of caps and the pier. The cofferdam would be constructed by driving 2-ft-wide section sheet piles 30 ft deep into the streambed using vibratory hammers. The piles would be tall enough so that the tops reach 5 ft above the surface of the water and would be placed adjacent to one another. The area within the cofferdam would then be dewatered and excavated to 2 ft below the footing elevation; water removed from the cofferdam would be discharged into the slough. A 2-ft-deep seal course of poured concrete would be placed at the base of the cofferdam to prevent water leakage. The CISS piles would be driven by impact hammer, with pile drivers situated on the temporary trestles. The material inside each pile would be drilled out using drills situated on the temporary trestles, leaving a plug of native material at the bottom. Then, rebar would be placed in the shell, and the shell would be filled with concrete using pumps from the temporary bridge. Forms and rebar would be placed over the pile ends and then filled with concrete to form the cap, and the same process would be used to form the pier.

For Pier 2 and Pier 4, CISS piles would be driven without cofferdams into the streambed using impact hammers situated on the temporary trestles, and the pile shells would be drilled out, leaving a plug of native material at the bottom. Rebar would be placed into the shells, which would then be filled with concrete. Forms would be constructed around the top of the shells to construct concrete caps approximately 9 ft wide by 26 ft long by 5 ft high, on which the bridge and abutment sections would rest after construction. Fenders with a 3-ft-wide cap on 2-ft-diameter piles spaced 5 to 8 ft apart would be placed adjacent to Pier 2 and Pier 3 only. The fenders would extend 10 ft past the edge of the deck on the east and west sides, and would then curve for another 20 ft.

VICINITY MAP



LEGEND

- Project Limits
- Project Study Area
- Existing Staging Area
- Cut & Fill
- Edge of Pavement

Shade Impacts to Other Waters Only

- Existing Bridge (0.12 acre)
- New Bridge (0.18 acre)

Permanent Impacts

- New Road
- Proposed Bridge (Shade Area 0.34 acre)
- Control House
- Concrete Pier
- Parking Lot
- Staging Area

Temporary Impacts

- Cut and Fill
- Control House Temporary Construction Area
- Cofferdam
- North Trestle
- South Trestle
- Removal of Existing Road
- Existing Bridge to be Demolished (0.19 acre)

N

0 150 300
Feet

Caltrans

FIGURE 1-3
Replacement Alternative Project Components
Miner Slough Bridge Replacement Project
EA 04-0G660, State Route 84 Post Mile 12.1/12.2
Solano County, California

Adjacent to Pier 2 and Pier 3 will be a fender system to protect the piers from navigable traffic. The fender system would consist of two 195 ft caps on piles spaced from 5 to 8 ft. A cofferdam will be placed around the fender footprint, and water will be removed. Piles will be driven and caps will be formed on top of piles. Plastic lumber will be placed vertically around the cap. A design alternative would be to place a minimum of four dolphins (fixed structures that extend above the water level and are not connected to the shore or the bridge), two each adjacent to the piers. The type of pier protection will need to be determined in design.

Operator Control House

An operator control house would be constructed approximately 50 ft north of the abutment on the levee, downslope, facing the slough. This would provide the control house operator a better view of the bridge opening from the bend in the slough on the northern side than one would have from the southern side. The control house structure would consist of a 25-ft-wide by 25-ft-long concrete structure with windows and a metal roof, with its operating floor approximately 25 ft above the levee road. A 20-by-30-ft parking area (parking slab) for personnel vehicles would be provided across from the control house on the northern side of Holland Road for maintenance. Construction of the structure would begin with steel pipe piles being driven into the levee with an impact hammer; the piles would be approximately 40 ft long. Three bents would be installed 20 ft on center, using 10 CISS piles with a 2-ft-diameter footprint. The interior of the piles would be cleaned out, a rebar cage would be placed inside the pile, and then the cage would be filled with concrete. A 5-ft-wide stairway leading to the control house would also be constructed.

The operator control house would be next to the north end of the bridge and would contain the switch gear and generator to be attached to the drive mechanism at Pier 3 via underwater cables. The main drive motor would be below the deck at Pier 3 on a platform near the drive gear machinery. A separate motor and hydraulic pump would be used to operate the end jack mechanisms via hydraulic pipes and hoses extending to both ends of the bridge.

Abutment Foundations

On the levees at the ends of each approach span at elevation 29.25 ft on the north end and 29.42 ft on the south end, and above the high-water elevation (16.84 ft), two rows of 28 2-ft-diameter piles with a 91-ft-long by 8-ft-wide concrete cap would be constructed. The seat abutments would be approximately 16.5 ft high by 89 ft in length. The area would be excavated to a depth of 5 ft for a length of 93 ft to

construct an 8-ft-wide trench. In the trench, approximately 40-ft-long CISS piles would be placed in a predrilled hole and would then be driven into the trench, drilled out, and filled with rebar and concrete. The 91-ft-long by 8-ft-wide by 5-ft-deep cap would be constructed over the tops of the piles to support the abutment, which is an approach span with a 4-to-5-ft abutment stem, either a precast abutment slab or cast in place.

Bridge Structure

A swing span, steel girder bridge would make up the superstructure of the proposed new bridge. Continuous steel I-girder beams longitudinally connected by cross-frames and diaphragms would provide support from the superstructure down to the piers. The dimensions of the bridge superstructure would consist of two 121.5-ft spans supported by a central pivot pier. The depth of the superstructure would be 7.8 ft at center, and 6.1 ft at the ends.

The bridge would be constructed from prefabricated girders that would be positioned into place using a crane mounted on a temporary trestle or from the edge of the levee. Larger sections would be assembled in the staging area, while smaller sections would be assembled offsite and brought in by truck. A concrete deck would be poured on top of the girders.

Approach Structure

Precast, prestressed concrete I-girders evenly spaced would be mounted on top of all piers to form the lower part of the superstructure. Between the precast I-girders, forms would be placed to lay out the deck reinforcement, and then the forms would be filled with concrete and the curbs would be installed.

From Abutment 1 to Pier 2, the section would flare from approximately 89 to 44 ft wide, with a length of 49.5 ft. From Pier 4 to Abutment 5, the section would flare from approximately 89 to 44 ft wide, with a length of 49.5 ft. This part of the superstructure would be 4.3 ft deep, and the deck would be approximately 9 inches deep.

On the south end of the bridge, the approach slab would conform to the edge of the existing highway. On the north end of the bridge, the approach slab would be higher by 3 ft at the edge of Holland Road.

Pavement Section

The bridge deck would have standard RC for the swing span and approach spans. Caltrans standards would be followed for placing AC pavement sections conforming to the bridge deck. This would include excavating 12 inches of soil, adding a gravel sub-base, compacting, and then placing the AC.

A section of SR 84 immediately north of the bridge would be permanently realigned for a stretch of approximately 900 ft, beyond which it would conform to the existing highway. This realignment would have a standard 12-ft lane with an 8-ft paved shoulder in each direction. The realigned section of SR 84 would be on fill, ranging in depth from 0.25 ft to 15.5 ft, and its footprint from toe-of-fill to toe-of-fill would range from 80 to 160 ft. Before placement of the fill, the Project area would undergo vegetation clearing and grubbing, scraping and excavating up to 1 ft below ground surface, compacting the soil, and adding gravel base. An approximately 250-ft-long section of the existing SR 84 would be widened to conform to the realigned section of SR 84. To achieve this, there would be an approximately 2-to-3-ft excavation within the existing roadway and fill area. After the newly realigned section of SR 84 is open to the public, the old paved section would be scarified, removed, and revegetated.

Holland Road would be repaved for approximately 200 ft on either side of the new bridge, at which point it would conform to the existing Holland Road. The new toe line for fill on this stretch of the road will be 12 ft out from the edge of the existing pavement on the south side (slough side) of the local road, and would vary from 16 to 84 ft on the north side of the road from the edge of the existing pavement.

Electrical, Including Lighting

An armored underwater electrical cable would be laid on the bed of the slough to connect the control house with the central span. A generator would be used to run the bridge and the control gates; the generator would fit into the control house. No outside utilities or lighting are anticipated.

Drainage

Scuppers (outlets for water drainage) would be used for the concrete barriers on either side of the bridge shoulders. On the new stretch of SR 84 on the north side of the new bridge, cross culverts of up to 48 inches would be installed for maintenance of proper drainage.

Staging Areas and Access Roads

Staging would occur in the triangular area between the existing and new alignment of SR 84 north of the bridge. This area would be cleared by the construction contractor for use as staging and preparation of the new SR 84 alignment. Staging would also occur on barges anchored to piers located on the north bank of Miner Slough. Shipping traffic navigates through the slough close to the main channel near the southern bank; therefore, anchoring barges on the northern bank would not block the shipping channel.

A property located southeast of the existing bridge would be used for storing materials and equipment for the new bridge. This area is currently used for staging of bridge material for emergency repairs.

The existing bridge would continue to be used for traffic during construction of the new bridge. Traffic coordination and limited closures of the existing bridge may occur for construction of the trestles, as well as for conforming of the approach spans of the new bridge to the highway lanes.

Demolition of the Existing Bridge

The trestles described above would be used during the existing bridge demolition. The barrier rail and post would most likely be removed by hand. The swing span may need temporary supports to provide stability during the demolition of the truss.

The removal of the beams would require a crane that would be staged on a barge. Once the truss is removed, the deck AC and concrete would be chipped with a hoe ram; the chipped pieces would be caught on a working platform and removed with a loader. Steel beams, cross beams, and stringers would be removed by a crane. The pivot pier would have steel plates that would be removed by a crane.

The approach spans' superstructure would be removed in a similar way.

The RC bents would be chipped down to 3 ft below the timber. The wooden bents would have the RC caps removed and the wood piles removed to at least 3 ft below the channel bed. Disturbed soil on the levees would be restored to Reclamation District requirements.

The pivot pier would be chipped down with a hoe ram, and chunks of RC would be loaded out of the cofferdam area. The pivot pier would be chipped down 3 ft below the mud-sounding elevation. The removed soil would need to be replaced by hand.

The dolphins (fixed structures that extend above the water level and are not connected to the shore or the bridge) would need to be removed 3 ft below the mud soundings.

The trestles would be removed from a barge located in Miner Slough.

Utility Relocation

No utility relocation is anticipated.

Traffic Management Plan

Traffic coordination and limited closures of the existing bridge would occur for the construction of the temporary trestles near the abutments and the construction of the new approaches at the abutments. Aside from these limited closures, the existing bridge would remain open to traffic during new bridge construction and would be closed and removed only after the new bridge is open to traffic.

K-rails (concrete or plastic barriers) would be used as well as changeable message signs to notify motorists of construction zone activities. A Traffic Management Plan (TMP) would be prepared and implemented during construction to minimize or prevent delays and inconveniences to the traveling public. The need for nighttime and weekend lane closures during off-peak hours (5:00 p.m. to 9:00 a.m.) would be identified during the plans, specifications, and estimates (PS&E) stage. Coordination with and a permit from the U.S. Coast Guard (USCG) would be required to shut off watercraft access under the bridge during some stages of construction.

Borrow and Disposal

Gravel and rock would be imported for road widening and stored in Project staging areas. Any unused portion of these materials would be removed upon completion of the Project, and removal and disposal of this material would be implemented through contractors and subcontractors in compliance with Caltrans standard Best Management Practices (BMPs) and the Storm Water Pollution Prevention Plan (SWPPP) that would be prepared for the Project. BMPs and SWPPP measures are a standard part of the plans and specifications for the Project and would be covered by the Central Valley Regional Water Quality Control Board (Central Valley RWQCB) 401 Water Quality Certification.

Construction Schedule

Construction is scheduled to begin in January 2018 and last approximately 3 years. Out-of-water work would occur for three seasons of each year, typically starting in April and ending in December, if weather permits and permit conditions are met.

Work in the water (to include pile driving associated with the temporary trestles and construction of the Pier 3 cofferdam and Piers 2, 3, and 4, as well as demolition of the existing bridge's Piers 2, 3, 7, 8, 9, 10, and 11 and the abutment of Pier 12) would take place between August 1 and November 30. Foundation and bridge structure work could occur year-round once the trestles, cofferdam, and piers have been constructed. Nighttime and weekend lane closures for roadway realignment of SR 84 north of the bridge could occur to accommodate construction activities.

1.2.2 Alternative 2- Bridge Rehabilitation

This project alternative proposes to rehabilitate the existing bridge built in 1933. This alternative comprises three new approach spans with new foundations, and substructure work at the center swing span pier. The load rating for the bridge, the characteristics of the existing truss swing span superstructure, and the limited existing bridge width would remain the same.

1.2.2.1 PROJECT COMPONENTS- REHABILITATION ALTERNATIVE

Operator Control House

The control house for the existing bridge is located on the west side of the swing span and is attached to the edge of deck and side of the truss. No changes to the operator control house would occur during rehabilitation of the existing bridge. Project components are shown on Figure 1-4.

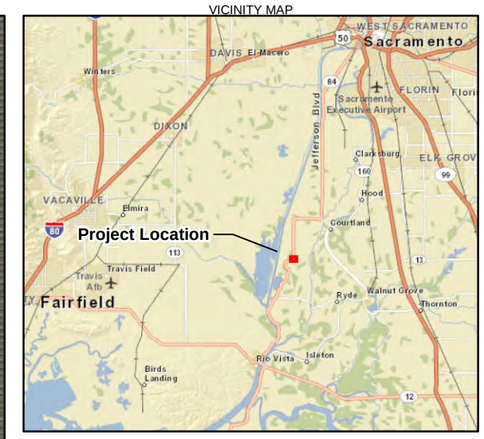
Approach Spans and Abutments

Prior to construction of new approach spans, the existing approach spans would be removed. A platform would be constructed under the existing approach structures. The platform would be attached to the floor beams of the bridge or the existing timber piles. The deck surface would remove by saw cutting and jack-hammering. Then the stringers, floor beams, and platform would be removed.

A new approach span would be constructed on the south end of the bridge from abutment 1 to pier 2 and would be 55 ft long, with width varying from 44 ft to 26 ft. On the north end of the bridge the new approach span from pier 4 to Pier 5 would be 55 ft long with width varying from 26 ft to 50 ft. From pier 5 to abutment 6, the span would be 55 ft long with varying widths of 50 to 60 ft.

New abutments for the approach spans would be constructed. The width of the Abutment 1 pile cap would be 44 ft with 6 piles, and the width of Abutment 6 pile cap would be 60 ft with 8 piles.

VICINITY MAP



LEGEND

- Project Limits
- Project Study Area
- Existing Staging Area
- Cut & Fill
- Edge of Pavement
- Existing Bridge (0.19 acre)

Shade Impacts to Other Waters Only

- Existing Bridge (0.12 acre)
- Rehabilitated Bridge (0.02 acre)

Permanent Impacts

- Staging Area
- Rehabilitated Bridge Area

Temporary Impacts

- Cut and Fill
- North Trestle
- South Trestle

N

0 150 300
Feet

Caltrans

FIGURE 1-4
Rehabilitation Alternative Project Components
Miner Slough Bridge Replacement Project
EA 04-0G660, State Route 84 Post Mile 12.1/12.2
Solano County, California

New Pier Supports

The existing wooden piers and RC piers would be removed. The existing truss would remain turned open for an extended time. To support the truss, a temporary cable system would be installed. An alternate method to support truss while open may be a two bents positioned approximately 55 ft adjacent to the existing bridge. The north side holding bent would need to be adjacent to the trestle. Each bent would include two driven 5 ft diameter CISS piles with a steel stringer on top of both. The existing Pier 2 and Pier 4 will be replaced with new piers. All existing bents will be removed. There will be a new Pier 5 between Pier 4 and the abutment on the north end. Each of the three new piers will be supported on 3 pile extensions with cap. Each pile is 5 ft diameter. At pier 2 and pier 4 mechanical Items will be built in each pier to include jack pads and center locks. New Pier 5 will have 4 pile extensions with cap. Each pile will be 5 ft diameter. An alternate design for Pier 2 and Pier 4 would be to drive two 5-6 ft diameter CISS piles adjacent to each side of the bent. On top of the pile extension would be a RC cap. The existing concrete could be chipped down and caught on a platform.

Bridge Structure

Work on the bridge structure includes placing precast/pre-stressed I girders between the new piers. This would be accomplished by use of cranes located on the trestles. The deck would be built up and the deck and barrier rails would be formed.

On the swing-span, the wooden stringers would be removed in the same manner as the approach spans, by use of a platform under the existing approach structures. Steel girders would be placed using a crane and the deck and barrier rails would be built.

Work on the Center Pier would occur from the trestle and a barge. A 40 ft by 40 ft cofferdam would be constructed around the pier, and water would be evacuated. Two inch diameter CISS piles would be driven around the perimeter of the existing pile cap. A new pile cap would be connected with the existing by drill and bonding rebar into the existing cap and then forming the cap on top of the piles. The mechanical system would be upgraded with a new motor.

Pavement Sections

As the profile of bridge access span on the north side is raised, Holland Road profile would need to be raised for a length of 500 ft to conform to the bridge access span. The new toe line for fill on this stretch of the Holland road would vary from 2 ft to 36

ft from edge of pavement on creek side of Holland Rd. Along the north side of Holland Road it would vary from 3 ft to 76 ft from edge of pavement.

Profile of Route 84 to the north of Holland Rd. will also have to be raised for a stretch of 240 ft to conform to the newly paved Holland Road. The new toe line for fill would vary from 2 ft to 5 ft from the edge of pavement on the west side and would vary from 7 ft to 75 ft on the east side from edge of pavement. Before placement of the fill, the project area would undergo vegetation clearing and grubbing, scraping and excavating up to 1 ft below ground surface, compacting of soil.

Staging and Access Roads

Staging areas and access roads would be similar to those discussed under the replacement alternative (see Section 1.1.9). Staging would occur in the triangular area east of SR 84 on the north side of Miner Slough. Staging would also occur on barges anchored to the piers located on the north bank of Miner Slough. The property located southeast of the existing bridge would be used for storing materials and equipment for the bridge rehabilitation.

Traffic Management Plan

Closure of the existing bridge for a period of approximately 6 months for work on the existing bridge. During bridge closure traffic travelling north or south via Route 84 would be detoured to the east of Ryer Island via Routes 220 and 160, using the J-Mack Ferry. Holland Road (on the north levee) and Highway 84/Ryer Road (on the south levee) would be available for local traffic, however for approximately 3 weekends of the construction period these roads would be closed to traffic for construction activities.

The swing span would be accessible (able to open) for passage of boat traffic during the majority of the construction period. However, during rehabilitation of the swing-span it would be non-operable. It is estimated that the swing-span would be non-operable for a period of approximately 1 week. Coordination with and a permit from USCG would be required to shut off watercraft access under the bridge during various stages of construction.

A TMP would be prepared and implemented during construction to minimize or prevent delays and inconveniences to the travelling public. Preparation of a TMP would occur as part of the final design phase for the rehabilitation alternative. The need for weekend lane closures on Holland Road and Route 84/Ryer Road would be identified during the PS&E stage.

Construction Schedule

The project is scheduled to begin in January 2018 and would and last approximately 1 year. Rehabilitation of the bridge and construction activities on HWY 84 would last for approximately 6 months. Out-of-water and in-water work would occur as discussed under the replacement alternative. Closure of SR 84 over Miner Slough is anticipated to last approximately 6 months. Intermittent closures for raising profiles of Holland Road and Hwy 84 would occur for approximately 3 weekends of the construction period.

1.2.3 No-Build (No-Action) Alternative

Under the No-Build Alternative the existing Miner Slough Bridge would continue to operate. Caltrans would continue to maintain the existing structure. The No-Build Alternative serves as the baseline for evaluation of the Replacement and Rehabilitation Alternatives.

1.2.4 Alternatives Considered but Eliminated from Further Discussion

An alternative to maintain the existing SR 84 alignment on the north side of the new replacement bridge was studied at length and rejected for the following reasons:

- Design Speed: Between Station (Sta.) 29+26 and Sta. 31+50, only a maximum design speed of 14 miles per hour (mph) could be achieved due to superimposing the proposed crest vertical curve over the existing roadway alignment.

- Superelevation Transition: The superelevation transition would not meet design standards. North of the bridge the horizontal curve radii are 65 ft and 95 ft. The maximum superelevation rate for these radii should be 12 percent with 300-ft runoff lengths; however, the actual lengths are approximately 200 ft below standard. Also, the superelevation transition would need to be accommodated between two reverse curves at very steep transition rates due to the relatively short distance between these curves.

- Staging: Locating staging areas under this alternative would be difficult without closure of the existing traffic lanes of the highway for a long duration (up to 1 year). The proposed Build Alternative eliminates the need for long-duration lane closures of SR 84 as the new connector on the north side can be built without a full closure of traffic and conformed to Holland Road with an overnight operation.

Chapter 2 Study Methods

To prepare this NES, Caltrans and consultant biologists reviewed various databases, historical records, and other scientific literature to ascertain the environmental baseline for the area of the proposed project. Local biological experts were contacted, and technical assistance was also requested from local, state, and federal resource agencies. A BSA was determined prior to conducting field studies. The BSA includes the area within the project limits, plus a 200-ft buffer. Caltrans and consultant biologists conducted general field surveys of the BSA to assess existing natural resources and to identify the following:

- Plant community and habitat types
- Potential wetlands
- Factors indicating the potential presence of special-status species
- Need for further in-depth or protocol-level surveys

2.1 Regulatory Requirements

Project implementation will affect natural resources within the jurisdiction of the following federal and state agencies:

- U.S. Fish and Wildlife Service (USFWS) (Sacramento Office)
- U.S. Army Corps of Engineers (USACE) (Sacramento Office)
- National Marine Fisheries Service (NMFS) (Sacramento Office)
- U.S. Coast Guard (USCG) (Oakland Office)
- California Department of Fish and Wildlife (CDFW) (Bay-Delta Region Office)
- Central Valley Regional Water Quality Control Board (Central Valley RWQCB) (Sacramento Office)

The federal regulatory requirements and laws that apply to the proposed project include the following:

- National Environmental Policy Act (NEPA) (42 U.S. Code [U.S.C.] § 4321)
- Federal Endangered Species Act (FESA) (16 U.S.C. § 1531)
- Clean Water Act (CWA), Sections 404 (33 U.S.C. § 1344) and 401 (33 U.S.C. § 1341)

- Migratory Bird Treaty Act (MBTA) (16 U.S.C. § 703-712)
- Magnuson-Stevens Act (16 U.S.C. § 1801-1884)
- Bald Eagle Protection Act (16 U.S.C. § 668 et seq.)
- Executive Order 11990 (Protection of Wetlands) (42 Code of Federal Regulations [CFR] 26921)
- Executive Order 13112 (Invasive Species) (64 CFR 6183)

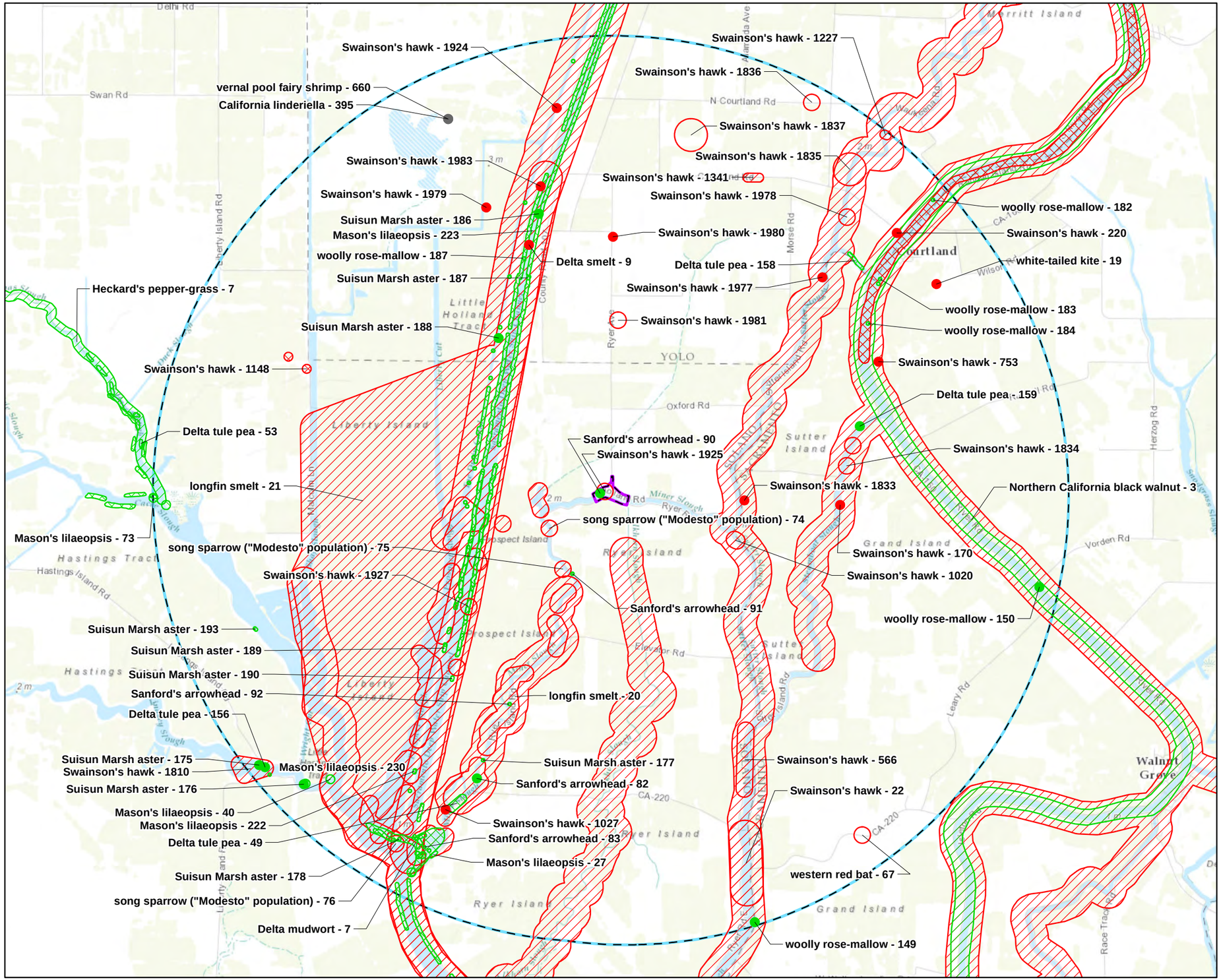
The applicable state laws and regulations include the following:

- California Environmental Quality Act (Public Resources Code § 21000 et seq.)
- California Endangered Species Act of 1984 (CESA) (Fish and Game Code [F.G.C.] § 2050 et seq.)
- Native Plant Protection Act of 1977 (NPPA) (F.G.C. §§ 1900-1913)
- Lake and Streambed Alteration Agreement (F.G.C. §§ 1600-1607)
- Protection of Migratory Birds (F.G.C. § 3503, 3515, and 3800)
- State Senate Bill 857 (fish passage) (F.G.C. § 5901)

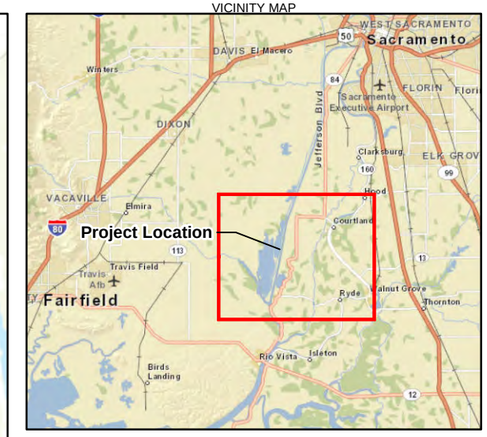
2.2 Database and Literature Review

A literature review was conducted to investigate the potential presence of sensitive resources, special-status species, and Critical Habitat(s) within the BSA and vicinity. A regional list of special-status wildlife and flora species was developed by querying the following databases, and each species was then evaluated to determine its potential to occur within the BSA:

- A species list from USFWS (2015) was generated for the following nine U.S. Geological Survey (USGS) 7.5-minute quadrangles (USFWS 2015): Isleton (480A), Rio Vista (480B), Birds Landing (481A), Clarksburg (497A), Saxon (497B), Liberty Island (497C), Courtland (497D), Dixon (498A), and Dozier (498D).
- The California Native Plant Society (CNPS) Inventory of Rare and Endangered Plants of California database was searched for the same nine quadrangles listed above (CNPS 2015).
- The California Natural Diversity Database (CNDDB) (CDFW 2015a, b) was queried for all occurrence records within 5 miles of the BSA (Figure 2-1).



VICINITY MAP



LEGEND

- Biological Study Area (BSA)
- 5 Miles from BSA

CNNDDB Occurrences

- Plant (Specific bounded area with an 80-meter radius)
- Plant (Specific, non-circular bounded area)
- Plant (Non-specific bounded area)
- Animal (Specific bounded area with an 80-meter radius)
- Animal (Specific, non-circular bounded area)
- Animal (Non-specific bounded area)
- Animal (Non-specific, circular feature)
- Multiple (Specific bounded area with an 80-meter radius)

Note:
CNDDB version July 2015.
The occurrences shown on this map represent the known locations of the species listed here as of the date of this version. There may be additional occurrences or additional species within this area which have not yet been surveyed and/or mapped. Lack of information in the CNDDB about a species or an area can never be used as proof that no special status species occur in an area.

N

0 6,000 12,000
Feet

Caltrans

FIGURE 2-1
California Natural Diversity Database (CNDDB) Occurrences Within 5 Miles of BSA
Miner Slough Bridge Replacement Project
EA 04-0G660, State Route 84 Post Mile 12.1/12.2
Solano County, California

- The National Wetlands Inventory database (NWI 2015) was reviewed for wetlands analysis.
- The National Resources Conservation Service (NRCS) soils information was reviewed, and maps were created (NRCS 2015a).
- Climatic information was obtained from the NRCS National Weather and Climate Center (NRCS 2015b) and the Western Regional Climate Center (WRCC) (2015).
- Data on river conditions (stage, velocity, temperature, and salinity) were obtained from the California Department of Water Resources (DWR) California Data Exchange Center database (DWR 2015).
- A review of the Draft Solano County Multispecies Habitat Conservation Plan (Solano County Water Agency 2012) was conducted for the region of the proposed project.
- A review of the California State Clearinghouse CEQAnet database for projects in Solano County between November 2014 and April 2015.

The results from the searches informed the preliminary technical studies that were conducted to evaluate special-status species and resources for this NES. The result of the evaluations, including species potential for occurrence, is provided in Table 3-1 in Section 3 and Appendix B.

2.3 Technical Studies

Various studies were conducted in the preparation of this NES. Studies included surveys of protected resources and special-status species, and are described below.

2.3.1 Jurisdictional Wetland Delineation

A wetland delineation was conducted according to the methods outlined in the USACE 1987 *Wetland Delineation Manual* (Environmental Laboratory 1987) and the *Arid West Regional Supplement to the 1987 Manual* (USACE 2006) for all waters of the United States, including wetlands, occurring within the BSA. Wetland delineation was performed by Caltrans Biologists Rosalie Wilson and Robert Vogt on March 4, 2014. The survey report is included as Appendix C.

2.3.2 Rare Plant Surveys

Protocol-level rare plant surveys were performed by Caltrans Biologists Andrew Amacher, Whitney Brennan, Rosalie Wilson, and Erik Schwab to capture

special-status plants with potential to occur in the BSA. No federally listed plant species were identified within the BSA during the surveys. The botanical survey methods followed the methodology established in the following guidelines:

- *Guidelines for Assessing the Effects of Proposed Projects on Rare, Threatened, and Endangered Plants and Natural Communities* (CDFW 2000)
- *CNPS Botanical Survey Guidelines* (CNPS 2001)
- *Guidelines for Conducting and Reporting Botanical Inventories for Federally Listed, Proposed and Candidate Plants* (USFWS 1996a)

All plant species encountered during the botanical survey were identified to the extent necessary to determine if they met the criteria as a federal- or state-listed rare, threatened, or endangered species under FESA, CESA, CNPS, or California Environmental Quality Act criteria (i.e., identified using local floras to the genus or species level). The survey report and supplemental updates are included as Appendix D.

2.3.3 Valley Elderberry Longhorn Beetle Habitat Assessment

A valley elderberry longhorn beetle (VELB) survey and habitat assessment was conducted by CH2M HILL Biologists Holly Barbare and Jeanette Weisman in April 2014. Four elderberries were observed within the BSA, but did not contain exit holes, and VELBs were not observed (see Figure 4-5 and 4-6 in Section 4). This survey report is included as Appendix E.

2.3.4 Giant Garter Snake Habitat Assessment

A giant garter snake (GGS) survey and habitat assessment was conducted by Caltrans Biologist Whitney Brennan in April 2014. The habitat surrounding the Miner Slough Bridge was determined to be marginal, and no GGSs were observed during the survey. The survey report is included as Appendix F.

2.3.5 Swainson’s Hawk Survey

The proposed project falls within the known range of Swainson’s hawk. Opportunistic surveys were conducted by Caltrans staff Andrew Amacher between March and August 2014. An active Swainson’s hawk nest was observed and monitored within the BSA on the northwest side of the bridge.

2.3.6 Hydro-acoustic Modeling

Hydro-acoustic modeling was conducted to determine the noise effects of pile driving on aquatic species potentially present during the in-water work portion of the Project. Illingworth & Rodkin prepared the analysis using threshold data from NMFS and based underwater sound levels on similar pile-driving projects. The summary of this analysis is included in Chapter 4, and the full report is included as Appendix G.

2.3.7 Tree Survey

A survey of tree species observed within the BSA was conducted in January 2015 by Caltrans Biologist Erik Schwab. Trees to be impacted by Alternatives 1 and 2 are presented in Figures 4-17 and 4-18 in Section 4, respectively.

2.4 Survey Dates and Personnel

Table 2-1 summarizes the personnel and survey dates of each of the field studies.

Table 2-1 Survey Dates and Personnel

Survey Type	Date(s)	Objective	Personnel
Wetland Delineation	March 4, 2014	Delineation of all waters of the United States, including wetlands, occurring within the BSA	Caltrans Biologists Rosalie Wilson and Robert Vogt
Rare Plant Survey	April 9, June 10, and August 5, 2014	Protocol-level rare plant surveys	Caltrans Biologists Andrew Amacher, Whitney Brennan, Rosalie Wilson, and Erik Schwab
VELB Survey	April 23, 2014	Survey and assessment for VELB	CH2M HILL Biologists Holly Barbare and Jeanette Weisman
GGS	April 9, 2014	Survey and assessment for GGS habitat	Caltrans Biologist Whitney Brennan
Swainson's Hawk Survey	March-August 2014	Surveying for active Swainson's hawk nests	Caltrans Biologist Andrew Amacher
Tree Survey	January 2015	Mapping of trees within the project impact area	Caltrans Biologist Erik Schwab

2.5 Agency Coordination and Professional Contacts

- **June 4, 2013:** Caltrans submitted a request for technical assistance to Dylan VanDyne at NMFS by requesting a species list and essential fish habitat in the project area.

- **June 5, 2013:** Caltrans submitted a request for technical assistance to John Cleckler at USFWS by providing initial project description and requesting a species list.

- **January 24, 2014**: Received technical assistance from John Cleckler and Brian Hansen of USFWS and Dylan VanDyne of NMFS. Mr. Cleckler stated that he will be drafting the biological opinion for USFWS, but Mr. Hansen will review the delta smelt section. Mr. Hansen also stated that VELB and GGS would not be of concern on this Project. Mr. Hansen stated that impact hammering typically leads to formal consultation with NMFS.

2.6 Limitations that May Influence Results

Rainfall for the 2014 and 2015 survey periods was well below average, which may have limited plant germination and growth.

Protocol-level surveys for federally listed wildlife species were not performed on behalf of this Project. The potential for federally listed wildlife species to occur within the BSA was based on the evaluation of habitat suitability for target species during field surveys and the inference of presence. The field surveys were augmented through a review of authoritative databases (e.g., CNDDB) for species occurrences in the project vicinity, previous habitat assessments and reconnaissance-level site visits, and the review of aerial photographs.

Chapter 3 Environmental Setting

The following chapter provides a description of the biological study area and the physical and biological conditions.

3.1 Biological Study Area

The bridge spans Miner Slough at PM 12.1-12.2 on SR 84 within the Sacramento-San Joaquin River Delta, and is located near the City of Rio Vista, in Solano County.

The following terms have been used to describe the Project:

- Project Limit: The Project limit is defined as the Caltrans ROW and the temporary construction easements.
- Biological Study Area: The BSA established for the Project encompasses the area within the Project limit of both alternatives, and includes a 200-ft buffer.

The BSA consists of a roughly rectangular area of approximately 33 acres associated with the slough, banks, and riparian areas, plus SR 84 and adjacent ruderal vegetation located just north of the Miner Slough Bridge. The BSA includes all of the existing Caltrans ROW and some adjacent private lands that may be used for Project-related activities.

3.2 Physical and Biological Conditions in the Biological Study Area

The BSA is located in the Delta subsection of the Great Valley subregion (Miles and Goudey 1997). This region is characterized by a low, level plain at the confluence of the Sacramento River and Miner Slough. Numerous levees have been constructed throughout the region to reclaim lands for agricultural production. Elevations are generally around sea level; however, decomposition of organic matter has resulted in subsidence of areas within the levees.

3.2.1 Physical Conditions

3.2.1.1 TOPOGRAPHY

The topography of the BSA is characterized by low relief (see Figure 3-1). The banks of the slough are dominated by riparian vegetation, with some open areas with riprap

and an access road adjacent to the bridge along the north bank of Miner Slough. Below the edge of the banks, the slough has been left in a relatively undisturbed state.

3.2.1.2 Soils

Three soil series are found in the BSA (Natural Resources Conservation Service [NRCS] 2015a)—Columbia, Sacramento, and Valdez—all three of which are included on the state hydric soil list (United States Department of Agriculture [USDA] 2015a). General descriptions of the soil series based on the NRCS official Soils Series Descriptions (United States Department of Agriculture [USDA] 2015b) are provided in the Wetland Delineation Report (Appendix C).

3.2.1.3 Climate and Hydrology

Climate in this area is typical of northern California's Mediterranean-type climate with an average yearly temperature of 73 degrees Fahrenheit (ºF). Average winter temperatures range from 36 to 72ºF, and summer temperatures range from 47 to 91ºF. On average, the annual rainfall is 17.37 inches. Rain falls mainly from November to March (Western Regional Climate Center [WRCC] 2015).

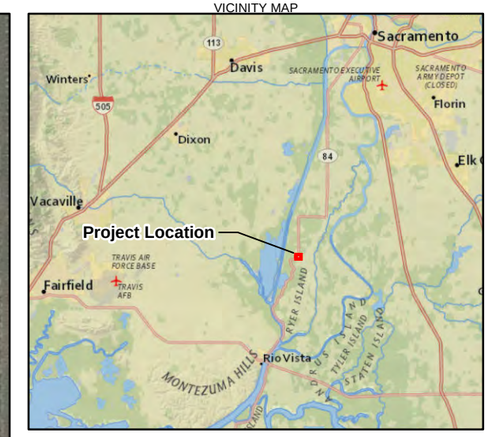
The dominant hydrology in the region consists of low-gradient perennial and intermittent streams (Wiken et al. 2011). The two large rivers in the region, the San Joaquin and Sacramento, are fed by rivers from the Sierra Nevada, and an extensive delta is created when the two rivers converge.

The BSA is located in the Sacramento River Hydrologic Region and Sacramento Delta Hydrologic Unit (18020109). It is a tributary to the Sacramento River. Miner Slough is tidally influenced and brackish. The Sacramento River watershed drainage consists of an area of approximately 27,000 square miles (Sacramento River Watershed Program 2015). The river has a 400-mile path from the headwaters of the Klamath Mountains to Suisun Bay.

3.2.2 Biological Conditions

The Sacramento Valley, San Joaquin Valley, and San Francisco Bay Floristic Provinces lie within 20 miles of the BSA. Additionally, there are local sites with high rates of endemism within this region, such as Antioch Dunes and Mount Diablo to the south in Contra Costa County, Suisun Marsh, and the areas north of the Montezuma Hills such as Jepson Prairie to the north in Solano County. The broader region is highly diverse with species that are adapted to specific local conditions.

VICINITY MAP



LEGEND

- Biological Study Area (BSA)
- 1 Foot Elevation Contours

Habitat Type

- Agriculture (3.56 acres)
- Annual Grassland (7.90 acres)
- Wetlands (0.36 acre)
- Other Waters (10.30 acres)
- Urban / Developed (3.59 acres)
- Valley Foothill Riparian (7.31 acres)

N

0 200 400 Feet

FIGURE 3-1
Habitat Types within the Biological Study Area
Miner Slough Bridge Replacement Project
EA 04-0G660, State Route 84 Post Mile 12.1/12.2
Solano County, California

The BSA is in a sparsely populated area where the majority of the vegetation consists of valley foothill riparian, annual grassland, and cropland/pasture.

3.2.2.1 VEGETATION TYPES

The majority of the vegetation consists of native riparian forest with a mix of native and nonnative species in the understory. A dense tree canopy formed by species such as white alder (*Alnus rhombifolia*), narrow-leafed willow (*Salix exigua*), and box elder (*Acer negundo*) shades the river bed. The understory vegetation includes wild grape (*Vitus californica*), poison hemlock (*Conium maculatum*), mugwort (*Artemesia douglasiana*), and Himalayan blackberry (*Rubus armeniacus*). Vegetation observed on the upland slope includes black walnut (*Juglans californica*), oats (*Avena sativa*), Himalayan blackberry, scouring rush (*Equisetum hymale*), and ripgut brome (*Bromus diandrus*).

The new area north of the bridge consists of invasive grassy and broad-leaved vegetation, including wild oat (*Avena fatua)*, soft chess (*Bromus hordeaceus)*, poison hemlock (*Conium maculatum)*, and cheeseweed *(Malva parviflora).* This new area was once a home site and orchard, and includes relic tree species such as English walnut (*Juglans regia*), olive (*Olea europaea)*, and fig trees (*Ficus carica*).

In addition to natural vegetation, the BSA contains agricultural fields. The natural vegetation types are based on Sawyer et al. (2009). Vegetation descriptions are based on field observations from the 2014 and 2015 surveys. The three vegetation types found within the Project area are listed below.

Figure 3-1 displays the habitat types mapped in the BSA.

3.2.2.2 VALLEY FOOTHILL RIPARIAN

Valley foothill riparian makes up approximately 7.31 acres of the BSA. It is dominated by cottonwood (*Populus fremontii*), California sycamore (*Platanus racemosa*), and valley oak (*Quercus lobata*). White alder *(Alnus rhombifolia)*, box elder *(Acer negundo)*, and Oregon ash (*Fraxinus latifolia*) are found in the subcanopy, while wild grape, wild rose (*Rosa spp*.), California blackberry (*Rubus ursinus*), blue elderberry (*Sambucus mexicana*), poison oak (*Toxicodendron diversilobum*), buttonbush (*Cephalanthus occidentalis*), and willows (*Salix* spp.*)* are found in the understory. Canopy height is approximately 98 ft with a canopy cover of 20 to 80 percent. The valley foothill riparian vegetation type borders both sides of Miner Slough. Both rare plants observed in the BSA were found in this habitat type.

3.2.2.3 ANNUAL GRASSLAND

The annual grassland makes up approximately 7.88 acres of the BSA. It is dominated by introduced annual grasses such as wild oats, soft chess, ripgut brome *(Bromus diandrus)*, wild barley (*Hordeum spp*.), and foxtail fescue (*Festuca myuros*). The annual grassland vegetation type borders the valley foothill riparian habitat and the road. Few native plants were observed in this habitat.

3.2.2.4 AQUATIC

Aquatic areas make up approximately 10.3 acres of the BSA. Miner Slough makes up the riverine habitat in the BSA. In addition, three wetland types can be found bordering the slough. A palustrine tidal wetland is located on the north side of Miner Slough. The dominant vegetation within the wetland is white alder, red willow (*Salix laevigata*), curly dock (*Rumex crispus*), and common rush (*Juncus patens*). A palustrine emergent seasonal wetland was found along the north bank of Miner Slough. The dominant vegetation within the wetland is white alder, red willow, common rush, and sedge (*Carex* spp.). Caltrans biologists were unable to survey the island directly east of the existing bridge for wetlands because the island is inaccessible. The National Wetlands Inventory Wetlands Mapper (USFWS 2015) classifies the island as palustrine shrub scrub.

3.3 Regional Species and Habitats of Concern

Tables 3-1 and 3-2, respectively, identify the special-status plant and wildlife species included on the CNDDB, USFWS, and CNPS lists that have the potential to occur in the BSA based on the USGS 7.5-minute quadrangle map that encompasses the BSA (Liberty Island quadrangle) and the eight adjacent quadrangles (Dixon, Saxon, Clarksburg, Dozier, Courtland, Birds Landing, Rio Vista, and Isleton). See Figure 2-1 for locations of CNDDB occurrences of these species within a 5-mile radius of the BSA. A complete list of species from the database searches is provided in Appendix B.

Table 3-1 Special-Status Plant Species and Critical Habitat Potentially Occurring or Known to Occur in the Biological Study Area and Vicinity

Common Name	Scientific Name	Status*	General Habitat Preferences	Suitable Habitat Present/Absent in Biological Study Area	Potential to Occur in Biological Study Area
Plants					
Ferris' milk-vetch	*Astragalus tener* var. *ferrisiae*	1B.1	Meadows, and valley and foothill grassland. Subalkaline flats on overflow land in the Central Valley; usually seen in dry, adobe soil. 5-75 m.	Present	**Moderate.** Minimal grassland found in BSA. Closest CNDDB occurrence is 8 miles away.
Alkali milk-vetch	*Astragalus tener* var. *tener*	1B.2	Alkali playa, valley and foothill grassland, and vernal pools. Low ground, alkali flats, and flooded lands; in annual grassland or in playas or vernal pools. 1-170 m.	Present	**Moderate.** Minimal grassland found in BSA. Closest CNDDB occurrence is 8 miles away.
heartscale	*Atriplex cordulata* var. *cordulata*	1B.2	Chenopod scrub, valley and foothill grassland, and meadows. Alkaline flats and scalds in the Central Valley, sandy soils. 0-560 m.	Present	**Moderate.** Minimal grassland found in BSA. Closest CNDDB occurrence is 8 miles away.
watershield	*Brasenia schreberi*	2B.3	Freshwater marshes and swamps. Aquatic from water bodies both natural and artificial in California.	Absent	**Moderate.** Closest CNDDB occurrence is 7 miles away and is from 1976.
bristly sedge	*Carex comosa*	2B.1	Marshes and swamps. Lake margins, wet places; site below sea level is on a Delta island. -5-1,005 m.	Absent	**Moderate.** Closest CNDDB occurrence is 6 miles away.
Bolander's water-hemlock	*Cicuta maculata* var. *bolanderi*	2B.1	Marshes, fresh or brackish water. 0-200 m.	Absent	**Moderate.** Closest CNDDB occurrence is 6 miles away.
fragrant fritillary	*Fritillaria liliacea*	1B.2	Coastal scrub, valley and foothill grassland, and coastal prairie. Often on serpentine; various soils reported though usually clay, in grassland. 3-410 m.	Present	**Moderate.** Minimal grassland found in BSA. Closest CNDDB occurrence is 9 miles away.

Table 3-1 Special-Status Plant Species and Critical Habitat Potentially Occurring or Known to Occur in the Biological Study Area and Vicinity

Common Name	Scientific Name	Status*	General Habitat Preferences	Suitable Habitat Present/Absent in Biological Study Area	Potential to Occur in Biological Study Area
Boggs Lake hedge-hyssop	*Gratiola heterosepala*	SE/1B.2	Marshes and swamps (freshwater), and vernal pools. Clay soils; usually in vernal pools, sometimes on lake margins. 10-2,375 m.	Absent	**Moderate.** Closest CNDDB occurrence is 8 miles away.
woolly rose-mallow	*Hibiscus lasiocarpus* var. *occidentalis*	1B.2	Scattered in freshwater marsh at small locations in central California from Butte County to San Joaquin County.	Present	**Detected.** Observed within the BSA in 2014.
Carquinez goldenbush	*Isocoma arguta*	1B.1	Valley and foothill grassland. Alkaline soils, flats, and lower hills. On low benches near drainages and on tops and sides of mounds in swale habitat. 1-20 m.	Present	**Moderate.** Minimal grassland found in BSA. Closest CNDDB occurrence is 9 miles away.
delta tule pea	*Lathyrus jepsonii* var. *jepsonii*	1B.2	Freshwater and brackish marshes. Often found with Typha, Aster lentus, Rosa calif., Juncus spp., Scirpus, etc. Usually on marsh and slough edges.	Present	**High.** Closest CNDDB occurrence is 2 miles away. Found in neighboring Lindsay Slough.
Heckard's pepper-grass	*Lepidium latipes* var. *heckardii*	1B.2	Valley and foothill grassland. Grassland and sometimes vernal pool edges. Alkaline soils. 2-200 m.	Present	**Moderate.** Minimal grassland in BSA. Closest CNDDB occurrence is 4 miles away.
Mason's lilaeopsis	*Lilaeopsis masonii*	1B.1	Freshwater and brackish marshes, and riparian scrub. Tidal zones, in muddy or silty soil formed through river deposition or river bank erosion. 0-10 m.	Present	**High.** CNDDB occurrences within 1.5 miles of BSA. Found in neighboring Lindsay Slough.

Table 3-1 Special-Status Plant Species and Critical Habitat Potentially Occurring or Known to Occur in the Biological Study Area and Vicinity

Common Name	Scientific Name	Status*	General Habitat Preferences	Suitable Habitat Present/Absent in Biological Study Area	Potential to Occur in Biological Study Area
delta mudwort	*Limosella australis*	2B.1	Riparian scrub, freshwater marsh, and brackish marsh. Probably the rarest of the suite of Delta rare plants. Usually on mud banks of the Delta in marshy or scrubby riparian associations; often with Lilaeopsis masonii. 0-3 m.	Present	**High.** Closest CNDDB occurrence is 4 miles away.
Sanford's arrowhead	*Sagittaria sanfordii*	1B.2	Marshes and swamps. In standing or slow-moving freshwater ponds, marshes, and ditches. 0-650 m.	Present	**Detected.** Observed within the BSA in 2002.
side-flowering skullcap	*Scutellaria lateriflora*	2B.2	Meadows and seeps, and marshes and swamps. Wet meadows and marshes. In the Delta, often found on logs. -3-500 m.	Present	**Moderate.** Closest CNDDB occurrence is 7 miles away.
Suisun Marsh aster	*Symphyotrichum lentum*	1B.2	Marshes and swamps (brackish and freshwater). Most often seen along sloughs with Phragmites, Scirpus, blackberry, Typha, etc. 0-3 m.	Present	**High.** Closest CNDDB occurrence is within 1.3 miles. Found in neighboring Lindsay Slough
Saline clover	*Trifolium hydrophilum*	1B.2	Marshes and swamps, valley and foothill grassland, and vernal pools. Mesic, alkaline sites. 0-300 m.	Present	**Moderate.** Closest CNDDB occurrence is 7 miles away.

Source: Reprinted from the *Miner Slough Bridge Replacement Project Special-Status Plant Survey* (Caltrans 2015 [Appendix C]).

Notes:

*CNPS Status definitions are as follows:

1B = Plants rare, threatened or endangered In California or elsewhere

2B = Plants 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 = Fairly threatened in California (20-80% occurrences threatened / moderate degree and immediacy of threat)

0.3 = Not very threatened in California (<20% of occurrences threatened / low degree and immediacy of threat or no current threats known)

Table 3-2 Special-Status Wildlife Species and Critical Habitat Potentially Occurring or Known to Occur in the Biological Study Area and Vicinity

Common Name	Scientific Name	Status[a]	General Habitat Preferences	Suitable Habitat Present/Absent in Biological Study Area	Potential to Occur in Biological Study Area
Invertebrates					
VELB	*Desmocerus californicus dimorphus*	FE	Restricted to the Central Valley of California, in association with blue elderberry (*Sambucus mexicana*) with stems that are 1-inch diameter or greater at ground level.	Present	**Low.** Elderberry shrubs found within the BSA; however, no sign of VELB was observed. The closest VELB record noted in the CNDDB is approximately 13 miles away from the Project along the Cosumnes River in Sacramento County. See Appendix E for further information. No effect to this species is anticipated as elderberry shrubs are located outside the Project impact area and will have a fenced buffer around them to prevent direct effects.
Fishes					
longfin smelt	*Spirinchus thaleichthys*	FC, ST, SSC	Euryhaline, nektonic, and anadromous. Found in open waters of estuaries, mostly in middle or bottom of water column. Prefer salinities of 15 to 30 parts per trillion, but can be found in completely fresh water to almost pure seawater.	Absent	**Very Low.** Estuarine habitat is not present within the BSA. Nearest CNDDB documented occurrence is 3.7 miles. No effect to this species is anticipated as project impacts are outside species habitat.
delta smelt	*Hypomesus transpacificus*	FT	Sacramento-San Joaquin Delta, seasonally in Suisun Bay, Carquinez Strait, and San Pablo Bay. Seldom found at salinities greater than 10 parts per thousand, most often at salinities less than 2 parts per thousand.	Present	**High.** Species known to seasonally occur in the vicinity of Miner Slough between December and July. Critical habitat includes Miner Slough within BSA. Project may affect, but is not likely to adversely affect, delta smelt and will not adversely modify or destroy designated critical habitat.

Table 3-2 Special-Status Wildlife Species and Critical Habitat Potentially Occurring or Known to Occur in the Biological Study Area and Vicinity

Common Name	Scientific Name	Status[a]	General Habitat Preferences	Suitable Habitat Present/Absent in Biological Study Area	Potential to Occur in Biological Study Area
Central California Coastal steelhead	*Oncorhynchus mykiss irideus*	FT	From the Russian River southward to Soquel Creek and to, but not including, Pajaro River; San Francisco and San Pablo Bay Basins.	Present	**Moderate.** Spawning of adults and rearing of juveniles only occurs upstream of the BSA in the Sacramento River watershed and in the San Joaquin River watershed. Presence in the BSA can only be inferred during the upstream migration of adults and the downstream migration of juveniles. Designated critical habitat within the BSA in Miner Slough. Project will likely adversely affect but not jeopardize Central Valley steelhead and will not adversely modify or destroy designated critical habitat for the Central Valley steelhead DPS.
Central Valley spring-run chinook salmon	*Oncorhynchus tshawytscha*	FT, SSC	Over-summer in deep pools of the mainstem Sacramento River and its large perennial tributaries where fish can access cold headwaters during the warmer months. Water temperatures above 27 degrees Celsius is lethal to adults.	Present	**Moderate.** Spawning and rearing of adults only occurs upstream of the BSA in the upper reaches of the Sacramento River watershed. Presence in the BSA can only be inferred during the upstream migration of adults and the downstream migration of juveniles. The BSA is located within designated critical habitat for Central Valley spring-run Chinook salmon ESU. Project may affect, but is not likely to adversely affect, the Central Valley spring-run Chinook salmon ESU or its habitat and will not adversely modify or destroy designated critical habitat for this ESU.

Table 3-2 Special-Status Wildlife Species and Critical Habitat Potentially Occurring or Known to Occur in the Biological Study Area and Vicinity

Common Name	Scientific Name	Status[a]	General Habitat Preferences	Suitable Habitat Present/Absent in Biological Study Area	Potential to Occur in Biological Study Area
Winter-run chinook salmon, Sacramento River	*Oncorhynchus tshawytscha*	FE, SSC	Sacramento River below Keswick Dam. Spawns in the Sacramento River but not in tributary streams. Requires clean, cold water over gravel beds with water temperatures between 6 and 14 degrees Celsius for spawning.	Present	**Moderate.** Spawning of adults and rearing of juveniles only occurs upstream of the BSA in the upper reaches of the Sacramento River watershed. Presence in the BSA can only be inferred during the upstream migration of adults and the downstream migration of juveniles. The BSA is not located within designated critical habitat for Sacramento River winter-run Chinook salmon ESU. Project may affect, but is not likely to adversely affect, the Sacramento River winter-run Chinook salmon ESU or its habitat, and will have no effect on designated critical habitat for this ESU.
North American green sturgeon Southern Distinct Population Segment (DPS)	*Acipenser medirostris*	FT	Spawn in deep pools or “holes” in large turbulent freshwater river mainstems. Eggs likely are broadcast over large cobble substrates, but range from clean sand to bedrock substrates as well. Adults live in oceanic waters, bays, and estuaries when not spawning.	Present	**Moderate.** Post-spawning adults are known to remain in the Sacramento River through the fall, and juvenile/subadult green sturgeon remain in the Delta region for 2 to 3 years before entering the estuary or ocean. Post-spawning adults and rearing juveniles/subadults may be present in the BSA because of its proximity to the Sacramento River. Project will likely adversely affect but not jeopardize the Southern DPS of green sturgeon and will not adversely modify or destroy designated critical habitat.

Table 3-2 Special-Status Wildlife Species and Critical Habitat Potentially Occurring or Known to Occur in the Biological Study Area and Vicinity

Common Name	Scientific Name	Status[a]	General Habitat Preferences	Suitable Habitat Present/Absent in Biological Study Area	Potential to Occur in Biological Study Area
Reptiles					
Giant garter snake	*Thamnophis gigas*	FT, ST	Permanent or seasonal water, mud bottoms, and vegetated dirt banks. Sufficient water to supply cover and food such as small fish and amphibians. Emergent, herbaceous wetland vegetation, accompanied by vegetated banks to provide basking and foraging habitat and escape cover; high ground or upland habitat above the annual high-water mark to provide cover and refuge from flood.	Present	**Moderate.** Marginally suitable habitat is present within the BSA. Although no CNDDB occurrence records are located within 5 miles of the BSA, the Project is within the historic and currently recognized range of the species. Project may affect, but is not likely to adversely affect giant garter snake.
Western pond turtle	*Actinemys marmorata*	SSC	Aquatic turtle of ponds, lakes, marshes, rivers, streams, and irrigation ditches that typically have rocky or muddy bottom, with aquatic vegetation. Nests in uplands associated with wetland habitat.	Present	**Moderate.** Suitable habitat (foraging, breeding) is present in BSA. Although no CNDDB occurrence records are located within 5 miles of the BSA, the Project is within the historic and currently recognized range of the species.
Birds					
Swainson's hawk	*Athene cunicularia*	ST	Open agricultural fields, grasslands, and low hills, with sparse trees. Nesting often associated with riparian areas.	Present	**Detected**. Active nest observed in 2014 within BSA.
Song sparrow ("Modesto" population)	*Melospiza melodia maxillaris*	SSC	Brackish-water, freshwater marshes, and tangles bordering sloughs.	Present	**Moderate.** Marginally suitable nesting habitat is present within the BSA. Three CNDDB occurrence records are located within 5 miles of the BSA.

Table 3-2 Special-Status Wildlife Species and Critical Habitat Potentially Occurring or Known to Occur in the Biological Study Area and Vicinity

Common Name	Scientific Name	Status[a]	General Habitat Preferences	Suitable Habitat Present/Absent in Biological Study Area	Potential to Occur in Biological Study Area
White-tailed kite	*Elanus leucurus*	FP	Open grasslands or meadows for foraging close to isolated, dense-topped trees for nesting and perching.	Present	**Moderate.** Marginally suitable nesting habitat is present within the BSA. One CNDDB occurrence records is located within 5 miles of the BSA, approximately 4 mi northeast of the Project.

Sources: CDFW 2014a, 2014b, 2014c; CNPS 2014; USFWS 2014a.

Notes:

DPS = Distinct Population Segment

ESU = Evolutionary Significant Unit

VELB = Valley Elderberry Longhorn Beetle

[a] USFWS and CDFW listing status definitions:

FE = Federal Endangered

FT = Federal Threatened

FDL = Federal Delisted

FP = Fully Protected

SE = State Endangered

SC=State Candidate for Listing

SDL = State Delisted

SSC = State Species of Special Concern

CNPS Rankings

1B.1 = Plants rare, threatened, or endangered in California and elsewhere; ranked as seriously threatened in California

1B.2 = Plants rare, threatened, or endangered in California and elsewhere; ranked as moderately threatened in California

2.1 = Plants rare, threatened, or endangered in California but more common elsewhere; ranked as seriously endangered in California.

2.2 = Plants rare, threatened, or endangered in California but more common elsewhere; ranked as fairly endangered in California.

Plant species identified in Table 3-1 and in Appendix D were evaluated for their potential to occur within the project area. These plant species were eliminated from further consideration based on the absence of suitable habitat characteristics. As described in the Rare Plant Survey Report in Appendix D, protocol-level rare plant surveys were completed in 2014, and no federally listed or rare plants were identified within the BSA.

The wildlife species listed in Table 3-2 were evaluated for their potential to occur within the project area. A species was determined absent from the project area if (1) no suitable habitat was identified in the project area and (2) the project area was found to be outside of the species range.

Special-status species that have the potential or are known to occur in the BSA based on the field surveys conducted are given further consideration in Chapter 4. These include the following species:

- Sanford's arrowhead (*Sagittaria sanfordii*)
- Woolly rose-mallow (*Hibiscus lasiocarpus* var. *occidentalis*)
- Delta smelt (*Hypomesus transpacificus*)
- Longfin smelt (*Spirinchus thaleichthys*)
- Central Valley spring-run Chinook salmon (*Oncorhynchus tshawytscha*)
- Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*)
- Central Valley steelhead (*Oncorhychus mykiss irideus*)
- Southern DPS North American green sturgeon (*Acipenser medirosstris*)
- GGS (*Thamnophus gigas*)
- Swainson's hawk (*Buteo swainsoni*)
- VELB (*Desmocerus californicus dimorphus*)

Chapter 4 Results: Biological Resources, Discussion of Impacts, and Mitigation

As a result of literature reviews and field evaluations, it was determined that several species and habitat types could be impacted by Project activities. This chapter provides a detailed discussion of potential Project impacts to species and habitat types. As explained in the project description (Chapter 1), “Alternative 1” refers to the bridge replacement alternative, and “Alternative 2” refers to the bridge rehabilitation alternative.

Project effects are addressed below as direct or indirect impacts. Direct impacts are Project activities that are caused by or result from the proposed action and include both impacts to aquatic habitat in Miner Slough and impacts to terrestrial habitat. Within Miner Slough, direct impacts would include disturbance of the bottom substrate and temporary loss of habitat, both within the water column and to the river bottom from the installation of piles for the temporary marine trestle. Direct impacts to terrestrial habitat would result from compaction of soil from temporary access roads and staging areas; and on the south shore, direct impacts would result from shading from the temporary marine trestle. Additional direct impacts would occur from any pile driving required from either project alternative (Figure 4-1).

Indirect impacts are Project activities (proposed actions) that are caused by or will result from the proposed action and are later in time, or occur outside the Project limits, but are still reasonably certain to occur. Indirect impacts from the Project would also include shade impacts from the replacement bridge and removal of riparian vegetation for new approach.

Descriptions of the species and habitats, as well as the potential impacts and avoidance and minimization efforts, are presented below.

4.1 General Avoidance and Minimization Measures

To reduce potential impacts to sensitive biological resources, Caltrans proposes to incorporate Caltrans standard construction BMPs and avoidance and minimization measures into the proposed Project. These measures will be communicated to the contractor through the use of special provisions included in the contract bid solicitation package. These measures include the following:

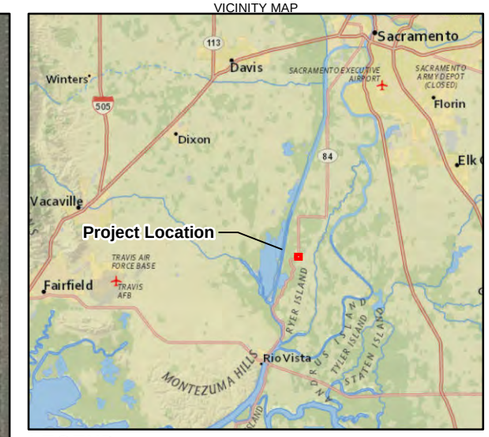
1. **Seasonal Avoidance**. To the extent practicable, construction will not occur during the wet season. Work within the streambed will be limited to the period from August 1 to November 30.

2. **Worker Environmental Awareness Training**. Before the onset of construction activities, a qualified biologist will conduct an education program for all construction personnel. The training will include a description of all listed species with the potential to occur in the BSA as well as migratory birds and their habitats; the occurrence of these species within the Project area; an explanation of the status of these species and protection under FESA and CESA; the measures to be implemented to conserve listed species and their habitats as they relate to the work site; and boundaries within which construction may occur. A fact sheet conveying this information will be prepared and distributed to all Project personnel entering the Project area. Upon completion of the training program, personnel will sign a form stating that they attended the program and understand all the avoidance and minimization measures and implications of FESA.

3. **Environmentally Sensitive Area (ESA) Fencing.** Prior to the start of construction, ESAs (defined as areas containing sensitive habitats adjacent to or within construction work areas for which physical disturbance is not allowed) will be clearly delineated using high-visibility orange fencing. The ESA fencing will remain in place throughout the duration of the Project and will prevent the encroachment of construction equipment/personnel into sensitive habitat areas. The final Project plans will depict all locations where ESA fencing will be installed and how it will be installed. The special provisions in the bid solicitation package will clearly describe acceptable fencing material and prohibited construction-related activities, vehicle operation, material and equipment storage, and other surface-disturbing activities within ESAs.

4. **Implementation of Water Quality/Erosion Control BMPs**. An SWPPP and erosion control BMPs will be developed and implemented to minimize any wind- or water-related erosion. They will also be in compliance with the requirements of the Regional Water Quality Control Board (RWQCB). Caltrans' BMP Guidance Handbook will provide guidance for design staff to include provisions in construction contracts for measures to protect sensitive areas as well as prevent and minimize storm water and non-storm-water discharges. Protective measures will include the following, at a minimum:

VICINITY MAP



LEGEND

Biological Study Area (BSA)

Project Limits

Habitat Type

Emergent Seasonal Wetland (0.016 acre)

Other Waters (10.30 acres)

Shrub Scrub Wetland (0.25 acre)

Tidal Wetland (0.09 acre)

Disturbance

Permanent Imapact Area (1.24 acre)

Temporary Impact Area (3.09 acres)

Shade Impact Area (0.34 acre)

Tidal Wetland Impacts

Temporary (0.016 acre)

Shade (0.019 acre)

Other Waters Impacts

Permanent (0.020 acre)

Temporary (0.18 acre)

Shade (0.18 acre)

0 200 400
Feet
N

Caltrans

FIGURE 4-1
Impacts to Potential Wetlands and Other Waters Replacement Alternative
Miner Slough Bridge Replacement Project
EA 04-0G660, State Route 84 Post Mile 12.1/12.2
Solano County, California

a. Disallowing any discharging of pollutants from vehicle and equipment cleaning into any storm drains or watercourses.

b. Keeping vehicle and equipment fueling and maintenance operations at least 50 ft from the ordinary high water mark or the edge of sensitive habitat (e.g., wetlands), except at established commercial gas stations or established vehicle maintenance facilities.

c. Collecting and disposing of concrete wastes in washouts and water from curing operations; neither will be allowed into watercourses. Sediment and debris removed from the roadway will be disposed of off-site at an approved location where the sediment and debris cannot enter surface waters.

d. Maintaining spill containment kits onsite at all times during construction operations and/or staging or fueling of equipment.

e. Using water trucks and dust palliatives to control dust in excavation-and-fill areas, and covering of temporary stockpiles when weather conditions require.

f. Installing coir rolls or straw wattles along or at the base of slopes during construction to capture sediment.

g. Protecting graded areas from erosion using a combination of silt fences, fiber rolls along toes of slopes or along edges of designated staging areas, and erosion control netting (such as jute or coir) as appropriate on sloped areas.

h. Establishing permanent erosion control measures to receive storm water discharges from the highway or other impervious surfaces.

5. **Construction Site Management Practices**. The following site restrictions will be implemented to avoid or minimize impacts to listed species and their habitats:

a. Enforcing a speed limit of 15 miles per hour within the Project footprint in unpaved and paved areas to reduce dust and excessive soil disturbance.

b. Locating construction access, staging, storage, and parking areas outside of any designated ESA or outside of the ROW in areas environmentally cleared and permitted by the contractor. The following areas will be limited to the minimum necessary to construct the proposed Project: access routes, staging

and storage areas, and contractor parking. Routes and boundaries of roadwork will be clearly marked prior to initiating construction or grading.

c. Certifying, to the maximum extent practicable, any borrow material to be non-toxic and weed free.

d. Enclosing all food and food-related trash items in sealed trash containers, and removing them from the site at the end of each day.

e. Prohibiting all pets within the Project area during construction.

f. Prohibiting firearms within the Project site except for those carried by authorized security personnel or local, state, or federal law enforcement officials.

g. Maintaining all equipment in order to prevent the leakage of vehicle fluids such as gasoline, oils, or solvents, and developing a Spill Response Plan. Hazardous materials such as fuels, oils, and solvents will be stored in sealable containers in a designated location that is at least 50 ft from aquatic habitats.

6. **Avoidance of Entrapment**. To prevent inadvertent entrapment of animals during construction, all excavated, steep-walled holes or trenches more than 1 foot deep will be covered at the close of each working day by plywood or similar materials, or will be provided with one or more escape ramps constructed of earth fill or wooden planks. Before such holes or trenches are filled, they must be thoroughly inspected for trapped animals. All replacement pipes, culverts, or similar structures stored within the Project area overnight will be inspected before they are subsequently moved, capped, and/or buried.

7. **Agency-Approved Biologist.** A biologist approved by USFWS and CDFW will conduct pre-construction surveys for federally and state-listed species, and the biologist will be present during construction activities including vegetation clearing and grubbing, as required by the resource agencies. If at any point any listed species is discovered within the Project limits, the agency-approved biologist, through the Resident Engineer or his/her designee, will halt all work within 50 ft of the animal and contact the corresponding agency (USFWS or CDFW) to determine how to proceed.

8. **Handling of Listed Species**. If at any time a listed species is discovered, the Resident Engineer and the agency-approved biologist will be immediately

informed. The agency-approved biologist will determine whether relocating the species is necessary, and will work with the corresponding agency (USFWS or CDFW) prior to handling or relocating unless otherwise authorized.

9. **Vegetation Removal.** Vegetation within the Project limits may be impacted by construction activities, and some clearing will be needed. Vegetation will be cleared only where necessary and will be cut above soil level except in areas that will be excavated for roadway construction. This will allow plants that reproduce vegetatively to resprout after construction. All clearing and grubbing of woody vegetation will occur by hand tools or using light construction equipment such as backhoes and excavators. A qualified biologist(s) will survey for nesting birds within the area(s) to be disturbed, including a perimeter buffer of 50 ft for passerines and 300 ft for raptors, before clearing activities begin during the nesting season (February 16 through August 31). All nest avoidance requirements of the MBTA and California Fish and Game Code will be observed. All cleared vegetation will be removed from the BSA to prevent attracting animals to the Project site. The contractor will be responsible for obtaining all permits, licenses, and environmental clearances for properly disposing of such materials.

10. **Replant, Reseed, and Restore Disturbed Areas**. Caltrans will restore temporarily disturbed areas to the pre-construction function and values to the maximum extent practicable. Exposed slopes and bare ground will be reseeded with native grasses and shrubs to stabilize and prevent erosion. Where disturbance includes the removal of trees and woody shrubs, native species will be replanted based on the local species composition.

11. **Reduce Spread of Invasive Species.** To reduce the spread of invasive nonnative plant species and minimize the potential decrease of palatable vegetation for wildlife species, Caltrans will comply with Executive Order 13112. This order is intended to prevent the introduction of invasive species and provide for their control in order to minimize the economic, ecological, and human health impacts. In the event that noxious weeds are disturbed or removed during construction-related activities, the contractor will be required to contain the plant material associated with these noxious weeds and dispose of it in a manner that will not promote the spread of the species. The contractor will be responsible for obtaining all permits, licenses, and environmental clearances for properly disposing of materials. Areas subject to noxious weed removal or disturbance will be replanted with fast-growing native grasses or a native erosion control seed mixture. If

seeding is not possible, the area within the Project area should be covered to the extent practicable with heavy black plastic solarization material until the end of the Project.

12. **Water Diversion Plan.** Caltrans will submit a water diversion plan to the appropriate agencies for review prior to construction. The approved temporary water diversion system will be used during construction so that there is no flowing water in the river bed during in-stream construction activity.

13. **Fish Removal and Relocation Plan.** Caltrans will submit a fish capture and relocation plan to CDFW, USFWS, and NMFS for review and approval prior to the installation and operation of the water diversion system.

14. **Use of temporary lighting for night construction activities.** The following apply to construction activities occurring at night:

    a. Maintenance and construction activities will be avoided at night to the extent practicable.

    b. When night work cannot be avoided, disturbance to listed species will be avoided and minimized by restricting substantial use of temporary lighting to the least sensitive seasonal and meteorological windows.

    c. Lights on work areas will be shielded and focused to minimize lighting of listed species' habitat.

4.2 Natural Communities of Special Concern

4.2.1 Wetlands and Other Waters of the United States

Wetland communities have been observed in the BSA. Wetland types include tidal wetland, emergent season wetland, and shrub scrub wetland. The wetland delineation report and maps are included in Appendix C.

A tidal wetland is located on the north side of Miner Slough. The dominant vegetation within the wetland is white alder, red willow (*Salix laevigata*), curly dock (*Rumex crispus*), and common rush (*Juncus patens*). An emergent seasonal wetland was found along the north bank of Miner Slough. The dominant vegetation within the wetland is white alder, red willow, common rush, and sedge (*Carex* spp.). Caltrans biologists were unable to survey the island directly east of the existing bridge for wetlands because it was not easily accessible. The island will not be affected by either

Project alternative. The NWI Wetlands Mapper (USFWS 2014) classifies the island as shrub scrub wetland.

4.2.1.1 Survey Results

Three wetland areas totaling 0.33 acre, tidal wetlands totaling 0.08 acre, emergent seasonal wetlands totaling 0.01 acre, other waters totaling 10.30 acre, and shrub scrub wetland totaling 0.24 acre were identified and mapped within the BSA (refer to Appendix C, Figure 3 for details).

4.2.1.2 Avoidance and Minimization Efforts

The emergent wetland on the south bank of Miner Slough will be spanned by the temporary marine trestle, thereby avoiding permanent impacts to the wetland community, although some temporary shading will occur. No temporary or permanent impacts to these emergent wetlands are anticipated. The staging area is located in an upland area and will be demarcated with ESA fencing.

Modifications to bed and bank, or fill into the waters, are minimized to the maximum extent possible given the project requirements. The general construction avoidance and minimization measures described in Section 4.1 will be implemented to avoid and minimize effects to waters of the United States.

4.2.1.3 Project Impacts

Alternative 1

There are no expected permanent or temporary impacts to emergent seasonal wetlands. Temporary impacts includes 0.016 acre of shading from the temporary north trestle. Permanent impacts to tidal wetlands on the north shore of Miner Slough include shading of 0.02 acre of tidal wetland and other waters beneath the new bridge (Figure 4-1).

Alternative 2

There are no expected permanent or temporary impacts to emergent seasonal wetlands. Temporary impacts to tidal wetlands includes 0.016 acre of shading from the temporary north trestle. No permanent impacts will result to wetlands or other waters from this alternative (Figure 4-2).

4.2.1.4 Compensatory Mitigation

Alternative 1

Jurisdictional wetlands that are temporarily impacted by the Project would be restored and revegetated with appropriate native species. Restoration will also be achieved by

removing the temporary trestles. Compensatory mitigation for permanent effect on 0.020 acre of other waters will be provided through habitat replacement off-site. Permanent loss of aquatic habitat will require mitigation at a 1:1 ratio (habitat replaced:habitat lost) based on square footage. These effects may be mitigated at a USACE-approved wetland mitigation bank that covers the project or at a turnkey mitigation property located close to the project.

Alternative 2

Jurisdictional wetlands that are temporarily impacted by the Project would be restored and revegetated with appropriate native species. Restoration will also be achieved by removing the temporary trestles. Because no permanent impacts are expected from this alternative, off-site mitigation is proposed.

4.2.1.5 CUMULATIVE IMPACTS

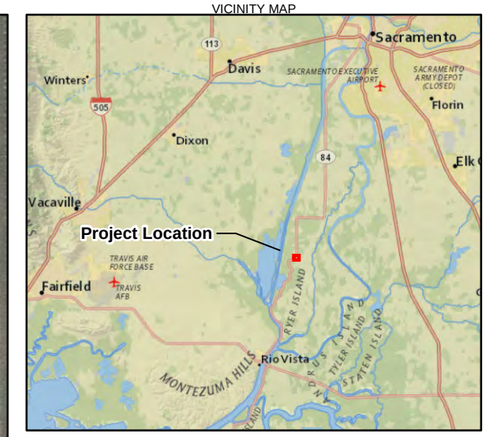
Cumulative impacts on wetland and aquatic habitats results from past, current, and reasonably foreseeable future projects in the region, including periodic maintenance and replacement of bridges, and associated installation of hardscape and erosion protection measures such as rock slope placement along banks, throughout the region. These projects will all undergo (or have undergone) separate environmental review, and will require separate environmental permitting from regulatory agencies. Ecological impacts for these individual projects will be mitigated as part of the environmental review and regulatory/resource agency permit acquisition process. Thus, with implementation of measures to avoid and minimize destruction of jurisdictional wetlands designed into the Project as well as the onsite restoration that Caltrans has proposed, the Project would result in a negligible contribution to cumulative impacts to jurisdictional wetlands.

4.3 Special-status Plant Species

This section addresses the plant species documented to occur or considered likely to occur in the BSA. A complete list of special-status species for the nine-quadrangle region is provided in Appendix B.

Two special-status plant species, Sanford’s arrowhead and woolly rose-mallow, were found in the BSA during the special-status plant surveys in 2014. Sanford’s arrowhead and woolly rose-mallow are designated as threatened (List 1B.1) by CNPS, but have no state or federal designation. Both plant species were found in the tidal wetland along the northern shore of Miner Slough.

VICINITY MAP



LEGEND

- Biological Study Area (BSA)
- Project Limits

Habitat Type

- Emergent Seasonal Wetland (0.016 acre)
- Other Waters (10.30 acres)
- Shrub Scrub Wetland (0.25 acre)
- Tidal Wetland (0.09 acre)

Disturbance

- Permanent Imapact Area (0.50 acre)
- Temporary Impact Area (1.31 acres)

Tidal Wetland Impacts

- Temporary (0.016 acre)
- Shade (0.011 acre)

Other Waters Impacts

- Temporary (0.18 acre)
- Shade (0.017 acre)

N

0 200 400
Feet

Caltrans

FIGURE 4-2
Impacts to Potential Wetlands and Other Waters Rehabilitation Alternative
Miner Slough Bridge Replacement Project
EA 04-0G660, State Route 84 Post Mile 12.1/12.2
Solano County, California

No federal- or state-listed species were observed within the BSA during the protocol-level plant surveys. The complete results of the special-status plant survey are included as Appendix D.

4.3.1 Sanford's Arrowhead

Sanford's arrowhead (*Sagittaria sanfordii*) is a rhizomatous perennial herb in the Alismataceae family. The CNPS rates this species as a List 1B.2 on its inventory of rare and endangered plants. This species is endemic to California and almost always occurs within marshes and swamps in shallow freshwater (CNPS 2015). It blooms from May through November. It is considered extirpated from southern California, and mostly extirpated from the Central Valley. It is threatened by grazing, development, recreational activities, non-native plants, road widening, channel alteration, and maintenance (CNPS 2015).

4.3.1.1 Survey Results

A population of Sanford's arrowhead was located on the northern side of Miner Slough, on both sides of the existing bridge. Approximately 100 plants were located along 137 ft of shoreline northwest of the existing bridge, and 50 plants were found along 31 ft of shoreline on the northeastern side of the bridge. During the June 2014 site visit, 75 percent of the plants were blooming. The occurrence lies in an area that will be spanned by the temporary trestles.

4.3.1.2 Avoidance and Minimization Efforts

The location of the temporary marine trestle cannot be altered; therefore, some impact to Sanford's arrowhead habitat is unavoidable. The design of the trestle will span the tidal wetland, which will limit impact of temporary shading to the tidal wetland, thereby avoiding direct destruction of individuals of the species. Caltrans will relocate these individuals to an area that will not be impacted by Project activities. The general construction avoidance and minimization measures described in Section 4.1 will be implemented to avoid and minimize effects to Sanford's arrowhead.

4.3.1.3 Project Impacts

Alternative 1

Approximately 174 square ft (0.004 acre) of the tidal wetland where Sanford's arrowhead is found would be directly impacted by shading caused by installation of the temporary trestle, with an expected impact to several individuals of the species. This impact estimate will be revised to a lower figure that will include only the area of individual populations being relocated out of the project area. No indirect impacts will occur to this species (Figure 4-3).

Alternative 2

Approximately 348 square ft (0.008 acre) of the tidal wetland where Sanford's arrowhead is found would be directly impacted by shading caused by installation of the temporary trestle, with an expected impact to several individuals of the species. This impact estimate will be revised to a lower figure that will include only the area of individual populations being relocated out of the project area. No indirect impacts will occur to this species (Figure 4-4).

4.3.1.4 COMPENSATORY MITIGATION

Caltrans is not proposing mitigation because no permanent impacts are expected to Sanford's arrowhead or its habitat. Caltrans proposes to relocate this population outside of the work zone in a similar area.

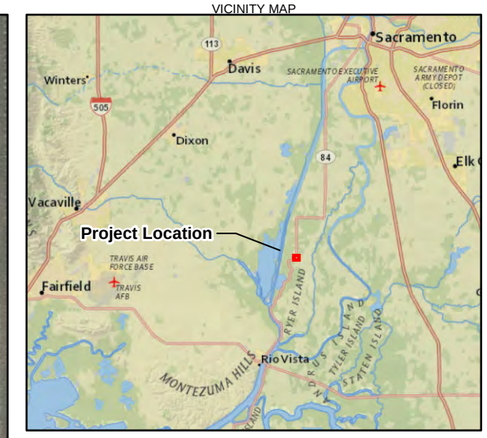
4.3.1.5 CUMULATIVE IMPACTS

Cumulative impacts on Sanford's arrowhead results from past, current, and reasonably foreseeable future projects in the region, including periodic maintenance and replacement of bridges, and associated installation of hardscape and erosion protection measures such as rock slope placement along banks, throughout the region. These projects will all undergo (or have undergone) separate environmental review, and will require separate environmental permitting from regulatory agencies. Ecological impacts for these individual projects will be mitigated as part of the environmental review and regulatory/resource agency permit acquisition process. Thus, with implementation of measures to avoid and minimize destruction of jurisdictional wetlands designed into the Project as well as the onsite restoration that Caltrans has proposed, the Project would result in a negligible contribution to cumulative impacts to jurisdictional wetlands.

4.3.2 Woolly Rose-mallow

Woolly rose-mallow is a rhizomatous perennial herb in the family Malvaceae. It blooms from June through September. The CNPS rates this species as a List 1B.2 on its inventory of rare and endangered plants. This species is endemic to California and almost always occurs within freshwater marsh and swamp habitats, often in riprap on sides of levees. Woolly rose-mallow is threatened by habitat disturbance, development, agriculture, recreational activities, and channelization of the

VICINITY MAP



LEGEND

- Woolly Rose Mallow
- Sanford's Arrowhead
- Biological Study Area (BSA)
- Project Limits

Disturbance

- Permanent Imapact Area (1.24 acre)
- Temporary Impact Area (3.09 acres)
- Shade Impact Area (0.34 acre)
- Temporary Imapct (Bridge Removal 0.19 acre)

Impacts to Rare Plants

- Temorary (0.004 acre)

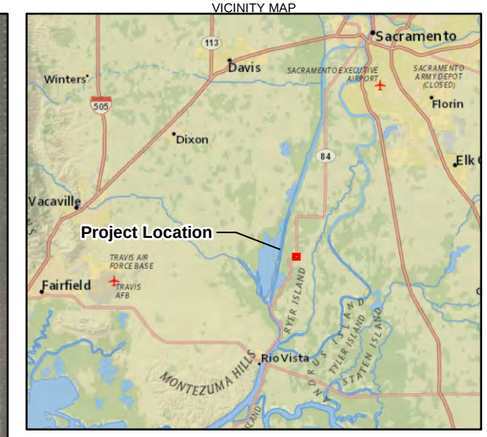
N

0 200 400
Feet

Caltrans

FIGURE 4-3
Impacts to Special-status Plant Species
Replacement Alternative
Miner Slough Bridge Replacement Project
EA 04-0G660, State Route 84 Post Mile 12.1/12.2
Solano County, California

VICINITY MAP



LEGEND

- Woolly Rose Mallow
- Sanford's Arrowhead
- Biological Study Area (BSA)
- Project Limits

Disturbance

- Permanent Imapact Area (0.50 acre)
- Temporary Impact Area (1.31 acres)

Impacts to Rare Plants

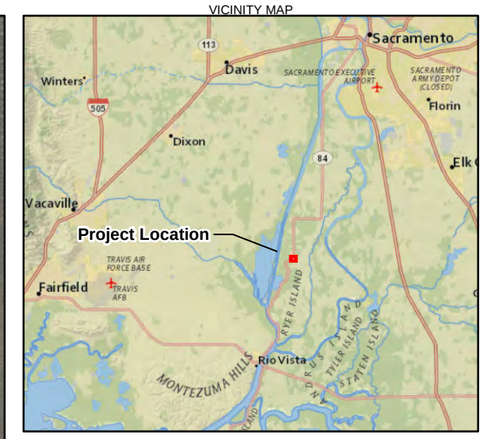
- Permanent (0.008 acre)

N

0 200 400
Feet

FIGURE 4-4
Impacts to Special-status Plant Species
Rehabilitation Alternative
Miner Slough Bridge Replacement Project
EA 04-0G660, State Route 84 Post Mile 12.1/12.2
Solano County, California

VICINITY MAP



LEGEND

- Elderberry Location
- 100 Feet From Elderberry
- Biological Study Area (BSA)
- Project Limits
- Control House

Disturbance

- Permanent Imapact Area (1.24 acre)
- Temporary Impact Area (3.09 acres)
- Shade Impact Area (0.34 acre)

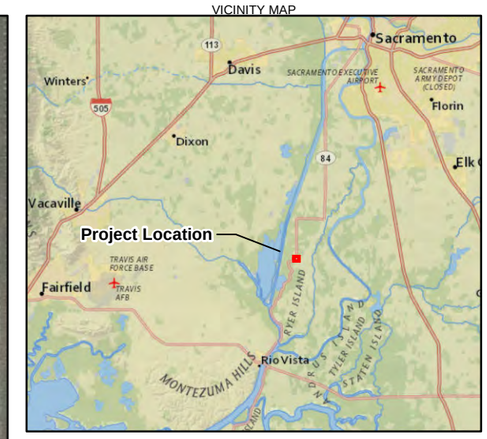
N

0 200 400
Feet

Caltrans

FIGURE 4-5
Impacts to Valley Elderberry Longhorn Beetle Replacement Alternative
Miner Slough Bridge Replacement Project
EA 04-0G660, State Route 84 Post Mile 12.1/12.2
Solano County, California

VICINITY MAP



LEGEND

- Elderberry Location
- 100 Feet From Elderberry
- Biological Study Area (BSA)
- Project Limits

Disturbance

- Permanent Imapact Area (0.50 acre)
- Temporary Impact Area (1.31 acres)

N

0 200 400
Feet

Caltrans

FIGURE 4-6
Impacts to Valley Elderberry Longhorn Beetle Replacement Alternative
Miner Slough Bridge Rehabilitation Project
EA 04-0G660, State Route 84 Post Mile 12.1/12.2
Solano County, California

BAO C:\PROJ\CALTRANS\477335ENVONCALL\TO1_BIOLOGICAL_SUPPORT\0G660_SOL84_MINERSLOUGHBRIDGE\GIS\MAPFILES\2015\NES\AUGUST\FIG4-6_IMPACTS_TO_VALLEY_ELDERBERRY_LONGHORN_BEETLE_REHABILITATION_ALTERNATIVE.MXD CARCHER 8/11/2015 2:13:33 PM

Sacramento River and its tributaries. It is also threatened by weed control measures and erosion (CNPS 2015).

4.3.2.1 Survey Results

A population of woolly rose-mallow was found on the northern side of Miner Slough on top of a fallen log under the existing bridge. One plant was found in this location and it was in peak bloom. The species occurs in an area that will be spanned by the temporary marine trestle.

4.3.2.2 Avoidance and Minimization Efforts

The location of the temporary trestle cannot be altered; therefore, some impact to woolly rose-mallow habitat is unavoidable. The design of the trestle will span the tidal wetland, which will limit impact to temporary shading of the tidal wetland, thereby avoiding direct destruction of individuals of the species. Caltrans is also exploring the possibility of relocating these individuals to an area that will not be impacted by Project activities.

4.3.2.3 Project Impacts

Alternative 1

Approximately 174 square ft (0.004 acre) of the tidal wetland where woolly rose-mallow is found would be directly impacted by shading caused by installation of the temporary trestle, with an expected impact to several individuals of the species. No indirect impacts to this species are anticipated. This impact estimate will be revised to a lower figure that will include only the area of individual populations being relocated out of the project area. No indirect impacts will occur to this species.

Alternative 2

Approximately 348 square ft (0.008 acre) of the tidal wetland where woolly rose-mallow is found would be directly impacted by shading caused by installation of the temporary trestle, with an expected impact to several individuals of the species. This impact estimate will be revised to a lower figure that will include only the area of individual populations being relocated out of the project area. No indirect impacts will occur to this species.

4.3.2.4 Compensatory Mitigation

Caltrans is not proposing mitigation because no permanent impacts are expected to woolly rose-mallow or its habitat. Caltrans proposes to relocate this population outside of the work zone in a similar area.

4.3.2.5 CUMULATIVE IMPACTS

Cumulative impacts on woolly rose-mallow result from past, current, and reasonably foreseeable future projects in the region, including periodic maintenance and replacement of bridges, and associated installation of hardscape and erosion protection measures such as rock slope placement along banks, throughout the region. These projects will all undergo (or have undergone) separate environmental review, and will require separate environmental permitting from regulatory agencies. Ecological impacts for these individual projects will be mitigated as part of the environmental review and regulatory/resource agency permit acquisition process. Thus, with implementation of measures to avoid and minimize destruction of jurisdictional wetlands designed into the Project as well as the onsite restoration that Caltrans has proposed, the Project would result in a negligible contribution to cumulative impacts to jurisdictional wetlands.

4.4 Special-status Wildlife Species Occurrences

This section addresses the special-status wildlife species documented to occur or considered likely to occur in the BSA. A complete list of special-status species for the nine-quadrangle region is provided in Appendix B.

4.4.1 Delta Smelt

The delta smelt (*Hypomesus transpacificus*) was federally listed as threatened on March 5, 1993 (58 Federal Register (Fed. Reg.) 12854). The species was listed as state threatened the same year. Critical habitat for delta smelt was designated on December 19, 1994 (59 Fed. Reg. 65256). The Delta Native Fishes Recovery Plan was completed in 1996 (USFWS 1996b). The Five Year Status Review for the delta smelt was completed on March 31, 2004 (USFWS 2004a).

Delta smelt are endemic to the upper Delta. They occur in the Delta primarily downstream of the mouth of the American River on the Sacramento River, downstream of Mossdale on Miner Slough, and in Suisun Bay in the western Delta. Adult delta smelt migrate into freshwater to spawn in the Sacramento River upstream to the confluence with the Feather River, as well as in the Mokelumne River system, Cache Slough region, central Delta, Montezuma Slough, Suisun Bay, Suisun Marsh, Carquinez Strait, Napa River, Napa Marsh, and San Pablo Bay. It is unknown whether delta smelt found in San Pablo Bay are a permanent population or whether they are distributed into the Bay only during high outflow periods. Since 1982, the area of highest delta smelt abundance has been the northwestern Delta in the channel of the Sacramento River (Beacham et al. 2000).

Wang (1986) reported spawning in freshwater at temperatures of about 45 to 59°F; however, hatched larvae have been collected at temperatures of 59 to 72°F. Temperatures that are optimal for survival of embryos and larvae have not yet been determined. Delta smelt of all sizes are found in the main channels of the Delta and Suisun Marsh, and the open waters of Suisun Bay where the waters are well oxygenated and temperatures relatively cool, usually less than 68 to 72°F in summer. When not spawning, they tend to be concentrated in the mixing zone where the highest primary productivity occurs and where zooplankton populations are usually most abundant (Knutson and Orsi 1983; Orsi and Mecum 1986). At all life stages, delta smelt are found in greatest abundance in the top 6.5 ft of the water column and usually not in close association with the shoreline.

In most years, spawning occurs in shallow water habitats (SWH) in the Delta. Shortly before spawning, adult smelt migrate upstream from the mixing zone to disperse widely into river channels and tidally influenced backwater sloughs (Radtke 1966; Moyle 1976, 2002; Wang 1991). Spawning locations appear to vary widely from year to year (DWR and U.S. Bureau of Reclamation [Reclamation] 1993). Sampling of larval smelt in the Delta suggests spawning has occurred in the Sacramento River; Barker, Lindsey, Cache, Georgiana, Prospect, Beaver, Hog, and Sycamore sloughs; Miner Slough off Bradford Island, including Fisherman's Cut; False River along the shore zone between Franks tract and Webb tract; and possibly other areas (Wang 1991). In years of moderate to high Delta outflow, smelt larvae are often most abundant in Suisun Bay and sloughs of Suisun Marsh. Some spawning probably occurs in shallow water habitats in Suisun Bay and Suisun Marsh during wetter years (Sweetnam and Stevens 1993; Wang 1991). Spawning has also been recorded in Montezuma Slough near Suisun Bay (Wang 1986) and may also occur in Suisun Slough in Suisun Marsh (P. Moyle, UCD, unpublished data as cited by USFWS 2004a).

The spawning season varies from year to year, and may occur from winter (December) to early summer (July). Wang (1991) estimated that spawning took place from mid-February to late June or early July, with peak spawning occurring in late April and early May. A study of delta smelt eggs and larvae (Wang and Brown 1993 as cited in DWR and Reclamation 1994) confirmed that spawning may occur from February through June, with a peak in April and May.

Observations have indicated that delta smelt are broadcast spawners (DWR and Reclamation 1994) and eggs are demersal and adhesive. Newly hatched delta smelt

have a large oil globule making them semi-buoyant (R. Mager, UCD, unpublished data as cited by USFWS 2004a). Once the swim bladder develops, larvae become more buoyant and rise up higher into the water column. At this stage, most larvae are transported downstream until they reach the mixing zone. In August, young-of-the-year fish dominate trawl catches, and adults become rare. The abrupt change from a single-age, adult cohort during spawning in spring to a population dominated by juveniles in summer suggests strongly that most adults die after they spawn (Radtke 1966; Moyle 1976, 2002). However, in some years when temperatures rise above 64°F before all adults have spawned, some fraction of the unspawned population may also hold over as 2-year-old fish and spawn in the subsequent year.

Delta smelt feed primarily on planktonic copepods, cladocerans, and, to a lesser extent, insect larvae.

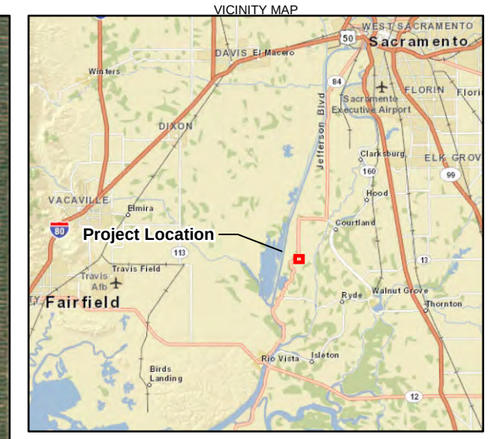
Delta smelt historically was one of the most common fish in the Sacramento-San Joaquin River estuary. Delta smelt abundance fluctuates greatly from year to year, as indicated by seven independent data sets, which demonstrated a dramatic decline of the delta smelt population and low population levels from 1983 to 1992 (CDFW 2008c). In 1993, abundance increased in an apparent response to a rise in available habitat brought about by a wet winter and spring. Fall abundance of delta smelt is usually higher when low salinities of 2 parts per thousand (ppt) or less occur in Suisun Bay in the preceding spring (CDFW 2008c). The actual size of the delta smelt population is not known. However, the pelagic lifestyle, short life span, spawning habits, and relatively low fecundity of delta smelt indicate that a fairly substantial population probably is necessary to keep the species from becoming extinct.

4.4.1.1 Survey Results

No aquatic surveys were conducted for the Project. However, because the BSA lies within designated critical habitat for delta smelt, presence of the species is inferred. This species may be present in the brackish water of Miner Slough where the Project is located.

Hydro-acoustic modeling was performed to analyze potential impacts to aquatic species during pile installation for the temporary marine trestle (Figure 4-7 and 4-8).

VICINITY MAP



LEGEND

- Biological Study Area (BSA)
- Proposed Bridge
- Curbs Gutters & Dikes
- Temporary Trestles
- Attenuated 183 dB Cumulative SEL
- Unattenuated 183 dB Cumulative SEL.

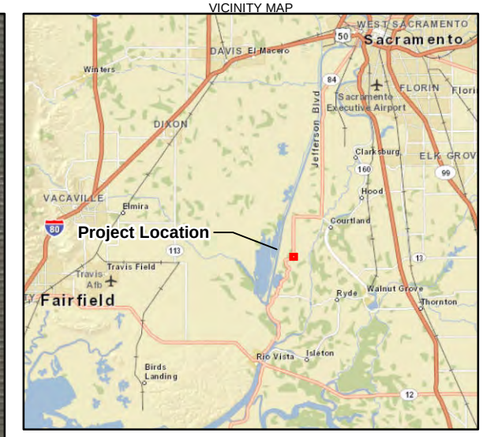
N

0 300 600 Feet

Caltrans

FIGURE 4-7
Biological Study Area Including 183 dB Cumulative SEL Replacement Alternative
Miner Slough Bridge Replacement Project
EA 04-0G660, State Route 84 Post Mile 12.1/12.2
Solano County, California

VICINITY MAP



LEGEND

- Biological Study Area (BSA)
- Proposed Bridge
- Curbs Gutters and Dikes
- Temporary Trestles
- Attenuated 187 dB Cumulative SEL
- Unattenuated 187 dB Cumulative SEL.

N

0 200

Caltrans

FIGURE 4-8
Biological Study Area Including 187 dB Cumulative SEL Replacement Alternative
Miner Slough Bridge Replacement Project
EA 04-0G660, State Route 84 Post Mile 12.1/12.2
Solano County, California

The results of the hydro-acoustic modeling analysis are presented in Table 4-1.

Table 4-1 Results of Hydro-acoustic Analysis

Threshold	Upstream			Downstream		
	Distance to 206 dB RMS Criteria (ft)	Distance to 187 SEL dB Cumulative SEL Criteria (ft)	Distance to 183 SEL dB Cumulative SEL Criteria (ft)	Distance to 206 dB RMS Criteria (ft)	Distance to 187 SEL dB Cumulative SEL Criteria (ft)	Distance to 183 SEL dB Cumulative SEL Criteria (ft)
dB re:1 µPa	**206 dB**	**187 dB**	**183 dB**	**206 dB**	**187 dB**	**183 dB**
New Bridge						
Abutment 1	<33	43	75	<33	43	75
72-inch Pile Unattenuated (Piers 2 and 4)	98	2,192	2,192	98	750	1,290
72-inch Pile Attenuated (Piers 2 and 4)*	<33	751	1290	<33	750	1,290
Steel Sheet Piles (Pier 3)	na	na	na	na	na	na
24-inch Pile Unattenuated (Pier 3)	<33	1,371	2,000	<33	797	797
24-inch Pile Attenuated (Pier 3)	<33	354	607	<33	354	607
Abutment 5	<33	<33	43	<33	<33	43
Temporary Span						
Unattenuated piles	56	2,000	2,000	56	797	797
Attenuated piles	<33	648	1,113	<33	797	797

Notes*:*
1 µPa = 1 micropascal (reference pressure for sound in water).
dB = decibel
RMS = Root mean square
SEL = sound exposure level
*Only Pier 2 can be attenuated because Pier 4 is located on land.

4.4.1.2 AVOIDANCE AND MINIMIZATION EFFORTS

Caltrans and its contractors would implement the following measure, consistent with the programmatic consultation on delta smelt for the Central Zone of the Delta (USFWS 2004c), to avoid and minimize potential effects to delta smelt during in-water work activities:

- Restricting in-water work to the proposed work window of August 1 to November 30.

- Hydro-acoustic monitoring by qualified fisheries biologists would occur during periods of pile driving to ensure minimal levels of hydro-acoustic impacts.

In addition, the following measure would be implemented during dewatering of the cofferdam at Pier 3:

- Fish rescue and relocation will be conducted by qualified fisheries biologist(s). The qualified biologist(s) will remain onsite during the entire dewatering process. Relocation would be accomplished by seining, dipnetting, and/or electrofishing. The biologist will minimize handling of fish species, and all captured fish will be held in a container with a lid that contains cool, shaded, adequately aerated water until the fish species is relocated outside of the cofferdam.

4.4.1.3 PROJECT IMPACTS

Alternative 1

In the programmatic consultation on delta smelt (USFWS 2004b), the USFWS noted that "take" of delta smelt is difficult to detect and quantify owing to their small size and secretive nature and, therefore, use acreage impact to SWH as a substitute means of quantifying "take" of delta smelt. SWH and shading of shallow water habitat are defined as follows:

- Shallow Water Habitat: USFWS has defined this element of delta smelt habitat as all waters between mean high water mark (MHWM) and 9.84 ft below the mean lower low water mark. All waters with depths less than 9.84 ft at any given time are within the photic zone and are highly productive. These areas are considered suitable habitat for delta smelt and are both vegetated and unvegetated, including areas where rock riprap may have once been applied. Critical habitat for delta smelt encompasses this definition but is not exclusive of SWH.

- Shadow Zone: This is the shadow created by a structure placed over or in the waterways of the Delta within the SWH zone. The shadow zone causes a loss of productivity, and loss, prevention, or thinning of the aquatic vegetation. The footprint of the structure shall be used to calculate the shadow zone and to offset all adverse effects resulting from the Project (USFWS 2004b).

Consistent with the programmatic consultation on delta smelt (USFWS 2004c), replacement of an existing structure is considered an activity that will not result in the loss or shading of SWH (USFWS 2004c) as follows:

- *Maintenance.* The repair, rehabilitation, or replacement of any previously authorized, currently serviceable structure or fill, or any currently serviceable structure or fill authorized by 33 CFR 330.3, provided that the structure or fill is not to be put to uses differing from those specified or contemplated for it in the original permit or in the most recently authorized modification, and provided that no discharge of dredged or fill material occurs. Minor deviations in the structure's configuration or filled area, including those due to changes in materials, construction techniques, or current construction codes or safety standards that are necessary to make repair, rehabilitation, or replacement are minimal (i.e., repair, rehabilitation, or replacement of piers, dolphins, boat docks, or levees where existing riprap occurs and no woody riparian or aquatic vegetation has become established). Currently, "serviceable" means useable as is or with some maintenance, but not so degraded as to essentially require reconstruction.

The installation of the temporary trestles would also not result in a shading of SWH, consistent with the programmatic consultation (USFWS 2004c) as follows:

- *Temporary Construction, Access and Dewatering.* Temporary structures, work and discharges, including cofferdams, are necessary for construction activities or access fills or dewatering of construction sites, provided that the associated primary activity is authorized by the USACE or the USCG, or other construction activities not subject to USACE or USCG regulations. Appropriate measures must be taken to maintain near-normal downstream flows and to minimize flooding. Fill must be of materials, and placed in a manner that will not be eroded by expected high flows. The use of dredged material may be allowed if it is determined by the District Engineer that it will not cause more than minimal adverse effects on aquatic resources. Temporary fill must be entirely removed to upland areas, or dredged material returned to its original location, following completion of the construction activity, and the affected areas must be restored to the pre-Project conditions. Cofferdams cannot be used to dewater wetlands or other aquatic areas so as to change their use.

The Maintenance and Temporary Access sections of the programmatic consultation for delta smelt identify the bridge replacement and temporary trestle as activities that will not result in the loss or shading of SWH (USFWS 2004c).

Removal of the old bridge will open up 0.12 acre of shaded SWH, and will offset a portion of the 0.18 acre of shaded SWH associated with the replacement bridge (see

Figure 4-9). The Project will result in a net increase of 0.06 acre of shaded SWH. By adhering to the August 1 to November 30 work window, Caltrans does not anticipate take of individuals of delta smelt. No indirect effects to this species are expected.

Alternative 2

Alternative 2 would utilize the same programmatic consultation for delta smelt listed in Alternative 1. However, all impacts associated with this alternative would be temporary, resulting in 0.18 acre of temporary impacts (Figure 4-10). By adhering to the August 1 to November 30 work window, Caltrans does not anticipate take of individuals of delta smelt. No indirect effects to this species are expected.

4.4.1.4 COMPENSATORY MITIGATION

Alternative 1

Consistent with the programmatic consultation for delta smelt, Caltrans proposes to mitigate the net increase of shaded SWH associated with the replacement bridge at a 3:1 ratio (USFWS 2004c). The proposed Project will result in a net increase of 0.06 acre of shaded SWH; therefore, Caltrans proposes to purchase 0.18 acre of mitigation credits for delta smelt.

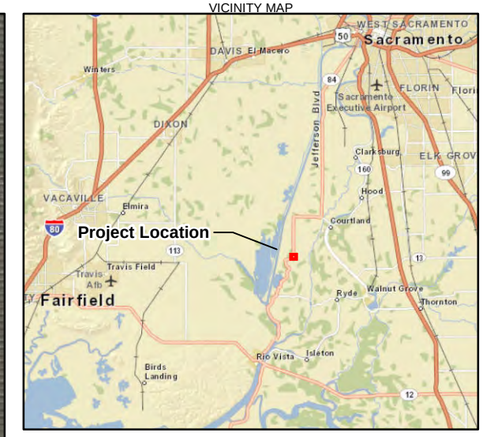
Alternative 2

This alternative would create no net increase in shaded SWH nor have any permanent impacts to delta smelt habitat; therefore, Caltrans is not proposing any compensatory mitigation for this alternative.

4.4.1.5 CUMULATIVE IMPACTS

Cumulative impacts on Delta Smelt result from past, current, and reasonably foreseeable future projects in the region, including periodic maintenance and replacement of bridges throughout Solano County, flood control projects, and slope placement along banks, throughout the region. These projects will all undergo (or have undergone) separate environmental review, and will require separate environmental permitting from regulatory agencies. Although these and similar projects could result in impacts on Delta Smelt, it is expected that most current and future projects that impact this species and its habitats will be required to mitigate these impacts through the California Environmental Quality Act (CEQA), Section 1600, or Section 404/401 permitting process, as well as through the FESA Section 7 consultation process. As a result, most projects in the region will mitigate their

VICINITY MAP



LEGEND

- Biological Study Area (BSA)
- Project Limits

Fisheries Impacts

- Benifical Impact Bridge Removal (0.12 acre)
- Permanent Impact (0.02 acre)
- Permanent Shade (0.18 acre)
- Temporary Impact (0.18 acre)

N

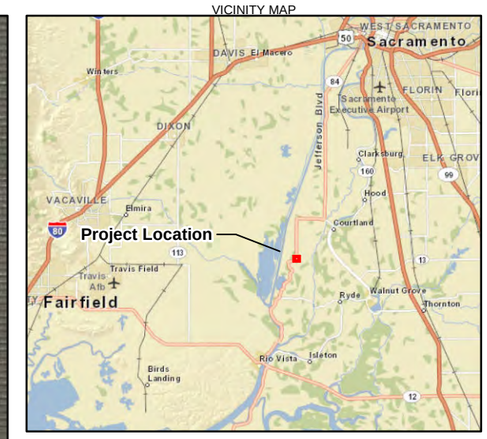
0 200 400 Feet

Caltrans

FIGURE 4-9
Fisheries Impacts
Bridge Replacement
Miner Slough Bridge Project
EA 04-0G660, State Route 84 Post Mile 12.1/12.2
Solano County, California

BAO C:\PROJ\CALTRANS\477335ENVONCALL\TO1_BIOLOGICAL_SUPPORT\0G660_SOL84_MINERSLOUGHBRIDGE\GIS\MAPFILES\2015\NES\AUGUST\FIG4-9_FISHERIES IMPACTS_BRIDGE_REPLACEMENT.MXD CARCHER 8/25/2015 11:25:09 AM

VICINITY MAP



LEGEND

- Biological Study Area (BSA)
- Project Limits

Fisheries Impacts

- Permanent Shade (0.017 acre)
- Temporary Impact (0.18 acre)

N

0 200 400 Feet

Caltrans

FIGURE 4-10
Fisheries Impacts
Bridge Rehabilitation
Miner Slough Bridge Project
EA 04-0G660, State Route 84 Post Mile 12.1/12.2
Solano County, California

impacts in Delta Smelt, minimizing cumulative impacts in these species. With implementation of avoidance and minimization measures, this project will not make a considerable contribution to cumulative impacts on the Delta Smelt.

4.4.2 Longfin Smelt

On May 6, 2008, a petition by the Bay Institute, Center for Biological Diversity, and the Natural Resources Defense Council to list longfin smelt (*Spirinchus thaleichthys*) was found by USFWS to present sufficient information about the imperiled condition of the species to initiate a status review and consider its listing under FESA (USFWS 2008a). USFWS found that the San Francisco Bay Distinct Population Segment (DPS) did not warrant listing under FESA. In 2011, another status review was initiated on the species, and this species is currently considered a candidate for listing under the FESA. Critical habitat has not been designated for longfin smelt.

Longfin smelt are a small silvery fish that can be distinguished from other smelts by their long pectoral fins and incomplete lateral line (Moyle 2002). Mature males are generally darker colored than females, have an enlarged and more rigid dorsal and anal fin, and have breeding tubercles on their paired fins. In California, longfin smelt are an anadromous species that can tolerate salinities ranging from freshwater to nearly pure seawater.

Populations in California were historically known from the San Francisco estuary, Humboldt Bay, Eel River estuary, and Klamath River estuary (Moyle 2002). In the San Francisco estuary, longfin smelt are rarely found upstream of Rio Vista or Medford Island in the Delta. Adults can occur seasonally in the South San Francisco Bay but are more commonly known to be concentrated in Suisun, San Pablo, and North San Francisco bays (Moyle 2002). This species is regularly seen in the Gulf of the Farallones west of the Golden Gate Bridge, and a specimen has been identified from Monterey, California. The species is also known from bays and estuaries from Oregon to Alaska (e.g., Coos Bay, Oregon; Skagit Bay, Grays Harbor, and Willapa Bay, Washington; and Prince William Sound, Alaska) (Moyle et al. 1995).

Longfin smelt are euryhaline, nektonic, and anadromous, moving into freshwater to spawn. They are found in a wide range of salinities from freshwater to seawater with a preference in the range of 15 to 19 ppt (Moyle 2002). This species can occupy water as warm as 68°F in summer months, but prefers 59 to 64°F waters. The principal food organism of longfin smelt is the opossum shrimp (*Neomysis mercedis*). Other copepods and crustaceans also are commonly preyed on by longfin smelt. Longfin

smelt can move up and down within the water column to maintain their position within the mixing zone of the estuary and to seek their prey, which vertically migrates diurnally.

Longfin smelt congregate for spawning in the upper end of Suisun Bay and in the lower and middle Delta, especially in the Sacramento River channel and sloughs (Moyle et al. 1995). The Sacramento longfin smelt has a very prolonged spawning

season, with spawning occurring as early as November into June (Baxter, unpublished data as cited by Moyle et al. 1995). The peak breeding season occurs between February and April with larger and older longfin smelt spawning later in the year (Wang 1986 as cited by Moyle et al. 1995). Longfin smelt typically die after spawning, although a few females may survive another year. The eggs hatch in around 40 days at 45°F, and the larvae are transported downstream into the estuary. Larvae are mobile and move according to salinity preferences. In 30 to 60 days, the larvae morphologically change into juvenile fish.

There is a strong positive correlation between winter and spring Delta outflows and longfin abundance the following year (Moyle 2002). There is also a strong correlation between juvenile survival in the San Francisco estuary and Delta outflow. This is likely as a result of increased rates of transport of juveniles into preferable rearing habitats in Suisun Bay with higher outflows from the Delta (Moyle 2002). Historically in the San Francisco estuary, there were large fluctuations in longfin abundances. Numbers typically fell to their lowest abundances following drought years and recovered during wet water years (Moyle 2002). However, despite good Delta outflows in 1995-1999, smelt populations remained relatively low. This decline in longfin abundance was similar to that for other Delta fishes, including delta smelt, but to a greater extent.

4.4.2.1 SURVEY RESULTS

No aquatic surveys were conducted for the Project. However, Caltrans biologists reviewed data from the CDFW Smelt Larva Survey stations in the Sacramento River with the nearest downstream stations approximately 5 miles (Sta. 723) and 10 miles (Sta. 711) south of the Project area, respectively. At these stations, longfin smelt larva are captured largely between January and April. These data, along with data from the literature, indicate that longfin smelt will typically only be present within the BSA between December and June. The CDFW data indicate that longfin smelt adults, juveniles, and larva are largely absent from the BSA between May and January. The

results from the hydro-acoustic analysis (presented in Table 4-1) also apply to longfin smelt.

4.4.2.2 AVOIDANCE AND MINIMIZATION EFFORTS

The measures for delta smelt shown in Section 4.4.1.2 should adequately avoid and minimize impacts to longfin smelt.

4.4.2.3 PROJECT IMPACTS

Alternative 1

Longfin smelt adults, juveniles, and larva are not expected to be present within the BSA during the proposed in-water work window. Because all in-water work activities will be conducted when longfin smelt are absent from the BSA, no direct effects are expected during construction.

In addition, regarding direct effects to delta smelt habitat, the programmatic consultation on delta smelt considers the in-water work activities to not result in the loss or shading of SWH (USFWS 2004b).

Removal of the old bridge will open up 0.12 acre of shaded SWH, and will offset a portion of the 0.18 acre of shaded SWH associated with the replacement bridge (see Figure 4-9). The Project will result in a net increase of 0.06 acre of shaded SWH.

Alternative 2

All impacts associated with this alternative would be temporary, resulting in 0.18 acre of impacts (Figure 4-10). By adhering to the August 1 to November 30 work window, Caltrans does not anticipate take of individuals of delta smelt. No indirect effects to this species are expected.

4.4.2.4 COMPENSATORY MITIGATION

The mitigation measures for delta smelt in Section 4.4.1.4 should adequately mitigate for impacts to longfin smelt.

4.4.2.5 CUMULATIVE IMPACTS

Cumulative impacts on Longfin Smelt result from past, current, and reasonably foreseeable future projects in the region, including periodic maintenance and replacement of bridges throughout Solano County, flood control projects, and slope placement along banks, throughout the region. These projects will all undergo (or have undergone) separate environmental review, and will require separate environmental permitting from regulatory agencies. Although these and similar projects could result in impacts on Longfin Smelt, it is expected that most current and

future projects that impact this species and its habitats will be required to mitigate these impacts through the CEQA, Section 1600, or Section 404/401 permitting process. As a result, most projects in the region will mitigate their impacts in Longfin Smelt, minimizing cumulative impacts in these species. With implementation of avoidance and minimization measures, this project will not make a considerable contribution to cumulative impacts on the Longfin Smelt.

4.4.3 Central Valley Spring-run Chinook Salmon

Central Valley spring-run Chinook salmon (*Oncorhynchus tshawytscha*) were listed as federally threatened on September 16, 1999 (64 Fed. Reg. 50394-50415), and as state threatened on February 5, 1999. Critical habitat for spring-run Chinook salmon was designated on February 16, 2000 (65 Fed. Reg. 7764-7787). Critical habitat for the federal Central Valley spring-run Chinook salmon Evolutionary Significant Unit (ESU) includes all river reaches accessible to listed Chinook salmon in the Sacramento River and its tributaries in California (70 Fed. Reg. 52488-52626). Also included are adjacent riparian zones, and river reaches and estuarine areas of the Delta; all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait; all waters of San Pablo Bay westward of the Carquinez Bridge; and all waters of San Francisco Bay north of the San Francisco/Oakland Bay Bridge from San Pablo Bay to the Golden Gate Bridge. Excluded are tribal lands and areas above specific dams or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years). There is no critical habitat for spring-run Chinook salmon within the BSA.

Currently, the most consistent self-sustaining wild populations of spring-run Chinook salmon in the Sacramento Valley are in Deer and Mill Creeks, Tehama County. Additionally, a few spring-run Chinook are annually documented in Antelope, Battle, Big Chico, and Beegum creeks in some years. Large numbers of spring-run Chinook salmon are also present in Butte Creek and the Feather River, but the Feather River Hatchery may have a large role in the abundance of spring-run Chinook seen annually in the Feather River. Many Feather River spring-run Chinook salmon may also stray into the Yuba River, where apparently they have been observed in the cold water below Engelbright Reservoir (Moyle et al. 1995).

Spring-run Chinook salmon migrate considerable distances up streams to spawn. They enter the rivers from the ocean from March through May (Moyle at al. 1995). A majority of the adults are 3 years old on entrance to freshwater from the ocean. Like

all salmon during migration and holding in the river, spring-run Chinook salmon do not feed, and rely on stored body fat reserves for maintenance and maturation (Moyle et al. 1995). Spring-run Chinook are immature on their entrance into freshwater, and their gonads develop during the summer holding period (Marcotte 1984 as cited by Moyle et al. 1995). In upper Sacramento Valley tributaries, spawning occurs from late August to mid-October. Eggs are laid in redds, and embryos hatch following a 5- to 6-week incubation period. Sac-fry remain in the gravel for another 2 to 3 weeks adsorbing a yolk sac. Fry then emerge and begin external feeding. In the tributary streams, juveniles spend 9 to 10 months during which they feed on drifting insects (Moyle et al. 1995). Juveniles move downstream soon after hatching in March-April or may move downstream the following fall as yearlings (C. Harvey, pers. comm. as cited by Moyle et al. 1995). These emigrants may spend additional time in the Sacramento River or Delta before going out to sea. In the ocean, salmon are largely piscivorous and grow rapidly. Adult spring-run Chinook migrate up Sacramento Valley tributary creeks from March through June (Vogel 1987).

Most spring-run Chinook salmon move out of holding areas into the upper watershed areas when ready to spawn; the rest remain and spawn in the tails of the holding pools. Spring-run Chinook adults hold in cold deep pools with suitable cover. These holding areas are generally in proximity to patches of gravel suitable for spawning. Prolonged water temperatures above 80°F are lethal to adults (Cramer and Hammack 1952 as cited by Moyle et al. 1995). Holding pools are generally greater than 3 to 6 ft deep, with bedrock bottoms and moderate velocities. Spawning occurs in gravel beds with gravel of a size that fish can excavate.

Overall population trends for spring-run Chinook salmon in California are detailed by Campbell and Moyle (1991). Twenty “historically large populations” of spring-run Chinook have been extirpated or reduced since 1940 (Moyle et al. 1995). Four additional runs (Butte, Big Chico, Deer, and Mill creeks) have exhibited significant declines during the same period. The only substantial, essentially wild populations of spring-run Chinook remaining in California are in Deer, Mill, and other smaller tributary creeks in the Sacramento River watershed. The Feather River population and other populations may need to be supported by hatchery stocks or comingled with fall-run stocks. Spring-run Chinook salmon populations reached low abundance levels during the late 1980s (with 5-year mean population sizes of 67-243 spawners), compared to a historical peak abundance of nearly 700,000 spawners for the ESU (NMFS 2005).

4.4.3.1 Survey Results

No aquatic surveys were conducted for the Project. From their known life history characteristics, spawning and rearing of the adult Central Valley spring-run Chinook salmon occur in the upper reaches of the Sacramento River watershed. The presence of Central Valley spring-run Chinook salmon in the BSA is inferred during the upstream migration of adults and the downstream migration of juveniles.

From their known life history characteristics, adult Sacramento River spring-run Chinook salmon are spawning in the upper regions of the Sacramento River basin and are not likely to be present in the BSA during the August 1 to November 30 proposed in-water work window.

4.4.3.2 Avoidance and Minimization Efforts

Avoidance and minimization efforts for delta smelt as shown in Section 4.3.1.2 should adequately reduce impacts to spring-run Chinook salmon.

4.4.3.3 Project Impacts

Alternative 1

Observation of the August 1 to November 30 work window will avoid the upstream migration of adult Central Valley spring-run Chinook salmon, and will avoid all but late emigrating juveniles. Given that these emigrating Central Valley spring-run Chinook salmon juveniles are simply passing downstream through the BSA during the proposed work window, it is highly unlikely that any individuals will be impacted by the cumulative sound exposure levels (SELs) over the course of a working day, and mortality would only arise from impacting the piles to proof them. Therefore, conducting work within the proposed in-water work window will minimize the likelihood of potential mortality.

If spring-run Chinook salmon are present in the BSA during the proposed in-water work, then there is the possibility of take associated with sound pressure waves from the installation of piles for the temporary marine trestle and replacement bridge. However, given that rearing habitat conditions in the BSA are marginal at best, only early-emigrating juvenile Sacramento River spring-run Chinook salmon are expected to be migrating through the BSA during the proposed in-water work window. Because Chinook salmon in the BSA are migrating and are highly mobile, it is unlikely that any individuals will be affected by the 187 dB cumulative SEL over the course of a working day, and mortality associated with 206 dB peak sound levels would arise only from impacting the piles to proof them. Mortality would only occur

within 100 feet of Piers 2 and 4 during unattenuated pile-driving activities, or within 33 feet for all other attenuated or unattenuated pile driving.

Installation of the temporary cofferdam around Pier 3 may result in fish stranding. To minimize potential effects to federally listed fish species, a qualified fisheries biologist will conduct fish rescue and relocation to collect fish that are located within the cofferdam. This rescue effort would be implemented during dewatering of the area behind the cofferdam.

The piles for the replacement bridge will result in a loss of 0.02 acre of aquatic habitat, but this will be offset by the removal of the existing bridge, which will open up 0.12 acre of aquatic habitat. This will result in a net increase of 0.1 acre of aquatic habitat (Figure 4-9). The presence of the new bridge and temporary trestles will not appreciably diminish the ability of Central Valley spring-run Chinook salmon to migrate upstream to spawning habitat, or downstream to the ocean. The Project will have no effect on critical habitat.

With the proposed avoidance and minimization measures, the Project is not expected to result in mortality of Central Valley spring-run Chinook salmon. No impacts to spring-run Chinook salmon designated critical habitat will occur. No indirect impacts to spring-run Chinook salmon are expected.

Alternative 2

Hydro-acoustic and temporary impacts under this alternative would be similar to those of Alternative 1 (Figure 4-10). Implementation of this alternative would not result in any permanent impacts to spring-run Chinook salmon designated critical habitat or individuals.

4.4.3.4 COMPENSATORY MITIGATION

Under Alternative 1, there would be a net increase of 0.10 acre aquatic habitat because of the removal of the existing bridge structure and reduced pile size of the proposed new bridge. Alternative 2 would not have any permanent impacts to salmon habitat. Therefore, compensatory mitigation is not proposed for Central Valley spring-run Chinook salmon.

4.4.3.5 CUMULATIVE IMPACTS

Cumulative impacts on spring-run Chinook salmon results from past, current, and reasonably foreseeable future projects in the region, including periodic maintenance and replacement of bridges throughout Solano County, flood control projects, and

slope placement along banks, throughout the region. These projects will all undergo (or have undergone) separate environmental review, and will require separate environmental permitting from regulatory agencies. Ecological impacts for these individual projects will be minimized, and other projects that affect this species' habitats. Although these and similar projects could result in impacts on spring-run Chinook salmon, it is expected that most current and future projects that impact this species and its habitats will be required to mitigate these impacts through the CEQA, Section 1600, or Section 404/401 permitting process, as well as through the FESA Section 7 consultation process. As a result, most projects in the region will mitigate their impacts in spring-run Chinook salmon, minimizing cumulative impacts in these species. With implementation of avoidance and minimization measures, this project will not make a considerable contribution to cumulative impacts on the spring-run Chinook salmon.

4.4.4 Sacramento River Winter-run Chinook Salmon

Sacramento River winter-run Chinook salmon (SRWRCS) (*Oncorhynchus tshawytscha*) were listed as federally endangered on January 4, 1994 (59 Fed. Reg. 440-450), and state endangered on September 22, 1989. Federal status was reaffirmed on June 28, 2005 (70 Fed. Reg. 37160). Critical habitat for SRWRCS was designated on June 16, 1993 (58 Fed. Reg. 33212). Critical habitat is designated to include the Sacramento River from Keswick Dam in Shasta County (river mile [RM] 302) to Chipps Island (RM 0) at the westward margin of the Delta; all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Suisun Bay, and Carquinez Strait; all waters of San Pablo Bay westward of the Carquinez Bridge; and all waters of San Francisco Bay north of the San Francisco/Oakland Bay Bridge from San Pablo Bay to the Golden Gate Bridge. Major river basins containing spawning and rearing habitat for this ESU total approximately 9,329 square miles in California.

Currently, spawning populations of SRWRCS are restricted to the uppermost portion of the Sacramento River and Battle Creek in Shasta County. Dams on the Sacramento River and Battle Creek have restricted this species from their historic range, which was the McCloud River in Siskiyou County and Battle Creek in Shasta County (Moyle 2002).

Generally, winter-run adults migrate from December through July with a peak occurring in March in most years (Moyle 2002). Most returning adults are 3 years old on return from the ocean. Spawning occurs in mid- to late April and continues through early August in most years, with a peak occurring in May and June. Fry

emerge from the gravel in July through October, and juveniles remain in the Sacramento River from 5 to 10 months (Moyle 2002). Juveniles may spend an indeterminate length of time in the Delta (Moyle 2002). Except for over-summering holding pools, habitat requirements for SRWRCS are similar to those previously described for spring-run Chinook salmon.

SRWRCS numbers have increased overall since the early 1990s when spawning escapements were estimated to be in the hundreds (CDFW 2008d). Escapement of the species fell below 200 fish in the 1990s. Population size declined from highs of near 100,000 fish in the late 1960s, indicating a sustained period of poor survival (NMFS 2005). However, except for 2007 when the estimated spawning escapement was approximately 2,500 adults, winter-run Chinook salmon spawning escapement estimates have exceeded 7,000 adults annually since 2001 (CDFW 2008d). From 2007 to 2014, the spawning escapement estimates based on carcass surveys averaged around 2,500 adults annually with a high of 5,623 adults in 2013 and a low of 637 adults in 2011 (Pacific Fisheries Management Council (PFMC) 2015).

4.4.4.1 Survey Results

From their known life history characteristics, adult SRWRCS are spawning in the upper regions of the Sacramento River basin and are not likely to be present in the BSA during the August 1 to November 30 proposed in-water work window (during construction of the temporary marine trestle and driving piles for the new bridge).

Winter-run Chinook salmon spawn only in the mainstem Sacramento River, almost exclusively above the Red Bluff Diversion Dam (NMFS 2010); no spawning habitat is located in the BSA. Adult Chinook salmon do not feed during their upstream migration and spawning; therefore, adult foraging habitat does not occur within the BSA. Juvenile Chinook salmon are not expected to use habitat within the BSA for rearing because the leveed and riprapped banks of Miner Slough have low habitat diversity and complexity, which likely leads to a low abundance of food organisms, and the minimal overhanging riparian corridor and small emergent wetlands provide minimal protection from predation by fish and birds. Therefore, juvenile Chinook salmon are not expected to rear within Miner Slough. Potential habitat for SRWRCS ESU within the BSA is, therefore, limited to migration habitat for both adults and juveniles, and to marginal rearing habitat for juveniles.

Essential Fish Habitat (EFH) for Chinook salmon, including SRWRCS ESU, is defined as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity” (NMFS 2007). Freshwater EFH for SRWRCS ESU

within the BSA consists of the following components: (1) juvenile rearing habitat, (2) juvenile migration corridors, and (3) adult migration corridors.

4.4.4.2 Avoidance and Minimization Efforts

The avoidance and minimization efforts for delta smelt shown in Section 4.3.1.2 should adequately reduce impacts to SRWRCS.

4.4.4.3 Project Impacts

Alternative 1

The installation of the temporary marine trestle and piles associated with the new bridge will occur when adult SRWRCS ESU are expected to be absent from the BSA; therefore, there are no anticipated direct or indirect effects to adult SRWRCS ESU. Juveniles may be present during the proposed in-water work window, but they are expected to only be migrating through the BSA and not rearing.

If winter-run Chinook salmon are present in the BSA during the proposed in-water work, then there is the possibility of take associated with sound pressure waves from the installation of piles for the temporary marine trestle and replacement bridge. However, given that rearing habitat conditions in the BSA are marginal at best, only juvenile SRWRCS are expected to be migrating through the BSA during the proposed in-water work window. Because Chinook salmon in the BSA are migrating and highly mobile, it is unlikely that any individuals will be affected by the cumulative sound levels (187 dB cumulative SEL) over the course of a working day, and mortality associated with 206 dB peak sound levels would arise only from impacting the piles to proof them. Mortality would only occur within 100 feet of Piers 2 and 4 during unattenuated pile-driving activities, or within 33 feet of all other attenuated or unattenuated pile driving.

Installation of the temporary cofferdam around Pier 3 may result in fish stranding. To minimize potential effects to federally listed fish species, a qualified fisheries biologist will conduct fish rescue and relocation to collect fish that are located within the cofferdam. This rescue effort would be implemented during dewatering of the area behind the cofferdam.

With the proposed avoidance and minimization measures identified in Chapter 5.7, the Project is not expected to result in mortality of SRWRCS.

The piles for the replacement bridge will result in a loss of 0.02 acre of aquatic habitat, but this will be offset by the removal of existing bridge, which will open up

0.12 acre of aquatic habitat. This will result in a net increase of 0.08 acre of aquatic habitat (Figure 4-9). The presence of the new bridge and temporary trestles will not appreciably diminish the ability of SRWRCS to migrate upstream to spawning habitat, or downstream to the ocean. The Project will have no effect on critical habitat for this species.

Alternative 2

Hydro-acoustic and temporary impacts under this alternative would be similar to those of Alternative 1 (Figure 4-10). Implementation of this alternative would not result in any permanent impacts to SRWRCS designated critical habitat or individuals.

4.4.4.4 COMPENSATORY MITIGATION

Compensatory mitigation is not proposed for SRWRCS under either alternative.

4.4.4.5 CUMULATIVE IMPACTS

Cumulative impacts on SRWRCS result from past, current, and reasonably foreseeable future projects in the region, including periodic maintenance and replacement of bridges throughout Solano County, flood control projects, and slope placement along banks, throughout the region. These projects will all undergo (or have undergone) separate environmental review, and will require separate environmental permitting from regulatory agencies. Although these and similar projects could result in impacts on spring-run Chinook salmon, it is expected that most current and future projects that impact this species and its habitats will be required to mitigate these impacts through the CEQA, Section 1600, or Section 404/401 permitting process, as well as through the FESA Section 7 consultation process. As a result, most projects in the region will mitigate their impacts in SRWRCS, minimizing cumulative impacts in these species. With implementation of avoidance and minimization measures, this project will not make a considerable contribution to cumulative impacts on the SRWRCS.

4.4.5 Central Valley Steelhead

The Central Valley steelhead (*Oncorhynchus mykiss irideus*) DPS was listed as federally threatened on March 19, 1998 (63 Fed. Reg. 13347-13371). Following a status review, a final listing determination was made on January 5, 2006 (71 Fed. Reg. 71, 833-862). Critical habitat was originally designated on February 16, 2000 (70 Fed. Reg. 52488-52627). NMFS revised the description of designated critical habitat on September 2, 2005 (70 Fed. Reg. 52488-52627). The BSA lies in designated critical habitat for Central Valley steelhead.

Steelhead are sea-run rainbow trout that have been reported to attain a large size, up to 20 pounds or more (Hubbs 1946; Titus and Erman, unpubl. ms. as cited by Moyle et al. 1995).

The Central Valley steelhead DPS is thought to have occurred historically from the McCloud River and other northern tributaries to Tulare Lake and the Kings River in the southern San Joaquin Valley. The NMFS Biological Review Team reported that recent spawner surveys of small Sacramento River tributaries (Mill, Deer, Antelope, Clear, and Beegum creeks) and incidental captures of juvenile steelhead via monitoring on the Calaveras, Cosumnes, Stanislaus, Tuolumne, and Merced rivers confirmed that steelhead are distributed throughout accessible streams and rivers (NMFS 1996).

Central Valley steelhead enter freshwater as adults in August with a peak from late September to October (Moyle 2002). They typically spawn in tributaries to the Sacramento River and Miner Slough, often ascending long distances. Spawning generally occurs from December through April depending on the local population. Steelhead have the ability to return to spawn more than once unlike other Pacific salmon. Adult females dig redds in coarse gravel in tail-outs of pools or in riffles. Eggs incubate and hatch in 3 to 4 weeks into sac-fry, depending on water temperature, and emerge from the gravel after an additional 2 to 3 weeks. Fry initially live in quiet edge waters of streams close to shore and are passive feeders for several weeks (Moyle 2002). Under good food conditions, juveniles can reach 10- to 12-centimeter (cm) (approximately 4- to 5-inch) fork length in the first year and 16- to 17-cm (approximately 6- to 7-inch) fork length by the end of the second year. Juveniles remain in fresh water for 1 to 2 years and emigrate as smolts (physiologically adapted to saltwater conditions) as they near the ocean. Most reside in the ocean for 1 to 3 years before returning to their natal streams to spawn (Moyle 2002). Habitat requirements are similar to those for Chinook salmon in that they require cool, clean, flowing water with sufficient dissolved oxygen and minimal turbidity for successful incubation and rearing.

Steelhead populations spawning above Red Bluff Diversion Dam have a small population size and exhibit negative trends in abundance (NMFS 2008). No escapement estimates have been made for the area above Red Bluff Diversion Dam since the mid-1990s. A crude extrapolation from juvenile data from 1998 to 2008 estimated 3,600 spawning female steelhead in the Central Valley (NMFS 2008). Prior

to 1850, there were 1 to 2 million spawners, and in the 1960s there were about 40,000 spawners (NMFS 2008).

4.4.5.1 Survey Results

Based on existing literature and the documented life history characteristics of Central Valley steelhead, adult Central Valley steelhead would be expected to be migrating upstream from the ocean/estuary into freshwaters to spawn from July through the winter. Therefore, adult Central Valley steelhead may be present within the BSA during the proposed August 1 to November 30 in-water work window. Juvenile Central Valley steelhead are not expected to be present in the BSA during the proposed in-water work window.

4.4.5.2 Avoidance and Minimization Efforts

Avoidance and minimization efforts for delta smelt as shown in Section 4.3.1.2 should adequately reduce impacts to Central Valley steelhead.

4.4.5.3 Project Impacts

Alternative 1

Observation of the August 1 to November 30 in-water work window occurs during the upstream migration of adult Central Valley steelhead. Given that these adult Central Valley steelhead are simply passing downstream through the BSA during this time, it is highly unlikely that any individuals will be physically harmed by the cumulative SELs over the course of a working day, and mortality would only arise from impacting the piles to proof them. Any rearing or migrating Central Valley steelhead juveniles that may be present during pile driving may be affected by the peak sound levels from piles being proofed and/or from cumulative sound levels over the course of a working day. Conducting work within the proposed in-water work window will minimize the likelihood of potential mortality. Mortality would only occur within 100 ft of Piers 2 and 4 during unattenuated pile-driving activities, or within 33 ft for all other attenuated or unattenuated pile driving.

Installation of the temporary cofferdam around Pier 3 may result in fish stranding. It is unlikely that adult steelhead would be stranded within the cofferdam. However, to minimize potential effects to federally listed fish species, a qualified fisheries biologist will conduct fish rescue and relocation to collect fish that are located within the cofferdam. This rescue effort would be implemented during dewatering of the area behind the cofferdam.

Presence of the piles will not appreciably diminish the ability of Central Valley steelhead to migrate upstream to spawning habitat, or downstream to the Ocean. The piles for the replacement bridge will result in a loss of 0.02 acre of aquatic habitat, but this will be offset by the removal of existing bridge, which will open up 0.12 acre of aquatic habitat. This will result in a net increase of 0.10 acre of aquatic habitat (Figure 4-9). The loss of habitat is minimal and temporal; therefore, there will be no adverse modification to the value of the critical habitat, and there will be an overall beneficial impact with the net increase of habitat.

The proposed avoidance and minimization measures will be implemented to minimize the potential for mortality of Central Valley steelhead.

Alternative 2

Hydro-acoustic and temporary impacts under this alternative would be similar to those of Alternative 1 (Figure 4-10). Implementation of this alternative would not result in any permanent impacts to Central Valley steelhead designated critical habitat or individuals.

4.4.5.4 COMPENSATORY MITIGATION

Under Alternative 1, there would be a net increase of 0.08 acre aquatic habitat because of the removal of the existing bridge structure and reduced pile size of the proposed new bridge. Alternative 2 would not have any permanent impacts to salmon habitat. Therefore, compensatory mitigation is not proposed for Central Valley Steelhead.

4.4.5.5 CUMULATIVE IMPACTS

Cumulative impacts on Central Valley Steelhead result from past, current, and reasonably foreseeable future projects in the region, including periodic maintenance and replacement of bridges throughout Solano County, flood control projects, and slope placement along banks, throughout the region. These projects will all undergo (or have undergone) separate environmental review, and will require separate environmental permitting from regulatory agencies. Although these and similar projects could result in impacts on Central Valley Steelhead, it is expected that most current and future projects that impact this species and its habitats will be required to mitigate these impacts through the CEQA, Section 1600, or Section 404/401 permitting process, as well as through the FESA Section 7 consultation process. As a result, most projects in the region will mitigate their impacts in Central Valley Steelhead, minimizing cumulative impacts in these species. With implementation of

avoidance and minimization measures, this project will not make a considerable contribution to cumulative impacts on the Central Valley Steelhead.

4.4.6 Southern DPS North American Green Sturgeon

The southern DPS of North American green sturgeon was listed as federally threatened on April 7, 2006 (71 Fed. Reg. 17757). NMFS determined that the southern DPS presently contains only a single spawning population from the Sacramento River. Critical habitat for the southern DPS of green sturgeon was designated in 2009 (74 Fed. Reg. 52300).

The North American green sturgeon is a long-lived anadromous species that generally migrates upstream through the San Francisco and San Pablo bays and into the freshwater of the Sacramento River between late February and late July (CDFW 2002). Mature males of this species range from 139 to 199 cm (55 to 78 inches) total length at 15 to 30 years of age, and mature females range from 157 to 223 cm (62 to 88 inches) total length at 17 to 40 years of age (Van Eenennaam et al. 2001). Maximum ages of green sturgeon are likely to range from 60 to 70 years (Moyle 2002).

Green sturgeon may spawn every 2 to 5 years during March through July, with peak spawning occurring in April through June (Moyle et al. 1995). Spawning occurs in the Sacramento River when water temperatures reach 46°F to 57°F (Moyle et al. 1995). Water temperature in excess of 68°F is thought to be lethal to green sturgeon embryos (Cech et al. 2000). Spawning takes place in swift, deep water (greater than 10 ft) where eggs are broadcast over clean sand to large cobble substrates (Moyle et al. 1995). Van Eenennaam et al. (2001) found that these eggs are much larger and much less adhesive than those of white sturgeon, which are characteristics that distinguish green sturgeon from white sturgeon embryos. Deng et al. (2002) determined that green sturgeon also do not exhibit a swim-up or post-hatching pelagic behavior characteristic of white sturgeon.

Post-spawning adult green sturgeon remain in the Sacramento River throughout the summer and early fall in deep pools before they exit the river following the first big runoff flows in the winter (Corwin 2008). These adults then reside in the San Pablo Bay and vicinity before eventually moving back to the ocean. Alternatively, these adults may remain in San Pablo Bay/San Francisco Bay for a number of years (Chase 2008). Juvenile green sturgeon are transported into, and rear in, the Delta and Suisun-San Pablo Bay estuary for 1 year or longer before entering the deeper San

Francisco Bay and exiting into the ocean. They enter the ocean primarily during the summer and fall months at approximately 2 years old or older (Moyle et al. 1995).

Spawning-aged adult southern DPS green sturgeon immigrate through the northern San Francisco and San Pablo bays (Moyle 2002) and are known to scour the benthos within the Delta foraging for invertebrate food sources including shrimp, mollusks, amphipods, isopods, and small fish (EPIC 2001). Juvenile green sturgeon, which rear in the Delta and San Francisco Bay estuary for approximately 3 years, consume small crustaceans such as amphipods and opossum shrimp (CDFW 2001). Because the populations of southern and northern DPS green sturgeon overlap in range in the San Pablo Bay, where most of the subadult and adult green sturgeon have been caught by the Interagency Ecological Program, it is unknown what percentage of the green sturgeon captured there were southern DPS North American green sturgeon.

Population information for southern DPS North American green sturgeon is scant and was summarized in the status review (NMFS 2002). CDFW has estimated that the population of the green sturgeon in the Sacramento-Miner Slough watershed between the years 1954 and 2001 averaged approximately 1,500 fish per year, but these estimates may not be reliable. Based on salvage information of green sturgeon at the federal and state fish protection facilities in the Delta, the abundance of green sturgeon has apparently declined significantly in recent decades (71 Fed. Reg. 17757-17766).

4.4.6.1 Survey Results

No aquatic surveys were conducted for the Project. From what is known of their life history, upstream migration of adult southern green sturgeon and spawning occur outside of the August 1 to November 30 in-water work window. Post-spawning adult southern green sturgeon remain in the Sacramento River through the fall; however, they are likely to return downstream to San Pablo Bay and the San Francisco Bay estuary outside of the in-water work window. Juvenile/subadult southern green sturgeon remain in the Delta region for 2 to 3 years prior to returning to the estuary or the ocean; therefore, individual juvenile/subadult southern green sturgeon are inferred to be present within the BSA during the August 1 to November 30 in-water work window.

4.4.6.2 Avoidance and Minimization Efforts

Avoidance and minimization measures for delta smelt as shown in Section 4.3.1.2 should adequately reduce impacts to green sturgeon.

4.4.6.3 PROJECT IMPACTS

Alternative 1

Only younger-aged juveniles are likely to be present in the BSA during the August 1 to November 30 in-water work window, because salinity during this window will likely be too low for older-aged juveniles, and water temperatures will be too warm for larvae. Individuals of the species would be subject to take associated with sound pressure waves from pile driving during the installation of piles for the temporary marine trestle and replacement bridge. However, because green sturgeon are highly mobile, it is unlikely that any individuals will be affected by the 187 dB cumulative SEL over the course of a working day, and mortality associated with 206 dB peak sound levels would arise only from impacting the piles to proof them. Mortality would only occur within 100 feet of Piers 2 and 4 during unattenuated pile-driving activities, or within 33 feet for all other attenuated or unattenuated pile driving.

Installation of the temporary cofferdam around Pier 3 may result in fish stranding. It is unlikely that juvenile and sub-adult green sturgeon would be trapped within the cofferdam. However, to minimize potential effects to this and other federally listed fish species, a qualified fisheries biologist will conduct fish rescue and relocation to collect fish that are located within the cofferdam. This rescue effort would be implemented during dewatering of the area behind the cofferdam.

The piles for the replacement bridge will result in a loss of 0.02 acre of foraging and open water habitat, but this will be offset by the removal of existing bridge, which will open up 0.12 acre of aquatic habitat. This will result in a net increase of 0.10 acre of foraging and open water habitat within the BSA (Figure 4-9). The presence of the new bridge and temporary trestles will not appreciably diminish foraging habitat and open water habitat within the BSA.

The proposed avoidance and minimization measures will be implemented to minimize the potential for mortality of Southern green sturgeon.

Alternative 2

Hydro-acoustic and temporary impacts under this alternative would be similar to those of Alternative 1 (Figure 4-7 and 4-8). Implementation of this alternative would not result in any permanent impacts to Southern green sturgeon.

4.4.6.4 COMPENSATORY MITIGATION

Compensatory mitigation is not proposed for southern green sturgeon under either alternative.

4.4.6.5 CUMULATIVE IMPACTS

Cumulative impacts on Southern green sturgeon result from past, current, and reasonably foreseeable future projects in the region, including periodic maintenance and replacement of bridges throughout Solano County, flood control projects, and slope placement along banks, throughout the region. These projects will all undergo (or have undergone) separate environmental review, and will require separate environmental permitting from regulatory agencies. Although these and similar projects could result in impacts on Southern green sturgeon, it is expected that most current and future projects that impact this species and its habitats will be required to mitigate these impacts through the CEQA, Section 1600, or Section 404/401 permitting process, as well as through the FESA Section 7 consultation process. As a result, most projects in the region will mitigate their impacts in Southern green sturgeon, minimizing cumulative impacts in these species. With implementation of avoidance and minimization measures, this project will not make a considerable contribution to cumulative impacts on the Southern green sturgeon.

4.4.7 Giant Garter Snake

GGS (*Thamnophis gigas*) was listed as threatened in California in 1971 and as federally threatened in 1993 (58 Fed. Reg. 54053). Critical habitat has not been designated for this species.

The current distribution of GGS extends from near Chico, Butte County, to the vicinity of Burrel, Fresno County (USFWS 1999). This species feeds primarily in pools that contain aquatic organisms such as amphibian egg masses, tadpoles and adults, and small fish species. GGS are most active from early spring through mid-fall. During the winter, they are generally inactive (Jones and Stokes 2006).

GGS occurs in areas that contain freshwater wetlands, low-gradient streams and sloughs, ponds, associated waterways, and adjacent uplands. Additionally, it has adapted to human-made habitats such as drainage canals, irrigation ditches, and rice fields (USFWS 1999). During the active season, GGS generally remain in close proximity to wetland habitats, but can move at least 800 ft into upland areas. Also, individual GGS have been observed moving a total of 5 miles, over several days, from their original wetland habitat into new wetland areas, because of unsuitable conditions developing in their original habitat (Jones and Stokes 2006).

Habitat loss, degradation, and fragmentation are the primary threats to GGS populations (USFWS 1999). Conversion of wetlands for agricultural, urban, and

industrial development has resulted in the loss of approximately 90 percent of suitable habitat in the Central Valley (Jones and Stokes 2006).

4.4.7.1 Survey Results

A search of the California Natural Diversity Database indicated that there are no CNDDB occurrence records for GGS within 5 miles of the BSA. Within a 10-mile buffer of the BSA, there are nine GGS occurrence records (CDFW 2015a). The nearest records (CNDDB Occurrence Records 79 and 82) were associated with the Liberty Farms GGS population and are located approximately 5.2 miles northwest of the BSA. These populations of GGS were considered to be possibly extirpated in 2005, and are presumed to have been extirpated by 2012 (USFWS 2012). The other records (Occurrences 247, 133, 132, 310, 308, 250, and 309) are located more than 5 miles from the BSA.

Within the BSA, potential GGS habitat consists of the outer levee banks of Miner Slough. These designations correspond with perimeter levee habitat. Potential GGS habitat is described below in detail. Within the boundaries of the BSA, potential habitat for GGS consists of the banks of Miner Slough. Miner Slough provides a year-round source of water, and its banks are generally sunny and provide suitable basking sites, and there is some terrestrial vegetation that would provide cover for GGS. Although no burrows were observed within the BSA, there were cracks in the soil that could be used as refuge. The northern side of the slough has slow-flowing water over a natural bottom, but the southern side is lined with rock slope protection (RSP) and is less suitable as habitat for GGS. Adjacent lands are row crops and are unsuitable for GGS. Overall, it was determined that the Project area provides marginal habitat for GGS.

If GGS are present within the BSA, aspects of the Project would result in an increased risk of mortality or species take. Potential impacts are associated with facilities construction and increased vehicle traffic on surface roads adjacent to open-water habitat during Project construction. GGS could be crushed beneath heavy construction equipment or entombed in below-ground retreats during staging activities. In addition, any ditches or aquatic features that are either dewatered or modified would constitute either a temporary or permanent reduction in available habitat.

4.4.7.2 Avoidance and Minimization Efforts

The biological sensitivity of the habitats and resources that occur within the BSA were identified early in the Project. Caltrans biologists coordinated closely with

project development team (PDT) members and consultants during the design process to inform the PDT members of the biological resources present on the site and to advise the PDT on alternatives that would avoid and minimize effects to biological resources.

Caltrans and its contractors will implement several measures to avoid and minimize potential effects to GGS when construction occurs in the vicinity. The following minimization measures are proposed, following guidelines presented in a recent biological opinion (USFWS 2009) and Programmatic formal consultation for USACE 404 permitted projects with relatively small effects on the giant garter snake (USFWS 2004a):

- All ground-disturbing construction activity within GGS habitat shall be conducted between May 1 and October 1. Given that all construction activity is confined to upland habitat (over-wintering and movement habitat), the initial grading and disturbance of the laydown and work areas in GGS habitat will occur during the snake's active season. Once the temporary access road is in place, no further ground-disturbing activity will take place, and mortality to any individuals of the species during hibernation due to construction is not anticipated.

- A qualified biologist shall inspect construction-related activities at the Project site to ensure that no unauthorized take of federally listed species or destruction of their habitat occurs. The biologist shall be available for monitoring throughout all phases of construction that may result in adverse effects to the GGS. Additionally, if GGS is encountered during construction, the biologist shall have the authority through communication with the resident engineer to stop construction activities in the immediate area until appropriate corrective measures have been completed, or until the snake is determined to be unharmed. Snakes encountered during construction activities shall be allowed to move away from the area on their own volition. The biologist shall notify the USFWS immediately if any listed species are found onsite, and will submit a report, including date(s), location(s), habitat description, and any corrective measures taken to protect the species found. The biologist shall be required to report any take of listed species to the USFWS immediately by telephone at (916) 414-6600 and by electronic mail or written letter addressed to the Chief, Endangered Species Division, within 3 working days of the incident.

- A Worker Environmental Awareness Training Program for construction personnel shall be conducted by the USFWS-approved biologist for all construction workers, including contractors, prior to the commencement of construction activities. The program shall provide workers with information on their responsibilities with regard to the snake, an overview of the life history of this species, information on take prohibitions, protections afforded this animal under the ESA, and an explanation of the relevant terms and conditions of the Biological Opinion. Written documentation of the training must be submitted to the Sacramento Fish and Wildlife Office within 30 days of the completion of training.

- At most, 24 hours prior to the commencement of construction activities, the Project site shall be surveyed for GGS by a qualified biologist. The Project area shall be re-inspected by the monitoring biologist whenever a lapse in construction activity of 2 weeks or greater has occurred.

- Aquatic habitat that will be disturbed or removed will be dewatered 15 days prior to the initiation of construction activities. If complete dewatering is not possible, then potential snake prey (i.e., fish and tadpoles) will be removed so that snakes and other wildlife are not attracted to the construction area.

- BMPs, including an SWPPP and a Water Pollution Control Program, will be implemented to minimize effects to the snake during construction. BMPs will be implemented to prevent sedimentation from entering environmentally sensitive areas and to reduce erosion, dust, noise, and other deleterious aspects of construction-related activities. These BMPs may include, but are not limited to, silt fencing, temporary berms, restrictions on cleaning equipment in or near ESAs, installation of vegetative strips, and temporary sediment disposal. Runoff from dust control and hazardous materials will be retained on the construction site and prevented from flowing into the ESAs.

- Tightly woven fiber netting or similar material shall be used for erosion control and other purposes at the Project site to ensure that the GGS is not trapped or does not become entangled. This limitation shall be communicated to the contractor using special provisions included in the bid solicitation package.

- During construction operations, the number of access routes, number and size of staging areas, and total area of the proposed Project activity will be limited to the minimum necessary. Routes and boundaries will be clearly demarcated.

Movement of heavy equipment to and from the Project site will be restricted to established roadways to minimize habitat disturbance. Project-related vehicles shall observe a 20 mph speed limit within construction areas except on county roads and on state and federal highways. This is particularly important during periods when the snake may be sunning or moving on roadways. All heavy equipment, vehicles, and supplies will be stored at the designated staging area at the end of each work period.

- During construction operations, stockpiling of construction materials, portable equipment, vehicles, and supplies will be restricted to the designated construction staging areas and exclusive of the ESAs. Caltrans will ensure that contamination of habitat does not occur during such operations.

- All food-related trash items such as wrappers, cans, bottles, and food scraps must be disposed of in closed containers and removed at the end of each workday from the entire Project site.

- Prior to the commencement of construction activities, high visibility fencing will be erected around the habitats of federally listed species to identify and protect these designated ESAs from encroachment of personnel and equipment. These areas will be avoided by all construction personnel. The fencing shall be inspected before the start of each work day and maintained by the Project proponents until completion of the Project. The fencing may be removed only when the construction of the Project is completed. Fencing will be established at least 200 ft from the edge of aquatic snake habitat.

- Signs will be posted every 50 ft along the edge of the ESAs, with the following information: “This area is habitat of federally threatened and/or endangered species, and must not be disturbed. These species are protected by the federal Endangered Species Act. Violators are subject to prosecution, fines, and imprisonment.” The signs should be clearly readable from a distance of 20 ft, and must be maintained for the duration of construction.

- After construction activities are complete, any temporary fill or construction debris shall be removed, and disturbed areas shall be restored to their pre-Project conditions. An area subject to “temporary” disturbance includes any area that is disturbed during the Project, but after Project completion will not be subject to further disturbance and has the potential to be revegetated. All snake habitats subject to temporary ground disturbances, including storage and staging areas and

temporary roads, will be restored. These areas shall be recontoured, if appropriate, and revegetated with appropriate locally collected native plant species to promote restoration of the area to pre-Project conditions. Appropriate methods and plant species used to revegetate such areas will be determined on a site-specific basis. Restoration work may include replanting emergent vegetation. Refer to the USFWS *Guidelines for the Restoration and/or Replacement of Giant Garter Snake Habitat* (USFWS 1996c). A written report shall be submitted to the USFWS within 10 working days of the completion of construction at the Project site.

- Caltrans will restore the site to preconstruction conditions and will monitor the Project site for 1 year following the completion of construction and restoration activities. Monitoring reports documenting the restoration effort should be submitted to USFWS upon the completion of the restoration implementation and 1 year after the restoration implementation. Monitoring reports should include photo documentation, the date that restoration was completed, a list of materials used, a list of specified plantings, and justifications of any substitutions to the USFWS-recommended guidelines.

4.4.7.3 PROJECT IMPACTS

Alternative 1

Figure 4-11 depicts the areas of direct effects on potentially suitable GGS habitat. Design modifications have avoided direct effects to potentially suitable aquatic habitat. Direct impacts to potentially suitable GGS habitat would occur in areas of upland habitat. The majority of these direct effects would result from the laydown and work areas associated with the Project on both sides of Miner Slough. These areas would temporarily affect approximately 0.36 acre of potentially suitable upland habitat within the Project footprint. The realignment of SR 84 and widening of other existing roads will permanently affect approximately 0.10 acre of potentially suitable upland habitat. The total area of upland habitat that would be directly impacted by Project activities is approximately 0.46 acre. No indirect impacts to this species are expected.

Alternative 2

Figure 4-12 depicts the areas of direct effects on potentially suitable GGS habitat. Design modifications have avoided direct effects to potentially suitable aquatic habitat. Direct impacts to potentially suitable GGS habitat would occur in areas of upland habitat. The majority of these direct effects would result from the laydown and

work areas associated with the Project on both sides of Miner Slough. These areas would temporarily affect approximately 0.17 acre of potentially suitable upland habitat within the Project footprint. The realignment of SR 84 and widening of other existing roads will permanently affect approximately 0.02 acre of potentially suitable upland habitat. The total area of upland habitat that would be directly impacted by Project activities is approximately 0.19 acre. No indirect impacts to this species are expected.

4.4.7.4 COMPENSATORY MITIGATION

Alternative 1

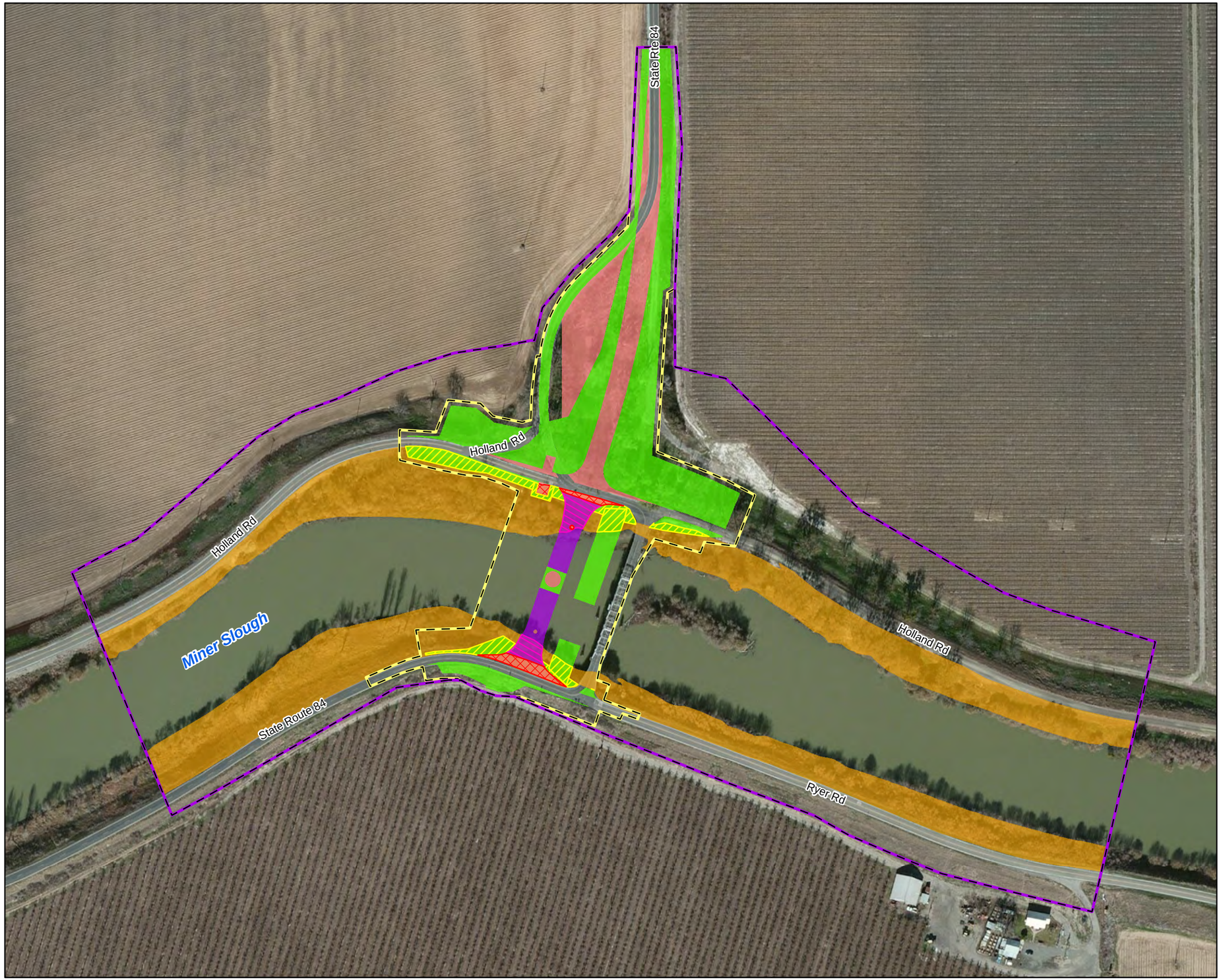
Following the guidelines provided in the programmatic consultation for GGS (USFWS 1997), Caltrans will mitigate the approximately 0.36 acre of temporary direct effects by onsite restoration and purchasing credit at a 2:1 ratio at a USFWS- and CDFW-approved mitigation bank. The approximately 0.1 acre of direct impact due to the permanent impacts within GGS habitat will be offset at a ratio of 3:1 by purchasing land through a USFWS- and CDFW-approved mitigation bank.

Restoration will be accomplished by removing the aggregate rock installed on top of geotextile fabric. The geotextile fabric will be removed, and hydroseed mix will be applied to restore the ground cover vegetation. If the area has been substantially compacted, disking the top 4 to 6 inches of soil will be performed prior to applying the hydroseed mix.

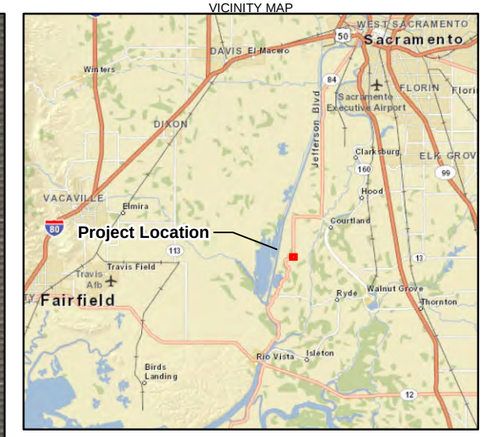
Alternative 2

Following the guidelines provided in the programmatic consultation for GGS (USFWS 1997), Caltrans will mitigate the approximately 0.17 acre of temporary direct effects by onsite restoration and purchasing credit at a 2:1 ratio at a USFWS- and CDFW-approved mitigation bank. The approximately 0.1 acre of direct impact due to the permanent impacts within GGS habitat will be offset at a ratio of 3:1 by purchasing land through a USFWS- and CDFW-approved mitigation bank..

Restoration will be accomplished by removing the aggregate rock installed on top of geotextile fabric. The geotextile fabric will be removed, and hydroseed mix will be applied to restore the ground cover vegetation. If the area has been substantially compacted, disking the top 4 to 6 inches of soil will be performed prior to applying the hydroseed mix.



VICINITY MAP



LEGEND

- Biological Study Area (BSA)
- Project Limits

Disturbance

- Permanent Impacts (1.24 acres)
- Temporary Impacts (3.09 acres)
- Shade Impacts (0.34 acre)
- Giant Garter Snake Upland Habitat (7.01 acres)

Giant Garter Snake Habitat Impacts

- Permanent (0.10 acre)
- Temporary (0.36 acre)
- Shade (0.14 acre)

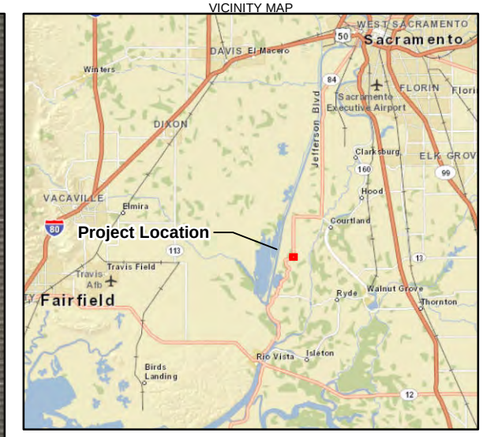
N

0 200 400 Feet

Caltrans

FIGURE 4-11
Giant Garter Snake Habitat
Bridge Replacement
Miner Slough Bridge Project
EA 04-0G660, State Route 84 Post Mile 12.1/12.2
Solano County, California

VICINITY MAP



LEGEND

- Biological Study Area (BSA)
- Project Limits

Disturbance

- Permanent Impacts (0.50 acre)
- Temporary Impacts (1.31 acres)
- Giant Garter Snake Upland Habitat (7.01 acres)

Giant Garter Snake Habitat Impacts

- Permanent (0.02 acre)
- Temporary (0.17 acre)

N

0 200 400 Feet

Caltrans

FIGURE 4-12
Giant Garter Snake Habitat
Bridge Rehabilitation
Miner Slough Bridge Project
EA 04-0G660, State Route 84 Post Mile 12.1/12.2
Solano County, California

BAO C:\PROJ\CALTRANS\477335ENVONCALL\TO1_BIOLOGICAL_SUPPORT\0G660_SOL84_MINERSLOUGHBRIDGE\GIS\MAPFILES\2015\NES\AUGUST\FIG4-12_GGS_HABITAT_IMPACTS_BRIDGE_REHABILITATION.MXD CARCHER 8/25/2015 11:27:07 AM

4.4.7.5 CUMULATIVE IMPACTS

Cumulative impacts on GGS results from past, current, and reasonably foreseeable future projects in the region, including periodic maintenance and replacement of bridges throughout Solano County, flood control projects, and slope placement along banks, throughout the region. These projects will all undergo (or have undergone) separate environmental review, and will require separate environmental permitting from regulatory agencies. Although these and similar projects could result in impacts on GGS, it is expected that most current and future projects that impact this species and its habitats will be required to mitigate these impacts through the CEQA, Section 1600, or Section 404/401 permitting process, as well as through the FESA Section 7 consultation process. As a result, most projects in the region will mitigate their impacts in GGS, minimizing cumulative impacts in these species. With implementation of avoidance and minimization measures, this project will not make a considerable contribution to cumulative impacts on the GGS.

4.4.8 Swainson's Hawk

The Swainson's hawk (*Buteo swainsoni*) is listed as state threatened. The Swainson's hawk breeds in the western U.S. and Canada, and winters in South America as far south as Argentina. As a raptor adapted to the open grasslands, it has become increasingly dependent on agriculture, especially alfalfa crops, as native communities are converted to agricultural lands. The diet of the Swainson's hawk in California is varied, but mainly consists of voles (*Microtus* sp.); however, other small mammals, birds, and insects are also taken. Swainson's hawks generally nest in isolated trees, narrow bands of vegetation, or along riparian corridors in grassland, shrubland, and agricultural landscapes. Reduction of rodent populations due to conversion of native grassland to cropland has resulted in declines of Swainson's hawks in some locations in North America, especially in central California. In California, the Swainson's hawk is vulnerable to extirpation due to its very restricted range (primarily the Central Valley), few populations, steep population declines, and loss of habitat. In California, most breeding occurs in the Central Valley between Modesto and Sacramento (Bloom 1980), and approximately 95 percent of the breeding pairs now occur in the Central Valley. The typical Swainson's hawk breeding season lasts from February 15 to July 15 (CDFW 2007).

4.4.8.1 SURVEY RESULTS

An active Swainson's hawk nest was observed within the BSA on the northwestern side of the bridge during the initial habitat assessment in 2014.

There are 20 CNDDB occurrences of this species within 5 miles of the BSA. The closest occurrence (No. 947) was documented in 2005, approximately 0.75 mile (1.20 kilometers) south of the proposed BSA. Preconstruction surveys are scheduled to be conducted in 2015 by a qualified biologist prior to the initiation of ground-disturbing activities.

4.4.8.2 Avoidance and Minimization Efforts

Avoidance and minimization measures may include seasonal avoidance and monitoring. Preconstruction and construction nest surveys will be conducted within the BSA for all bird species, and if special-status species are detected, Caltrans will consult with CDFW or USFWS as appropriate. Surveys will include at least one survey conducted one full breeding season prior to the beginning of construction.

4.4.8.3 Project Impacts

Alternative 1

The Project could potentially displace an unknown number of Swainson's hawks, if they are nesting within or adjacent to the BSA during construction. This project would temporarily impact 2.4 acres and permanently impact 1.1 acres of potential foraging habitat for Swainson's Hawk (Figure 4-13). No indirect effects are expected to Swainson's hawks as a result of Project development.

Alternative 2

The Project could potentially displace an unknown number of Swainson's hawks, if they are nesting within or adjacent to the BSA during construction. This project would temporarily impact 1.0 acre and permanently impact 0.46 acre of potential foraging habitat for Swainson's Hawk (Figure 4-14). No indirect effects are expected to Swainson's hawks as a result of Project development.

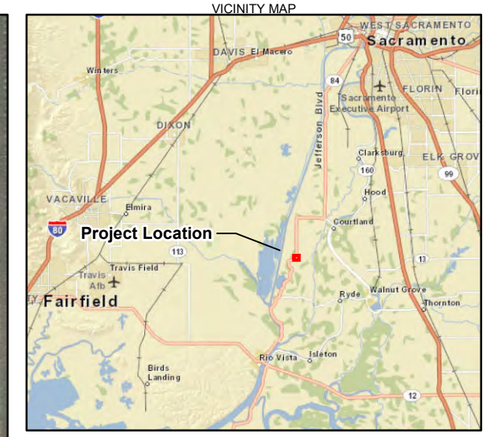
4.4.8.4 Compensatory Mitigation

Compensatory mitigation, if necessary, will be developed in consultation with CDFW.

4.4.8.5 Cumulative Impacts

Cumulative impacts on Swainson's hawk result from past, current, and reasonably foreseeable future projects in the region, including periodic maintenance and replacement of bridges throughout Solano County, flood control projects, and other projects that affect this species' habitats. These projects will all undergo (or have undergone) separate environmental review, and will require separate environmental permitting from regulatory agencies. Although these and similar projects could result

VICINITY MAP



LEGEND

- Swainson's Hawk Nest
- 500 Feet From Swainsons Hawk Nest
- Project Limits
- Project Study Area
- Temporary Impacts
- Permanent Impatcs
- Swainsons Hawk Potential Foraging Habitat

Impact to Potential Foraging Habitat

- Permanent (1.10 acres)
- Temporary (2.40 acres)

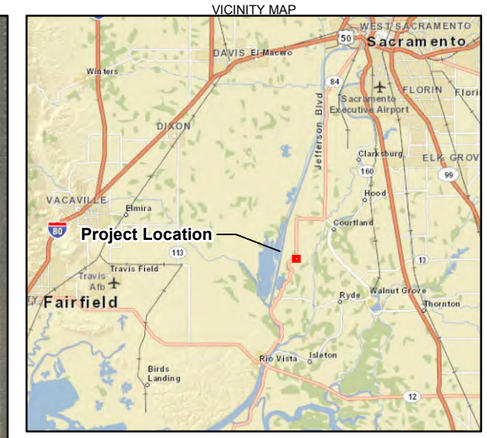
N

0 200 400
Feet

Caltrans

FIGURE 4-13
Swainson's Hawk Habitat Impacts
Bridge Replacement
Miner Slough Bridge Project
EA 04-0G660, State Route 84 Post Mile 12.1/12.2
Solano County, California

VICINITY MAP



LEGEND

- Swainson's Hawk Nest
- 500 Feet From Swainsons Hawk Nest
- Project Limits
- Project Study Area
- Permanent Impatcs
- Temporary Impacts
- Swainsons Hawk Potential Foraging Habitat

Impact to Potential Foraging Habitat

- Permanent (0.46 acre)
- Temporary (1.00 acres)

N

0 200 400
Feet

Caltrans

FIGURE 4-14
Swainson's Hawk Habitat Impacts
Bridge Rehabilitation
Miner Slough Bridge Project
EA 04-0G660, State Route 84 Post Mile 12.1/12.2
Solano County, California

in impacts on Swainson's hawk, it is expected that most current and future projects that impact this species and its habitats will be required to mitigate these impacts through the CEQA, Section 1600, or Section 404/401 permitting process. As a result, most projects in the region will mitigate their impacts in Swainson's hawk, minimizing cumulative impacts in these species. With implementation of avoidance and minimization measures, this project will not make a considerable contribution to cumulative impacts on the Swainson's hawk.

4.4.9 Migratory Birds

4.4.9.1 SONG SPARROW ("MODESTO" POPULATION) AND WHITE-TAILED KITE

The song sparrow ("Modesto" population) (*Melospiza melodia*) is protected by the federal MBTA and is considered a State Species of Concern by CDFW. This species is a resident of brackish-water and freshwater marshes. It inhabits cattails (*Typha* sp.), tules and other sedges, and pickleweed (*Salicornia* sp). The species is also known to frequent tangles bordering sloughs.

The white-tailed kite (*Elanus leucurus*) is also protected by the federal MBTA and is considered Fully Protected status by CDFW. This species is found in rolling foothills and valley margins with scattered oaks, river bottomlands, and marshes next to deciduous woodland. The white-tailed kite requires open grasslands or meadows for foraging close to isolated, dense-topped trees for nesting and perching. They are year-round residents in California but migrate in other parts of the U.S.

The following subsections apply to both above-mentioned species of migratory birds.

4.4.9.2 SURVEY RESULTS

Formal surveys have not been conducted for nesting birds. Neither species has been observed in the BSA; however, suitable nesting habitat for each species was found within the BSA.

4.4.9.3 AVOIDANCE AND MINIMIZATION EFFORTS

Caltrans is currently exploring several options for avoidance and minimization of impacts to active bird nests. Potential efforts may include exclusionary fencing, use of sprinklers or high-pressure hoses to exclude nests, visual monitoring, and staging Project work to avoid nesting birds. Once potentially active nests have been removed from the Project limits outside of the nesting season, exclusionary devices will be installed to prevent any nesting birds from returning to build or rebuild their nests.

Preconstruction and construction nest surveys will be conducted within the BSA for all bird species, and if special-status species are detected, Caltrans will consult with CDFW or USFWS as appropriate. Surveys will include at least one survey conducted one full breeding season prior to the beginning of construction. If bird nests are found, they will be avoided/buffered to the extent suggested by a qualified biologist to avoid take of an active bird nest.

4.4.9.4 PROJECT IMPACTS

Under either alternative, efforts will be made to remove all potentially active nests present within the BSA outside of nesting season (February to August).

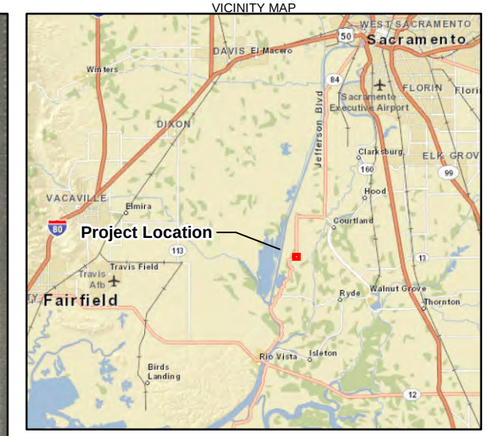
4.4.9.5 COMPENSATORY MITIGATION

No mitigation is proposed for impacts to migratory birds.

4.4.9.6 CUMULATIVE IMPACTS

With implementation of the avoidance and minimization measures described above, the project will make no measureable contribution to cumulative impacts on populations or habitat of migratory bird species.

VICINITY MAP



LEGEND

- Project Limits
- Project Study Area
- Temporary Impacts
- Permanent Impatcs
- Trees to be removed

Tree Species

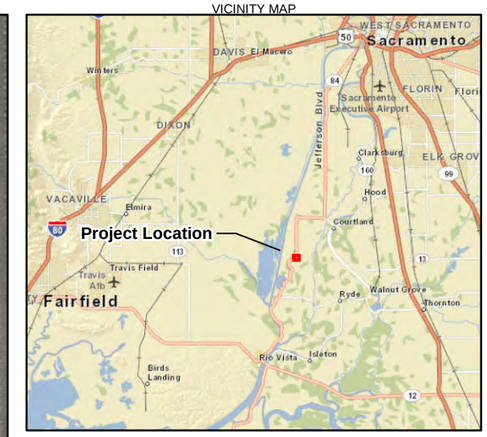
- Acacia
- Blaack Walnut
- F. Cottonwood
- Fig
- Olive
- Sweet bay
- Sycamore

N

0 150 300
Feet

FIGURE 4-15
Tree Survey and Impacts
Bridge Replacement
Miner Slough Bridge Project
EA 04-0G660, State Route 84 Post Mile 12.1/12.2
Solano County, California

VICINITY MAP



LEGEND

- Project Limits
- Project Study Area
- Temporary Impacts
- Permanent Impatcs
- Trees to be removed

Tree Species

- Acacia
- Blaack Walnut
- F. Cottonwood
- Fig
- Olive
- Sweet bay
- Sycamore

N

0 150 300
Feet

FIGURE 4-16
Tree Survey and Impacts
Bridge Rehabilitation
Miner Slough Bridge Project
EA 04-0G660, State Route 84 Post Mile 12.1/12.2
Solano County, California

Caltrans

BAO C:\PROJ\CALTRANS\477335ENVONCALL\TO1_BIOLOGICAL_SUPPORT\0G660_SOL84_MINERSLOUGHBRIDGE\GIS\MAPFILES\2015\NES\AUGUST\FIG4-16_TREE_SURVEY_BRIDGE_REHABILITATION.MXD CARCHER 8/25/2015 11:32:41 AM

Chapter 5 Permits, Laws, Regulations, and Conclusions

5.1 Regulatory Requirements

Caltrans would obtain the following permits to complete construction of this Project:

- 401 Water Quality Certification from the RWQCB (Section 401 of the Clean Water Act [CWA])
- 404 Nationwide Permit from USACE (Section 404 of the CWA)
- 1602 Lake and Streambed Alteration Agreement from CDFW (Section 1602 of the California Fish and Game Code)
- 2080.1 Consistency Determination from the CDFW (Section 2080.1 of the California Fish and Game Code)

5.2 Federal Endangered Species Act Consultation Summary

Caltrans has submitted a biological assessment for the federally threatened GGS, for the federally threatened delta smelt, and for the candidate for listing longfin smelt under Section 7 Formal Consultation with USFWS. Caltrans has also submitted a biological assessment for federally endangered SRWRCS ESU and federally threatened Central Valley spring-run Chinook salmon ESU, federally threatened Central Valley steelhead, federally threatened green sturgeon and designated critical habitat for Central Valley steelhead, and SRWRCS and green sturgeon under Section 7 Formal Consultation with NMFS.

5.3 California Endangered Species Act Consultation Summary

Caltrans has submitted biological assessments to CDFW for consultation on GGS and delta smelt.

5.4 Wetlands and Other Waters Coordination Summary

A wetland delineation was performed on March 4, 2014 and December 8, 2014, and a draft Wetland Delineation Report was submitted to USACE in November 2014

(Caltrans 2014). The Jurisdictional Determination was received from USACE on April 6, 2015. The jurisdictional delineation report is included in Appendix C.

Caltrans will be submitting a request for a Nationwide Permit with USACE, a water quality certification with the RWQCB, and a lake and streambed alteration agreement with CDFW.

5.5 Migratory Bird Treaty Act

MBTA implements international treaties between the U.S. and other nations devised to protect migratory birds and any of their parts, eggs, and nests from activities such as hunting, pursuing, capturing, killing, selling, and shipping, unless expressly authorized in the regulations or by permit. As authorized by the MBTA, USFWS issues permits to qualified applicants for the following types of activities: falconry, raptor propagation, scientific collecting, special purposes (e.g., rehabilitation, education, migratory game bird propagation, and salvage), take of depredating birds, taxidermy, and waterfowl sale and disposal. The regulations governing migratory bird permits can be found in 50 CFR part 13 General Permit Procedures and 50 CFR part 21 Migratory Bird Permits. While no permits are issued for species protected under codes, coordination with USFWS is required.

Chapter 6 References

Beacham, Walton, Castronova, F.V. and Suzanne Sessine, eds. Beacham's Guide to International Endangered Species. Osprey, FL: Beacham Pub., 2000.

Bloom, P. H. 1980. The Raptorial Birds of Camp Pendleton Marine Corps Base, San Diego County, California. U.S. Department of Defense. 33 pp

California Department of Fish and Wildlife (CDFW) (formerly known as California Department of Fish and Game). 2015a. Wildlife and Habitat Data Analysis Branch. California Natural Diversity Database (CNDDB). RareFind 5. Electronic database. Sacramento, California. Available online at http://www.dfg.ca.gov/biogeodata/cnddb/maBSAnddata.asp. Accessed on March 26, 2015.

_____. 2015b. Natural Diversity Database. *Special Animals List*. Periodic publication. 51 pp. Available online at http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/SPAnimals.pdf. January.

_____. 2008. A Status Review of the Threatened Delta Smelt (*Hypomesus transpacificus*) in California. 23 pp. Available online at https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=26543. January.

_____. 2007. *California Swainson's Hawk Inventory: 2005–2006.* U.C. Davis Wildlife Health Center and Department of Fish and Game Resource Assessment Program. P0485902.

_____. 2002. *California's General Plant and Animal Information*. Web application. Habitat Conservation Planning Branch, Sacramento, California. Available online at http://www.dfg.ca.gov/wildlife/nongame/genplantsanimals.html.

_____. 2001. *California Living Marine Resources: A Status Report.* California Department of Fish and Game Bulletin 465-466. December.

_____. 2000. *Guidelines for Assessing the Effects of Proposed Projects on Rare, Threatened, and Endangered Plants and Natural Communities.*

California Department of Water Resources (DWR). 2015. California Data Exchange Center Database. Available online at http://cdec.water.ca.gov/.

California Department of Water Resources (DWR) and U.S. Bureau of Reclamation (Reclamation). 1994. *Effects of the Central Valley Project and State Water Project on delta smelt and Sacramento splittail.* Sacramento, California. 230 pp.

_____. 1993. *Effects of the Central Valley Project and State Water Project on delta smelt*. Sacramento County, California. 134 pp.

California Native Plant Society (CNPS). 2015. Database search for Liberty Island and Courtland quadrangles. Inventory of Rare and Endangered Plants (online edition, v7-08d). California Native Plant Society. Sacramento, CA. Accessed November 5, 2008. Available online at http://www.cnps.org/inventory.

_____. 2001. *CNPS Botanical Survey Guidelines*. Originally published December 9, 1983; Revised June 2, 2001. Available online at http://cnps.org/cnps/rareplants/pdf/cnps_survey_guidelines.pdf.

California Department of Transportation (Caltrans). 2015. *Miner Slough Bridge Replacement Project Special-Status Plant Survey.* Caltrans internal document. Updated January.

_____. 2014. *Final California Coastal Commission Wetland Delineation Report*. September.

_____. 2007. *Structure Replacement and Improvement Needs Report,* Office of Structure Maintenance and Investigation.

Campbell, E.A. and P.B. Moyle. 1991. "Historical and recent population sizes of spring-run Chinook salmon in California." Pages 155-216, In: T.J. Hassler, ed., *Proceedings of the 1990 Northeast Pacific Chinook and Coho Salmon Workshop*. American Fisheries Society, Humboldt State University, Arcata, California.

Cech, J.J., S. Doroshov, G. Moberg, B. May, R. Schaffter, and D. Kohlhorst. 2000. *Biological Assessment of Green Sturgeon in the Sacramento-San Joaquin Watershed (Phase I).* CALFED Bay-Delta Program.

Chase, Robert. 2008. "Green Sturgeon Monitoring in the Upper Sacramento River" Presentation to the Upper Sacramento River Monitoring Program Team (USRMPT) Workshop, Red Bluff, CA. March 12.

Corwin, Richard. 2008. "Summary of Reclamation's Green Sturgeon Monitoring Activities in the upper Sacramento River." Presentation to the Upper Sacramento River Monitoring Program Team (USRMPT) Workshop, Red Bluff, CA. March 12.

Cotroneo, Rachel/Caltrans District 4 Associate Planner-Biologist. 2011. Personal communication with Melissa Escaron/CDFW Staff Environmental Scientist. January 18.

_____. 2010. Personal communication (e-mail) with Joe Heublein/National Marine Fisheries Service. December 9.

Deng, X., J. P. Van Eenennaam, and S. I. Doroshov. 2002. "Comparison of Early Life Stages and Growth of Green and White Sturgeon." In: W. Van Winkle, P. J. Anders, E.H. Secor, and D.A. Dixon, eds., *Biology, Management, and Protection of North American Sturgeon*, pages 237 248. American Fisheries Society, Symposium 28, Bethesda, MD.

Environmental Laboratory. 1987. *Corps of Engineers Wetlands Delineation Manual*. Technical Report Y-87-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss. Available online at http://www.wetlands.com/regs/tlpge02e.htm.

Environmental Protection Information Center (EPIC). 2001. Petition to List the North American Green Sturgeon (*Acipenser medirostris*) as an Endangered or Threatened Species under the Endangered Species Act. Center for Biological Diversity, and Water Keepers Northern California.

Heublein, Joe/National Marine Fisheries Service. 2011a. Personal communication with Rachel Cotroneo/Caltrans. March 25.

_____. 2011b. Personal communication with Rachel Cotroneo/Caltrans. April 7.

_____. 2011c. Personal communication with Tim Hamaker/CH2M HILL. April 7.

Hubbs, C.L. 1946. "Wandering of pink salmon and other salmonoid fishes into Southern California." California Fish and Game, 32:81-86.

Jones and Stokes. 2006. East Contra Costa County Habitat Conservation Plan/Natural Community Conservation Plan (ECC HCP/NCCP), San Jose, California.

Knutson, A.C., Jr. and J.J. Orsi. 1983. "Factors regulating abundance and distribution of the shrimp *Neomysis mercedis* in the Sacramento-San Joaquin Estuary." *Transactions of the American Fisheries Society* 112:476-485.

Miles, Scott and Charles Goudey (editors). 1997. *Ecological Subregions of California*. United States Department of Agriculture, Forest Service. Pacific Southwest Division. R5-EM-TP-005. San Francisco.

Moyle, P.B. 2002. *Inland Fishes of California, 2nd Edition*. University of California Press. Berkeley, California. 576 pp.

_____. 1976. *Inland Fishes of California, 1st Edition*, University of California Press, Berkeley, California. 405 pp.

Moyle, P. B., R. M. Yoshiyama, J. E. Williams, and E. D. Wikramanayake. 2008. *California Central Valley Steelhead DPS (Oncorhynchus mykiss*). NOAA's National Marine Fisheries Service Southwest Regional Office. Available online at http://swr.nmfs.noaa.gov/recovery/Steelhead_CCVS.htm.

_____. 2007. Salmon and Steelhead. Southwest Regional Office. Available online at http://swr.nmfs.noaa.gov/salmon.htmhttp://swr.nmfs.noaa.gov/salmon.htm.

_____. 2005. *Updated Status of Federally Listed ESUs of West Coast Salmon and Steelhead.* NOAA Technical Memorandum NMFS-NWFSC-66. June, 2005. Available online at http://www.nwr.noaa.gov/Publications/Biological-Status-Reviews/upload/SR2005-allspecies.pdf.

_____. 1996. *Status review of West Coast Steelhead from Washington, Oregon, Idaho and California*. August, 1996. Available online at http://www.nwr.noaa.gov/Publications/Biological-Status-Reviews/upload/SR1997-steelhead0.pdf

_____. 1995. *Fish Species of Special Concern in California*. Prepared for the State of California Resources Agency, Department of Fish and Game, Inland Fisheries Division, Rancho Cordova, California. June. 272 pp.

Natural Resources Conservation Service (NRCS). 2015a. Web Soil Inventory. Available online at http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx.

_____. 2015b. National Weather and Climate Center. Available online at http://www.wcc.nrcs.usda.gov/climate/wst_fact.html.

National Wetlands Inventory (NWI). 2015. Available online at http://www.fws.gov/wetlands/.

Orsi, J.J. and W.L. Mecum. 1986. "Zooplankton distribution and abundance in the Sacramento/San Joaquin Delta in relation to certain environmental factors." Estuaries 9(4B):326-339.

Pacific Fisheries Management Council (PFMC). 2015.

Radtke, L.D. 1966. Distribution of smelt, juvenile sturgeon, and starry flounder in the Sacramento-San Joaquin Delta. pp. 115-119 in J.L. Turner and D.W. Kelley (eds.). Ecological studies of the Sacramento-San Joaquin Estuary, Part 2. California Department of Fish and Game Fish Bulletin No. 136.

Sacramento River Watershed Program. 2015. *Sacramento River Basin*. Sacramento River Watershed Program. Available online at http://www.sacriver.org/aboutwatershed/roadmap/sacramento-river-basin. Accessed on: February 4, 2015.

Sawyer, J.O., T. Keeler-Wolf, and J.M. Evens. 2009. *A Manual of California Vegetation*, 2nd edition. California Native Plant Society, Sacramento, CA.

Solano County Water Agency. 2012. Draft Solano County Multispecies Habitat Conservation Plan.

Sweetnam, D.A. and D.E. Stevens. 1993. Report to the Fish and Game Commission: A status review of the delta smelt (*Hypomesus transpacijicus*) in California. Candidate Species Status Report 93-DS. Sacramento, California. 98 pages plus appendices.

United States Army Corps of Engineers (USACE). 2006. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region.* December.

United States Department of Agriculture (USDA). 2015a. Natural Resources Conservation Service. National Hydric Soils List by State. Available online at http://soils.usda.gov/use/hydric/lists/state.html.

_____. 2015b. Natural Resources Conservation Service. Official Soil Series Descriptions. Available online at http://soils.usda.gov/technical/classification/osd/index.html.

U.S. Fish and Wildlife Service (USFWS). 2015. Online endangered species database for Solano County and Liberty Island quadrangle and the eight surrounding quadrangles, Sacramento Fish and Wildlife Office. Available online at http://www.fws.gov/sacramento/ES_Species/Lists/es_species_lists-form.cfm. Accessed on April 10, 2015

_____. 2014. Species Assessment and Listing Priority Assignment Form for Delta Smelt (*Hypomesus transpacificus*). https://ecos.fws.gov/docs/species/uplisting/doc4452.pdf

_____. 2012. Five year Status Review for the Giant Garter Snake. Sacramento, California. 63 pp.

_____. 2004a. Five Year Status Review for the Delta Smelt. Sacramento, California. 50 pp.

_____. 2004b. Formal Programmatic Consultation on the Issuance of Section 10 and 404 Permits for Projects with Relatively Small Effects on the Delta Smelt (*Hypomesus transpacificus*) and its Critical Habitat within the jurisdiction of the Sacramento Fish and Wildlife Office of the US Fish and Wildlife Service, California. November 5, 2008. Available online at http://www.fws.gov/sacramento/es/consultations/coe_delta_smelt.pdf

_____. 1999. *Draft Recovery Plan for the Giant Garter Snake* (Thamnophis gigas). Sacramento, California.

_____. 1997. "Programmatic Formal Consultation for U.S. Army Corps of Engineers 404 Permitted Projects 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." Letter from Wayne White, USFWS, to Art Champ, USACE, Sacramento District. November 13, 2008. Available online at http://www.fws.gov/sacramento/es/documents/ggs%20programmatic%20bo.pdf.

_____. 1996a. *Guidelines for Conducting and Reporting Botanical Inventories for Federally Listed, Proposed and Candidate Plants.* Accessed online at http://www.fws.gov/sacramento/es/documents/Listed_plant_survey_guidelines.PDF

_____. 1996b. Sacramento-San Joaquin Delta Native Fishes Recovery Plan. Portland, Oregon.

_____. 1996c. *Guidelines for the Restoration and/or Replacement of Giant Garter Snake Habitat.*

Van Eenennaam, J.P., M.A.H. Webb, X. Deng, S.I. Doroshov, R.B. Mayfield, J.J. Cech, Jr., D.C. Hillemeir, and T.E. Wilson. 2001. Artificial spawning and larval rearing of Klamath River green sturgeon. Transactions of the American Fisheries Society 130:159-165.

Vogel, D.A. 1987. *Estimation of the 1986 spring Chinook salmon run in Deer Creek, California. Report No. FR1/FAO-87-3,* Fisheries Assistance Office, U.S. Fish and Wildlife Service, Red Bluff, CA.

Wang, J.C.S. 1991. Early life stages and early life history of the delta smelt, *Hypomesus transpacificus*, in the Sacramento-San Joaquin Estuary, with comparison of early life stages of the longfin smelt, *Spirinchus thaleichthys*. Interagency Ecological Studies Program for the Sacramento-San Joaquin Estuary. Sacramento, California. Technical Report 28.

_____. 1986. Fishes of the Sacramento-San Joaquin estuary and adjacent waters, California: A guide to the early life histories. Interagency Ecological Study Program for the Sacramento-San Joaquin Estuary. Sacramento, California. Technical Report 9.

Western Regional Climate Center (WRCC). 2015. Clarksburg, California: Western Regional Climate Center. Available online at http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca1784. Accessed February 4, 2015.

Wiken, E., Francisco, J.N., and G. Griffith. 2011. North American Terrestrial Ecoregions – Level III. Commission for Environmental Cooperation, Montreal, Canada.

Federal Register Notices

Endangered and Threatened Wildlife and Plants: Proposed Rulemaking to Designate Critical Habitat for the Threatened Southern Distinct Population Segment of North American Green Sturgeon, Proposed Rule. *Federal Register* 73:174 (September 8, 2008) p. 52084.

Endangered and Threatened Wildlife and Plants: Threatened Status for Southern Distinct Population Segment of North American Green Sturgeon, Final Rule. *Federal Register* 71: 67 (April 7, 2006) p. 17757.

Endangered and Threatened Species: Final Listing Determinations for 10 Distinct Population Segments of West, Final Rule. Coast Steelhead. *Federal Register* 71:16 (January 5, 2006) p. 834.

Endangered and Threatened Species; Designation of Critical Habitat for Seven Evolutionarily Significant Units of Pacific Salmon and Steelhead in California, Final Rule. *Federal Register* 70: 170 (September 2, 2005) p. 52488.

Endangered and Threatened Species: Final Listing Determinations for 16 ESUs of West Coast Salmon, and Final 4(d) Protective Regulations for Threatened Salmonid ESUs, Final Rule. *Federal Register* 70:123 (June 28, 2005) p. 37160.

Endangered and Threatened Species; Establishment of Species of Concern List, Addition of Species to Species of Concern List, Description of Factors for Identifying Species of Concern, and Revision of Candidate Species List Under the Endangered Species Act, Notice of establishment of species of concern list, addition of species to species of concern list, description of factors for identifying species of concern, and revision of candidate species list. *Federal Register* 69:73 (April 15, 2004) p. 19975.

Endangered and Threatened Wildlife and Plants; Notice of Remanded Determination of Status for the Sacramento splittail (*Pogonichthys macrolepidotus*), Final Rule; Revised Determination. *Federal Register* 68:183 (September 22, 2003) p. 55139.

Designated Critical Habitat: Critical Habitat for 19 Evolutionarily Significant Units of Salmon and Steelhead in Washington, Oregon, Idaho, and California, Final Rule. *Federal Register* 65:32 (February 16, 2000) p. 7764.

Endangered and Threatened Species; Threatened Status for Two Chinook Salmon Evolutionarily Significant Units (ESUs) in California, Final Rule, Notice of Determination. *Federal Register* 64: 179 (September 16, 1999) p. 50394.

Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Sacramento Splittail, Final Rule. *Federal Register* 64:25 (February 8, 1999) p. 5963.

Endangered and Threatened Species: Threatened Status for Two ESUs of Steelhead in Washington, Oregon, and California, Final Rule and Notice of Determination. *Federal Register* 63: 53 (March 19, 1998) p. 13347.

Endangered and Threatened Wildlife and Plants; Critical Habitat Determination for the Delta Smelt, Final Rule. *Federal Register* 59:242, (December 19, 1994) p. 65256.

Amendment to a Fishery Management Plan: Groundfish of the Gulf of Alaska, Notice of Availability and Request for Comments. *Federal Register* 59:2 (January 4, 1994) p. 440.

Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Giant Garter Snake, Final Rule. *Federal Register* 58:201 (October 20, 1993) p. 54053.

Designated Critical Habitat: Critical Habitat for Winter-run Chinook Salmon, Final Rule. *Federal Register* 58:114 (June 16, 1993) p. 33212.

Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Delta Smelt, Final Rule. *Federal Register* 58:42 (March 5, 1993) p. 12854.

Appendix A Preliminary Project Construction and Drainage Plans

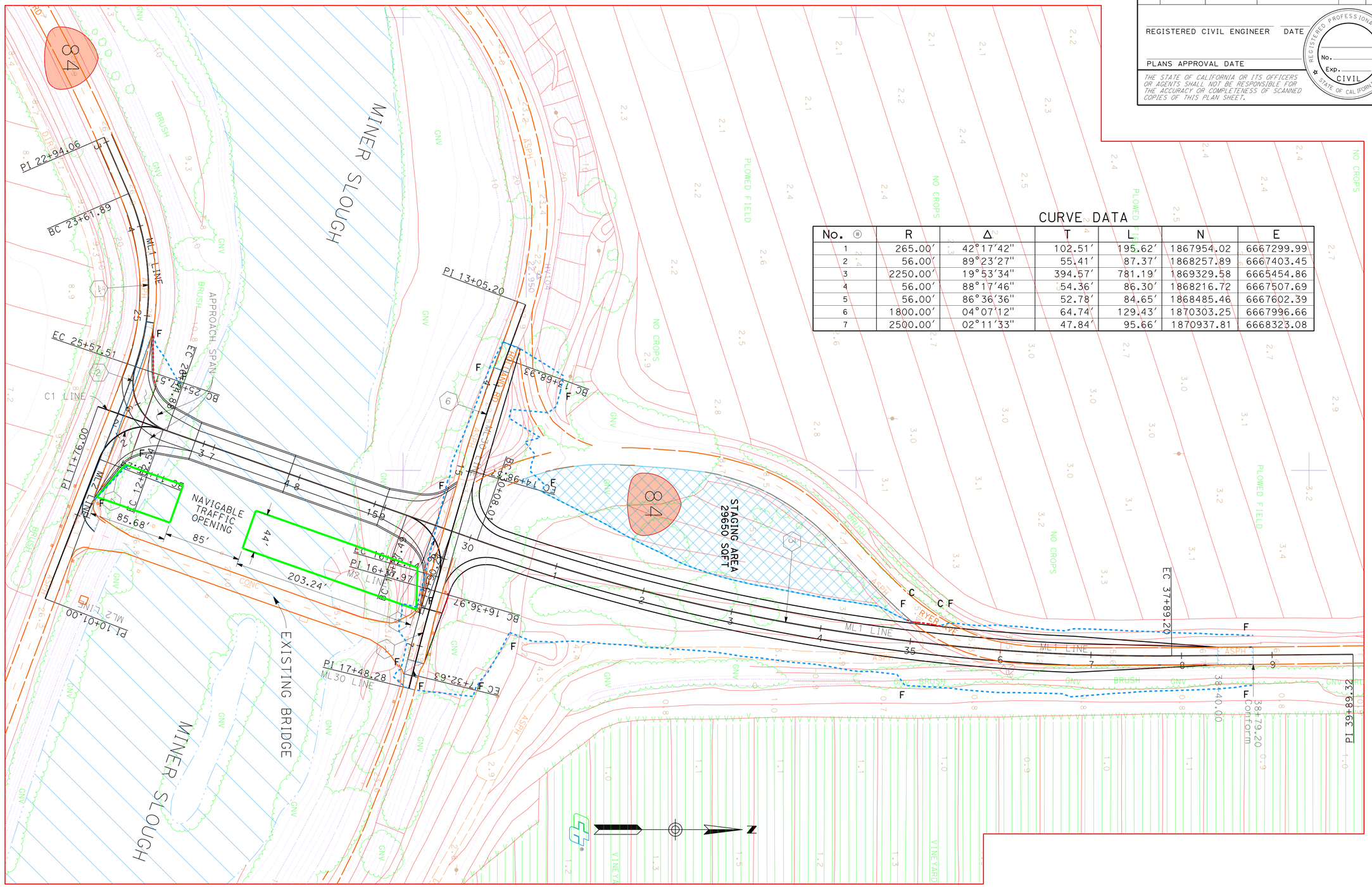
Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER No. Exp. CIVIL STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.



CURVE DATA

No.	R	Δ	T	L	N	E
1	265.00′	42°17′42"	102.51′	195.62′	1867954.02	6667299.99
2	56.00′	89°23′27"	55.41′	87.37′	1868257.89	6667403.45
3	2250.00′	19°53′34"	394.57′	781.19′	1869329.58	6665454.86
4	56.00′	88°17′46"	54.36′	86.30′	1868216.72	6667507.69
5	56.00′	86°36′36"	52.78′	84.65′	1868485.46	6667602.39
6	1800.00′	04°07′12"	64.74′	129.43′	1870303.25	6667996.66
7	2500.00′	02°11′33"	47.84′	95.66′	1870937.81	6668323.08

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

FUNCTIONAL SUPERVISOR

CALCULATED-DESIGNED BY

CHECKED BY

REVISED BY

DATE REVISED

LAST REVISION 00-00-00

DATE PLOTTED => 14-JAN-2015

TIME PLOTTED => 16:18

BORDER LAST REVISED 7/2/2010

USERNAME => s112021

DGN FILE => 1308A Minor Slough Alignmnt .dgn

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0000

PROJECT NUMBER & PHASE 00000000001

Appendix B USFWS, CNPS, and CNDDB Species Lists

U.S. Fish & Wildlife Service

Sacramento Fish & Wildlife Office

Federal Endangered and Threatened Species that Occur in or may be Affected by Projects in the Counties and/or U.S.G.S. 7 1/2 Minute Quads you requested

Document Number: 150922032917

Current as of: September 22, 2015

Quad Lists

Listed Species

Invertebrates

Branchinecta conservatio
Conservancy fairy shrimp (E)

Branchinecta lynchi
vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus
valley elderberry longhorn beetle (T)

Elaphrus viridis
delta green ground beetle (T)

Lepidurus packardi
vernal pool tadpole shrimp (E)

Fish

Hypomesus transpacificus
Critical habitat, delta smelt (X)
delta smelt (T)

Oncorhynchus mykiss
Central Valley steelhead (T) (NMFS)
Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha
Central Valley spring-run chinook salmon (T) (NMFS)
Critical Habitat, Central Valley spring-run chinook (X) (NMFS)
winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Ambystoma californiense
California tiger salamander, central population (T)

Rana draytonii
California red-legged frog (T)

Reptiles

Thamnophis gigas
giant garter snake (T)

Quads Containing Listed, Proposed or Candidate Species:

LIBERTY ISLAND (497C)

County Lists

Solano County

Listed Species

Invertebrates

Apodemia mormo langei
Lange's metalmark butterfly (E)

Branchinecta conservatio
Conservancy fairy shrimp (E)
Critical habitat, Conservancy fairy shrimp (X)

Branchinecta lynchi
Critical habitat, vernal pool fairy shrimp (X)
vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus
valley elderberry longhorn beetle (T)

Elaphrus viridis
Critical habitat, delta green ground beetle (X)
delta green ground beetle (T)

Incisalia mossii bayensis
San Bruno elfin butterfly (E)

Lepidurus packardi
Critical habitat, vernal pool tadpole shrimp (X)
vernal pool tadpole shrimp (E)

Speyeria callippe callippe
callippe silverspot butterfly (E)

Speyeria zerene myrtleae
Myrtle's silverspot butterfly (E)

Syncaris pacifica
California freshwater shrimp (E)

Fish

Acipenser medirostris
green sturgeon (T) (NMFS)

Eucyclogobius newberryi
tidewater goby (E)

Hypomesus transpacificus
Critical habitat, delta smelt (X)
delta smelt (T)

Oncorhynchus kisutch
coho salmon - central CA coast (E) (NMFS)

Oncorhynchus mykiss
Central California Coastal steelhead (T) (NMFS)

Central Valley steelhead (T) (NMFS)
Critical habitat, Central California coastal steelhead (X) (NMFS)
Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha
Central Valley spring-run chinook salmon (T) (NMFS)
Critical Habitat, Central Valley spring-run chinook (X) (NMFS)
Critical habitat, winter-run chinook salmon (X) (NMFS)
winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Ambystoma californiense
California tiger salamander, central population (T)
Critical habitat, CA tiger salamander, central population (X)

Rana draytonii
California red-legged frog (T)
Critical habitat, California red-legged frog (X)

Reptiles

Masticophis lateralis euryxanthus
Alameda whipsnake [=striped racer] (T)
Critical habitat, Alameda whipsnake (X)

Thamnophis gigas
giant garter snake (T)

Birds

Charadrius alexandrinus nivosus
western snowy plover (T)

Coccyzus americanus occidentalis
Western yellow-billed cuckoo (T)

Pelecanus occidentalis californicus
California brown pelican (E)

Rallus longirostris obsoletus
California clapper rail (E)

Sternula antillarum (=Sterna, =albifrons) browni
California least tern (E)

Strix occidentalis caurina
northern spotted owl (T)

Mammals

Reithrodontomys raviventris
salt marsh harvest mouse (E)

Vulpes macrotis mutica

San Joaquin kit fox (E)

Plants

Blennosperma bakeri
Baker's stickyseed [=Sonoma Sunshine] (E)

Castilleja affinis ssp. neglecta
Tiburon paintbrush (E)

Cirsium hydrophilum var. hydrophilum
Suisun thistle (E)

Cordylanthus mollis ssp. mollis
soft bird's-beak (E)

Erysimum capitatum ssp. angustatum
Contra Costa wallflower (E)
Critical Habitat, Contra Costa wallflower (X)

Holocarpha macradenia
Santa Cruz tarplant (T)

Lasthenia conjugens
Contra Costa goldfields (E)
Critical habitat, Contra Costa goldfields (X)

Limnanthes vinculans
Sebastopol meadowfoam (E)

Navarretia leucocephala ssp. pauciflora
few-flowered navarretia (E)

Neostapfia colusana
Colusa grass (T)
Critical habitat, Colusa grass (X)

Oenothera deltoides ssp. howellii
Antioch Dunes evening-primrose (E)
Critical habitat, Antioch Dunes evening-primrose (X)

Orcuttia inaequalis
San Joaquin Valley Orcutt grass (T)

Sidalcea keckii
Keck's checker-mallow (=checkerbloom) (E)

Trifolium amoenum
showy Indian clover (E)

Tuctoria mucronata
Critical habitat, Solano grass (=Crampton's tuctoria) (X)

Solano grass (=Crampton's tuctoria) (E)

Proposed Species

Amphibians

Anaxyrus canorus
Yosemite toad (PX)

Plants

Cirsium hydrophilum var. hydrophilum
Critical habitat, Suisun thistle (PX)

Cordylanthus mollis ssp. mollis
Critical habitat, soft bird's-beak (PX)

Key:

(E) *Endangered* - Listed as being in danger of extinction.
(T) *Threatened* - Listed as likely to become endangered within the foreseeable future.
(P) *Proposed* - Officially proposed in the Federal Register for listing as endangered or threatened.
(NMFS) Species under the Jurisdiction of the National Oceanic & Atmospheric Administration Fisheries Service. Consult with them directly about these species.
Critical Habitat - Area essential to the conservation of a species.
(PX) *Proposed Critical Habitat* - The species is already listed. Critical habitat is being proposed for it.
(C) *Candidate* - Candidate to become a proposed species.
(V) Vacated by a court order. Not currently in effect. Being reviewed by the Service.
(X) *Critical Habitat* designated for this species

Important Information About Your Species List

How We Make Species Lists

We store information about endangered and threatened species lists by U.S. Geological Survey 7½ minute quads. The United States is divided into these quads, which are about the size of San Francisco.

The animals on your species list are ones that occur within, **or may be affected by** projects within, the quads covered by the list.

- Fish and other aquatic species appear on your list if they are in the same watershed as your quad or if water use in your quad might affect them.
- Amphibians will be on the list for a quad or county if pesticides applied in that area may be carried to their habitat by air currents.
- Birds are shown regardless of whether they are resident or migratory. Relevant birds on the county list should be considered regardless of whether they appear on a quad list.

Plants

Any plants on your list are ones that have actually been observed in the area covered by the list. Plants may exist in an area without ever having been detected there. You can find out what's in the surrounding quads through the California Native Plant Society's online Inventory of Rare and Endangered Plants.

Surveying

Some of the species on your list may not be affected by your project. A trained biologist and/or botanist, familiar with the habitat requirements of the species on your list, should determine whether they or habitats suitable for them may be affected by your project. We recommend that your surveys include any proposed and candidate species on your list. See our Protocol and Recovery Permits pages.

For plant surveys, we recommend using the Guidelines for Conducting and Reporting Botanical Inventories. The results of your surveys should be published in any environmental documents prepared for your project.

Your Responsibilities Under the Endangered Species Act

All animals identified as listed above are fully protected under the Endangered Species Act of 1973, as amended. Section 9 of the Act and its implementing regulations prohibit the take of a federally listed wildlife species. Take is defined by the Act as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" any such animal.

> Take may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or shelter (50 CFR §17.3).

Take incidental to an otherwise lawful activity may be authorized by one of two procedures:

- If a Federal agency is involved with the permitting, funding, or carrying out of a project that may result in take, then that agency must engage in a formal consultation with the Service.

  During formal consultation, the Federal agency, the applicant and the Service work together to avoid or minimize the impact on listed species and their habitat. Such consultation would result in a biological opinion by the Service addressing the anticipated effect of the project on listed and proposed species. The opinion may authorize a limited level of incidental take.

- If no Federal agency is involved with the project, and federally listed species may be taken as part of the project, then you, the applicant, should apply for an incidental take permit. The Service may issue such a permit if you submit a satisfactory conservation plan for the species that would be affected by your project.

  Should your survey determine that federally listed or proposed species occur in the area and are likely to be affected by the project, we recommend that you work with this office and the California Department of Fish and Game to develop a plan that minimizes the project's direct and indirect impacts to listed species and compensates for project-related loss of habitat. You should include the plan in any environmental documents you file.

Critical Habitat

When a species is listed as endangered or threatened, areas of habitat considered essential to its conservation may be designated as critical habitat. These areas may require special management considerations or protection. They provide needed space for growth and normal behavior; food, water, air, light, other nutritional or physiological requirements; cover or shelter; and sites for breeding, reproduction, rearing of offspring, germination or seed dispersal.

Although critical habitat may be designated on private or State lands, activities on these lands are not restricted unless there is Federal involvement in the activities or direct harm to listed wildlife.

If any species has proposed or designated critical habitat within a quad, there will be a separate line for this on the species list. Boundary descriptions of the critical habitat may be found in the Federal Register. The information is also reprinted in the Code of Federal Regulations (50 CFR 17.95). See our Map Room page.

Candidate Species

We recommend that you address impacts to candidate species. We put plants and animals on our candidate list when we have enough scientific information to eventually propose them for listing as threatened or endangered. By considering these species early in your planning process you may be able to avoid the problems that could develop if one of these candidates was listed before the end of your project.

Species of Concern

The Sacramento Fish & Wildlife Office no longer maintains a list of species of concern. However, various other agencies and organizations maintain lists of at-risk species. These lists provide essential information for land management planning and conservation efforts. More info

Wetlands

If your project will impact wetlands, riparian habitat, or other jurisdictional waters as defined by section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act, you will need to obtain a permit from the U.S. Army Corps of Engineers. Impacts to wetland habitats require site specific mitigation and monitoring. For questions regarding wetlands, please contact Mark Littlefield of this office at (916) 414-6520.

Updates

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be December 21, 2015.

CNPS California Native Plant Rare and Endangered Plant Inventory

Plant List

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

Search Criteria

Found in Quad 38121C6

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
Downingia pusilla	dwarf downingia	Campanulaceae	annual herb	2B.2	S2	GU
Hibiscus lasiocarpos var. occidentalis	woolly rose-mallow	Malvaceae	perennial rhizomatous herb	1B.2	S2	G5T2
Lathyrus jepsonii var. jepsonii	Delta tule pea	Fabaceae	perennial herb	1B.2	S2	G5T2
Lepidium latipes var. heckardii	Heckard's pepper-grass	Brassicaceae	annual herb	1B.2	S2	G4T2
Lilaeopsis masonii	Mason's lilaeopsis	Apiaceae	perennial rhizomatous herb	1B.1	S2	G2
Sagittaria sanfordii	Sanford's arrowhead	Alismataceae	perennial rhizomatous herb	1B.2	S3	G3
Symphyotrichum lentum	Suisun Marsh aster	Asteraceae	perennial rhizomatous herb	1B.2	S2	G2
Trifolium hydrophilum	saline clover	Fabaceae	annual herb	1B.2	S2	G2

Suggested Citation

CNPS, Rare Plant Program. 2015. Inventory of Rare and Endangered Plants (online edition, v8-02). California Native Plant Society, Sacramento, CA. Website http://www.rareplants.cnps.org [accessed 08 January 2015].

Search the Inventory
- Simple Search
- Advanced Search
- Glossary

Information
- About the Inventory
- About the Rare Plant Program
- CNPS Home Page
- About CNPS
- Join CNPS

Contributors
- The Calflora Database
- The California Lichen Society

© Copyright 2010-2014 California Native Plant Society. All rights reserved.

CNPS California Native Plant Rare and Endangered Plant Inventory

Plant List

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

Search Criteria

Found in Quad 38121C5

Scientific Name	Common Name	Family	Lifeform	Rare Plant Rank	State Rank	Global Rank
Brasenia schreberi	watershield	Cabombaceae	perennial rhizomatous herb	2B.3	S2	G5
Carex comosa	bristly sedge	Cyperaceae	perennial rhizomatous herb	2B.1	S2	G5
Centromadia parryi ssp. rudis	Parry's rough tarplant	Asteraceae	annual herb	4.2	S3	G3T3
Cicuta maculata var. bolanderi	Bolander's water-hemlock	Apiaceae	perennial herb	2B.1	S2	G5T3T4
Hibiscus lasiocarpos var. occidentalis	woolly rose-mallow	Malvaceae	perennial rhizomatous herb	1B.2	S2	G5T2
Juglans hindsii	Northern California black walnut	Juglandaceae	perennial deciduous tree	1B.1	S1	G1
Lathyrus jepsonii var. jepsonii	Delta tule pea	Fabaceae	perennial herb	1B.2	S2	G5T2
Sagittaria sanfordii	Sanford's arrowhead	Alismataceae	perennial rhizomatous herb	1B.2	S3	G3
Scutellaria lateriflora	side-flowering skullcap	Lamiaceae	perennial rhizomatous herb	2B.2	S1	G5

Suggested Citation

CNPS, Rare Plant Program. 2015. Inventory of Rare and Endangered Plants (online edition, v8-02). California Native Plant Society, Sacramento, CA. Website http://www.rareplants.cnps.org [accessed 08 January 2015].

Search the Inventory
- Simple Search
- Advanced Search
- Glossary

Information
- About the Inventory
- About the Rare Plant Program
- CNPS Home Page
- About CNPS
- Join CNPS

Contributors
- The Calflora Database
- The California Lichen Society

© Copyright 2010-2014 California Native Plant Society. All rights reserved.

CAUTION: ABSENCE OF SITE RECORDS DOES NOT MEAN SENSITIVE SPECIES ARE ABSENT AND DOES NOT REPLACE THE NEED FOR APPROPRIATE BIOLOGICAL REVIEW.
CNDDB Metadata may be found here

For Photos of Animals search: http://dlp.cs.berkeley.edu/photos/fauna/
For photos of Plants search : http://dlp.cs.berkeley.edu/photos/flora/
or: http://www.calflora.org/
For photos of Habitat search: http://dlp.cs.berkeley.edu/photos/landscape/

63 NDDB Elements in selection
For Multiple Occurences, a summary table will appear below this report.

Species	Special Status	Last Observed	Presence	OccurenceType	Accuracy	Details	Habitat Requirements
California linderiella,Linderiella occidentalis		20110120	Presumed Extant	Natural/Native occurrence	80 meters	YOLO BYPASS, 2.0 AIR MILES SE OF DELHI RD AT LEVEE RD (ROAD 104), 11 MILES SE OF DIXON. MAPPED TO COORDINATES PROVIDED ON FIELD SURVEY FORM. DETECTED ON 20 JAN 2011.	SEASONAL POOLS IN UNPLOWED GRASSLANDS WITH OLD ALLUVIAL SOILS UNDERLAIN BY HARDPAN OR IN SANDSTONE DEPRESSIONS.
Delta mudwort,Limosella australis	CNPS	19900820	Presumed Extant	Natural/Native occurrence	specific area	MINER SLOUGH WILDLIFE AREA, CONFLUENCE OF MINER SLOUGH AND CACHE SLOUGH, SOUTH OF LIBERTY ISLAND. OBSERVED 1985 AND 1990 DURING LILAEOPSIS MASONII SURVEYS.	RIPARIAN SCRUB, FRESHWATER MARSH, BRACKISH MARSH. PROBABLY THE RAREST OF THE SUITE OF DELTA RARE PLANTS.
Delta smelt,Hypomesus transpacificus	FT SE	2007XXXX	Presumed Extant	Natural/Native occurrence	80 meters	SACRAMENTO DEEP WATER CHANNEL BETWEEN LIGHTS 59 AND 60. SPRING KODIAK TRAWL SURVEY STATION 719. SMELT DETECTED HERE IN 2005, 2006 & 2007.	SACRAMENTO-SAN JOAQUIN DELTA. SEASONALLY IN SUISUN BAY, CARQUINEZ STRAIT & SAN PABLO BAY.
Delta tule pea,Lathyrus jepsonii var. jepsonii	CNPS	1988XXXX	Presumed Extant	Natural/Native occurrence	specific area	RYER ISLAND ALONG MINER SLOUGH, APPROXIMATELY 0.5 MILE FROM THE SOUTHWEST TIP OF PROSPECT ISLAND. ALONG WATER SIDE OF LEVEE NEAR MOUTH OF MINER SLOUGH. MAP DETAIL IS ONLY SOURCE OF INFORMATION FOR THIS SITE. SITE QUALITY, POPULATION TRENDS, AND ECOLOGICAL INFORMATION NEEDED.	FRESHWATER AND BRACKISH MARSHES.
Delta tule pea,Lathyrus jepsonii var. jepsonii	CNPS	20090812	Presumed Extant	Natural/Native occurrence	specific area	CHANNEL BETWEEN SUTTER SLOUGH / ELK SLOUGH AND THE SACRAMENTO RIVER, WEST OF COURTLAND, AT SW END OF MERRITT ISLAND. RIPRAP? ON THE NORTH SIDE OF THE CHANNEL. APPROXIMATELY 20 PLANTS OBSERVED IN 2009, IN SCATTERED CLUMPS.	FRESHWATER AND BRACKISH MARSHES.
Delta tule pea,Lathyrus jepsonii	CNPS	20050811	Presumed Extant	Natural/Native occurrence	80 meters	NW SHORE OF STEAMBOAT SLOUGH, 0.3 MILE SW OF ITS	FRESHWATER AND BRACKISH

Species	Special Status	Last Observed	Presence	OccurenceType	Accuracy	Details	Habitat Requirements
var. jepsonii						CONFLUENCE WITH THE SACRAMENTO RIVER, ON WEST SIDE OF SUTTER ISLAND. SITE WAS RIP-RAPPED IN THE EARLY 1970'S. SOME COMPETITION FROM EXOTICS. L. J. VAR. JEPSONII ACCOUNTED FOR LESS THAN 1% OF THE PLANT COVER FOUND DURING A VEGETATION SURVEY AT THIS SITE IN 2005.	MARSHES.
Mason's lilaeopsis,Lilaeopsis masonii	SR CNPS	20090917	Presumed Extant	Natural/Native occurrence	specific area	ALONG THE SACRAMENTO DEEP WATER SHIP CHANNEL FROM PROSPECT ISLAND NORTH TO THE VICINITY OF GARCIA BEND. EROSION AND RECREATION ARE THREATS. MAPPED AS 29 POLYGONS STRETCHING OVER 16 MILES ACCORDING TO 2010 DWR DIGITAL DATA. MANY SCATTERED PATCHES OBSERVED IN 2009.	FRESHWATER AND BRACKISH MARSHES, RIPARIAN SCRUB.
Mason's lilaeopsis,Lilaeopsis masonii	SR CNPS	20091002	Presumed Extant	Natural/Native occurrence	specific area	CONFLUENCE OF MINER SLOUGH AND CACHE SLOUGH, SOUTH OF LIBERTY ISLAND. PUMPING FOR NORTH BAY AQUEDUCT MAY INCREASE CHANNEL EROSION. MAPPED BY CNDDB AS 5 POLYGONS TO ECOMPASS INFORMATION FROM A 1988 ECOS, INC REPORT, A 1991 GOLDEN & FIELDER REPORT, AND 2010 DWR DIGITAL DATA. 10,000+ PLANTS OBS IN 1985 ON SEVERAL TULE ISLANDS NEAR CONFLUENCE OF MINER SLOUGH AND CACHE SLOUGH. SEEN IN AREA IN 1988 & 1990. SMALL PATCHES OBSERVED IN 2009. PLANTS ALSO REPORTED IN VICINITY IN 1995 (ZEBELL AND FIEDLER, 1996).	FRESHWATER AND BRACKISH MARSHES, RIPARIAN SCRUB.
Mason's lilaeopsis,Lilaeopsis masonii	SR CNPS	19880501	Presumed Extant	Natural/Native occurrence	specific area	LINDSEY SLOUGH; NEAR ITS CONFLUENCE WITH CACHE SLOUGH, SOUTH END OF LITTLE HASTINGS TRACT. PUMPING FOR NORTH BAY AQUEDUCT WILL INCREASE CHANNEL EROSION. MANY PLANTS OBSERVED IN 1988.	FRESHWATER AND BRACKISH MARSHES, RIPARIAN SCRUB.
Mason's lilaeopsis,Lilaeopsis masonii	SR CNPS	20090904	Presumed Extant	Natural/Native occurrence	specific area	BETWEEN THE SACRAMENTO RIVER DEEP WATER SHIP CHANNEL AND PROSPECT SLOUGH, ~0.8 AIR MILE NE OF LIBERTY ISLAND FERRY. DREDGING IS A THREAT. DENSE PATCHES SCATTERED IN THIS AREA IN 2009.	FRESHWATER AND BRACKISH MARSHES, RIPARIAN SCRUB.
Northern California black walnut,Juglans hindsii	CNPS	200210XX	Extirpated	Natural/Native occurrence	nonspecific area	ALONG THE SACRAMENTO RIVER, BETWEEN FREEPORT AND RIO VISTA, MOSTLY AT WALNUT GROVE. TREES NO LONGER REMAIN AT THIS SITE, THEY WERE CUT PRIOR TO 1949 ACCORDING TO SMITH, 1949. TREES WERE ALONG BOTH SIDES OF RIVER. SITE EXTIRPATED ACCORDING TO	RIPARIAN FOREST, RIPARIAN WOODLAND. FEW EXTANT NATIVE STANDS REMAIN; WIDELY NATURALIZED.

Species	Special Status	Last Observed	Presence	OccurenceType	Accuracy	Details	Habitat Requirements
						CALLIZO (2002).	
Sacramento splittail,Pogonichthys macrolepidotus	CDFG	19950226	Presumed Extant	Natural/Native occurrence	specific area	SACRAMENTO RIVER FROM MISSOURI BEND N OF KNIGHTS LANDING TO S OF COURTLAND. ALSO, LOWER 10 MILES OF THE FEATHER RIVER. IN THE SACRAMENTO RIVER FROM RIVER MILE 33 SOUTH OF COURTLAND TO RIVER MILE 97 NORTH OF KNIGHTS LANDING, AND THE LOWER 10 MILES OF THE FEATHER RIVER. INFORMATION TAKEN FROM A SACRAMENTO RIVER ANGLER SURVEY CONDUCTED BETWEEN 1991 & 1995. FISH WERE TAKEN BY HOOK & LINE MOSTLY FROM SHORE. MOST OF THE SPLITTAIL CAUGHT WERE TAKEN INCIDENTALLY & WERE NOT THE SPECIES TARGETED BY THE ANGLER.	ENDEMIC TO THE LAKES AND RIVERS OF THE CENTRAL VALLEY, BUT NOW CONFINED TO THE DELTA, SUISUN BAY & ASSOCIATED MARSHES.
Sanford's arrowhead,Sagittaria sanfordii	CNPS	20050815	Presumed Extant	Natural/Native occurrence	80 meters	MINER SLOUGH ON EAST SIDE OF PROSPECT ISLAND, ABOUT 1 AIR MILE NNE OF CONFLUENCE WITH CACHE SLOUGH. MODERATELY IMPACTED BY COMPETITION FROM EXOTIC PLANTS. MAPPED IN THE NW 1/4 OF THE SW 1/4 OF SECTION 28 ACCORDING TO 2005 VEGCAMP COORDINATES. 0.2% COVER OF SAGITTARIA SEEN IN >5 ACRES IN 2005.	MARSHES AND SWAMPS.
Sanford's arrowhead,Sagittaria sanfordii	CNPS	20050822	Presumed Extant	Natural/Native occurrence	80 meters	NORTH BANK OF MINER SLOUGH; ABOUT 0.6 MILE EAST OF FIVE POINTS. LOW LEVELS OF IMPACTS FROM ROAD CONSTRUCTION/MAINTENANCE AND COMPETITION FROM EXOTICS. JUST WEST OF BRIDGE ACROSS SLOUGH. MAPPED ACCORDING TO 2005 COORDINATES FROM VEGCAMP. 0.2% COVER OF SAGITTARIA OBSERVED IN 1-5 ACRES IN 2005.	MARSHES AND SWAMPS.
Sanford's arrowhead,Sagittaria sanfordii	CNPS	20090904	Presumed Extant	Natural/Native occurrence	specific area	MINER SLOUGH; ABOUT 1 AIR MILE SOUTHWEST OF LENTS LANDING AND 0.3 MILE NORTHEAST OF DC STEWART LANDING. MAPPED IN THE SE 1/4 OF THE SW 1/4 OF SECTION 21 ACCORDING TO 2010 DIGITAL DATA FROM THE DEPARTMENT OF WATER RESOURCES. 60 PLANTS OBSERVED IN 2009.	MARSHES AND SWAMPS.
Sanford's arrowhead,Sagittaria sanfordii	CNPS	20090904	Presumed Extant	Natural/Native occurrence	specific area	MINER SLOUGH; ABOUT 0.85 AIR MILE SSE OF FIVE POINTS. MAPPED IN THE SE 1/4 OF THE NW 1/4 OF SECTION 15 ACCORDING TO 2010 DIGITAL DATA FROM THE DEPARTMENT OF WATER RESOURCES. 40 PLANTS OBSERVED IN 2009.	MARSHES AND SWAMPS.
Sanford's arrowhead,Sagittaria sanfordii	CNPS	20091002	Presumed Extant	Natural/Native occurrence	specific area	MINER SLOUGH; TIDAL FLAT JUST EAST OF CONFLUENCE WITH CACHE SLOUGH. MAPPED IN THE NE 1/4 OF THE SW 1/4 OF	MARSHES AND SWAMPS.

Species	Special Status	Last Observed	Presence	OccurenceType	Accuracy	Details	Habitat Requirements
						SECTION 32 ACCORDING TO 2010 DIGITAL DATA FROM THE DEPARTMENT OF WATER RESOURCES. 30 PLANTS OBSERVED IN 2009 IN A 6 FT BY 4 FT PATCH.	
Suisun Marsh aster,Symphyotrichum lentum	CNPS	20090917	Presumed Extant	Natural/Native occurrence	specific area	SACRAMENTO DEEP WATER SHIP CHANNEL, APPROX 2.2 TO 4.5 MILES NNE OF JUNCTION WITH CACHE SLOUGH, SOUTH END YOLO BYPASS. LOW IMPACT FROM ROAD, MODERATE IMPACT FROM COMPETITION WITH EXOTICS. BOTH SIDES OF CHANNEL. MAPPED BY CNDDB AS 3 POLYGONS ACCORDING TO 2010 DWR DIGITAL DATA. IN THE WEST 1/2 OF SECTION 9 SOUTH THROUGH THE SE 1/4 OF SECTION 8, NW 1/4 OF SECTION 16, EAST 1/2 OF SECTION 17, AND THE NE 1/4 OF SECTION 20. UNKNOWN NUMBER OF PLANTS OBSERVED DURING A 2005 VEGETATION SURVEY. 300 PLANTS OBSERVED IN 2009.	MARSHES AND SWAMPS (BRACKISH AND FRESHWATER).
Suisun Marsh aster,Symphyotrichum lentum	CNPS	20091002	Presumed Extant	Natural/Native occurrence	specific area	ALONG CACHE SLOUGH, MINER SLOUGH, AND THE SACRAMENTO RIVER DEEP WATER SHIP CHANNEL, NORTH OF RIO VISTA. MAPPED BY CNDDB AS 11 POLYGONS ACCORDING TO 2010 DWR DIGITAL DATA. IN THE SW 1/4 OF SECTION 29 SOUTH THROUGH SECTIONS 32 (WEST 1/2), 5 (WEST 1/2), 8 (NE 1/4) AND ENDING IN THE NW 1/4 OF SECTION 9. TOTAL OF 1091 PLANTS OBSERVED IN 2009.	MARSHES AND SWAMPS (BRACKISH AND FRESHWATER).
Suisun Marsh aster,Symphyotrichum lentum	CNPS	20050816	Presumed Extant	Natural/Native occurrence	80 meters	LINDSEY SLOUGH BETWEEN WRIGHT CUT AND CACHE SLOUGH, SOUTH OF LITTLE HASTINGS TRACT, NORTH OF RIO VISTA. IN THE SW 1/4 OF THE SW 1/4 OF SECTION 30. UNKNOWN NUMBER OF PLANTS OBSERVED DURING A 2005 VEGETATION SURVEY.	MARSHES AND SWAMPS (BRACKISH AND FRESHWATER).
Suisun Marsh aster,Symphyotrichum lentum	CNPS	20050919	Presumed Extant	Natural/Native occurrence	80 meters	SACRAMENTO RIVER DEEP WATER SHIP CHANNEL BETWEEN COURTLAND RD AND ROAD 159, ~1.7 MILES N OF THE YOLO/SOLANO COUNTY LINE. SITE MODERATELY IMPACTED BY COMPETITION WITH EXOTICS. EAST BANK. IN THE SW 1/4 OF THE NE 1/4 OF SECTION 28. UNKNOWN NUMBER OF PLANTS OBSERVED DURING A 2005 VEGETATION SURVEY.	MARSHES AND SWAMPS (BRACKISH AND FRESHWATER).
Suisun Marsh aster,Symphyotrichum lentum	CNPS	20050919	Presumed Extant	Natural/Native occurrence	80 meters	IN TOE DRAINAGE W OF SACRAMENTO DEEP WATER SHIP CHANNEL, ~0.25 MI N OF YOLO / SOLANO COUNTY LINE, S END OF YOLO BYPASS. SITE MODERATELY IMPACTED BY COMPETITION WITH EXOTICS.	MARSHES AND SWAMPS (BRACKISH AND FRESHWATER).

Species	Special Status	Last Observed	Presence	OccurenceType	Accuracy	Details	Habitat Requirements
						EAST BANK OF TOE DRAINAGE. IN THE SW 1/4 OF THE SW 1/4 OF SECTION 33. UNKNOWN NUMBER OF PLANTS OBSERVED DURING A 2005 VEGETATION SURVEY.	
Suisun Marsh aster,Symphyotrichum lentum	CNPS	20090917	Presumed Extant	Natural/Native occurrence	specific area	SACRAMENTO DEEP WATER SHIP CHANNEL, APPROXIMATELY 1.9 MILES NNE OF JUNCTION WITH CACHE SLOUGH, SOUTH END OF YOLO BYPASS. WESTERN SHORE OF PROSPECT ISLAND, EASTERN SHORE OF CHANNEL. MAPPED BY CNDDB ACCORDING TO 2010 DWR DIGITAL DATA. IN THE NORTH HALF OF THE SE 1/4 OF SECTION 20. FEW SCATTERED PLANTS OBSERVED IN 2009.	MARSHES AND SWAMPS (BRACKISH AND FRESHWATER).
Suisun Marsh aster,Symphyotrichum lentum	CNPS	20080121	Presumed Extant	Natural/Native occurrence	specific area	EAST SHORE OF HASTINGS TRACT AND WEST SHORE OF CACHE SLOUGH, APPROXIMATELY 0.6 AIR MILE NW OF FRENCH ISLAND. BANK EROSION. IN THE SE 1/4 OF THE SW 1/4 OF SECTION 13. 3 ROBUST CLUMPS OBSERVED IN 2008.	MARSHES AND SWAMPS (BRACKISH AND FRESHWATER).
Suisun Marsh aster,Symphyotrichum lentum	CNPS	20090917	Presumed Extant	Natural/Native occurrence	specific area	SACRAMENTO RIVER DEEP WATER SHIP CHANNEL, ~0.6 MILE SOUTH OF ROAD 159, ~1 MILE NORTH OF THE YOLO / SOLANO COUNTY LINE. EAST BANK. MAPPED BY CNDDB ACCORDING TO 2010 DWR DIGITAL DATA. IN THE NW 1/4 OF THE NE 1/4 OF SECTION 33. UNKNOWN NUMBER OF PLANTS OBSERVED IN 2009.	MARSHES AND SWAMPS (BRACKISH AND FRESHWATER).
Suisun Marsh aster,Symphyotrichum lentum	CNPS	20090904	Presumed Extant	Natural/Native occurrence	specific area	MINER SLOUGH, APPROXIMATELY 1.5 MILES FROM ITS CONFLUENCE WITH CACHE SLOUGH, SE SIDE OF PROSPECT ISLAND. MAPPED BY CNDDB ACCORDING TO 2010 DWR DIGITAL DATA. IN THE NW 1/4 OF THE SW 1/4 OF SECTION 28. 2 PLANTS OBSERVED IN 2009.	MARSHES AND SWAMPS (BRACKISH AND FRESHWATER).
Swainson's hawk,Buteo swainsoni	ST	20000727	Presumed Extant	Natural/Native occurrence	nonspecific area	VICINITY OF THE HOWARD LANDING FERRY CROSSING ON STEAMBOAT SLOUGH, NORTH OF HOWARD LANDING, 5 MILES NORTH OF ISLETON. 1994: ABOUT 1/4 MI S OF FERRY ON GRAND ISLAND (E) SIDE; COORDINATES FROM CDFW SWAINSON'S HAWK DATABASE.1999: AT FERRY STATION ON RYER ISLAND (W) SIDE; FROM MAP ATTACHED TO SURVEY FORM. 2000: SURVEYORS ATTEMPTED TO REVISIT 1994 SITE. DFG TERRITORY #SA012. ACTIVE NEST 1979, '81, '82, '85-88 W/YOUNG OBS '81, '82, '85, '86, '87. 1994: PAIR OBS NEAR NEST 28 APR, 1 JUV NEAR NEST TREE 7 JUN. 1999: PAIR OBS	BREEDS IN GRASSLANDS WITH SCATTERED TREES, JUNIPER-SAGE FLATS, RIPARIAN AREAS, SAVANNAHS, & AGRICULTURAL OR RANCH LANDS

Species	Special Status	Last Observed	Presence	OccurenceType	Accuracy	Details	Habitat Requirements
						COPULATING 21 APR. 2000: 2 ADULTS FLUSHED BUT NO NEST FOUND 27 JUL.	
Swainson's hawk,Buteo swainsoni	ST	20060803	Presumed Extant	Natural/Native occurrence	nonspecific area	STEAMBOAT SLOUGH, JUST S OF THE SUTTER SLOUGH CONFLUENCE & ABOUT 0.4 MI N OF HOWARD LANDING FERRY, 5 MILES W OF LOCKE. 1988: TRS & DESCRIPTION "RM 21.6R" GIVEN ON FIELD SURVEY FORM & IN CDFW SWAINSON'S HAWK DATABASE. 2006: 2 NEST SITES; S SITE AT "E RYER ROAD 0.4 MILE N OF FERRY, 1.5 MILE S OF ELEVATOR ROAD," & N SITE AT "W BASE OF LEVEE, E RYER RD." 1988: DFG SWHA TERRITORY #YO154/SL017; 2 ADULTS FLEDGED 2 YOUNG. 2006, SOUTH SITE: 2 ADULTS OBSERVED CARRYING NESTING MATERIAL ON 5 MAY; ALSO OBS 22 MAY AND 29 JUN. SUCCESS OF NEST UNKNOWN. 2006, NORTH SITE: PAIR FLEDGED 2 YOUNG BY 3 AUG.	BREEDS IN GRASSLANDS WITH SCATTERED TREES, JUNIPER-SAGE FLATS, RIPARIAN AREAS, SAVANNAHS, & AGRICULTURAL OR RANCH LANDS
Swainson's hawk,Buteo swainsoni	ST	20030508	Presumed Extant	Natural/Native occurrence	1/5 mile	ALONG DITCH ABOUT 0.5 MI SE OF N COURTLAND RD AT WIDGEON RD (=RD 149) & 0.5 MI NE OF COURTLAND RD AT DUCK SLOUGH BRIDGE. MAPPED TO COORDINATES FROM CDFW DATABASE OF 2000-2004 NEST SITES. COORDS FALL IN MIDDLE OF FIELD ABOUT 0.15 MI FROM NEAREST TREE TO E (IN AERIAL PHOTOS FROM 2003). DESCRIPTION GIVES NEAREST INTERSECTION, "N COURTLAND RD & WIDGEON RD." TWO FEATHERED YOUNG OBSERVED IN NEST ON 8 MAY 2003; PRESENCE AND BEHAVIOR OF ADULTS NOT RECORDED.	BREEDS IN GRASSLANDS WITH SCATTERED TREES, JUNIPER-SAGE FLATS, RIPARIAN AREAS, SAVANNAHS, & AGRICULTURAL OR RANCH LANDS
Swainson's hawk,Buteo swainsoni	ST	20030508	Presumed Extant	Natural/Native occurrence	1/5 mile	ALONG ELK SLOUGH JUST NORTH OF WAUKEENA RD AT COURTLAND RD, ABOUT 1.2 MILES NW OF COURTLAND. 1987 DETECTION OF BREEDING PAIR IN VICINITY (JEFFERSON RD 1/4 MI N OF COURTLAND RD). MAPPED TO 2003 LOCATION FROM CDFW DATABASE OF SWAINSON'S HAWK NEST RECORDS 2000-2004; COORDS DON'T QUITE MATCH "WAUKEENA RD-NORTH 1/4 MI COURTLAND RD." 1987: SWAINSON'S HAWK PAIR OBSERVED ON GROUND IN FIELD, MATE-FEEDING & COPULATING. 2003: 1 FEATHERED YOUNG OBS ON NEST ON 8 MAY, DETECTIONS OF ADULTS NOT RECORDED.	BREEDS IN GRASSLANDS WITH SCATTERED TREES, JUNIPER-SAGE FLATS, RIPARIAN AREAS, SAVANNAHS, & AGRICULTURAL OR RANCH LANDS
Swainson's hawk,Buteo swainsoni	ST	20030709	Presumed Extant	Natural/Native occurrence	nonspecific area	STEAMBOAT SLOUGH, ABOUT 0.4 MILES SW OF ITS SACRAMENTO RIVER CONFLUENCE AND 0.1 MILES N	BREEDS IN GRASSLANDS WITH SCATTERED

Species	Special Status	Last Observed	Presence	OccurenceType	Accuracy	Details	Habitat Requirements
						OF SUTTER ISLAND CROSS ROAD. MAPPED TO COORDINATES FROM CDFW DATABASE OF SWAINSON'S HAWK NEST RECORDS FROM 2000-2004. TWO NEST SITES, NORTH AT "SOUTHSIDE OF SLOUGH, 100 YARDS WEST [=SW?] OF MARINA," & SOUTH AT "0.2 MILE E OF SUTTER ISLAND RD/SUTTER ISLAND RR." NORTH NEST IDENTIFIED ON 7 MAY, SOUTH NEST ON 22 MAY. ON RETURN VISIT ON 9 JULY BOTH NESTS WERE UNOCCUPIED.	TREES, JUNIPER-SAGE FLATS, RIPARIAN AREAS, SAVANNAHS, & AGRICULTURAL OR RANCH LANDS
Swainson's hawk,Buteo swainsoni	ST	20060810	Presumed Extant	Natural/Native occurrence	nonspecific area	NE CORNER OF RYER ISLAND, ON RYER RD E JUST S OF CONFLUENCE OF MINER & SUTTER SLOUGHS & 1.5 MI ESE OF RYER AVE BRIDGE. MAPPED TO COORDINATES GIVEN ON FIELD SURVEY FORMS. RESSEGUIE'S COURTLAND 9 SITE. 2 ADULTS AND 1 JUVENILE OBSERVED AT THE NEST ON 4 JUL 1999. 2 ADULTS FLEDGED 1 YOUNG; SITE VISITED 10 TIMES FROM 16 MAR - 10 AUG 2006.	BREEDS IN GRASSLANDS WITH SCATTERED TREES, JUNIPER-SAGE FLATS, RIPARIAN AREAS, SAVANNAHS, & AGRICULTURAL OR RANCH LANDS
Swainson's hawk,Buteo swainsoni	ST	20090513	Presumed Extant	Natural/Native occurrence	1/10 mile	WEST SIDE OF PROSPECT ISLAND ON THE SACRAMENTO RIVER, ABOUT 1.5 MI SW OF FIVE POINTS AND 2.7 MI NE OF HASTINGS FERRY. MAPPED TO 2009 NESTING SITE PER DWR, FROM SHAPEFILE OF BAY DELTA CONSERVATION PLAN 2009-2010 ENVIRONMENTAL SURVEY DATA. EXACT LOCATION OF NEST TREE UNKNOWN. 1 NESTING SWAINSON'S HAWK OBSERVED ON 13 MAY 2009.	BREEDS IN GRASSLANDS WITH SCATTERED TREES, JUNIPER-SAGE FLATS, RIPARIAN AREAS, SAVANNAHS, & AGRICULTURAL OR RANCH LANDS
Swainson's hawk,Buteo swainsoni	ST	2007XXXX	Presumed Extant	Natural/Native occurrence	1/10 mile	EAST SIDE OF ELK SLOUGH ABOUT 0.3 MILES SOUTH OF RD 158 BRIDGE AND 0.8 MILES NW OF THE COURTLAND POST OFFICE. MAPPED TO COORDINATES FOR SITE YO-98 FROM 2008 ESTEP REPORT. NESTING TERRITORY DETECTED DURING 2007 SURVEY; NESTING OUTCOME UNKNOWN/UNCONFIRMED.	BREEDS IN GRASSLANDS WITH SCATTERED TREES, JUNIPER-SAGE FLATS, RIPARIAN AREAS, SAVANNAHS, & AGRICULTURAL OR RANCH LANDS
Swainson's hawk,Buteo swainsoni	ST	20090518	Presumed Extant	Natural/Native occurrence	1/10 mile	NORTH SIDE OF MINER SLOUGH, JUST SOUTH OF HOLLAND RD AT SR 84, 0.7 MILES E OF FIVE POINTS. MAPPED TO 2009 NESTING SITE PER DWR, FROM SHAPEFILE OF BAY DELTA CONSERVATION PLAN 2009-2010 ENVIRONMENTAL SURVEY DATA. EXACT LOCATION OF NEST TREE UNKNOWN. 1 NESTING SWAINSON'S HAWK OBSERVED ON 18 MAY 2009;	BREEDS IN GRASSLANDS WITH SCATTERED TREES, JUNIPER-SAGE FLATS, RIPARIAN AREAS, SAVANNAHS, & AGRICULTURAL OR RANCH LANDS

Species	Special Status	Last Observed	Presence	OccurenceType	Accuracy	Details	Habitat Requirements
						NEST SUCCESS UNKNOWN.	
Swainson's hawk,Buteo swainsoni	ST	2007XXXX	Presumed Extant	Natural/Native occurrence	1/10 mile	E SIDE OF RYER AVENUE, ABOUT 0.3 MI S OF SUTTER ROAD INTERSECTION AND 1 MI N OF OXFORD RD, 1 MI NE OF MEDORA LAKE. ROW OF TREES WERE REMOVED BY 2008 AS PER AERIAL PHOTOS. MAPPED TO COORDINATES FOR SITE YO-96 FROM 2008 ESTEP REPORT. NEST WITH 1 YOUNG OBSERVED DURING 2007 SURVEY.	BREEDS IN GRASSLANDS WITH SCATTERED TREES, JUNIPER-SAGE FLATS, RIPARIAN AREAS, SAVANNAHS, & AGRICULTURAL OR RANCH LANDS
Swainson's hawk,Buteo swainsoni	ST	20050729	Presumed Extant	Natural/Native occurrence	nonspecific area	SOUTH SIDE OF COURTLAND ROAD, 0.5 MILE WEST OF MORSE (=MORRIS) ROAD, 2 MILES NW OF COURTLAND. COURTLAND 3 SITE. 2004 NEST TREE ON S SHOULDER 0.5 MILES W OF MORSE. 2005-06 NEST TREE ON S SHOULDER 0.35 MILES W OF MORSE, "FIRST TREE EAST OF 2004 NEST TREE." 2004 TREE (W) APPEARS TO HAVE FALLEN OVER, 2009+ AERIALS & GOOGLE STREETVIEW. MONITORED 15 MAY-3 AUG 2004: 1 YOUNG FLEDGED. INCUBATION OBS 8 MAY 2005, NEW NEST VACANT BY 29 MAY, TWIGS CARRIED TO '04 NEST TREE ON 2 JUL, NO NEST/YOUNG BY 29 JUL. 2006: INCUBATION OBS 22 MAY, PAIR DEFENSIVE 3 AUG, NO YOUNG BY 14 AUG.	BREEDS IN GRASSLANDS WITH SCATTERED TREES, JUNIPER-SAGE FLATS, RIPARIAN AREAS, SAVANNAHS, & AGRICULTURAL OR RANCH LANDS
Swainson's hawk,Buteo swainsoni	ST	2007XXXX	Presumed Extant	Natural/Native occurrence	specific area	VICINITY OF LOOKOUT SLOUGH & SHAG SLOUGH CONFLUENCE, 2.5 MILES WEST OF THE SACRAMENTO RIVER DEEP WATER CHANNEL. TWO NEST SITES. NW SITE ACTIVE IN 2001-2005, MAPPED TO UTMS FROM FIELD SURVEY FORMS FOR RESSEGUIE SITE LIBERTY ISLAND 1. SE SITE ACTIVE IN 2007, AT "LIBERTY FARMS HQ," MAPPED TO COORDINATES FOR SITE YO-116 FROM 2008 ESTEP REPORT. NEST MONITORED 27 APR-25 JUL 2001; 2 FLEDGED. MONITORED 4 APR-23 JUL 2002; 1 FLEDGED. MONITORED 18 MAR-15 AUG 2004; ACTIVE THROUGH 18 MAY/NO SIGHTINGS THEREAFTER. MONITORED 9 MAY-16 JUL 2005; 1 FLEDGED. ACTIVE NEST/SUCCESS UNKNOWN IN 2007.	BREEDS IN GRASSLANDS WITH SCATTERED TREES, JUNIPER-SAGE FLATS, RIPARIAN AREAS, SAVANNAHS, & AGRICULTURAL OR RANCH LANDS
Swainson's hawk,Buteo swainsoni	ST	2007XXXX	Presumed Extant	Natural/Native occurrence	80 meters	WEST SIDE OF DEEP WATER SHIP CHANNEL ON LIBERTY ISLAND ABOUT 2 MI NW OF VALDEZ. MAPPED TO SITE YO-50 FROM 2008 ESTEP REPORT. NEST WITH 1 YOUNG OBSERVED DURING 2007 SURVEY.	BREEDS IN GRASSLANDS WITH SCATTERED TREES, JUNIPER-SAGE FLATS, RIPARIAN AREAS,

Species	Special Status	Last Observed	Presence	OccurenceType	Accuracy	Details	Habitat Requirements
							SAVANNAHS, & AGRICULTURAL OR RANCH LANDS
Swainson's hawk,Buteo swainsoni	ST	2007XXXX	Presumed Extant	Natural/Native occurrence	80 meters	RYER AVE ABOUT 0.7 MI S OF RD 158 JUNCTION & 1 MI NW OF VALDEZ. MAPPED TO COORDINATES FOR SITE YO-51 FROM 2008 ESTEP REPORT. NEST WITH 1 YOUNG OBSERVED DURING 2007 SURVEY.	BREEDS IN GRASSLANDS WITH SCATTERED TREES, JUNIPER-SAGE FLATS, RIPARIAN AREAS, SAVANNAHS, & AGRICULTURAL OR RANCH LANDS
Swainson's hawk,Buteo swainsoni	ST	2007XXXX	Presumed Extant	Natural/Native occurrence	80 meters	LIBERTY ISLAND, ABOUT 1.2 MILES WSW OF ROAD 150 AT ROAD 158 & 2.75 MILES NE OF LIBERTY FARMS. MAPPED TO COORDINATES FOR SITE YO-95 FROM 2008 ESTEP REPORT. ACTIVE NEST OBSERVED DURING 2007 SURVEY; SUCCESS UNKNOWN.	BREEDS IN GRASSLANDS WITH SCATTERED TREES, JUNIPER-SAGE FLATS, RIPARIAN AREAS, SAVANNAHS, & AGRICULTURAL OR RANCH LANDS
Swainson's hawk,Buteo swainsoni	ST	2007XXXX	Presumed Extant	Natural/Native occurrence	80 meters	ALONG SUTTER SLOUGH, ABOUT 0.4 MI ENE OF MORSE RD AT SUTTER RD & 0.6 MI W OF MORGANS LANDING ON THE SACRAMENTO RIVER. MAPPED TO COORDINATES GIVEN FOR SITE YO-99 FROM 2008 ESTEP REPORT. 2003 DETECTION WAS ABOUT 0.3 MILES TO SOUTH. ACTIVE NEST WITH 1 YOUNG OBSERVED DURING 2007 SURVEY.	BREEDS IN GRASSLANDS WITH SCATTERED TREES, JUNIPER-SAGE FLATS, RIPARIAN AREAS, SAVANNAHS, & AGRICULTURAL OR RANCH LANDS
Swainson's hawk,Buteo swainsoni	ST	2007XXXX	Presumed Extant	Natural/Native occurrence	80 meters	WEST SIDE OF THE SACRAMENTO RIVER, RM 34.4(R), VICINITY OF COURTLAND ROAD AT SOUTH RIVER ROAD. VICINITY OF TERRITORY #YO082/#YO037 FROM CDFW SWAINSON'S HAWK OBSERVATIONS DATABASE. MAPPED TO COORDINATES FOR SITE YO-100 FROM 2008 ESTEP REPORT. 1982, 1985: 1 ADULT OBSERVED SOARING, BUT NO NEST FOUND (#YO037).1988: 2 ADULTS AND 1 JUVENILE OBSERVED AT NEST (#YO082). 1994: PAIR OBS FORAGING & PERCHING ON LONE OAK ON 13 JUL; NO NEST SEEN IN THIS TREE. 2007: NEST WITH 2 YOUNG OBSERVED.	BREEDS IN GRASSLANDS WITH SCATTERED TREES, JUNIPER-SAGE FLATS, RIPARIAN AREAS, SAVANNAHS, & AGRICULTURAL OR RANCH LANDS
Swainson's hawk,Buteo swainsoni	ST	20090610	Presumed Extant	Natural/Native occurrence	80 meters	ALONG TOE DRAIN, ABOUT 0.7 MILES W OF RD 150 AT N COURTLAND RD & 3.3 MILES SW OF GREENDALE. MAPPED TO POINT FROM CDFW SHAPEFILE OF SWAINSON'S HAWK NEST RECORDS FROM	BREEDS IN GRASSLANDS WITH SCATTERED TREES, JUNIPER-SAGE FLATS,

Species	Special Status	Last Observed	Presence	OccurenceType	Accuracy	Details	Habitat Requirements
						2009. NEST WITH YOUNG OBSERVED ON 10 JUN 2009.	RIPARIAN AREAS, SAVANNAHS, & AGRICULTURAL OR RANCH LANDS
Swainson's hawk,Buteo swainsoni	ST	20030507	Presumed Extant	Natural/Native occurrence	80 meters	SUTTER ISLAND; ALONG E SIDE OF SUTTER SLOUGH ABOUT 0.3 MI N OF CONFLUENCE WITH MINER SLOUGH AND 1.5 MI SE OF OXFORD. MAPPED TO COORDINATES FROM CDFW DATABASE OF SWAINSON'S HAWK NEST SITES. STATED LOCATION "SUTTER ISLAND - WEST SIDE." SWAINSON'S HAWK OBSERVED ON NEST, INCUBATING; ONE FEATHERED CHICK OBS IN NEST ON 7 MAY 2003.	BREEDS IN GRASSLANDS WITH SCATTERED TREES, JUNIPER-SAGE FLATS, RIPARIAN AREAS, SAVANNAHS, & AGRICULTURAL OR RANCH LANDS
Swainson's hawk,Buteo swainsoni	ST	20090629	Presumed Extant	Natural/Native occurrence	80 meters	SOUTH END OF PROSPECT ISLAND, ALONG MINER SLOUGH, 6 MILES NNE OF RIO VISTA. MAPPED TO COORDINATES FOR NEST TREE FROM 1999 FIELD SURVEY FORM. MULTIPLE DETECTIONS REPORTED FROM VICINITY IN DWR SHAPEFILE OF BAY DELTA CONSERVATION PLAN ENVIRONMENTAL SURVEY DATA 2009-2010; EXACT NEST TREE LOCZATIONS UNCLEAR, NOT MAPPED. 2 ADULTS AND 1 CHICK OBSERVED AT THE NEST ON 21 JUN 1999. MULTIPLE OBSERVATIONS OF SWAINSON'S HAWK PAIR EXHIBITING NESTING/TERRITORIAL BEHAVIOR, APR-JUN 2009.	BREEDS IN GRASSLANDS WITH SCATTERED TREES, JUNIPER-SAGE FLATS, RIPARIAN AREAS, SAVANNAHS, & AGRICULTURAL OR RANCH LANDS
Swainson's hawk,Buteo swainsoni	ST	20010622	Presumed Extant	Natural/Native occurrence	80 meters	STEAMBOAT SLOUGH, 0.3 MILE SOUTH OF SUTTER ISLAND CROSS ROAD AND 1 MILE WEST OF HIGHWAY 160 ALONG THE SACRAMENTO RIVER. 1983: DETECTION AT T5N R2E S18, NE1/4 OF SW1/4. 1987: SW1/4 OF NE1/4 OF SAME SECTION, AT RM 25L. 1988: S1/2 OF SAME SECTION. 2000-2001: COORDINATES OF NEST SITE OR COORDS OF OBSERVATION POINT PLUS BEARING & DISTANCE FROM NEST GIVEN. DFG SWHA #SA034. 1983: 1 ADULT (A) OBS, NO NEST FOUND. '84: NO HAWKS. '87: 1A + 2 YOUNG (Y) OBS 15 JUN. '88: 2A AT NEST OBS. 2000: 2 FLEDGED Y OBS 14 JUL. 1 SWHA OBS ON W SIDE SLOUGH, 27 JUL. '01: 2A & 1Y OBS ON 22 JUN, YOUNG BANDED.	BREEDS IN GRASSLANDS WITH SCATTERED TREES, JUNIPER-SAGE FLATS, RIPARIAN AREAS, SAVANNAHS, & AGRICULTURAL OR RANCH LANDS
Swainson's hawk,Buteo swainsoni	ST	20000727	Presumed Extant	Natural/Native occurrence	80 meters	EAST SIDE OF THE SACRAMENTO RIVER, 0.3 MILE SOUTH OF THE PAINTERSVILLE BRIDGE, ABOUT 1 MILE SSW OF COURTLAND. 1994: NEST TREE WAS LOCATED 100 YARDS EAST	BREEDS IN GRASSLANDS WITH SCATTERED TREES, JUNIPER-SAGE

Species	Special Status	Last Observed	Presence	OccurenceType	Accuracy	Details	Habitat Requirements
						OF RIVER ROAD ALONG A DRIVEWAY. COORDINATES FROM CDFW SWAINSON'S HAWK DATABASE. 2000: SURVEYOR REVISITED COORDINATES FROM CDFW DATABASE. 1994: 2 ADULTS AND 1 FEATHERED JUVENILE OBSERVED AT THE NEST ON 7 JUL. 2000: NO NEST LOCATED AND NO SWAINSON'S HAWKS OBSERVED ON 27 JUL, POSSIBLY DUE TO THE SURVEY BEING LATE IN THE SEASON.	FLATS, RIPARIAN AREAS, SAVANNAHS, & AGRICULTURAL OR RANCH LANDS
longfin smelt,Spirinchus thaleichthys	FC ST CDFG	20120709	Presumed Extant	Natural/Native occurrence	nonspecific area	CACHE SLOUGH N OF ELKHORN SLOUGH CONFLUENCE, LIBERTY ISLAND, & SACRAMENTO RIVER DEEP WATER SHIP CHANNEL TO COURTLAND RD. BAY-DELTA POPULATION IN DECLINE DUE TO DIVERSION, DROUGHT, ENTRAINMENT, FOOD LIMITATION CAUSED BY INVASIVE AMUR CLAM. CDFW 20MM/SMELT LARVAL SURVEY(SLS)/SPRING KODIAK TRAWL(SKT) STATIONS 713, 715, 716, 719, 723. DWR SAMPLED W/SCREW TRAPS IN DEEP WATER CHANNEL 1999-2002. IEP SAMPLED FISH OCCUPANCY OF LIBERTY ISLAND(LI) 2010-12 W/BEACH SEINE & LARVAL TRAWLS. 59 YOY FROM DWR TRAPS, '02. 20 MM CATCH/YEAR: 3/'97 24/'01 296/'02 15/'03 1/'05 22/'08 47/'09 35/'10 6/'11 62/'12. SKT: 23/'02 1/'04 1/'06 1/'08 1/'09 2/'10 1/'11 1/'12. SLS: 97/'09 235/'10 316/'11 255/'12. 137 LARVAE FROM LI, 2010-12.	EURYHALINE, NEKTONIC & ANADROMOUS. FOUND IN OPEN WATERS OF ESTUARIES, MOSTLY IN MIDDLE OR BOTTOM OF WATER COLUMN.
longfin smelt,Spirinchus thaleichthys	FC ST CDFG	20120604	Presumed Extant	Natural/Native occurrence	nonspecific area	MINER SLOUGH, FROM THE VICINITY OF THE CACHE SLOUGH CONFLUENCE NORTH TO THE VICINITY OF ELEVATOR ROAD, WEST RYER ISLAND. BAY-DELTA POPULATION IN DECLINE DUE TO DIVERSION, DROUGHT, ENTRAINMENT, FOOD LIMITATION CAUSED BY INVASIVE AMUR CLAM. MAPPED TO VICINITY OF COORDINATES GIVEN FOR CDFW 20 MM SAMPLING STATIONS 724 AND 726. LOW NUMBERS OF SMELT LARVAE CAUGHT IN 2008 (4), 2009 (2), AND 2012 (1).	EURYHALINE, NEKTONIC & ANADROMOUS. FOUND IN OPEN WATERS OF ESTUARIES, MOSTLY IN MIDDLE OR BOTTOM OF WATER COLUMN.
song sparrow ("Modesto" population),Melospiza melodia	CDFG	20090528	Presumed Extant	Natural/Native occurrence	nonspecific area	ALONG PROSPECT AND MINER SLOUGH, FROM CONFLUENCE N TO FIVE POINTS, W AND S SIDES OF PROSPECT ISLAND. MAPPED TO INCLUDE PROVIDED COORDINATES. DWR DETERMINED DETECTIONS WERE FOR "MODESTO" POPULATION BASED ON LOCATION. ONLY BIRDS DETECTED WITH NESTING	

Species	Special Status	Last Observed	Presence	OccurenceType	Accuracy	Details	Habitat Requirements
						BEHAVIOR WERE MAPPED. 17-140 SONG SPARROWS (UNCERTAIN SUBSPECIES, BUT ASSUMED TO BE OF "MODESTO" POPULATION) PERCHED IN THE AREA 22 APR-28 MAY 2009. UP TO 93 DETECTED AND DETERMINED TO BE NESTING IN AREA 13 APR-28 MAY 2009.	
song sparrow ("Modesto" population),Melospiza melodia	CDFG	20090528	Presumed Extant	Natural/Native occurrence	nonspecific area	ALONG MINER SLOUGH, SR 84 AT ELEVATOR RD, E SIDE OF PROSPECT ISLAND, 2-3 MI S OF MEDORA LAKE, 5.5 MI SW OF COURTLAND. MAPPED TO INCLUDE PROVIDED COORDINATES. DWR DETERMINED DETECTIONS WERE FOR "MODESTO" POPULATION BASED ON LOCATION. ONLY BIRDS DETECTED WITH NESTING BEHAVIOR WERE MAPPED. 1-15 SONG SPARROWS (UNCERTAIN SUBSPECIES, BUT ASSUMED TO BE OF "MODESTO" POPULATION) PERCHED IN THE AREA 22 APR-13 MAY 2009. 2-7 DETECTED AND DETERMINED TO BE NESTING IN AREA 13 APR-28 MAY 2009.	
song sparrow ("Modesto" population),Melospiza melodia	CDFG	20090528	Presumed Extant	Natural/Native occurrence	nonspecific area	ALONG MINER SLOUGH AT FIVE POINTS, NE END OF PROSPECT ISLAND, ABOUT 1.5 MI S OF MEDORA LAKE & 5 MI SW OF COURTLAND. MAPPED TO INCLUDE PROVIDED COORDINATES. DWR DETERMINED DETECTIONS WERE FOR "MODESTO" POPULATION BASED ON LOCATION. ONLY BIRDS DETECTED WITH NESTING BEHAVIOR WERE MAPPED. 1-10 SONG SPARROWS (UNCERTAIN SUBSPECIES, BUT ASSUMED TO BE OF "MODESTO" POPULATION) PERCHED IN THE AREA 27 APR-18 MAY 2009. 1 & 3 DETECTED AND DETERMINED TO BE NESTING IN AREA 8-28 MAY 2009.	
steelhead - Central Valley DPS,Oncorhynchus mykiss irideus	FT	20120507	Presumed Extant	Natural/Native occurrence	nonspecific area	SACRAMENTO-SAN JOAQUIN DELTA, FROM CHIPPS ISLAND TO SAN JOAQUIN R AT DOS REIS(RM51) & SACRAMENTO R AT GARCIA BEND(RM49). ENTRAINMENT; DREDGING; BANK EROSION; CHANNEL OCCLUSION BY SILT & AQUATIC VEGETATION; POLLUTED RUNOFF. AREA OF DELTA MAPPED INCLUDES 19 BEACH SEINE SITES AT WHICH STEELHEAD WERE REGULARLY DETECTED, 1976-2012; VARIOUS MIDWATER TRAWL SITES SAMPLED 1968-2005; AND THE CHIPPS ISLAND TRAWL SITE, OPERATED SINCE 1976. ANNUAL SEINE CATCH 1-136 (HIGH IN	POPULATIONS IN THE SACRAMENTO AND SAN JOAQUIN RIVERS AND THEIR TRIBUTARIES.

Species	Special Status	Last Observed	Presence	OccurenceType	Accuracy	Details	Habitat Requirements
						1995) SINCE 1976; OVER 90% HATCHERY-ORIGIN (HO) FROM 2000-2012. CHIPPS TRAWL CATCH 9-488 (HIGH IN '95); %HO INCREASED FROM 2000-12. ANALYSIS SUGGESTS PRODUCTION OF 100-300K WILD SMOLTS/YR; MAY BE DECLINING.	
steelhead - Central Valley DPS,Oncorhynchus mykiss irideus	FT	201104XX	Presumed Extant	Natural/Native occurrence	nonspecific area	EASTERN EDGE OF YOLO BYPASS; INCLUDING TOE DRAIN, SACRAMENTO DEEP WATER SHIP CHANNEL (DWSC), AND SACRAMENTO BYPASS. ENTRAINMENT & STRANDING BEHIND MIGRATION BARRIERS. USFWS & DWR FYKE TRAPS & SCREW TRAPS (RSTS) LOCATED IN TOE DRAIN (TD). SACRAMENTO RIVER FLOOD FLOWS CONNECT TD WITH YOLO BYPASS (YB) & PUTAH CREEK (PC), ENABLING FURTHER MIGRATION (NOT MAPPED). DWSC IS A DEAD END FOR STEELHEAD. ANALYSIS OF OTOLITHS FROM 40 PC TROUT SHOWED 0 SH PROGENY. TD FYKE TRAPS CAUGHT 15 MIGRATING SH, 2001-2006. TD RST CAUGHT 91 SH, 1998-2006. STRANDED SH SEINED FROM SACRAMENTO BYPASS 1998-99 & FROM BELOW FREMONT WEIR IN 1998-99 & 2011.	POPULATIONS IN THE SACRAMENTO AND SAN JOAQUIN RIVERS AND THEIR TRIBUTARIES.
vernal pool fairy shrimp,Branchinecta lynchi	FT	20110120	Presumed Extant	Natural/Native occurrence	80 meters	YOLO BYPASS, 2.0 AIR MILES SE OF DELHI RD AT LEVEE RD (ROAD 104), 11 MILES SE OF DIXON. MAPPED TO COORDINATES PROVIDED ON FIELD SURVEY FORM. FEWER THAN 20 OBSERVED THROUGH ENTIRE SAMPLING SEASON IN 2011.	ENDEMIC TO THE GRASSLANDS OF THE CENTRAL VALLEY, CENTRAL COAST MTNS, AND SOUTH COAST MTNS, IN ASTATIC RAIN-FILLED POOLS.
western red bat,Lasiurus blossevillii	CDFG	19990726	Presumed Extant	Natural/Native occurrence	1/10 mile	GRAND ISLAND, ABOUT 1.3 MILES ENE OF HOWARD LANDING. MAPPED ACCORDING TO LAT/LONG COORDINATES PROVIDED BY SOURCE, WITH LOCALITY "PARKING." SOURCE LISTS 3 COORDINATES FOR "ISLETON, GRAND ISLAND." BAT ASSUMED TO BE DETECTED AT ALL 3 LOCATIONS (OCC #67-68). BAT(S) DETECTED ON 26 JUL 1999.	ROOSTS PRIMARILY IN TREES, 2-40 FT ABOVE GROUND, FROM SEA LEVEL UP THROUGH MIXED CONIFER FORESTS.
white-tailed kite,Elanus leucurus		19920530	Presumed Extant	Natural/Native occurrence	80 meters	0.3 MILE WSW OF WILSON ROAD AND 0.3 MILE SE OF COURTLAND. ONE OR BOTH ADULTS WERE OBSERVED FOR ABOUT 2 MONTHS IN THIS AREA. ON 30 MAY 1992, BOTH ADULTS WERE OBSERVED, ONE CARRYING A SNAKE TOWARD VEGETATION WHERE NEST	ROLLING FOOTHILLS AND VALLEY MARGINS WITH SCATTERED OAKS & RIVER BOTTOMLANDS OR MARSHES NEXT TO

Species	Special Status	Last Observed	Presence	OccurenceType	Accuracy	Details	Habitat Requirements
						WAS PRESUMED TO BE LOCATED.	DECIDUOUS WOODLAND.
woolly rose-mallow,Hibiscus lasiocarpos var. occidentalis	CNPS	20070912	Presumed Extant	Natural/Native occurrence	80 meters	LEFT BANK OF SACRAMENTO RIVER AT RIVER MILE 29.8. LEVEE IS REGULARLY CLEARED OF WOODY VEGETATION. PLANT APPEARS TO HAVE BEEN MOWED/PRUNED IN PAST. LEVEE REHABILITATION. GROWING IN RIPRAP ALONG THE LEVEE NEAR THE WATERLINE. MAPPED ACCORDING TO COORDINATE INFORMATION PROVIDED BY STRINGER 2007. 1 PLANT IN 2007. LEVEE SEGMENT IS SCHEDULED TO BE REHABILITATED, WHICH WILL DESTROY THE ROSE MALLOW.	MARSHES AND SWAMPS (FRESHWATER).
woolly rose-mallow,Hibiscus lasiocarpos var. occidentalis	CNPS	20090812	Presumed Extant	Natural/Native occurrence	specific area	SACRAMENTO RIVER JUST SOUTH OF COURTLAND, EAST OF MORGANS LANDING. THREATENED BY FUTURE LEVEE WORK. TWO COLONIES MAPPED ON THE EAST BANK OF THE RIVER IN THE SW 1/4 OF THE NW 1/4 OF SECTION 32 ACCORDING TO 2010 DIGITAL DATA FROM THE DEPARTMENT OF WATER RESOURCES. 1 PLANT OBSERVED IN EACH COLONY IN 2009.	MARSHES AND SWAMPS (FRESHWATER).
woolly rose-mallow,Hibiscus lasiocarpos var. occidentalis	CNPS	20090901	Presumed Extant	Natural/Native occurrence	specific area	SACRAMENTO RIVER DEEP WATER SHIP CHANNEL, ABOUT 2 AIR MILES WEST OF VALDEZ. MAPPED ON THE WEST SIDE OF THE CHANNEL AT THE BOTTOM OF THE S 1/2 OF SECTION 28 ACCORDING TO 2010 DIGITAL DATA FROM THE DEPARTMENT OF WATER RESOURCES. 2 PLANTS OBSERVED IN 2009.	MARSHES AND SWAMPS (FRESHWATER).
woolly rose-mallow,Hibiscus lasiocarpos var. occidentalis	CNPS	20090812	Presumed Extant	Natural/Native occurrence	specific area	SACRAMENTO RIVER JUST WEST OF PAINTERSVILLE, ABOUT 0.7 AIR MILE SSW OF COURTLAND. THREATENED BY FUTURE LEVEE REPAIR WORK. MAPPED ON THE EAST BANK OF THE RIVER IN THE APPROXIMATE SE 1/4 OF THE SE 1/4 OF SECTION 31 ACCORDING TO 2010 DIGITAL DATA FROM THE DEPARTMENT OF WATER RESOURCES. 1 PLANT OBSERVED IN 2009.	MARSHES AND SWAMPS (FRESHWATER).
woolly rose-mallow,Hibiscus lasiocarpos var. occidentalis	CNPS	20090807	Presumed Extant	Natural/Native occurrence	specific area	SACRAMENTO RIVER, ABOUT 0.7 AIR MILE NNE OF COURTLAND. THREATENED BY LEVEE MAINTENANCE. MAPPED ON THE NORTHWEST BANK OF THE RIVER IN THE NW 1/4 OF THE SE 1/4 OF SECTION 29 ACCORDING TO 2010 DIGITAL DATA FROM THE DEPARTMENT OF WATER RESOURCES. 1 PLANT OBSERVED IN 2009.	MARSHES AND SWAMPS (FRESHWATER).

F=FEDERAL; **S**=STATE;
T=THREATENED; **E**=ENDANGERED; **R**=RARE; **C**=CANDIDATE;

CNPS=California Natural Plant Society Species of Concern
CDFG=California Dept of Fish and Game Species of Concern

NDDB Summary

Occurences	Species	Special Status	Habitat Requirements
1	California linderiella,Linderiella occidentalis		SEASONAL POOLS IN UNPLOWED GRASSLANDS WITH OLD ALLUVIAL SOILS UNDERLAIN BY HARDPAN OR IN SANDSTONE DEPRESSIONS.
1	Delta mudwort,Limosella australis	CNPS	RIPARIAN SCRUB, FRESHWATER MARSH, BRACKISH MARSH. PROBABLY THE RAREST OF THE SUITE OF DELTA RARE PLANTS.
1	Delta smelt,Hypomesus transpacificus	FT SE	SACRAMENTO-SAN JOAQUIN DELTA. SEASONALLY IN SUISUN BAY, CARQUINEZ STRAIT & SAN PABLO BAY.
3	Delta tule pea,Lathyrus jepsonii var. jepsonii	CNPS	FRESHWATER AND BRACKISH MARSHES.
4	Mason's lilaeopsis,Lilaeopsis masonii	SR CNPS	FRESHWATER AND BRACKISH MARSHES, RIPARIAN SCRUB.
1	Northern California black walnut,Juglans hindsii	CNPS	RIPARIAN FOREST, RIPARIAN WOODLAND. FEW EXTANT NATIVE STANDS REMAIN; WIDELY NATURALIZED.
1	Sacramento splittail,Pogonichthys macrolepidotus	CDFG	ENDEMIC TO THE LAKES AND RIVERS OF THE CENTRAL VALLEY, BUT NOW CONFINED TO THE DELTA, SUISUN BAY & ASSOCIATED MARSHES.
5	Sanford's arrowhead,Sagittaria sanfordii	CNPS	MARSHES AND SWAMPS.
9	Suisun Marsh aster,Symphyotrichum lentum	CNPS	MARSHES AND SWAMPS (BRACKISH AND FRESHWATER).
22	Swainson's hawk,Buteo swainsoni	ST	BREEDS IN GRASSLANDS WITH SCATTERED TREES, JUNIPER-SAGE FLATS, RIPARIAN AREAS, SAVANNAHS, & AGRICULTURAL OR RANCH LANDS
2	longfin smelt,Spirinchus thaleichthys	FC ST CDFG	EURYHALINE, NEKTONIC & ANADROMOUS. FOUND IN OPEN WATERS OF ESTUARIES, MOSTLY IN MIDDLE OR BOTTOM OF WATER COLUMN.
3	song sparrow ("Modesto" population),Melospiza melodia	CDFG	
2	steelhead - Central Valley DPS,Oncorhynchus mykiss irideus	FT	POPULATIONS IN THE SACRAMENTO AND SAN JOAQUIN RIVERS AND THEIR TRIBUTARIES.
1	vernal pool fairy shrimp,Branchinecta lynchi	FT	ENDEMIC TO THE GRASSLANDS OF THE CENTRAL VALLEY, CENTRAL COAST MTNS, AND SOUTH COAST MTNS, IN ASTATIC RAIN-FILLED POOLS.
1	western red bat,Lasiurus blossevillii	CDFG	ROOSTS PRIMARILY IN TREES, 2-40 FT ABOVE GROUND, FROM SEA LEVEL UP THROUGH MIXED CONIFER FORESTS.
1	white-tailed kite,Elanus leucurus		ROLLING FOOTHILLS AND VALLEY MARGINS WITH SCATTERED OAKS & RIVER BOTTOMLANDS OR MARSHES NEXT TO DECIDUOUS WOODLAND.
5	woolly rose-mallow,Hibiscus lasiocarpos var. occidentalis	CNPS	MARSHES AND SWAMPS (FRESHWATER).

Appendix C Delineation of Wetlands and Other Waters of the United States

Miner Slough Bridge Replacement Project

Delineation of Wetlands and Other Waters of the United States

State Route 84
Solano County, California
04-SOL-84 PM 12.1.0

Caltrans EA 0G660

September 2014

Caltrans

For individuals with sensory disabilities, this document is available in Braille, in large print, on audiocassette, or on computer disk. To obtain a copy in one of these alternative formats, please write to Caltrans, Attn: Chris States, Office of Biological Sciences and Permits, 111 Grand Avenue, Oakland, CA 94623-0660; or call (510) 286-7185 (voice); or use the California Relay Service TTY number, (800) 735-2929.

Miner Slough Bridge Replacement Project
Delineation of Wetlands and Other Waters of the United States

State Route (SR) 84
04-SOL-84, PM 12.1

Caltrans EA 0G660

November 2014

U.S. DEPARTMENT OF TRANSPORTATION
STATE OF CALIFORNIA
Department of Transportation (Caltrans)

Prepared By: _____ Date: 9-10-14

Erik Schwab, AEP, District Biologist
(510) 286-5627
Office of Biological Sciences and Permits
District 4, Oakland
California Department of Transportation

Reviewed by: _____ Date: 9/10/14

Rosalie Wilson, AEP District Biologist
(510) 622-1745
Office of Biological Sciences and Permits
District 4, Oakland
California Department of Transportation

Approved By: _____ Date: 9/10/14

Christopher States, District Branch Chief
(510) 286-7185
Office of Biological Sciences and Permits
District 4, Oakland
California Department of Transportation

Signed for

Contents

Chapter 1 Introduction 7
1.1 Project Description 7
1.2 Project Location 7
1.3 Environmental Setting 7
1.3.1 Land Use and Terrestrial Habitats 8
1.3.2 Climate and Hydrology 8
1.3.3 Existing Field Conditions 11
1.3.4 Soils 11
Chapter 2 Methods 12
2.1 Wetland Delineation 12
2.2 Mapping of Other Waters 13
Chapter 3 Results 13
3.1 Miner Slough: Riverine Permanent Tidal (R1UBV) 13
3.2 Palustrine Tidal Wetland (PEMT) 13
3.3 Palustrine Emergent Seasonal Wetland (PEMC) 14
3.4 Palustrine Shrub Scrub Wetland (PSSR) 14
3.5 Potential Jurisdictional Wetlands and Waters of the U.S. 14
3.6 Detailed Wetland Narrative 15
3.6.1 Sample Point 1 15
3.6.2 Sample Point 2 15
3.6.3 Sample Point 3 15
3.6.4 Sample Point 4 16
3.7 Justification for Wetland Boundaries 16
References 18

Tables

Table 1 Summary of Potential Jurisdictional Waters of the U.S.....12

Figures

Figure 1 Project Regional Vicinity Map.....3
Figure 2 Project Biological Study Area.....5
Figure 3 Potential Jurisdictional Waters of the U.S.....13

Appendices

Appendix A: Soil Map
Appendix B: Representative Photographs
Appendix C: Wetland Delineation Data Sheets
Appendix D: National Wetlands Inventory Map of Biological Study Area (BSA)
Appendix E: Compiled List of Plant Species Observed at BSA

List of Abbreviations

F	degrees Fahrenheit
BSA	biological study area
Caltrans	California Department of Transportation
GPS	Global Positioning Systems
NRCS	Natural Resources Conservation Service
PM	post mile
SR	state route
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture

Chapter 1 Introduction

Wetlands and other waters are ecological habitats regulated in part under the federal Clean Water Act Section (404). Activities that have the potential to dredge or discharge fill materials into "waters of the United States," including wetlands, must be authorized by the United States Army Corps of Engineers (USACE). In addition, work conducted in navigable, tidal waters is subject to the Rivers and Harbors Act (Sections 9 and 10) and work conducted on an existing USACE flood control project (levee) is under 33 U.S.C. 408 jurisdiction. This report presents the results of a wetland delineation conducted for the California Department of Transportation (Caltrans) Miner Slough Bridge Replacement Project in Solano County. The results of this delineation are preliminary pending verification by USACE. The project and the environmental setting are described in this chapter. Study methods and results are provided in Chapters 2 and 3, respectively.

1.1 Project Description

The Miner Slough Bridge crosses Miner Slough at post mile (PM) 12.1 on State Route (SR) 84 in Solano County. The Structure Maintenance and Investigation's Bridge Inspection Reports recommended replacement of the bridge superstructure or full structure replacement on a new alignment due to deterioration of the timber plank deck and broken timber stringers. Caltrans proposes to rehabilitate the existing Miner Slough Bridge by constructing a new bridge on a new alignment approximately 100 feet west of the existing one.

The existing bridge is 18 feet (ft.) wide with a center steel truss swing span. The replacement bridge would be constructed with improvements such as: two 12 ft. lanes and two 8 ft. shoulders, standard vertical clearance, and flares at each end providing sufficient width for articulated truck turning movements.

1.2 Project Location

The proposed project is located near the City of Rio Vista in Solano County, as shown on Figure 1. The project is located on SR 84, at PM 12.1 (Figure 1). The project is in Rancho Los Ulpinos Land Grant in the Liberty Island United States Geological Survey (USGS) 7.5-minute topographic quadrangle. The Miner Slough Bridge is roughly centered at 38° 29' 00.00" N Latitude and 121 ° 63' 16.7" W Longitude. Miner Slough, a traditional navigable water, flows south into the Sacramento River and Suisun Bay, which flows into the San Francisco Bay.
For the purposes of this wetland delineation, the biological study area (BSA) includes the project footprint along SR 84 in which permanent and temporary project construction activities may occur and extends 300 ft upstream and downstream of the existing bridge to account for any project design changes that could result in changes to the footprint boundaries (Figure 2).

1.3 Environmental Setting

The terrain in this ecoregion consists of flat fluvial plains and terraces, with a few low or rolling hills (Wiken, et al. 2011).

The Great Central Valley geomorphic province is an alluvial plain that is 50 miles wide and 400 miles long. The eastern border is the west-sloping Sierran bedrock surface and the western border is underlain by east-dipping Cretaceous and Cenozoic strata. The elevation range is from near sea-level just east of San Francisco Bay to about 800 feet at the extreme northern and southern ends. Elevations in the immediate area range from sea level up to 689 feet above sea level (Wiken, et al. 2011).

The portion of the county where the project BSA is located lies within the Great Central Valley within the Sacramento River watershed in Solano County. The following sections describe the terrestrial habitats, climate, major hydrologic features, and soils within and near the BSA.

1.3.1 Land Use and Terrestrial Habitats

The natural plant communities within the BSA consist of White Alder and White Alder/Narrow-leafed Willow associations (Sawyer et al. 2008). The most notable natural habitats within the BSA are the valley foothill riparian habitat along the Miner Slough corridor and the annual grassland habitat in the surrounding area. Surrounding land use within a 1-mile radius of the BSA consists mainly of agricultural land.

The project area spans across Miner Slough in a low-density agricultural area where the majority of the vegetation consists of native riparian forest with a mix of native and non-native species in the understory. A dense tree canopy formed by species such as white alder (*Alnus rhombifolia*), narrow-leafed willow (*Salix exigua*), and box elder (*Acer negundo*) shades the river edge. The understory vegetation includes wild grape (*Vitus californica*), poison hemlock (*Conium maculatum*), mugwort (*Artemesia douglasiana*), and Himalayan blackberry (*Rubus armeniacus*).

On the upland slope, vegetation includes black walnut (*Juglans californica*), oats (*Avena sativa*), Himalayan blackberry, scouring rush (*Equisetum hymale*), and ripgut brome (*Bromus diandrus*).

1.3.2 Climate and Hydrology

Climate in this area is typical of northern California's Mediterranean-type climate with an average yearly temperature of 73 degrees Fahrenheit (°F). Average winter temperatures range from 36 to 72°F and summer temperatures range between 47 and 91°F. On average, the mean rainfall is 17.37 inches. Rain falls mainly from November to March (Western Regional Climate Center (WRRC) 2014).

The dominant hydrology in the region consists of low gradient perennial and intermittent streams (Wiken et al. 2011). The two large rivers in the region, the San Joaquin and Sacramento, are fed by rivers from the Sierra Nevada and an extensive delta is created when the two rivers converge. Miner Slough is only a small portion of the Sacramento River watershed within the Sacramento River hydrologic region. The Sacramento River watershed drainage consists of an area of approximately 27,000 square miles (Sacramento River Watershed Program 2014). The river has a 400 mile path from the headwaters of the Klamath Mountains to Suisun Bay. Miner Slough itself is within the Sacramento River Hydrologic Region and the Sacramento Delta Hydrologic Unit (18020109). It is a tributary to the Sacramento River. Miner Slough is tidally influenced.

The National Wetlands Inventory (NWI) Wetlands Mapper shows the BSA to contain riverine (R1UBV), freshwater forested/shrub wetland (PSSR), and other (PF) habitat (USFWS 2014). The BSA was experiencing significant drought at the time of sampling. However, sample points did not appear to be affected by these conditions at the time of delineation.

1.3.3 Existing Field Conditions

The BSA was experiencing significant drought at the time of sampling. However sample points did not appear to be affected by these conditions at the time of delineations. Miner Slough is tidally influenced, and delineated wetlands occurred near the tidally influenced zone.

1.3.4 Soils

The BSA is comprised of three soil units known as Columbia, Sacramento, and Valdez (NRCS 2014a). A general description of the soils based on the NRCS official soils series descriptions (USDA 2014b) is provided below. All soil colors are for moist soils. Soil color codes follow the Munsell color system. Soil maps for the BSA are included in Appendix A (USDA 2014a). All of these soil types are on the National Hydric Soils list (NRCS 2014b).

1.3.4.1 Columbia Series, Moderately Well Drained

The Columbia series consists of moderately well drained soils on floodplains and natural levees with slopes of 0 to 8 percent that formed in alluvium from mixed sources. Surface soil is a pale brown (10YR 6/3) fine sandy loam. Runoff is negligible to medium, and permeability is moderately rapid.

1.3.4.2 Sacramento Series, Poorly Drained

The Sacramento series consists of poor to very poorly drained soils that formed in fine textured alluvium of mixed origin. These soils are found in nearly level basins at elevations of near sea level to 60 feet. Surface soil is a gray (5YR 5/1) clay. This soil has very slow to slow runoff and slow permeability.

1.3.4.3 Valdez Series, Poorly Drained

The Valdez series formed in recent alluvium from mixed rock sources and consists of very deep, poorly drained soils. These soils are near rivers, sloughs, and old stream channels in river deltas and floodplains and have slopes of 0 to 2 percent. The surface soil is a pale brown (10YR 6/3) silt loam. This soil has slow to very slow runoff with moderately slow permeability.

Chapter 2 Methods

Caltrans biologists Rosalie Wilson and Robert Vogt delineated areas within the BSA on March 4, 2014, using the USACE three-parameter method for wetlands delineation as outlined in the USACE's 1987 Wetland Delineation Manual (Environmental Laboratory 1987) and OHWM/HTL using OHWM guidance (USACE 2005). MHW was defined as the average of all the high water heights observed over the National Tidal Datum Epoch (National Oceanic and Atmospheric Administration (NOAA) 2014). The approximately 6.2-acre BSA includes the existing Caltrans right-of-way along the length of the proposed project.

2.1 Wetland Delineation

USACE defines wetlands as areas that are "inundated by surface water or groundwater with 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" (Title 40 Code of Federal Regulations Section 230.3 and Title 33 Code of Federal Regulations Section 238). The survey methodology followed USACE's 1987 Wetland Delineation Manual (Environmental Laboratory 1987) and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Arid West Regional Supplement) guidelines (USACE 2008).

The USACE uses the three-parameter approach (vegetation, soils, and hydrology) to determine the presence of wetlands. As a general rule, under this method, evidence of a minimum of one positive primary indicator for each parameter must be found (under normal circumstances and in nonproblem areas) to make a positive wetland determination. In general, wetlands will normally meet the following criteria (Environmental Lab 1987, USACE 2008):

- **Hydrophytic Vegetation:** More than 50 percent of the dominant vegetation is composed of plant species that are adapted to survive and grow in hydrophytic (wet) conditions. Plants are assigned a wetland indicator status based on their probability of occurring in wetlands (Lichvar et al. 2014).

- **Hydric Soils:** The NRCS defines hydric soil as "soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part…" (USDA 1994). The criteria for establishing the presence of hydric soils vary among soil types, drainage classes, and land resource regions. The NRCS has developed field indicators for identification of hydric soils. These indicators are used by the USACE in the Arid West Regional Supplement guidelines (USACE 2008). They rely on soil characteristics such as texture, color, and the presence of redoximorphic features to determine if soils are hydric.

- **Wetland Hydrology:** Areas with wetland hydrology are defined as "…inundated either permanently or periodically at mean water depths less than 2 meters (6.6 feet), or the soil is saturated to the surface at some time during the growing season" (Environmental Laboratory 1987). This saturation or inundation must be present for at least 5 percent of the growing season. Wetlands located within the BSA were classified using the Cowardin classification system (Cowardin et al. 1979). The locations of these wetlands were mapped using a Trimble GeoXH

handheld Global Positioning System (GPS) unit. Caltrans biologists were unable to survey the island directly east of the existing bridge due to accessibility issues. The NWI Wetland Mapper was used to identify the wetland type found on the island (USFWS 2014).

2.2 Mapping of Other Waters

A water feature, Miner Slough, was mapped during the wetland delineation. The limits of this feature were determined based on defined bed and bank characteristics, as well as evidence of high tide line (HTL) such as scouring, drift lines, water marks, and sediment deposits (USACE 2005). The HTL was mapped using a Trimble GeoXH handheld GPS unit. The HTL shows the limit of CWA 404 jurisdiction.

Mean high water (MHW) was calculated as the average of all the high water heights observed over the National Tidal Datum Epoch (NOAA 2014). Using GIS, ground level lidar data were converted into a digital elevation model (DEM) in raster format. The DEM was smoothed using nearest-neighbor statistics. The MHW contour line was obtained using this data and the National Tidal Datum Epoch (NOAA 2014). The MHW shows the limit of the Rivers and Harbors Act (Sec. 9 and 10) jurisdiction.

Chapter 3 Results

Three wetland types were identified within the BSA. In addition, portions of Miner Slough within HTL and MHW were mapped and identified within the BSA. These features are all described below and include their specific Cowardin classification code. The limits of HTL and MHW of Miner Slough are shown on Figure 3. Representative site photographs are included in Appendix B.

3.1 Miner Slough: Riverine Permanent Tidal (R1UBV)

The HTL was chosen based on ecological features such as exposed roots and wracklines. The portion of Miner Slough within the HTL of the BSA (536 linear feet (lf) and 3.42 acres (ac)) supports a riparian canopy over a deep channel which is generally devoid of vegetation.

Miner Slough is a navigable waterway subject to the ebb and flow of tide. MHW was defined as the average of all the high water heights observed over the National Tidal Datum Epoch (NOAA 2014). MHW was calculated to be 5.7 ft. (NAVD88) (Siegel, et. al. In Preparation).

3.2 Palustrine Tidal Wetland (PEMT)

A palustrine tidal wetland is located on the north side of Miner Slough (0.08 ac. and 230 lf). The dominant vegetation within the wetland is white alder (FACW), red willow (*Salix laevigata,* FACW), curly dock (*Rumex crispus,* FAC), and common rush (*Juncus patens,* FACW).

3.3 Palustrine Emergent Seasonal Wetland (PEMC)

A palustrine emergent seasonal wetland was found along the north bank of Miner Slough (0.009 ac. and 41 lf). The dominant vegetation within the wetland is white alder (FACW), red willow (FACW), common rush (FACW), and sedge (*Carex spp.*).

3.4 Palustrine Shrub Scrub Wetland (PSSR)

Caltrans biologists were unable to survey the island directly east of the existing bridge for wetlands because it is inaccessible. The NWI Wetlands Mapper (USFWS 2014) classifies the island as palustrine shrub scrub (0.24 acres and 236 lf).

3.5 Potential Jurisdictional Wetlands and Waters of the U.S.

A total of 0.33 acre (507 lf) of potentially jurisdictional wetland waters of the U.S. and of 3.42 acres (536 lf) of potentially jurisdictional non-wetland other waters of the U.S. were identified within the CWA 404 jurisdictional boundary. A total of 3.22 acres (536 lf) of potentially jurisdictional waters under the Rivers and Harbors Act (Sec. 9 and 10) were identified within the BSA.

Table 1. Summary of Potential Jurisdictional Wetlands and Waters of the U.S.

Feature	Acreage	Average Width (ft.)	Linear Feet	Potentially Jurisdictional?
Open Water Features				
Miner Slough (404)	3.42	250	536	Yes
Miner Slough (Sec. 9 & 10)	3.22	253	536	Yes
Wetlands				
Tidal Wetland (PEMT)	0.08	16	230	Yes
Emergent Wetland (PEMC)	0.009	13	41	Yes
Shrub-Scrub Wetland (PSSR)	0.24	45	236	Yes

3.6 Detailed Wetland Narrative

3.6.1 Sample Point 1

Sample point 1 did not come out as a wetland. The single tree strata present onsite was *Acer negundo,* with an indicator status of FACW*, at 80% absolute cover. Herbaceous strata consisted of *Gallium aparine* which only amounted to 1% absolute cover, with an indicator status of FACU. Woody vine stratum contained *Rubus ursinus* (FAC) and *Vitis californica* (FACU), at 15% and 5% absolute cover, respectively. Vegetation at sample point 1 did not pass the Hydrophytic Vegetation Dominance Test but did pass the Prevalence Index for hydrophytic vegetation. Hydric soils were present: 0-8 inches depth showed a Munsell color of 10YR 4/2 which contained redox concentrations of 4% with a Munsell color of 5YR 4/6, located within the soil matrix. Soil depths of 8-18 inches showed a Munsell color of 10YR 4/4, with redox features of 15% and a Munsell color of 2.5YR 5/8. Soil texture at all depths was clay/loam with mixed organic matter. The data point met only two of the three parameters needed for a site to be considered a wetland. The data point was missing any evidence of wetland hydrology, but contained both hydric soils and hydrophytic vegetation.

3.6.2 Sample Point 2

Sample point 2 came out as a wetland. It met all three of the wetland parameters of hydric soils, hydrophytic vegetation and hydrology. Vegetation at sample point 2 was very different from sample point 1. Tree stratum contained two tree species, *Alnus rhombifolia* with an indicator status of FACW and an absolute cover of 60%, and *Salix laevigata* with an indicator status of FACW and only 2% absolute cover. Herbaceous strata included *Carex sp.* (unknown indicator status), and *Juncus patens*, with an indicator status of FACW. The two herbaceous species combined to give 35% absolute cover. The location also included a woody vine stratum in the form *of Rubus ursinus*, with an indicator status of FAC and an absolute cover percentage of 5%. Vegetation at the sample site passed the Hydrophytic Vegetation Dominance test with a 100% of dominant species being OBL, FACW, or FAC.

Soils came out as a Depleted Matrix (F3), with a Munsell soil color of 2.5YR 3/2 and redox features with a Munsell color of 5YR 5/8. Redox concentrations were 30% of the matrix as a whole (from 0-18"). Hydrology was noted with an obvious high water table at a depth of 11 inches. Saturation of the soil was present at a depth of 9 inches with a texture of sandy/clay/loam.

3.6.3 Sample Point 3

Sample Point 3 is also within a wetland. This sample point met all three of the wetland parameters of hydric soils, hydrophytic vegetation and hydrology. Tree stratum contained two tree species, *Alnus rhombifolia* with an indicator status of FACW and an absolute cover of 60%, and *Salix laevigata* with an indicator status of FACW and 5% absolute cover. Herbaceous strata included *Carex sp.* (unknown indicator status), *Juncus patens*, with an indicator status of FACW, *Rumex crispus* with an indicator status of FAC, *Galium aparine*, with an indicator status of FACU, and *Mentha arvensis* with an indicator status of FACW. The absolute cover of all five species is 54%. Vegetation at the sample site passed the Hydrophytic Vegetation Dominance test.

A soil pit was dug to 18 inches (0-18 inches). Soil from the pit displayed a Munsell color of 10YR 4/2, with a depleted matrix. The soil also contained redox features, specifically, a 20% redox concentration, with a Munsell color of 5YR 5/8. Soils in the pit were of a sandy/clay/ loam texture.

Hydrology indicators included saturation of the soil at a depth of 4 inches.

3.6.4 Sample Point 4

Sample point 4 did not contain a tree or woody vine stratum, nor did it come out as a wetland. The herbaceous stratum contained four dominant species, *Bromus diandrus,* 30% absolute cover, *Malva parvaflora*, and *Convolvulus arvensis*, all three carry an indicator status of UPL. The fourth plant, *Equisetum hyemale*, is the only FACW of the four. Because of the lack of dominant wetland plants the site failed the Hydrophytic Vegetation Dominance test.

Soils at the sample point show a layer that has a depleted matrix with 100% chroma of 1 and a thickness of greater than 6 inches within the upper 10 inches of the soil profile. Soils from a depth of 0-6 inches displayed a Munsell soil color of 10YR 5/6 and 10YR 3/2. Between 6 and 8 inches, the Munsell color was found to be 10YR 3/1. All soil textures within the pit were clay/loam. None of the soil from the pit showed redox features. No wetland hydrology indicators were observed. Sample point 4 only met one of the three wetland parameters, hydric soils, and did not show any signs of hydrology or dominance of hydrophytic plants. Therefore, the site is upland and not within a wetland.

FAC = Facultative FACU = Facultative Upland FACW = Facultative Wetland UPL = Upland

3.7 Justification for Wetland Boundaries

The determination of wetland boundaries was made from obvious changes in vegetation from hydrophytic vegetation to decidedly upland vegetation (as noted in the data sheets), and from data points taken from within and outside wetland areas showing hydric soils and obvious hydrologic indicators.

References

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. *Classification of wetlands and deepwater habitats of the United States.* United States Department of the Interior. Washington, DC

Environmental Laboratory. (1987). *Corps of Engineers Wetlands Delineation Manual, Technical Report Y-87-1.* U.S. Army Engineer Waterways Experiment Station. Vicksburg, MS.

Lichvar, R.W., M. Butterwick, N.C. Melvin, and W.N. Kirchner. 2014. *The National Wetland Plant List.* 2014 Update of Wetland Ratings. Phytoneuron 2014-41: 1-42.

National Oceanic and Atmospheric Administration. 2014. *Tidal Datums.* Available online at: http://tidesandcurrents.noaa.gov/datum_options.html.

Natural Resources Conservation Service (NRCS). 2014a. *Web Soil Survey.* Available online at: http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm. Accessed on: March 4, 2014.

Natural Resources Conservation Service (NRCS).2014b. *National List of Hydric Soils.* Available online at: http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/use/hydric/. Accessed on: March 4, 2014.

Sacramento River Watershed Program. 2014. *Sacramento River Basin.* Sacramento River Watershed Program. Available online at: http://www.sacriver.org/aboutwatershed/roadmap/sacramento-river-basin. Accessed on: March 4, 2014.

Sawyer, J.O., Keeler-Wolf, T., and J.M. Evens. 2008. *A Manual of California Vegetation.* California Native Plant Society Press. Sacramento, CA.

Siegel, S.W, C. Enright, J. Dudas, and B. Tom. *Delta Tidal Datum Analysis.* In preparation.

United States Army Corps of Engineers (USACE). 2005. *Regulatory Guidance Letter: Ordinary high Water Mark Identification.*

United States Army Corps of Engineers (USACE). 2008. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region.* Version 2.0. Eds. 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.

United States Department of Agriculture (USDA). 1994. *Changes in Hydric Soils of the United States, Federal Register.* FR DOC #: 94-16968. Vol 59 (133).

United States Department of Agriculture (USDA). 2014a. Natural Resources Conservation Service. *Soil Survey for Solano County, Web Soil Survey 2.0 National Cooperative Soil Survey.* Available online at: http://websoilsurvey.nrcs.usda.gov/app/

United States Department of Agriculture (USDA). 2014b. Natural Resources Conservation Service. *Official Soil Series Descriptions*. Available online at: https://soilseries.sc.egov.usda.gov/osdname.asp.

United States Fish and Wildlife Service (USFWS). 2014. *National Wetlands Inventory*. Available online at: http://www.fws.gov/wetlands/Data/Mapper.html.

Wiken, E., Francisco, J.N., and G. Griffith. 2011. *North American Terrestrial Ecoregions – Level III*. Commission for Environmental Cooperation, Montreal, Canada.

Western Regional Climate Center. 2014. *Clarksburg, California: Western Regional Climate Center*. Available at: http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca1784. Accessed March 4, 2014.

Appendix A: Soil Maps

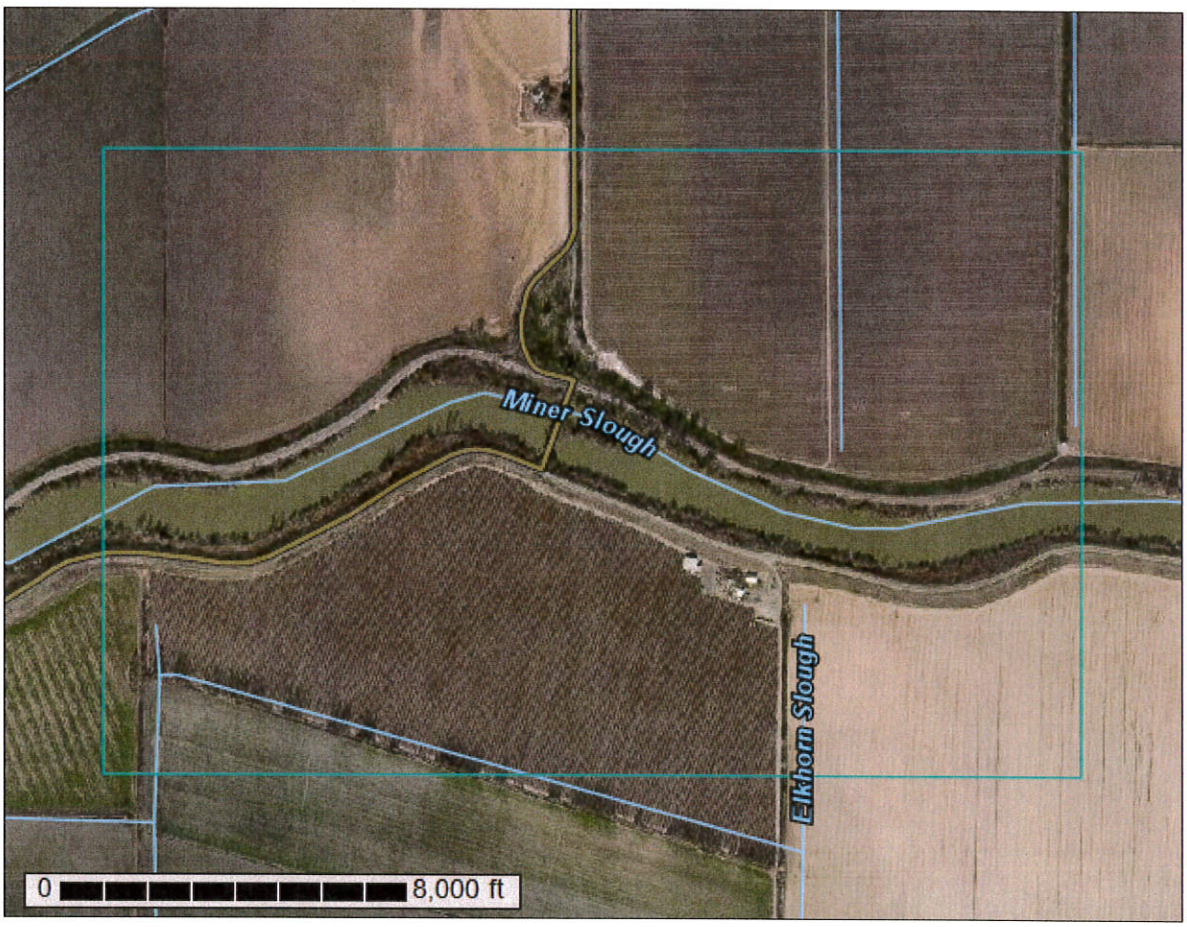
United States Department of Agriculture

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



May 1, 2014

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.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means

for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

Preface.....2
How Soil Surveys Are Made.....5
Soil Map.....7
Soil Map.....8
Legend.....9
Map Unit Legend.....10
Map Unit Descriptions.....10
Solano County, California.....12
Cm—Columbia fine sandy loam.....12
Sa—Sacramento silty clay loam.....13
Sd—Sacramento clay.....14
Va—Valdez silt loam drained.....15
W—Water.....16
References.....17

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.

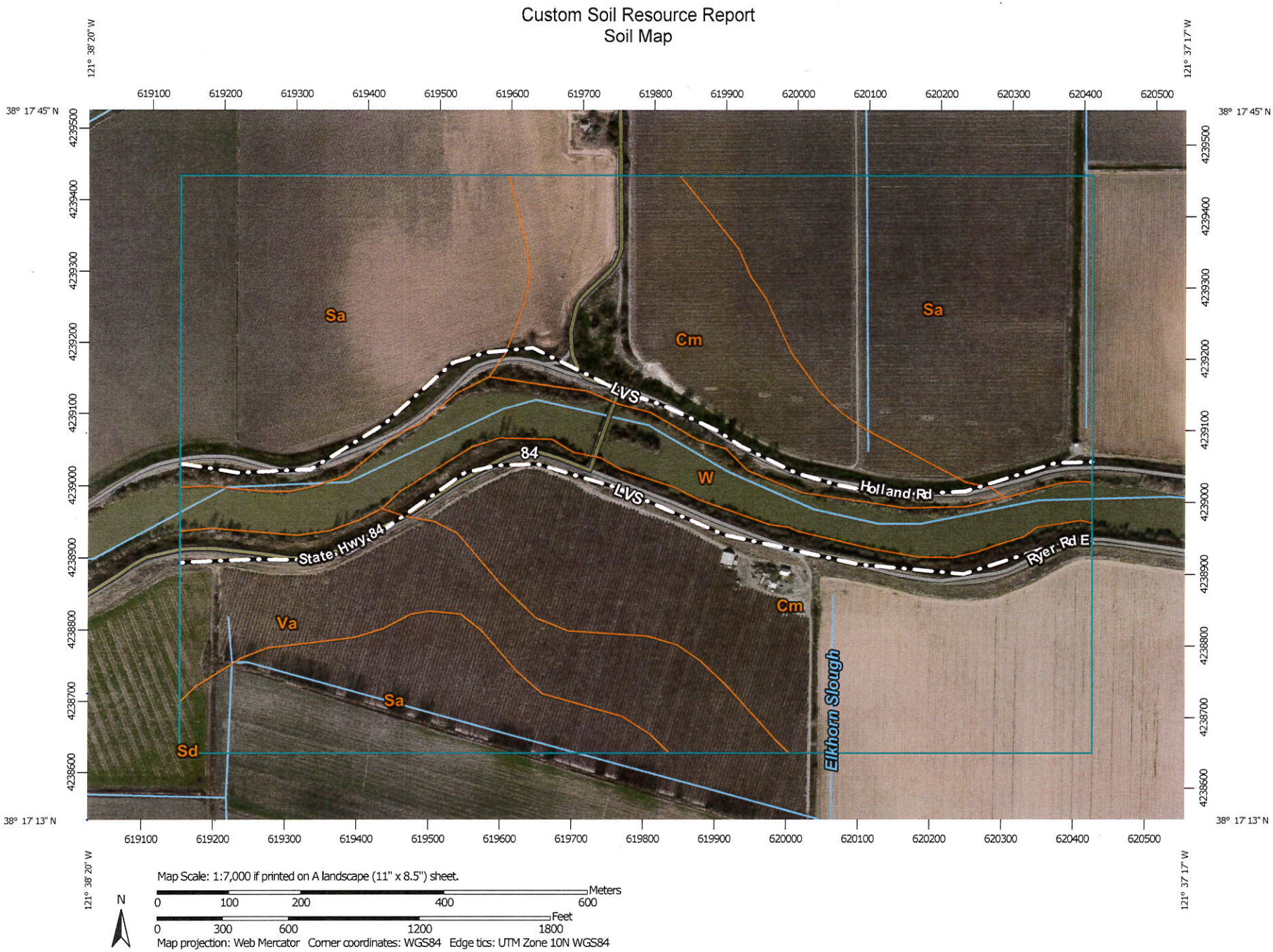
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree 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.

Custom Soil Resource Report
Soil Map



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.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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 6, Nov 26, 2013

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**
Cm	Columbia fine sandy loam	94.1	36.9%
Sa	Sacramento silty clay loam	111.2	43.6%
Sd	Sacramento clay	0.0	0.0%
Va	Valdez silt loam drained	27.2	10.7%
W	Water	22.4	8.8%
Totals for Area of Interest		**254.9**	**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

Cm—Columbia fine sandy loam

Map Unit Setting

Elevation: 0 to 10 feet
Mean annual precipitation: 16 to 18 inches
Mean annual air temperature: 61 to 63 degrees F
Frost-free period: 260 to 280 days

Map Unit Composition

Columbia and similar soils: 85 percent
Minor components: 15 percent

Description of Columbia

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
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 48 to 60 inches
Frequency of flooding: Rare
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water capacity: Moderate (about 8.3 inches)

Interpretive groups

Farmland classification: Prime farmland if irrigated
Land capability classification (irrigated): 2s
Land capability (nonirrigated): 4e
Hydrologic Soil Group: A

Typical profile

0 to 16 inches: Fine sandy loam
16 to 23 inches: Fine sandy loam
23 to 55 inches: Stratified sand to silt loam
55 to 60 inches: Silty clay loam

Minor Components

Ryde

Percent of map unit: 5 percent
Landform: Marshes

Valdez

Percent of map unit: 5 percent

Landform: Alluvial fans

Egbert

Percent of map unit: 5 percent

Sa—Sacramento silty clay loam

Map Unit Setting

Elevation: 0 to 10 feet
Mean annual precipitation: 16 to 20 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 250 to 270 days

Map Unit Composition

Sacramento and similar soils: 85 percent
Minor components: 13 percent

Description of Sacramento

Setting

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

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
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 36 to 48 inches
Frequency of flooding: Rare
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water capacity: Moderate (about 8.7 inches)

Interpretive groups

Farmland classification: Prime farmland if irrigated
Land capability classification (irrigated): 2w
Land capability (nonirrigated): 4w
Hydrologic Soil Group: C

Typical profile

0 to 15 inches: Silty clay loam
15 to 60 inches: Clay

Minor Components

Sacramento

Percent of map unit: 8 percent
Landform: Basin floors

Egbert

Percent of map unit: 5 percent
Landform: Basin floors

Sd—Sacramento clay

Map Unit Setting

Elevation: 0 to 10 feet
Mean annual precipitation: 16 to 20 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 250 to 270 days

Map Unit Composition

Sacramento and similar soils: 85 percent
Minor components: 15 percent

Description of Sacramento

Setting

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

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
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 36 to 48 inches
Frequency of flooding: Rare
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water capacity: Moderate (about 8.1 inches)

Interpretive groups

Farmland classification: Prime farmland if irrigated
Land capability classification (irrigated): 2w
Land capability (nonirrigated): 4w
Hydrologic Soil Group: C

Typical profile

0 to 27 inches: Clay
27 to 60 inches: Clay

Minor Components

Clear lake

Percent of map unit: 5 percent
Landform: Basin floors

Egbert

Percent of map unit: 5 percent
Landform: Basin floors

Sacramento

Percent of map unit: 3 percent
Landform: Basin floors

Ryde

Percent of map unit: 2 percent
Landform: Basin floors

Va—Valdez silt loam drained

Map Unit Setting

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

Map Unit Composition

Valdez and similar soils: 85 percent
Minor components: 15 percent

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

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
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
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water capacity: High (about 10.4 inches)

Interpretive groups
Farmland classification: Prime farmland if irrigated
Land capability classification (irrigated): 2w
Land capability (nonirrigated): 4w
Hydrologic Soil Group: C

Typical profile
0 to 12 inches: Silt loam
12 to 60 inches: Silt loam

Minor Components

Columbia
Percent of map unit: 10 percent

Unnamed, loam
Percent of map unit: 5 percent

W—Water

Map Unit Composition
Water: 100 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: Representative Photographs

Representative Photographs

Photo 1: View from upstream of the existing SR 84 Miner Slough Bridge looking downstream (September 2013)

PHOTO 2: From downstream of existing SR 84 Miner Slough Bridge looking upstream (September 2013).

PHOTO 3: Riparian vegetation along Miner Slough (September 2013)

PHOTO 4: From bridge looking downstream (September 2013)

PHOTO 5: From bridge looking upstream (September 2013)

PHOTO 6. From bridge looking upstream at island vegetation (March 2014)

Appendix C: Wetland Delineation Data Sheets

WETLAND DETERMINATION DATA FORM – ARID WEST REGION

Map #: N/A ; Sample Point: 1

Project Site: Highway 84 Over Miner's Slough - Caltrans EA 0G660		City / County: Solano	
Applicant / Owner: Caltrans		State: CA	Sampling Date: 3/4/14
Investigator(s): R. Wilson, R. Vogt	Section, Township, Range:		
Landforms (hillslope, terrace, etc.): streambank, floodplain	Local relief (concave, convex, none): none		Slope (%): 0
Subregion (LRR): LRR C (Mediterranean California)	Lat: 38.292352N	Long: 121.63439W	Datum:
Soil Map Unit Name: Columbia Fine Sandy Loam	NWI classification: R1UBV		
Are climatic / hydrologic conditions on the site typical for this time of year? ☐ Yes ☒ No			
Are vegetation ☐, Soil ☐, or Hydrology ☐, significantly disturbed? ☐ Yes ☒ No	Are "Normal Circumstances" present? ☒ Yes ☐ No		
Are vegetation ☐, Soil ☐, or Hydrology ☐, naturally problematic? ☐ Yes ☒ No	(If needed, explain any answers in Remarks.)		

SUMMARY OF FINDING – 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: LRR C is experiencing significant drought, however wetland parameters at the sample point did not appear to be affected by these conditions at the time of the wetland investigation. Sample point exhibits indicators of wetland vegetation and soils but not wetland hydrology. Sample point is not within a wetland.

VEGETATION

Tree Stratum (Use scientific names)		Absolute % Cover	Dominant Species	Indicator Status
1.	Acer negundo	80	YES	FACW
2.				
3.				
4.				
	50% = 40 / Total Cover:	80		
	20% = 16			
Sapling / Shrub Stratum				
1.				
2.				
3.				
4.				
5.				
	50% = / Total Cover:	0		
	20% =			
Herb Stratum				
1.	Gallium aparine	1	YES	FACU
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
	50% = / Total Cover:	1		
	20% =			
yWoody Vine Stratum				
1.	Rubus ursinus	15	YES	FAC
2.	Vitis californica	5	YES	FACU
	50% = 10 / Total Cover:	20		
	20% = 4			

% Bare Ground in Herb Stratum: 60 % 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	50	(A/B)

Prevalence Index Work Sheet

Total % Cover of:		Multiply By:	
OBL species:	0	X1	0
FACW species:	80	X2	160
FAC species:	15	X3	45
FACU species:	6	X4	24
UPL species:	0	X5	0
Column Totals:	101	(A)	229 (B)

Prevalence Index = B/A = 2.26

Hydrophytic Vegetation Indicators:

Dominance Test is > 50% ☐ Yes ☒ No

Prevalence Index is ≤ 3.0 ☒ Yes ☐ No

Morphological Adaptations* ☐ Yes ☐ No
(Provide supporting data in Remarks or on separate sheet)

Problematic Hydrophytic Vegetation ☐ Yes ☐ No
(Explain in remarks or separate sheet)

* Indicators of hydric soil and wetland hydrology must be present to call a plant Hydrophytic because of morphological adaptions alone.

Hydrophytic Vegetation Present ☒ Yes ☐ No

Remarks: Strata plot sizes: tree(15ft), woody vine/sapling/shrub(10ft), herb(5ft). Vegetation at sample point does not pass the dominance test but does pass the prevalence index for hydrophytic vegetation.

SOIL

Map #: N/A ; Sample Point: 1

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

Depth	Matrix		Redox Featrues					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Location[2]	Texture	Remarks
0-8	10YR 4/2	50	5YR 4/6	4	C	M	Clay Loam	organic matter mixed in horizon
0-8	10YR 2/2	50	n/a				Clay Loam	
8-18	10YR 4/4	85	2.5YR 5/8	15	C	M	Clay Loam	

Type[1]: [For describing the Type of Redox Feature] **C** = Redox Concentration; **D** = Redox Depletion; **RM** = Reduced Matrix, **NR** = No Reduction Noted

Location[2] [The location of the Redox feature is in the: **PL** = Pore Lining; **RC** = Root Channel; **M** = Matrix]

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)		**Indicators for Problematic Hydric Soils**[3]
☐ Histosol (A1)	☐ Sandy Redox (S5)	☐ 1cm Muck (A9) (LRR C)
☐ Histic Epipedon (A2)	☐ Stripped Matrix (S6)	☐ 2 cm Muck (A10) (LRR B)
☐ Black Histic (A3)	☐ Loamy Mucky Mineral (F1)	☐ Reduced Vertic (F18)
☐ Hydrogen Sulfide (A4)	☐ Loamy Gleyed Matrix (F2)	☐ Red Parent Material (TF2)
☐ Stratified Layers (A5) (LRR C)	☒ Depleted Matrix (F3)	☐ Other (Explain in Remarks)
☐ 1 cm Muck (A9) (LRR D)	☐ Redox Dark Surface (F7)	
☐ Depleted Below Dark Surface (A11)	☐ Depleated Dark Surface (F7)	
☐ Thick Dark Surface (A12)	☐ Redox Depression (F8)	
☐ Sandy Mucky Mineral (S1)	☐ Vernal Pools (F12)	
☐ Sandy Gleyed Matrix (S4)		

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present to call a soil an indicator for a problematic hydric soil.

Restrictive Layer Present ☐ Yes ☒ No (If yes, add type and depth information):

Type:

Depth (inches):

Wetland Soil Present: ☒ Yes ☐ No

Remarks: Soils at sample point meet hydric soils indicator F3.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (any one of these indicator is sufficient to call wetland hydrology present)		Secondary Indicators (2 or more are required)
☐ Surface Water (A1)	☐ Salt Crust (B11)	☐ Water Marks (B1) **(Riverine)**
☐ High Water Table (A2)	☐ Biotic Crust (B13)	☐ Sediment Deposits (B2) **(Riverine)**
☐ Saturation (A3)	☐ Aquatic Invertebrates (B13)	☐ Drift Deposits (B3) **(Riverine)**
☐ Water Marks (B1) **(Nonriverine)**	☐ Hydrogen Sulfide Odor (C1)	☐ Drainage Patterns (B10)
☐ Sediment Deposits (B2) **(Nonriverine)**	☐ Oxidized Rhizospheres along Living Roots (C3)	☐ Dry-Season Water Table (C2)
☐ Drift Deposits (B3) **(Nonrierine)**	☐ Presence of Reduced Iron (C4)	☐ Thin Muck Surface (C7)
☐ Surface Soil Cracks (B6)	☐ Recent Iron Reduction in Plowed Soils (C6)	☐ Crayfish Burrows (C8)
☐ Inundation Visible on Aerial Imagery (B7)	☐ Other (Explain in Remarks)	☐ Saturation Visible on Aerial Imagery (C9)
☐ Water-Stained Leaves (B9)		☐ 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 gaugh, monitoring well, aerial photos, previous inspections), If available:

Remarks: no wetland hydrology indicators were observed at sample point.

WETLAND DETERMINATION DATA FORM – ARID WEST REGION

Map #: N/A ; Sample Point: 2

Project Site: Highway 84 Over Miner's Slough - Caltrans EA 0G660		City / County: Solano	
Applicant / Owner: Caltrans		State: CA	Sampling Date: 3/4/14
Investigator(s): R. Wilson, R. Vogt	Section, Township, Range:		
Landforms (hillslope, terrace, etc.): streambank, floodplain	Local relief (concave, convex, none): none		Slope (%): 0
Subregion (LRR): LRR C (Mediterranean California)	Lat: 38.29237N	Long: 121.63145W	Datum: WGS 84
Soil Map Unit Name: Columbia Fine Sandy Loam	NWI classification: R1UBV		
Are climatic / hydrologic conditions on the site typical for this time of year?	☐ Yes ☒ No		
Are vegetation ☐, Soil ☐, or Hydrology ☐, significantly disturbed?	☐ Yes ☒ No	Are "Normal Circumstances" present?	☒ Yes ☐ No
Are vegetation ☐, Soil ☐, or Hydrology ☐, naturally problematic?	☐ Yes ☒ No	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDING – 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: LRR C is experiencing significant drought, however wetland parameters at the sample point did not appear to be affected by these conditions at the time of the wetland investigation. Sample point exhibits indicators of all three wetland parameters. Sample point is within a wetland.

VEGETATION

Tree Stratum (Use scientific names)			Absolute % Cover	Dominant Species	Indicator Status
1.	Alnus rhombifolia		60	YES	FACW
2.	Salix laevigata		2	NO	FACW
3.					
4.					
	50% = 31	Total Cover:	62		
	20% = 12.4				
Sapling / Shrub Stratum					
1.					
2.					
3.					
4.					
5.					
	50% =	Total Cover:	0		
	20% =				
Herb Stratum					
1.	Carex sp.		20	YES	
2.	Juncus patens		15	NO	FACW
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
13.					
14.					
	50% = 17.5	Total Cover:	35		
	20% = 7				
yWoody Vine Stratum					
1.	Rubus ursinus		5	YES	FAC
2.					
	50% = 2.5	Total Cover:	5		
	20% = 1				

% Bare Ground in Herb Stratum: 30 % 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 Work Sheet

Total % Cover of:		Multiply By:	
OBL species:		X1	
FACW species:		X2	
FAC species:		X3	
FACU species:		X4	
UPL species:		X5	
Column Totals:		(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

Dominance Test is > 50% ☒ Yes ☐ No

Prevalence Index is ≤ 3.0 ☐ Yes ☐ No

Morphological Adaptations* ☐ Yes ☐ No
(Provide supporting data in Remarks or on separate sheet)

Problematic Hydrophytic Vegetation ☐ Yes ☐ No
(Explain in remarks or separate sheet)

* Indicators of hydric soil and wetland hydrology must be present to call a plant Hydrophytic because of morphological adaptions alone.

Hydrophytic Vegetation Present ☒ Yes ☐ No

Remarks: Strata plot sizes: tree(15ft), woody vine/sapling/shrub(10ft), herb(5ft). One dominant species was not identifiable at the time of the field investigation, although as a Carex sp. it is likely to have an indicator status of FAC or wetter. Despite this, the Carex was not included in the dominance test. Vegetation at the sample point still passed hydrophytic dominance test.

SOIL

Map #: N/A ; Sample Point: 2

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

Depth	Matrix		Redox Featrues					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Location[2]	Texture	Remarks
0-18	2.5Y 3/2	70	5YR 5/8	30	C	M	Sandy Clay Loam	

Type[1] [For describing the Type of Redox Feature] **C** = Redox Concentration; **D** = Redox Depletion; **RM** = Reduced Matrix, **NR** = No Reduction Noted

Location[2] [The location of the Redox feature is in the: **PL** = Pore Lining; **RC** = Root Channel; **M** = Matrix]

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)		**Indicators for Problematic Hydric Soils**[3]
☐ Histosol (A1)	☐ Sandy Redox (S5)	☐ 1cm Muck (A9) (LRR C)
☐ Histic Epipedon (A2)	☐ Stripped Matrix (S6)	☐ 2 cm Muck (A10) (LRR B)
☐ Black Histic (A3)	☐ Loamy Mucky Mineral (F1)	☐ Reduced Vertic (F18)
☐ Hydrogen Sulfide (A4)	☐ Loamy Gleyed Matrix (F2)	☐ Red Parent Material (TF2)
☐ Stratified Layers (A5) (LRR C)	☒ Depleted Matrix (F3)	☐ Other (Explain in Remarks)
☐ 1 cm Muck (A9) (LRR D)	☐ Redox Dark Surface (F7)	
☐ Depleted Below Dark Surface (A11)	☐ Depleated Dark Surface (F7)	
☐ Thick Dark Surface (A12)	☐ Redox Depression (F8)	
☐ Sandy Mucky Mineral (S1)	☐ Vernal Pools (F12)	
☐ Sandy Gleyed Matrix (S4)		

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present to call a soil an indicator for a problematic hydric soil.

Restrictive Layer Present ☐ Yes ☒ No (If yes, add type and depth information):

Type:

Depth (inches):

Wetland Soil Present: ☒ Yes ☐ No

Remarks: Soils at sample point show a layer that has a depleted matrix with 70 percent chroma of 2, a thickness of 18" located below the soil surface, and redox concentrations. These conditions meet hydric soils indicator F3.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (any one of these indicator is sufficient to call wetland hydrology present)		Secondary Indicators (2 or more are required)
☐ Surface Water (A1)	☐ Salt Crust (B11)	☐ Water Marks (B1) **(Riverine)**
☒ High Water Table (A2)	☐ Biotic Crust (B13)	☐ Sediment Deposits (B2) **(Riverine)**
☐ Saturation (A3)	☐ Aquatic Invertebrates (B13)	☐ Drift Deposits (B3) **(Riverine)**
☐ Water Marks (B1) **(Nonriverine)**	☐ Hydrogen Sulfide Odor (C1)	☐ Drainage Patterns (B10)
☐ Sediment Deposits (B2) **(Nonriverine)**	☐ Oxidized Rhizospheres along Living Roots (C3)	☐ Dry-Season Water Table (C2)
☐ Drift Deposits (B3) **(Nonrierine)**	☐ Presence of Reduced Iron (C4)	☐ Thin Muck Surface (C7)
☐ Surface Soil Cracks (B6)	☐ Recent Iron Reduction in Plowed Soils (C6)	☐ Crayfish Burrows (C8)
☐ Inundation Visible on Aerial Imagery (B7)	☐ Other (Explain in Remarks)	☐ Saturation Visible on Aerial Imagery (C9)
☐ Water-Stained Leaves (B9)		☐ Shallow Aquitard (D3)
		☐ **FAC-Neutral Test (D5)**

Field Observations:

Surface Water Present?	☐ Yes	☒ No	Depth (inches)
Water Table Present?	☒ Yes	☐ No	Depth (inches) 11
Saturation Present (includes capillary fringe)	☒ Yes	☐ No	Depth (inches) 9

Wetland Hydrology Present? ☒ Yes ☐ No

Describe Recorded Data (stream gaugh, monitoring well, aerial photos, previous inspections), If available:

Remarks: Water table observed within upper 12 inches of soil profile; sample point meets wetland hydrology indicator A2.

WETLAND DETERMINATION DATA FORM – ARID WEST REGION

Map #: N/A ; Sample Point: 3

Project Site: Highway 84 Over Miner's Slough - Caltrans EA 0G660		City / County: Solano	
Applicant / Owner: Caltrans		State: CA	Sampling Date: 3/4/14
Investigator(s): R. Wilson, R. Vogt	Section, Township, Range:		
Landforms (hillslope, terrace, etc.): streambank, floodplain	Local relief (concave, convex, none): none		Slope (%): 0
Subregion (LRR): LRR C (Mediterranean California)	Lat: 38.29212N	Long: 121.63058W	Datum: WGS 84
Soil Map Unit Name: Columbia Fine Sandy Loam	NWI classification: R1UBV		
Are climatic / hydrologic conditions on the site typical for this time of year? ☐ Yes ☒ No			
Are vegetation ☐, Soil ☐, or Hydrology ☐, significantly disturbed? ☐ Yes ☒ No		Are "Normal Circumstances" present? ☒ Yes ☐ No	
Are vegetation ☐, Soil ☐, or Hydrology ☐, naturally problematic? ☐ Yes ☒ No		(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDING – 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: LRR C is experiencing significant drought, however wetland parameters at the sample point did not appear to be affected by these conditions at the time of the wetland investigation. Sample point meets all three wetland criteria. Sample point is located within a wetland.

VEGETATION

Tree Stratum (Use scientific names)		Absolute % Cover	Dominant Species	Indicator Status
1. Alnus rhombifolia		60	YES	FACW
2. Salix laevigata		5	NO	FACW
3.				
4.				
50% = 32.5	Total Cover:	65		
20% = 13				
Sapling / Shrub Stratum				
1.				
2.				
3.				
4.				
5.				
50% =	Total Cover:	0		
20% =				
Herb Stratum				
1. Rumex crispus		20	YES	FAC
2. Juncus patens		15	YES	FACW
3. Galium aparine		5	NO	FACU
4. Carex sp.		7	NO	
5. Mentha arvensis		7	NO	FACW
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
50% = 27	Total Cover:	54		
20% = 10.8				
yWoody Vine Stratum				
1. Rubus ursinus		3	YES	FAC
2.				
50% = 1.5	Total Cover:	5		
20% = .6				

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

Dominance Test Worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	4	(A)
Total number of Dominant Species Across All Strata:	4	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC	100	(A/B)

Prevalence Index Work Sheet

Total % Cover of:		Multiply By:	
OBL species:		X1	
FACW species:		X2	
FAC species:		X3	
FACU species:		X4	
UPL species:		X5	
Column Totals:		(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

Dominance Test is > 50% ☒ Yes ☐ No

Prevalence Index is ≤ 3.0 ☐ Yes ☐ No

Morphological Adaptations* ☐ Yes ☐ No
(Provide supporting data in Remarks or on separate sheet)

Problematic Hydrophytic Vegetation ☐ Yes ☐ No
(Explain in remarks or separate sheet)

* Indicators of hydric soil and wetland hydrology must be present to call a plant Hydrophytic because of morphological adaptions alone.

Hydrophytic Vegetation Present ☒ Yes ☐ No

Remarks: Strata plot sizes: tree(15ft), woody vine/sapling/shrub(10ft), herb(5ft).
Leaf litter/thatch absolute cover=40%. One plant was not identifiable at the time of the field investigation, however it was not a dominant plant at the sample point and did not affect the dominance test. Vegetation at the sample point passed hydrophytic dominance test.

Durio 111202

SOIL

Map #: N/A ; Sample Point: 3

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

Depth	Matrix		Redox Featrues					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Location[2]	Texture	Remarks
0-18	10YR 4/2	80	5YR 5/8	20	C	PL	Sandy Clay Loam	

Type[1] [For describing the Type of Redox Feature] **C** = Redox Concentration; **D** = Redox Depletion; **RM** = Reduced Matrix, **NR** = No Reduction Noted

Location[2] [The location of the Redox feature is in the: **PL** = Pore Lining; **RC** = Root Channel; **M** = Matrix]

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)		Indicators for Problematic Hydric Soils[3]
☐ Histosol (A1)	☐ Sandy Redox (S5)	☐ 1cm Muck (A9) (LRR C)
☐ Histic Epipedon (A2)	☐ Stripped Matrix (S6)	☐ 2 cm Muck (A10) (LRR B)
☐ Black Histic (A3)	☐ Loamy Mucky Mineral (F1)	☐ Reduced Vertic (F18)
☐ Hydrogen Sulfide (A4)	☐ Loamy Gleyed Matrix (F2)	☐ Red Parent Material (TF2)
☐ Stratified Layers (A5) (LRR C)	☒ Depleted Matrix (F3)	☐ Other (Explain in Remarks)
☐ 1 cm Muck (A9) (LRR D)	☐ Redox Dark Surface (F7)	
☐ Depleted Below Dark Surface (A11)	☐ Depleated Dark Surface (F7)	
☐ Thick Dark Surface (A12)	☐ Redox Depression (F8)	
☐ Sandy Mucky Mineral (S1)	☐ Vernal Pools (F12)	
☐ Sandy Gleyed Matrix (S4)		

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present to call a soil an indicator for a problematic hydric soil.

Restrictive Layer Present ☐ Yes ☒ No (If yes, add type and depth information):

Type:

Depth (inches):

Wetland Soil Present: ☒ Yes ☐ No

Remarks: Soils at sample point show a layer that has a depleted matrix with 80 percent chroma of 2, a thickness of 18" below the soil surface, and redox concentrations. These conditions meet hydric soils indicator F3.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (any one of these indicator is sufficient to call wetland hydrology present)		Secondary Indicators (2 or more are required)
☐ Surface Water (A1)	☐ Salt Crust (B11)	☐ Water Marks (B1) **(Riverine)**
☐ High Water Table (A2)	☐ Biotic Crust (B13)	☐ Sediment Deposits (B2) **(Riverine)**
☒ Saturation (A3)	☐ Aquatic Invertebrates (B13)	☐ Drift Deposits (B3) **(Riverine)**
☐ Water Marks (B1) **(Nonriverine)**	☐ Hydrogen Sulfide Odor (C1)	☐ Drainage Patterns (B10)
☐ Sediment Deposits (B2) **(Nonriverine)**	☐ Oxidized Rhizospheres along Living Roots (C3)	☐ Dry-Season Water Table (C2)
☐ Drift Deposits (B3) **(Nonrierine)**	☐ Presence of Reduced Iron (C4)	☐ Thin Muck Surface (C7)
☐ Surface Soil Cracks (B6)	☐ Recent Iron Reduction in Plowed Soils (C6)	☐ Crayfish Burrows (C8)
☐ Inundation Visible on Aerial Imagery (B7)	☐ Other (Explain in Remarks)	☐ Saturation Visible on Aerial Imagery (C9)
☐ Water-Stained Leaves (B9)		☐ 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) 4

Wetland Hydrology Present? ☒ Yes ☐ No

Describe Recorded Data (stream gaugh, monitoring well, aerial photos, previous inspections), If available:

Remarks: Saturated soil observed within upper 12 inches of soil profile; sample point meets wetland hydrology indicator A3.

WETLAND DETERMINATION DATA FORM – ARID WEST REGION

Map #: N/A ; Sample Point: 4

Project Site: Highway 84 Over Miner's Slough - Caltrans EA 0G660		City / County: Solano	
Applicant / Owner: Caltrans		State: CA	Sampling Date: 3/4/14
Investigator(s): R. Wilson, R. Vogt	Section, Township, Range:		
Landforms (hillslope, terrace, etc.): streambank, floodplain	Local relief (concave, convex, none): none		Slope (%): 0
Subregion (LRR): LRR C (Mediterranean California)	Lat: 38.29218N	Long: 121.63047W	Datum: WGS 84
Soil Map Unit Name: Columbia Fine Sandy Loam	NWI classification: R1UBV		
Are climatic / hydrologic conditions on the site typical for this time of year?	☐ Yes ☒ No		
Are vegetation ☐, Soil ☐, or Hydrology ☐, significantly disturbed?	☐ Yes ☒ No	Are "Normal Circumstances" present?	☒ Yes ☐ No
Are vegetation ☐, Soil ☐, or Hydrology ☐, naturally problematic?	☐ Yes ☒ No	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDING – 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: LRR C is experiencing significant drought, however wetland parameters at the sample point did not appear to be affected by these conditions at the time of the wetland investigation. Sample point meets only one of the wetland criteria. Sample point is not within a wetland.

VEGETATION

Tree Stratum (Use scientific names)		Absolute % Cover	Dominant Species	Indicator Status
1.				
2.				
3.				
4.				
	50% = / Total Cover:	0		
	20% =			
Sapling / Shrub Stratum				
1.				
2.				
3.				
4.				
5.				
	50% = / Total Cover:	0		
	20% =			
Herb Stratum				
1.	Bromus diandrus	30	YES	UPL
2.	Equisetum hyemale	12	YES	FACW
3.	Malva parviflora	1	NO	UPL
4.	Convolvulus arvensis	1	NO	UPL
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
	50% = 22 / Total Cover:	44		
	20% = 8.8			
yWoody Vine Stratum				
1.				
2.				
	50% = / Total Cover:			
	20% =			

% Bare Ground in Herb Stratum: 20 % Cover of Biotic Crust: 0

Dominance Test Worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	1	(A)
Total number of Dominant Species Across All Strata:	2	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC	50	(A/B)

Prevalence Index Work Sheet

Total % Cover of:		Multiply By:	
OBL species:		X1	
FACW species:		X2	
FAC species:		X3	
FACU species:		X4	
UPL species:		X5	
Column Totals:		(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

Dominance Test is > 50% ☐ Yes ☒ No

Prevalence Index is ≤ 3.0 ☐ Yes ☐ No

Morphological Adaptations* ☐ Yes ☐ No
(Provide supporting data in Remarks or on separate sheet)

Problematic Hydrophytic Vegetation ☐ Yes ☐ No
(Explain in remarks or separate sheet)

* Indicators of hydric soil and wetland hydrology must be present to call a plant Hydrophytic because of morphological adaptions alone.

Hydrophytic Vegetation Present ☐ Yes ☒ No

Remarks: Strata plot sizes: tree(15ft), woody vine/sapling/shrub(10ft), herb(5ft).
Leaf litter/thatch absolute cover=15%. Vegetation at the sample point did not pass hydrophytic plant dominance test.

Dunio 111202

SOIL

Map #: N/A ; Sample Point: 4

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

Depth	Matrix		Redox Featrues					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Location[2]	Texture	Remarks
0-6	10YR 5/6	50					Clay Loam	no redox present
0-6	10YR 3/2	50					Clay Loam	no redox present
6-18	10YR 3/1	100					Clay Loam	no redox present

Type[1] [For describing the Type of Redox Feature] **C** = Redox Concentration; **D** = Redox Depletion; **RM** = Reduced Matrix, **NR** = No Reduction Noted

Location[2] [The location of the Redox feature is in the: **PL** = Pore Lining; **RC** = Root Channel; **M** = Matrix]

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)		**Indicators for Problematic Hydric Soils**[3]
☐ Histosol (A1)	☐ Sandy Redox (S5)	☐ 1cm Muck (A9) (LRR C)
☐ Histic Epipedon (A2)	☐ Stripped Matrix (S6)	☐ 2 cm Muck (A10) (LRR B)
☐ Black Histic (A3)	☐ Loamy Mucky Mineral (F1)	☐ Reduced Vertic (F18)
☐ Hydrogen Sulfide (A4)	☐ Loamy Gleyed Matrix (F2)	☐ Red Parent Material (TF2)
☐ Stratified Layers (A5) (LRR C)	☒ Depleted Matrix (F3)	☐ Other (Explain in Remarks)
☐ 1 cm Muck (A9) (LRR D)	☐ Redox Dark Surface (F7)	
☐ Depleted Below Dark Surface (A11)	☐ Depleated Dark Surface (F7)	
☐ Thick Dark Surface (A12)	☐ Redox Depression (F8)	
☐ Sandy Mucky Mineral (S1)	☐ Vernal Pools (F12)	
☐ Sandy Gleyed Matrix (S4)		

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present to call a soil an indicator for a problematic hydric soil.

Restrictive Layer Present ☐ Yes ☒ No (If yes, add type and depth information):

Type:

Depth (inches):

Wetland Soil Present: ☒ Yes ☐ No

Remarks: Soils at sample point show a layer that has a depleted matrix with 100 percent chroma of 1 and a thickness of greater than 6" within the upper 10" of the soil profile. The presence of redox concentrations is not required to meet indicator F3 becuase of the value/chroma of the soil. These conditions meet hydric soils indicator F3.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (any one of these indicator is sufficient to call wetland hydrology present)		Secondary Indicators (2 or more are required)
☐ Surface Water (A1)	☐ Salt Crust (B11)	☐ Water Marks (B1) **(Riverine)**
☐ High Water Table (A2)	☐ Biotic Crust (B13)	☐ Sediment Deposits (B2) **(Riverine)**
☐ Saturation (A3)	☐ Aquatic Invertebrates (B13)	☐ Drift Deposits (B3) **(Riverine)**
☐ Water Marks (B1) **(Nonriverine)**	☐ Hydrogen Sulfide Odor (C1)	☐ Drainage Patterns (B10)
☐ Sediment Deposits (B2) **(Nonriverine)**	☐ Oxidized Rhizospheres along Living Roots (C3)	☐ Dry-Season Water Table (C2)
☐ Drift Deposits (B3) **(Nonrierine)**	☐ Presence of Reduced Iron (C4)	☐ Thin Muck Surface (C7)
☐ Surface Soil Cracks (B6)	☐ Recent Iron Reduction in Plowed Soils (C6)	☐ Crayfish Burrows (C8)
☐ Inundation Visible on Aerial Imagery (B7)	☐ Other (Explain in Remarks)	☐ Saturation Visible on Aerial Imagery (C9)
☐ Water-Stained Leaves (B9)		☐ 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 gaugh, monitoring well, aerial photos, previous inspections), If available:

Remarks: No wetland hydrology indicators observed at sample point.

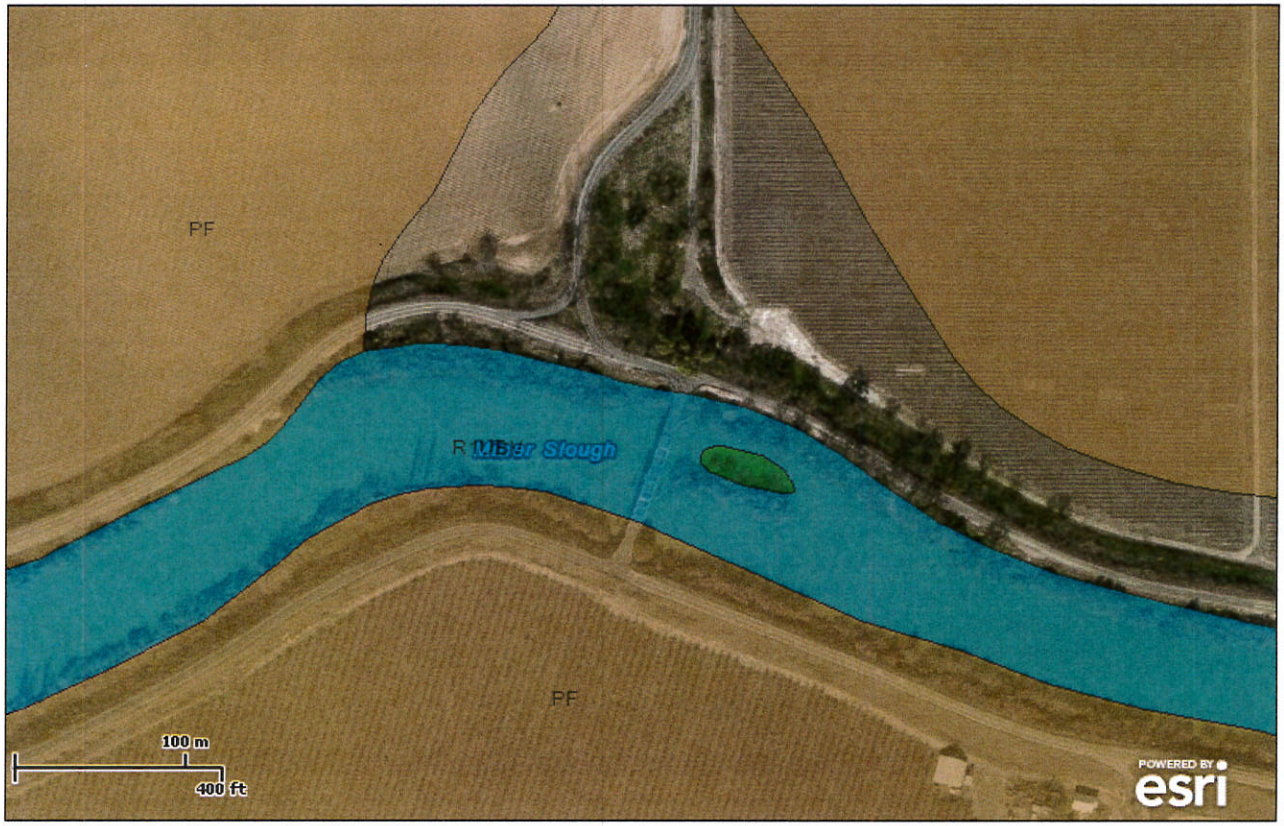
Appendix D: National Wetlands Inventory Map of BSA

U.S. Fish and Wildlife Service

National Wetlands Inventory

NWI Map of BSA

Jul 7, 2014



Wetlands

- Freshwater Emergent
- Freshwater Forested/Shrub
- Estuarine and Marine Deepwater
- Estuarine and Marine
- Freshwater Pond
- Lake
- Riverine
- Other

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

User Remarks:

Appendix E: Compiled List of Plant Species Observed at BSA

Compiled List of Plants Observed within BSA

Family	Scientific Name	Common Name	Nativity	Invasive	Wetland Indicator Status
Adoxaceae	*Sambucus nigra ssp. caerulea*	Elderberry	N		FAC
Agavaceae	*Agave americana*	century plant	X		UPL
Apiaceae	*Conium maculatum*	Poison hemlock	X	M	FACW
Apiaceae	*Foeniculum vulgare*	fennel	X	H	UPL
Apiaceae	*Scandix pecten-veneris*	Venus' needle	X		UPL
Apiaceae	*Torilis arvensis*	hedge parsley	X	M	UPL
Asteraceae	*Artemisia douglasiana*	Mugwort	N		FAC
Asteraceae	*Bidens frondosa*	sticktight	N		FACW
Asteraceae	*Helminthotheca echioides*	bristly oxtongue	X	L	FACU
Asteraceae	*Lactuca serriola*	wild lettuce	X		FACU
Asteraceae	*Pseudognaphalium luteoalbum*	cudweed	X		FAC
Asteraceae	*Senecio vulgaris*	common groundsel	X		FACU
Asteraceae	*Silybum marinum*	Milk thistle	N		UPL
Betulaceae	*Alnus rhombifolia*	Alder	N		FACW
Brassicaceae	*Capsella bursa-pastoris*	shepherd's purse	X		FACU
Brassicaceae	*Lepidium latifolium*	Pepperweed	X	H	FAC
Brassicaceae	*Raphanus sativa*	Radish	X		UPL
Convolvulaceae	*Convolvulus arvensis*	field bindweed	X		UPL
Cyperaceae	*Carex sp*	Carex	N		UNKOWN
Cyperaceae	*Schoenoplectus*	Bulrush	N		OBL
Equisetaceae	*Equisetum arvense*	common horsetail	N		FAC
Equisetaceae	*Equisetum hymale*	Scouring rush	N		FACW
Fabaceae	*Acacia longifolia*	golden wattle	X		UPL
Fabaceae	*Trifolium repens*	white clover	X		FACU
Geraniaceae	*Erodium cicutarium*	redstem filaree	X	L	UPL
Iridaceae	*Iris pseudacorus*	water iris	X	L	OBL
Juglandaceae	*Juglans californica*	Black walnut	N		FAC
Juncaceae	*Juncus patens*	Common rush	N		FACW
Lamiacaea	*Mentha arvensis*	field mint	N		FACW
Lythraceae	*Punica granatum*	pomegranate	X		UPL
Malvaceae	*Malva neglecta*	dwarf mallow	X		UPL

Malvaceae	*Malva parviflora*	Common mallow	X		UPL
Moraceae	*Ficus carica*	fig	X	M	FACU
Oleaceae	*Fraxinus latifolia*	oregon Ash	N		FACW
Onagraceae	*Epilobium ciliatum*	willowherb	N		FACW
Plantaginaceae	*Veronica persica*	birdeye speedwell	X		UPL
Poaceae	*Avena sativa*	Oats	X	M	UPL
Poaceae	*Bromus catharticus*	rescuegrass	X		UPL
Poaceae	*Bromus diandrus*	Ripgut brome	X	M	UPL
Poaceae	*Cynodon dactylon*	Bermudagrass	X	M	FACU
Poaceae	*Festuca arundinaceae*	tall fescue	X	M	UPL
Poaceae	*Festuca perennis*	Italian ryegrass	X	M	UPL
Poaceae	*Hordeum murinum*	foxtail barley	X	M	FACU
Poaceae	*Phalaris spp.*	canarygrass	X		UNKNOWN
Poaceae	*Triticum aestivum*	wheat	X		UPL
Polygonaceae	*Polygonum aviculare*	knotweed	X		FACW
Polygonaceae	*Rumex crispus*	Curly dock	X	L	FAC
Rosaceae	*Rubus ursinus*	Blackberry	N		FAC
Rubiaceae	*Gallium aparine*	Bedstraw	N		FACU
Salicaceae	*Salix exigua*	narrowleafed willow	N		FACW
Sapindaceae	*Acer negundo*	Box elder	N		FACW
Typhaceae	*Typha latifolia*	Cattail	N		OBL
Viscaceae	*Phoradendron serotinum ssp. tomentosum*	Pacific mistletoe	N		UPL
Vitaceae	*Parthenocissus quinquefolia*	Virginia creeper	X		FAC
Vitaceae	*Vitis californica*	Wild grape	N		FACU

Nativity

N=native

X=non-native

Cal-IPC classifications

M=Moderate

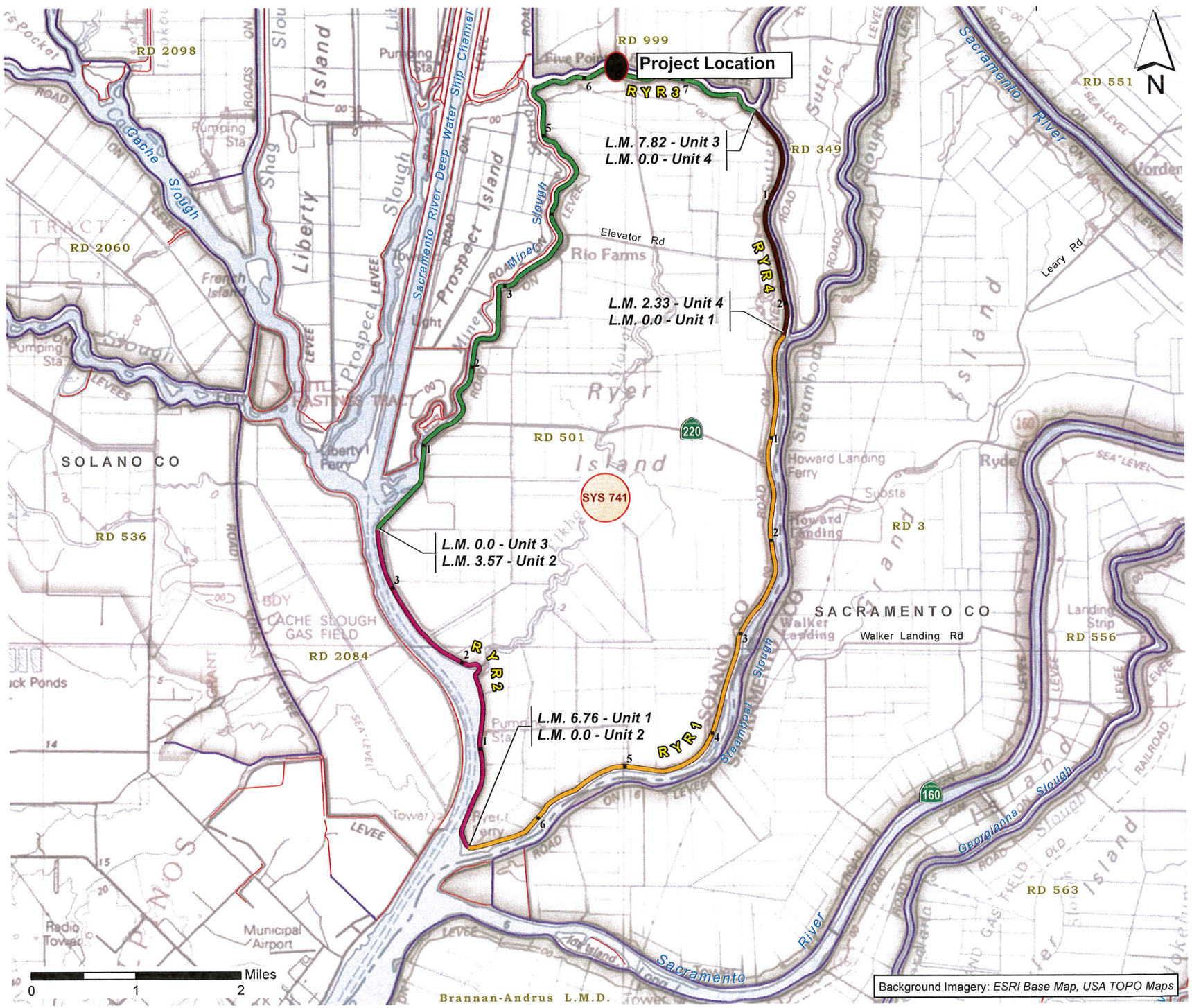
L=Limited

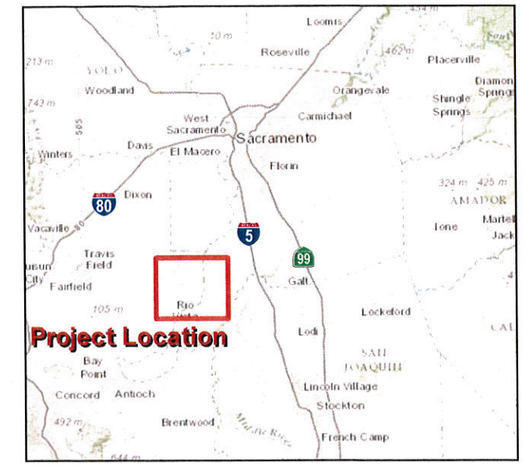
H=High

Wetland Indicator Status

UPL = Upland, OBL = obligate, FAC = Facultative, FACW = Facultative Wet, FACU = Facultative Upland

Figure 1: Project Location Map





Map Legend

NLD SYSTEMS and SEGMENTS
(Levee Inspection System Code)

SYSTEM 741

- RD 0501 - Unit 1, Steamboat Slough (RYR1)
- RD 0501 - Unit 2, Cache Slough (RYR2)
- RD 0501 - Unit 3, Miner Slough (RYR3)
- RD 0501 - Unit 4, Sutter Slough (RYR4)
- Other Federal Levees
- Non-Federal Levee
- Levee Mile*

*Mileage obtained from DWR levee inspection resources

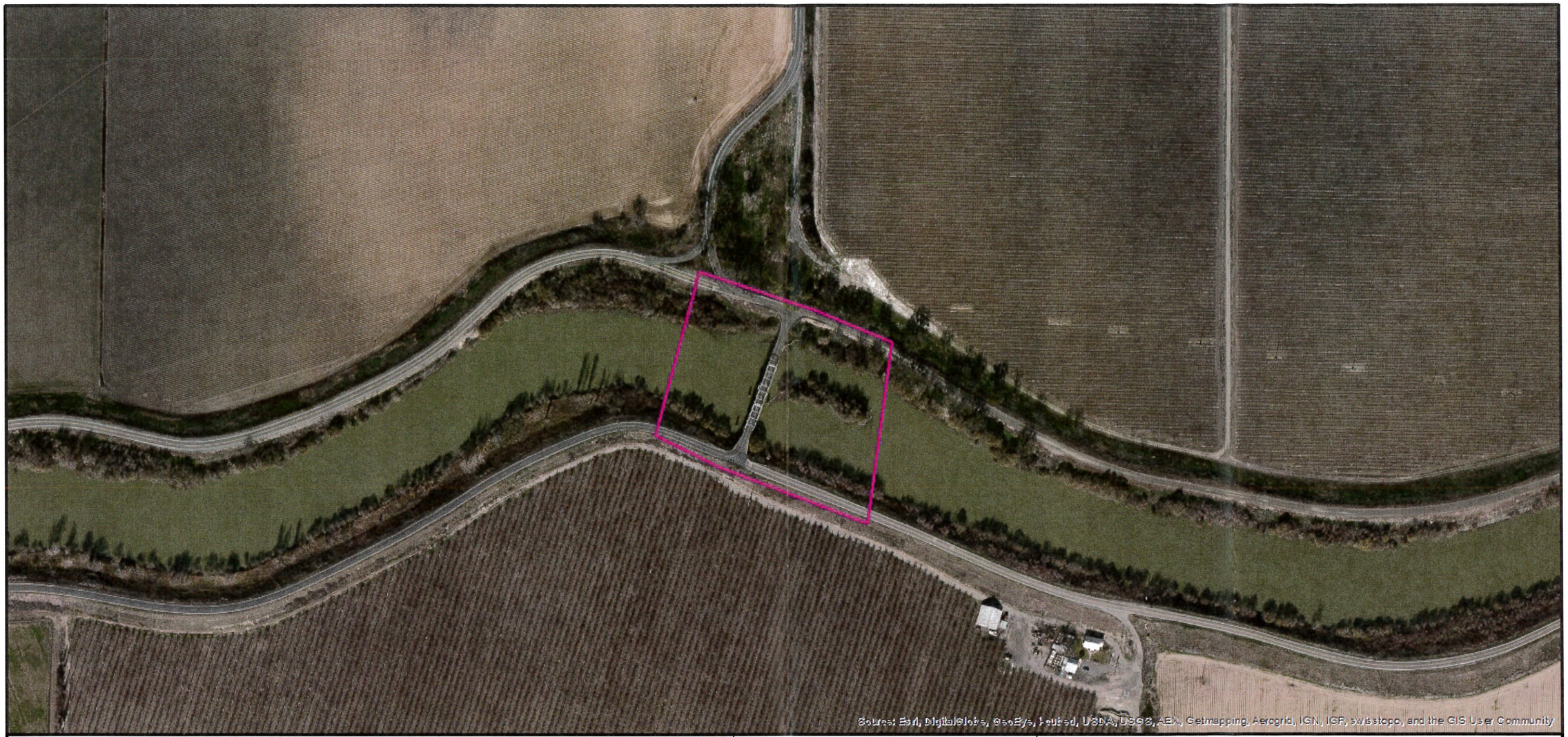
FEDERAL LEVEE PROJECTS SYSTEM MAP

RD 501-RYER ISLAND

U.S. ARMY CORPS OF ENGINEERS SACRAMENTO DISTRICT

Map Prepared by Jim Mars

FEB 2014



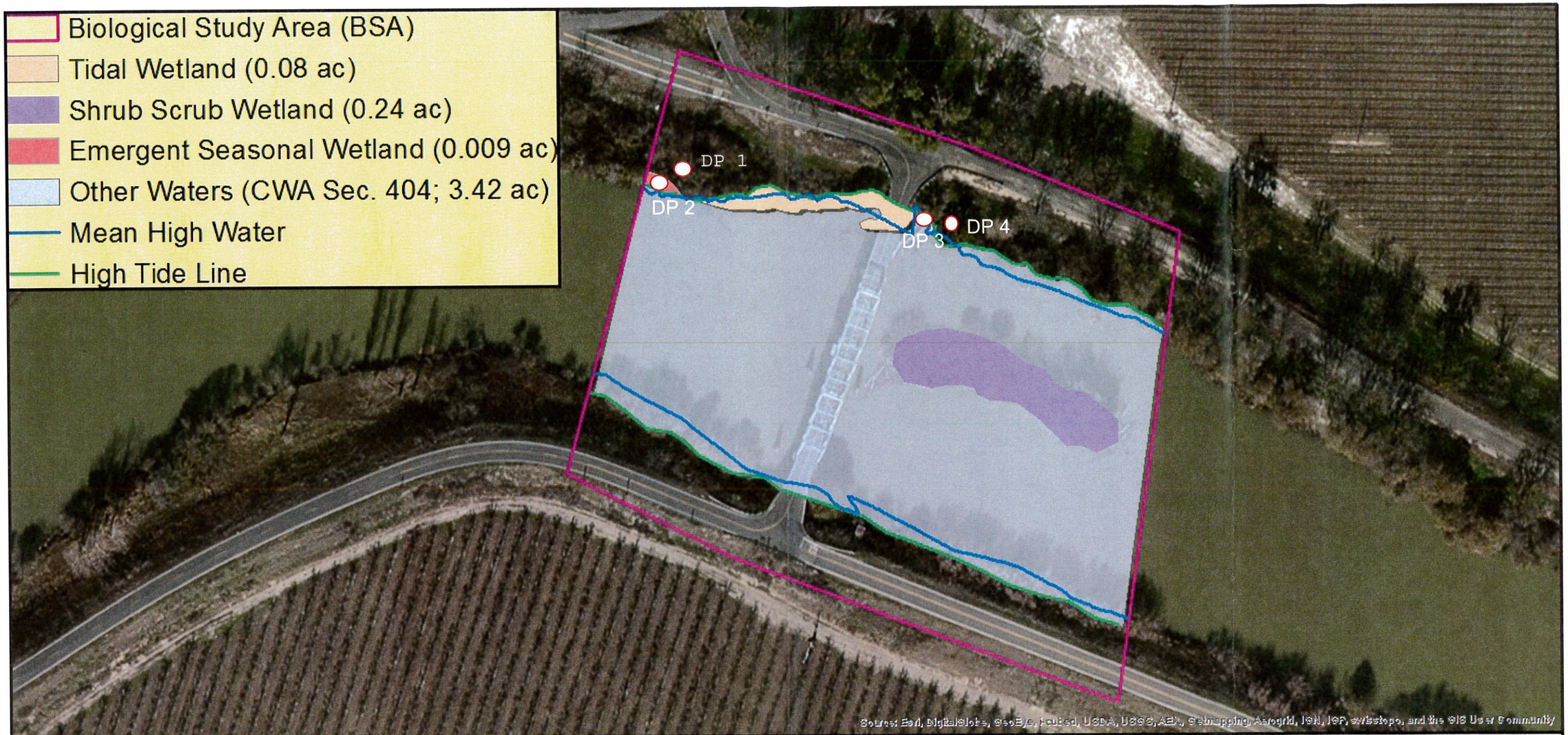
0 350 700 Feet

N

Figure 2. Biological Study Area

Biological Study Area (BSA)

Solano County
State Route 84 - PM 12.1



0 135 270 Feet

N

Figure 3. Potential Jurisdictional Waters

Delineators: R. Wilson and R. Vogt
Date: 3/4/14

Solano County
State Route 84 - PM 12.1

Appendix D Special-Status Plant Surveys

Miner Slough Bridge Replacement Project

Special-Status Plant Survey

Solano County, California

04-SOL-84-PM 12.1/12.2

EA 0G660/ID 0400000343

September 2014

Caltrans

Special-Status Plant Survey

Miner Slough Bridge Replacement Project, Solano, California

04-Sol-84-PM 12.1/12.2

EA 0G660/ID 0400000343

September 2014

STATE OF CALIFORNIA

Department of Transportation (Caltrans)

Prepared By: _____ Date: 9/10/14

Erik Schwab, Associate District Biologist
(510) 286-5627
Office of Biological Sciences and Permits
District 4, Oakland
California Department of Transportation

Reviewed By: _____ Date: 9/10/14

Andrew Amacher, PhD, Associate District Biologist
(510) 622-8727
Office of Biological Sciences and Permits
District 4, Oakland
California Department of Transportation

Approved by: _____ Date: 9/10/14

Signed for

Christopher States, District Branch Chief
(510) 286-7185
Office of Biological Sciences and Permits
District 4, Oakland
California Department of Transportation

For individuals with sensory disabilities, this document is available in Braille, large print, on audiocassette, or computer disk. To obtain a copy in one of these alternate formats, please call or write to Caltrans, Attn: Chris States, Office of Biological Sciences and Permits, 111 Grand Avenue, Oakland, CA 94623-0660; (510) 286-7185 Voice, or use the California Relay Service TTY number, (800) 735-2929.

Summary

In 2014, protocol-level special-status plant surveys were conducted for the Caltrans State Route (SR) 84 Miner Slough Bridge Project near Rio Vista, California in Solano County. The project area includes the Miner Slough Bridge over the active channel of Miner Slough and adjacent lands. The 2014 study area includes all of the existing Caltrans right-of-way (ROW) and some adjacent private lands that may be used for project-related activities. The 2014 study area is approximately 6.2 acres. This Project Study Area (PSA) defines the outer limit of potential project activities beyond the ROW.

Protocol-level special status plant surveys were conducted for the Miner Slough Bridge Project in April, June, and August of 2014. The goal of these surveys was to locate all populations of special-status species within the study area, to precisely record and map their locations, and to estimate the size, number of individuals, growth phase, and microhabitat conditions for each population. Surveys were floristic in scope and followed United States Fish and Wildlife Services' (USFWS) Guidelines for Conducting and Reporting Botanical Inventories for Federally Listed, Proposed and Candidate Plants (USFWS 1996). Surveys for this project also followed the recommendations of the botanical survey guidelines of the California Department of Fish and Wildlife (CDFW 2000) and the California Native Plant Society (CNPS 2001).

In preparation for the 2014 field surveys information on 31 potentially occurring special-status plants was compiled based on the results of a 9-quadrangle search of the California Natural Diversity Database's Rarefind 5 database (CNDDB 2014), the California Native Plant Society online inventory (CNPS 2014), and the United States Fish and Wildlife (USFWS) Species List (USWFS 2014). Three field surveys were conducted during the early, middle, and late parts of blooming season. The early-season survey was conducted on April 9, the mid-season survey was conducted on June 10, and the late-season survey was completed on August 5. One or more reference sites were visited prior to each of the surveys.

The 2014 PSA is approximately 6.2 acres. The PSA included all of the Caltrans ROW and some private land. Surveyors had permission to enter all of these areas during the three surveys in 2014. Special attention was paid to riverine habitat and other habitats suitable for special-status plants.

The natural plant communities within the PSA consist of White Alder and White Alder/Narrow-leafed Willow associations (Sawyer et al. 2008). The most notable natural habitats within the PSA are the valley foothill riparian habitat along the Miner Slough corridor and the annual grassland habitat in the surrounding area. Surrounding land use within a 1-mile radius of the PSA consists mainly of agricultural land.

Two special-status plant species, Sanford's arrowhead (*Sagittaria sanfordii*) and woolly rose-mallow (*Hibiscus lasiocarpos* var. *occidentalis)*, were found in the PSA during the special-status plant surveys in 2014. Sanford's arrowhead and woolly rose-mallow are designated as threatened (1B.1) by the CNPS, but have no state or federal designation. Both plant species were found in the riverine habitat along the northern shore of Miner Slough.

No federal or state-listed species are presumed to be present in the PSA due to lack of habitat.

Table of Contents

Summary ix

1. Introduction and Regional Setting **1**
- 1.1 Introduction 1
- 1.2 Regional Setting 1
- 1.3 Project Study Area and Work Areas 2
- 1.4 Project Description 2

2. Study Methods **4**
- 2.1 Introduction 4
- 2.2 Pre-field Preparations 4
- 2.3 Reference Site Visits 5
- 2.4 Field Survey Protocols 12

3. Results **14**
- 3.1 Climate and Hydrology 14
- 3.2 Soils 14
- 3.3 Vegetation Types 15
- 3.4 Special-status plants 16

4. Discussion **17**

5. References **18**

Appendix A: Vascular Plant Species Observed within the Study Area **20**

Appendix B: Soil Maps **24**

Appendix C: Representative Photos **25**

Tables

Table 1 Special-status plant species with potential to occur within the Miner Slough Bridge study area 13

Table 2 2014 reference site visits for the Miner Slough bridge protocol-level special-status plant surveys 20

Figures

Figure 1 Project Vicinity Map
Figure 2 Biological Study Area
Figure 3 Rare Plant Occurrences in PSA

List of Appendices

Appendix A Vascular Plant Species Observed within the Study Area
Appendix B Soil Maps
Appendix C Representative Photographs

List of Abbreviated Terms

°F	degrees Fahrenheit
ac	acre
BMP	best management practice
PSA	Project Study Area
Caltrans	California Department of Transportation
CCC	Central California Coast
CDFG	California Department of Fish and Game
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
CRLF	California red-legged frog
dbh	diameter at breast height
DPS	distinct population segment
ESA	environmentally sensitive area
FESA	Federal Endangered Species Act
ft^2	square feet
MBGR	metal beam guard rail
MBTA	Migratory Bird Treaty Act
NES	Natural Environment Study
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
PCE	primary constituent element
PM	post mile
Project	Sarco Creek Bridge Replacement Project
PVC	polyvinyl chloride
ROW	right-of-way
RSP	rock slope protection

RWQCB	Regional Water Quality Control Board
SR	State Route
STRAIN	Structures Replacement and Improvement Needs
SWPPP	stormwater pollution prevention plan
TCE	temporary construction easement
UCIPM	University of California Integrated Pest Management
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
yd^3	cubic yard(s)

1. Introduction and Regional Setting

1.1 Introduction

This report describes a protocol-level special-status plant survey that was completed for the Miner Slough Bridge project in 2014. A major focus of the 2014 special-status surveys was to search the study area for the 3 federally listed plants known in the area. These species are: Colusa grass (*Neostapfia colusana*), Solano grass (*Tuctoria mucronata*), and Keck's checkerbloom (*Sidalcea keckii*). In addition, surveys included other listed plants known to occur in the area for which potential habitat may be present within the study area. These include alkali milk-vetch (*Astragalus tener var. tener*), Suisun marsh aster (*Symphyotrichum lentum*), Sanford's arrowhead, Delta tule pea (*Lathyrus jepsonii var. jepsonii*), Delta mudwort (*Limosella australis*), Mason's lilaeopsis (*Lilaeopsis masonii*), and woolly rose-mallow.

The project area is located in Solano County (Figure 1). It includes the SR 84 Miner Slough Bridge over the active channel of Miner Slough and adjacent lands. The study area for the 2014 rare plant surveys, shown in Figure 2, consists of a roughly rectangular area of 6.2 acres. It includes all of the existing Caltrans ROW and some adjacent private lands that may be used for project-related activities. Caltrans proposes to replace the existing bridge.

1.2 Regional Setting

The proposed project is located near the City of Rio Vista in Solano County, as shown on Figure 1. The project is located on SR 84, at Post Mile (PM) 12.1 (Figure 1). Most of the project area is located adjacent to the active channel of Miner Slough, a tributary of the Sacramento River. The project is located in the Rancho Los Ulpinos Land Grant within the Liberty Island United States Geological Survey (USGS) 7.5-minute topographic quadrangle. The Miner Slough Bridge is roughly centered at 38° 29' 00.00" N Latitude and 121° 63' 16.7" W Longitude. Miner Slough flows south into the Sacramento River and Suisun Bay, which flows into the San Francisco Bay.

The terrain in this ecoregion consists of flat fluvial plains and terraces, with a few low or rolling hills (Wiken, et al. 2011). The Great Central Valley geomorphic province is an alluvial plain that is 50 miles wide and 400 miles long. The eastern border is the west-sloping Sierran bedrock surface and the western border is underlain by east-dipping Cretaceous and Cenozoic strata. The elevation range is from near sea-level just east of San Francisco Bay to about 800 feet at the extreme northern and southern ends. Elevations in the immediate project area range from sea level up to 210 meters above sea level (Wiken, et al. 2011).

The portion of the county where the project is located lies within the Great Central Valley in the Sacramento River watershed.

1.3 Project Study Area and Work Areas

The project limits, which include Caltrans right-of-way (ROW) and temporary construction easements (TCE), cover approximately 2.3 ac. The project limits consist of the project's permanent and temporary direct and indirect effect areas, including construction access and staging. The project Project Study Area (PSA) includes the project limits plus an additional 300 feet upstream and downstream of the existing bridge, for a total of 6.2 ac (Figure 2).

The project area is in a sparsely populated area where the majority of the vegetation consists of valley foothill riparian, annual grassland, and cropland/pasture. Annual grasses and ruderal forbs are found along the road shoulder and a valley foothill riparian forested area is found along Miner Slough (Sawyer et al. 2008).

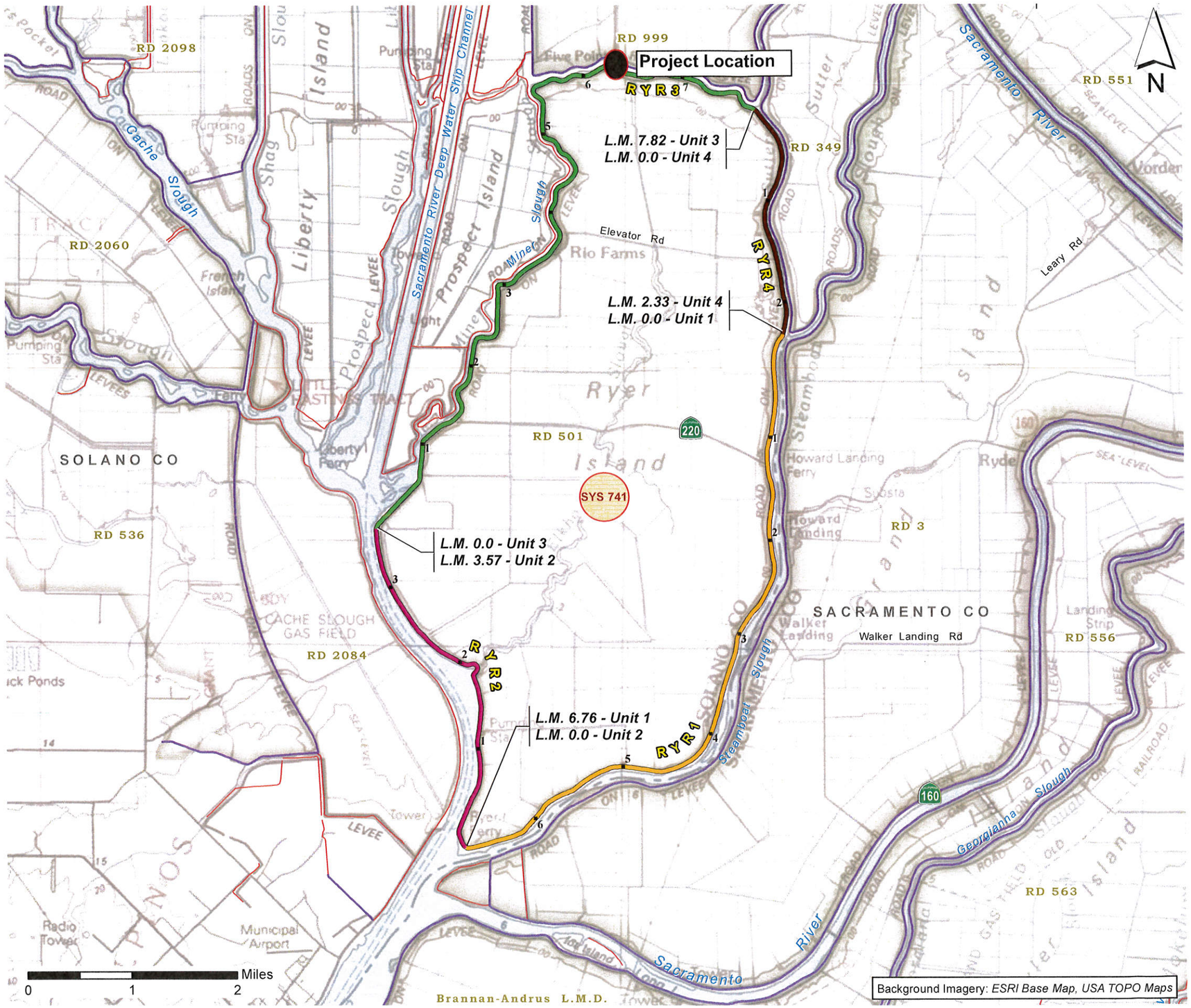
The majority of the vegetation consists of native riparian forest with a mix of native and non-native species in the understory. A dense tree canopy formed by species such as white alder (*Alnus rhombifolia*), narrow-leafed willow (*Salix exigua*), and box elder (*Acer negundo*) shades the river bed. The understory vegetation includes wild grape (*Vitus californica*), poison hemlock (*Conium maculatum*), mugwort (*Artemesia douglasiana*), and Himalayan blackberry (*Rubus armeniacus*). On the upland slope vegetation contains black walnut (*Juglans californica*), oats (*Avena sativa*), Himalayan blackberry, scouring rush (*Equisetum hymale*), and ripgut brome (*Bromus diandrus*).

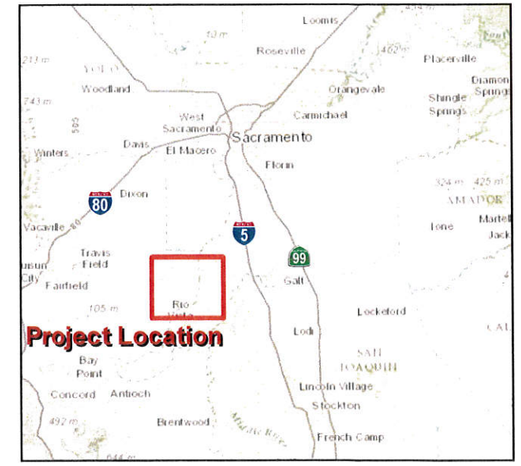
1.4 Project Description

Caltrans proposes to replace the existing Miner Slough Bridge on State Route 84 over Miner Slough. The 2007 STRAIN (Structure Replacement and Improvements Needs) Report indicated a need to replace the bridge superstructure. The deck surface in all spans continuously exhibits refractory cracks caused by the differential deflection of its parallel wooden planks, which deteriorate into spalls that create pavement voids. There are checks and cracks in all spans, which may decrease the weight.

The existing bridge is 367 feet long and is composed of three sections with timber planks decks and a two-inch thick asphalt concrete (AC) wearing surface. The 191-ft center steel truss swing span is on a reinforced concrete cylindrical swing pier, with reinforced concrete rest piers. The two approach spans are of timber stringers on timber cap and pile bents with abutments of reinforced concrete on timber piles.

Figure 1: Project Location Map





Map Legend

NLD SYSTEMS and SEGMENTS
(Levee Inspection System Code)

SYSTEM 741

- RD 0501 - Unit 1, Steamboat Slough (RYR1)
- RD 0501 - Unit 2, Cache Slough (RYR2)
- RD 0501 - Unit 3, Miner Slough (RYR3)
- RD 0501 - Unit 4, Sutter Slough (RYR4)

- Other Federal Levees
- Non-Federal Levee
- Levee Mile*

**Mileage obtained from DWR levee inspection resources*

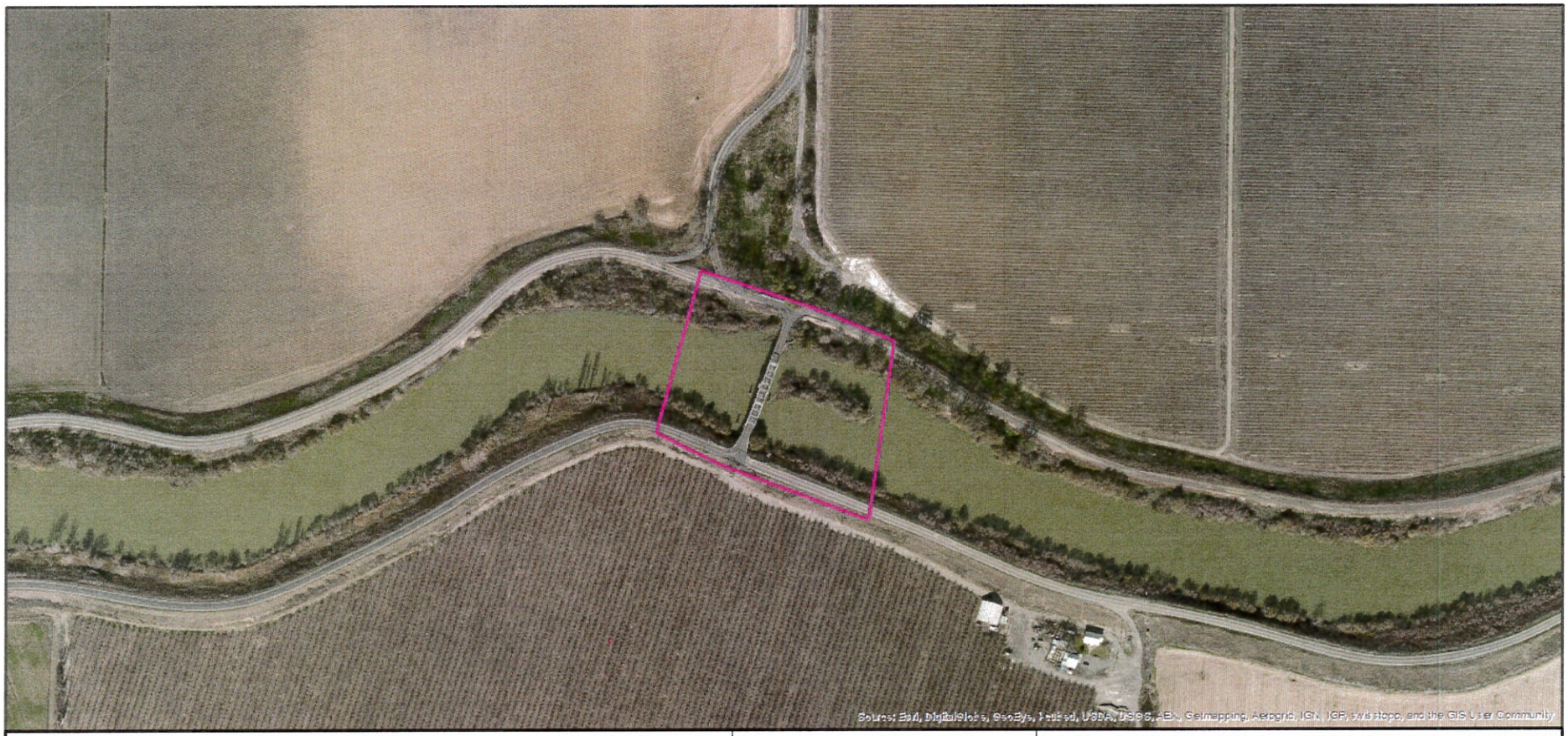
FEDERAL LEVEE PROJECTS SYSTEM MAP

RD 501-RYER ISLAND

U.S. ARMY CORPS OF ENGINEERS SACRAMENTO DISTRICT

Map Prepared by Jim Mars

FEB 2014



0 350 700 Feet

N

Figure 2. Biological Study Area

Biological Study Area (BSA)

Solano County
State Route 84 - PM 12.1

2. Study Methods

2.1 Introduction

Protocol-level special-status plant surveys were conducted for the Miner Slough Bridge project in April, June, and August of 2014. The goal of these surveys was to locate all populations of special-status plants within the PSA, to record and map their locations, and to estimate the size, number of individuals, phenology, and microhabitat characteristics of each special-status plant population. Surveys were floristic in scope and followed the USFWS's *Guidelines for Conducting and Reporting Botanical Inventories for Federally Listed, Proposed and Candidate Plants* (USFWS 1996). Surveys conducted for this project also followed California Department of Fish and Wildlife (CDFW 2000) and California Native Plant Society (CNPS 2001). All surveys were conducted by Caltrans biologists Andrew Amacher, Whitney Brennan, and Rosalie Wilson.

2.2 Pre-field Preparations

Preparation for the 2014 special-status plant surveys included compiling a list of special-status plants with potential to occur within the PSA. A plant taxon was considered to be of special status if it met one or more of the following criteria:

- Federally or state-listed, or proposed for listing, as rare, threatened, or endangered (USFWS 2014; CDFW 2014); or
- Special plant as defined by California Natural Diversity Database (CNDDB) (CNDDB 2014); or
- Designated by the California Native Plant Society in its Inventory of Rare and Endangered Plants of California (CNPS 2014)

A plant was determined to have the potential to occur in the PSA if its known or expected geographic range includes the PSA, and if its known or expected habitat is found within or near the PSA.

A preliminary list of potentially occurring special-status plants was compiled by conducting 9-quadrangle searches of the CNDDB Rarefind5 database and the CNPS online inventory. This project is located within the Liberty Island 7.5-minute quadrangle. The Bird's Landing, Clarksburg, Courtland, Dixon, Dozier, Isleton, Liberty Island, Saxon, and Rio Vista USGS 7.5-minute quadrangles were included in the 9-quadrangle search. The search produced a preliminary list of 31 species. Table 1 summarizes information about 31 special-status plants with potential to occur within the PSA. Potential to occur in the PSA was ranked as either none, low, moderate, or high.

Potential to Occur	*Description*
None	Habitat within the PSA does not satisfy the species' requirements and/or the project is not within the known or expected range of the species. No known occurrences have been reported from the region. The species' presence within the PSA is not expected.
Low	Habitat within the PSA satisfies very few of the species' requirements and/or the known or expected range of the species is within 5 miles of the PSA. In addition, no known occurrences have been reported from the PSA. The species' presence within the PSA is unlikely.
Moderate	Habitat within the PSA meets some of the species' requirements and known locations for the species are found in the region of the project. Presence of the species within the PSA is moderately likely.
High	Habitat within the PSA meets most or all of the species' requirements and known locations for the species are found within 5 miles of the project. Presence of the species within the PSA is highly likely.
Detected	Occurrences known from the PSA from previous CNDDB records.

Information on flowering time, status, habitat preferences, geographic distribution, elevational range, and potential to occur in the project area was gathered and reviewed prior to the initiation of field surveys. This information was compiled from the sources listed above and the CalFlora online database (CalFlora 2014).

2.3 Reference Site Visits

Reference populations were checked prior to each seasonal field survey when possible. The reference sites used were located based on CNDDB occurrences and included Jepson Prairie and Rush Ranch Open Space. Table 2 lists the reference site visits by date, location, and species target taxon, and summarizes the flowering condition of target plants during the reference site visits.

Reference site visits focused on the marsh, riverine, and wetland taxa because these were the special-status plants with the highest likelihood of being found within the PSA.

During the April survey, reference populations were checked for alkali milk-vetch at Jepson Prairie and this species was in bloom and located at CNDDB Occurrence #26 in Jepson Prairie (Table 2). Jepson Prairie is located on Cook Rd. near SR 113 south of Dixon. It is 10 miles from Miner Slough Bridge.

Reference site checks were also conducted for saline clover, Boggs Lake hedge-hyssop, heartscale, Mason's lilaeopsis, and fragrant fritillary, but none of these species were found in the field. No reference sites were visited for Heckard's pepper-grass, a plant with historic locations in the vicinity of the study area. The closest reference site was five miles away and from 1891. No other reference sites were available within the vicinity of the project area.

During the in bloom survey, reference site checks were conducted for Suisun marsh aster and this species was found at CNDDB Occurrence #182 between Rio Vista and Isleton (Table 2). The location was on the Sacramento River north of SR 160, approximately 8 miles from Miner Slough Bridge.

Reference site checks were also conducted for Sanford's arrowhead, bristly sedge, woolly rose mallow, and delta tule pea, but none of these species were located at potential reference sites. No reference sites were visited for delta mudwort or watershield, although historical locations occur in the vicinity of the study area. For delta mudwort, the most recent occurrence in the area was from 1999. For watershield, the only occurrence in the vicinity was from 1976.

Reference site checks were also conducted for Bolander's water hemlock, but this species was not located in the field.

During the August in bloom survey, reference site checks were conducted for Carquinez goldenbrush and this species was found at CNDDB Occurrence #12 on SR 12. This site was between Suisun City and Rio Vista, approximately 16 miles from the Miner Slough Bridge.

A reference site was also visited for side-flowering skullcap and this species was located and in bloom at CNDDB Occurrences #7 east of Walnut Grove. This occurrence is along north Mokelumne River north of North Walnut Grove Rd.; it is approximately 8 miles from Miner Slough Bridge. Mason's lilaeopsis was also found at this location (CNDDB Occurrence #219).

Table 1: Potential Special-Status Plants in the 9-Quad Area Surrounding Miner Slough

Scientific Name	Common Name	Status (Fed/State /CNPS)	Habitat	Subhabitat	Flowering Period	Potential to Occur within Project Area
Astragalus tener var. ferrisiae	Ferris' milk-vetch	None/None/ 1B.1	Meadows, valley and foothill grassland. Subalkaline flats on overflow land in the Central Valley; usually seen in dry, adobe soil. 5-75 meters (m).	Elevations up to 200 ft. Vernally moist meadows and subalkaline flats in valley grasslands.	Apr.-May	**Moderate.** Minimal grassland found in PSA. Closest CNDDB occurrence is 8 miles away.
Astragalus tener var. tener	Alkali milk-vetch		Alkali playa, valley and foothill grassland, vernal pools. Low ground, alkali flats, and flooded lands; in annual grassland or in playas or vernal pools. 1-170m.		Mar.-Jun.	**Moderate.** Minimal grassland found in PSA. Closest CNDDB occurrence is 8 miles away.
Atriplex cordulata var. cordulata	heartscale	None/None/ 1B.2	Chenopod scrub, valley and foothill grassland, meadows. Alkaline flats and scalds in the Central Valley, sandy soils. 0-560 m.	Elevations up to 500 ft. Saline or alkaline soils in alkali meadows, saltbrush scrub, and alkali sink communities.	Apr.-Oct.	**Moderate.** Minimal grassland found in PSA. Closest CNDDB occurrence is 8 miles away.
Atriplex depressa	brittlescale	None/None/ 1B.2	Chenopod scrub, meadows, playas, valley and foothill grassland, vernal pools. Usually in alkali scalds or alk. clay in meadows or annual grassland; rarely assoc with riparian, marshes, or vernal pools. 1-320 m.		Apr.-Oct.	**Low.** Minimal grassland found in PSA. Closest CNDDB occurrence is 10 miles away.
Atriplex joaquinana	San Joaquin spearscale	None/None/ 1B.2	Chenopod scrub, alkali meadow, playas, valley and foothill grassland. In seasonal alkali wetlands or alkali sink scrub with		Apr.-Oct.	**Low.** Minimal grasslands found in PSA. Closest CNDDB occurrence is 6 miles away from 1891.

			Distichlis spicata, Frankenia, etc. 1-835 m.			
Atriplex persistens	vernal pool smallscale	None/None/ 1B.2	Vernal pools. Alkaline vernal pools. 10-115 m.		Jun.-Oct.	**Low.** No vernal pools in PSA. Closest CNDDB occurrence is 11 miles away.
Brasenia schreberi	watershield	None/None/ 2B.3	Freshwater marshes and swamps. Aquatic from water bodies both natural and artificial in California.		Jun.-Sep.	**Moderate.** Closest CNDDB occurrence is 7 miles away and is from 1976.
Carex comosa	bristly sedge	None/None/ 2B.1	Marshes and swamps. Lake margins, wet places; site below sea level is on a Delta island. -5-1005m.		May-Sep.	**Moderate.** Closest CNDDB occurrence is 6 miles away.
Centromadia parryi ssp. parryi	pappose tarplant	None/None/ 1B.2	Coastal prairie, meadows and seeps, coastal salt marsh, valley and foothill grassland. Vernally mesic, often alkaline sites. 2-420m.		May-Nov.	**Low.** Minimal grassland found in PSA. Closest CNDDB occurrence is 14 miles away from 1933.
Cicuta maculata var. bolanderi	Bolander's water-hemlock	None/None/ 2B.1	Marshes, fresh or brackish water. 0-200m.		Jul.-Sep.	**Moderate.** Closest CNDDB occurrence is 6 miles away.
Downingia pusilla	dwarf downingia	None/None/ 2B.2	Valley and foothill grassland (mesic sites), vernal pools. Vernal lake and pool margins with a variety of associates. In several types of vernal pools. 1-445 m.		Mar.-May	**Low.** No vernal pools found in PSA. Closest CNDDB occurrence is 9 miles away.
Fritillaria liliacea	fragrant fritillary	None/None/ 1B.2	Coastal scrub, valley and foothill grassland, coastal prairie. Often on serpentine; various soils reported though usually clay, in grassland. 3-410m.		Feb.-Apr.	**Moderate.** Minimal grassland found in PSA. Closest CNDDB occurrence is 9 miles away.
Fritillaria pluriflora	adobe-lily	None/None/ 1B.2	Chaparral, cismontane woodland, foothill grassland. Usually on clay soils; sometimes serpentine. 60-705 meters.	Elevations of 200 to 2300 ft. Adobe soil (often derived from serpentine); foothill	Feb.-Apr.	**Low.** Minimal grassland and woodland found in PSA. Closest occurrence is 14 miles away and is from 1920.

				woodland or chaparral-foothill woodland interface; clay soils		
Gratiola heterosepala	Boggs Lake hedge-hyssop	None/Endangered/1B.2	Marshes and swamps (freshwater), vernal pools. Clay soils; usually in vernal pools, sometimes on lake margins. 10-2375 m.	Elevations of 50 to 5000 ft. Vernal pools, reservoir edges, similar mudflats; wet clay soil.	Apr.-Aug.	**Moderate.** Closest CNDDB occurrence is 8 miles away.
Hibiscus lasiocarpus var. occidentalis	Woolly rose-mallow	None/None/2	Scattered small locations in central California from Butte County to San Joaquin County	Freshwater marsh	Aug.-Sep.	**Detected.** Observed within the PSA in 2002.
Juglans hindsii	Northern California black walnut	None/None/1B.1	Riparian forest, riparian woodland. Few extant native stands remain; widely naturalized. Deep alluvial soil associated with a creek or stream. 0-440 m.		Apr.-May	**Low.** Closest CNDDB occurrence is 3 miles away, but is known to be extirpated. Next closest population is 32 miles away.
Isocoma arguta	Carquinez goldenbush	None/None/1B.1	Valley and foothill grassland. Alkaline soils, flats, lower hills. On low benches near drainages and on tops and sides of mounds in swale habitat. 1-20m.		Aug.-Dec.	**Moderate.** Minimal grassland found in PSA. Closest CNDDB occurrence is 9 miles away.
Lathyrus jepsonii var. jepsonii	Delta tule pea	None/None/1B.2	Freshwater and brackish marshes. Often found w/ *Typha, Aster lentus, Rosa calif., Juncus spp., Scirpus,* etc. Usually on marsh and slough edges.		May-Sep.	**High.** Closest CNDDB occurrence is 2 miles away. Found in neighboring Lindsay Slough.
Legenere limosa	legenere	None/None/1B.1	Vernal pools. Many historical occurrences are extirpated. In beds of vernal pools. 1-880m.	Elevations up to 2000 ft. Moist or wet ground associated with vernal pools, vernal marshes, lakes, ponds, and sloughs.	Apr.-Jun.	**Low.** No vernal pools found in PSA. Closest CNDDB occurrence is 9 miles away.

Lepidium latipes var. heckardii	Heckard's pepper-grass	None/None/ 1B.2	Valley and foothill grassland. Grassland, and sometimes vernal pool edges. Alkaline soils. 2-200 m.		Mar.-May	**Moderate.** Minimal grassland in PSA. Closest CNDDB occurrence is 4 miles away.
Lilaeopsis masonii	Mason's lilaeopsis	None/None/ 1B.1	Freshwater and brackish marshes, riparian scrub. Tidal zones, in muddy or silty soil formed through river deposition or river bank erosion. 0-10 m.		Apr.-Nov.	**High.** CNDDB occurrences within 1.5 miles of PSA. Found in neighboring Lindsay Slough
Limosella australis	Delta mudwort	None/None/ 2B.1	Riparian scrub, freshwater marsh, brackish marsh. Probably the rarest of the suite of Delta rare plants. Usually on mud banks of the Delta in marshy or scrubby riparian associations; often with Lilaeopsis masonii. 0-3 m.		May-Aug.	**High.** Closest CNDDB occurrence is 4 miles away.
Navarretia leucocephala ssp. bakeri	Baker's navarretia	None/None/ 1B.1	Cismontane woodland, meadows and seeps, vernal pools, valley and foothill grassland, lower montane coniferous forest. Vernal pools and swales; adobe or alkaline soils. 5-1740 m.	Elevations up to 5500 ft. Vernal pools in variety of communities.	Apr.-July	**Low.** Vernal pools not found in PSA. Closest CNDDB occurrence is 8 miles away.
Neostapfia colusana	Colusa grass	Threatened/ Endangered/ 1B.1	Vernal pools. Usually in large, or deep vernal pool bottoms; adobe soils. 5-200 m.		May-Aug.	**Low.** No vernal pools found in PSA. Closest CNDDB occurrence is 10 miles away.
Plagiobothrys hystriculus	bearded popcornflower	None/None/ 1B.1	Vernal pools, valley and foothill grassland. Wet sites. 0-275 m.		Apr.-May	**Low.** Vernal pools not found in PSA. Closest CNDDB occurrence is 8 miles away.
Sagittaria sanfordii	Sanford's arrowhead	None/None/ 1B.2	Marshes and swamps. In standing or slow-moving freshwater ponds, marshes, and ditches. 0-650 m.	Elevations from 10 to 2000 ft. Shallow, standing fresh water and sluggish	May-Oct.	**Detected.** Observed within the PSA in 2002.

				waterways associated with marshes, swamps, ponds, vernal pools, lakes, reservoirs, sloughs, ditches, canals, streams, and rivers.		
Scutellaria lateriflora	side-flowering skullcap	None/None/ 2B.2	Meadows and seeps, marshes and swamps. Wet meadows and marshes. In the Delta, often found on logs. -3-500m.		Jul.-Sep.	**Moderate.** Closest CNDDB occurrence is 7 miles away.
Sidalcea keckii	Keck's checkerbloom	Endangered/ None/1B.1	Cismontane woodland, valley and foothill grassland. Grassy slopes in blue oak woodland. 75-650 m.		Apr.-Jun.	**Low.** Minimal woodland and grassland in PSA. Closest CNDDB occurrence is 12 miles away and from 1892 and 1943.
Symphyotrichum lentum	Suisun Marsh aster	None/None/ 1B.2	Marshes and swamps (brackish and freshwater). Most often seen along sloughs with Phragmites, Scirpus, blackberry, Typha, etc. 0-3 m.		May-Nov.	**High.** Closest CNDDB occurrence is within 1.3 miles. Found in neighboring Lindsay Slough
Trifolium hydrophilum	saline clover	None/None/ 1B.2	Marshes and swamps, valley and foothill grassland, vernal pools. Mesic, alkaline sites. 0-300 m.		Apr.-Jun.	**Moderate.** Closest CNDDB occurrence is 7 miles away.
Tuctoria mucronata	Crampton's tuctoria or Solano grass	Endangered/ Endangered/ 1B.1	Vernal pools, valley and foothill grassland. Clay bottoms of drying vernal pools and lakes in valley grassland. 5-10 m.		Apr.-Aug.	**Low.** No vernal pools found in PSA. Closest CNDDB occurrence is 10 miles away.

2.4 Field Survey Protocols

Three field surveys were conducted during the early, middle, and late segments of the 2014 blooming season. The early-season survey was conducted on April 9, the mid-season survey was completed on June 10, and the late-season survey was conducted on August 5. Rainfall was below average for the 2013-2014 rainfall season, but there were some late season storms that maintained plant growth. An aerial photo basemap showing the boundaries of the 2014 survey area was used in the field (Figure 2).

The 2014 study area is approximately 6.2 acres. The study area included all of the Caltrans ROW and some private land. Surveyors had permission to enter all of the land within the PSA during all three surveys. Caltrans biologists were unable to survey the island directly east of the existing bridge due to accessibility issues. The project area was surveyed using transects completed on foot that visually covered all of the study area. Special attention was paid to wetland habitat.

During each survey, the surveyors made lists in the field of all of the plant species observed that were identifiable. Nearly all plants found within the PSA were identified to species level; all were identified to the level needed to determine if they were special-status plants. Samples were taken of plants that could not be readily identified in the field. These were identified by using keys in standard references such as The Jepson Manual (Baldwin, et al. 2012). A list of vascular plants found in the study area is included in Appendix A. Species recognized as non-native and/or noxious weeds were noted in the plant list.

Table 2. Reference site visits for the Miner Slough Bridge special-status plant surveys

Species checked	Location (CNDDB Occurrence)	Date in 2014	Species condition
Alkali milk vetch (*Astralagus tener var. tener*)	Jepson Prairie (#26)	April 10	75% of plants in bloom, some in senescence, some in bud; at peak bloom; associated with *Lasthenia fremontii, Frankenia salina, Erodium cicutarium, Psilocarphus brevissimus, Lythrum hyssopifolium*
Suisun marsh aster (*Symphyotrichum lentum*)	State Route 160 near Rio Vista (#182)	June 11	10% of plants in bloom; before peak bloom; 5 plants/clumps in a 40 ft. stretch; on mudflat with large rocks and driftwood; associated with *Juncus spp.*, *Mimulus guttatus*, *Paspalum dilatatum*
Carquinez goldenbrush (*Isocoma arguta*)	State Route 12 (#12)	August 5	85% of plants in bloom; peak bloom; associated with *Eryngium spp., Lolium spp., Bromus spp, and Festuca spp.*
Side-flowering skullcap (*Scutelleria laterfolia*)	East of Walnut Grove off of North Walnut Grove Rd. (#7)	August 5	25% of plants in bloom; 2-3 plants on fallen log; associated with *Juncus patens*, *Lycopus californicus*, and *Rumex crispus*
Mason's lilaeopsis (*Lilaeopsis masonii*)	East of Walnut Grove off of North Walnut Grove Rd. (#219)	August 5	15% of plants in bloom; associated with *Juncus patens*, *Lycopus californicus*, and *Rumex crispus*

3. Results

Natural vegetation and other vegetated land cover types found within the study area are described below, followed by the results of the special-status plant surveys. Common and scientific names for all plant species mentioned in the text, and others observed in the PSA, are listed in Appendix A.

The PSA is located in Solano County. The natural plant communities within the PSA consist of White Alder and White Alder/Narrow-leafed Willow associations (Sawyer, et al. 2008). The most notable natural habitats within the PSA are the valley foothill riparian habitat along the Miner Slough corridor and the annual grassland habitat in the surrounding area. Surrounding land use within a 1-mile radius of the PSA consists mainly of agricultural land.

3.1 Climate and Hydrology

Climate in this area is typical of northern California's Mediterranean-type climate with an average yearly temperature of 73 degrees Fahrenheit (°F). Average winter temperatures range from 36 to 72°F and summer temperatures range between 47 and 91°F. On average, the mean rainfall is 17.37 inches. Rain falls mainly from November to March (Western Regional Climate Center (WRRC) 2014).

The dominant hydrology in the region consists of low gradient perennial and intermittent streams (Wiken, et al. 2011). The two large rivers in the region, the San Joaquin and Sacramento, are fed by rivers from the Sierra Nevada and an extensive delta is created when the two rivers converge.

Miner Slough is only a small portion of the Sacramento River watershed within the Sacramento River hydrologic region. The Sacramento River watershed drainage consists of an area of approximately 27,000 square miles (Sacramento River Watershed Program 2014). The river has a 400 mile path from the headwaters of Klamath Mountains to Suisun Bay. Miner Slough itself is within the Sacramento River Hydrologic Region and the Sacramento Delta Hydrologic Unit (18020109). It is a tributary to the Sacramento River. Miner Slough is tidally influenced and brackish.

3.2 Soils

The PSA is mapped as being comprised of three soil units known as Columbia, Sacramento, and Valdez (NRCS 2014a). A general description of the soils based on the NRCS official soils series descriptions (USDA 2014b) is provided below. All soil colors are for moist soils. Soil color codes follow the Munsell color system. Soil maps for the PSA are included in Appendix B (USDA 2014a). All of these soil types are on the National Hydric Soils list (NRCS 2014b).

3.2.1 Columbia Series, Moderately Well Drained

The Columbia series consists of moderately well drained soils on floodplains and natural levees with slopes of 0 to 8 percent that formed in alluvium from mixed sources. Surface

soil is a pale brown (10YR 6/3) fine sandy loam. Runoff is negligible to medium, and permeability is moderately rapid.

3.2.2 Sacramento Series, Poorly Drained

The Sacramento series consists of poor to very poorly drained soils that formed in fine textured alluvium of mixed origin. These soils are found in nearly level basins at elevations of near sea level to 60 feet. Surface soil is a gray (5YR 5/1) clay. This soil has very slow to slow runoff and slow permeability.

3.2.3 The Valdez Series, Poorly Drained

The Valdez series formed in recent alluvium from mixed rock sources and consists of very deep, poorly drained soils. These soils are near rivers, sloughs, and old stream channels in river deltas and floodplains and have slopes of 0 to 2 percent. The surface soil is a pale brown (10YR 6/3) silt loam. This soil has slow to very slow runoff with moderately slow permeability.

3.3 Vegetation Types

The project area spans across Miner Slough in a low-density agricultural area where the majority of the vegetation consists of native riparian forest with a mix of native and non-native species in the understory. A dense tree canopy formed by species such as white alder, arroyo willow, and box elder shades the river bank. The understory vegetation includes wild grape, poison hemlock, mugwort, and Himalayan blackberry. On the upland slope, vegetation consists of black walnut, oats, Himalayan blackberry, scouring rush, and ripgut brome.

In addition to natural vegetation, the PSA contains agricultural fields. The natural vegetation types are based on Sawyer et al. (2008). Vegetation descriptions are based on field observations from the 2014 surveys. The three vegetation types found within the project area are listed below.

3.3.1 Valley Foothill Riparian

Valley foothill riparian is dominated by cottonwood (*Populus fremontii*), California sycamore (*Platanus racemosa*), and valley oak (*Quercus lobata*). White alder, box elder, and Oregon ash (*Fraxinus latifolia*) are found in the subcanopy while wild grape, wild rose (*Rosa spp.*), California blackberry (*Rubus ursinus*), blue elderberry (*Sambucus mexicana*), poison oak (*Toxicodendron diversilobum*), buttonbush (*Cephalanthus occidentalis*), and willows (*Salix spp.)* are found in the understory. Canopy height is approximately 98 ft. with a canopy cover of 20 to 80 percent. The valley foothill riparian vegetation type borders both sides of Miner Slough.

3.3.2 Annual Grassland

The annual grassland vegetation type is dominated by introduced annual grasses such as wild oats, soft chess (*Bromus hordeaceus*), ripgut brome, wild barley (*Hordeum spp.*), and foxtail fescue (*Festuca myuros*).

The annual grassland vegetation type borders the valley foothill riparian habitat and the road. Few native plants were observed in this habitat.

3.3.3 Aquatic

Miner Slough makes up the riverine habitat in the PSA. In addition, three wetland types can be found bordering the slough. A palustrine tidal wetland is located on the north side of Miner Slough. The dominant vegetation within the wetland is white alder, red willow (*Salix laevigata*), curly dock (*Rumex crispus*), and common rush (*Juncus patens*). A palustrine emergent seasonal wetland was found along the north bank of Miner Slough.

The dominant vegetation within the wetland is white alder, red willow, common rush, and sedge (*Carex spp.*). Caltrans biologists were unable to survey the island directly east of the existing bridge for wetlands because it is inaccessible. The National Wetlands Inventory (NWI) Wetlands Mapper (USFWS 2014) classifies the island as palustrine shrub scrub.

3.4 Special-status plants

No federally listed plants were identified within the study area during the 2014 protocol-level surveys conducted for this project. Two CNPS threatened (1B.1) plants, Sanford's arrowhead and woolly rose-mallow, were observed within the PSA.

3.4.1 Sanford's arrowhead (Sagittaria sanfordii)

Several historic locations for Sanford's arrowhead are known from the vicinity of the PSA. The closest is 168 feet from the PSA. There is one other occurrence of Sanford's arrowhead within 2 miles of the PSA. CNDDB occurrence #90 is located on the north bank of Miner Slough; about 0.6 miles east of Five Points. Occurrence #91 is located in Miner Slough about 0.85 air miles south-southeast of Five points, and occurrence #92 is located in Miner Slough; about 1 air mile southwest of Lents Landing and 0.3 miles northeast of DC Stewart Landing.

A population of Sanford's arrowhead was located on the north side of Miner Slough, on both sides of the existing bridge (Figure 3). Approximately one-hundred plants were located along 137 feet of shoreline northwest of the existing bridge and 50 plants were found along 31 feet of shoreline on the northeast side of the bridge. During the June site visit, 75 percent of the plants were blooming.

3.4.2 Woolly rose-mallow (Hibiscus lasiocarpos var. occidentalis)

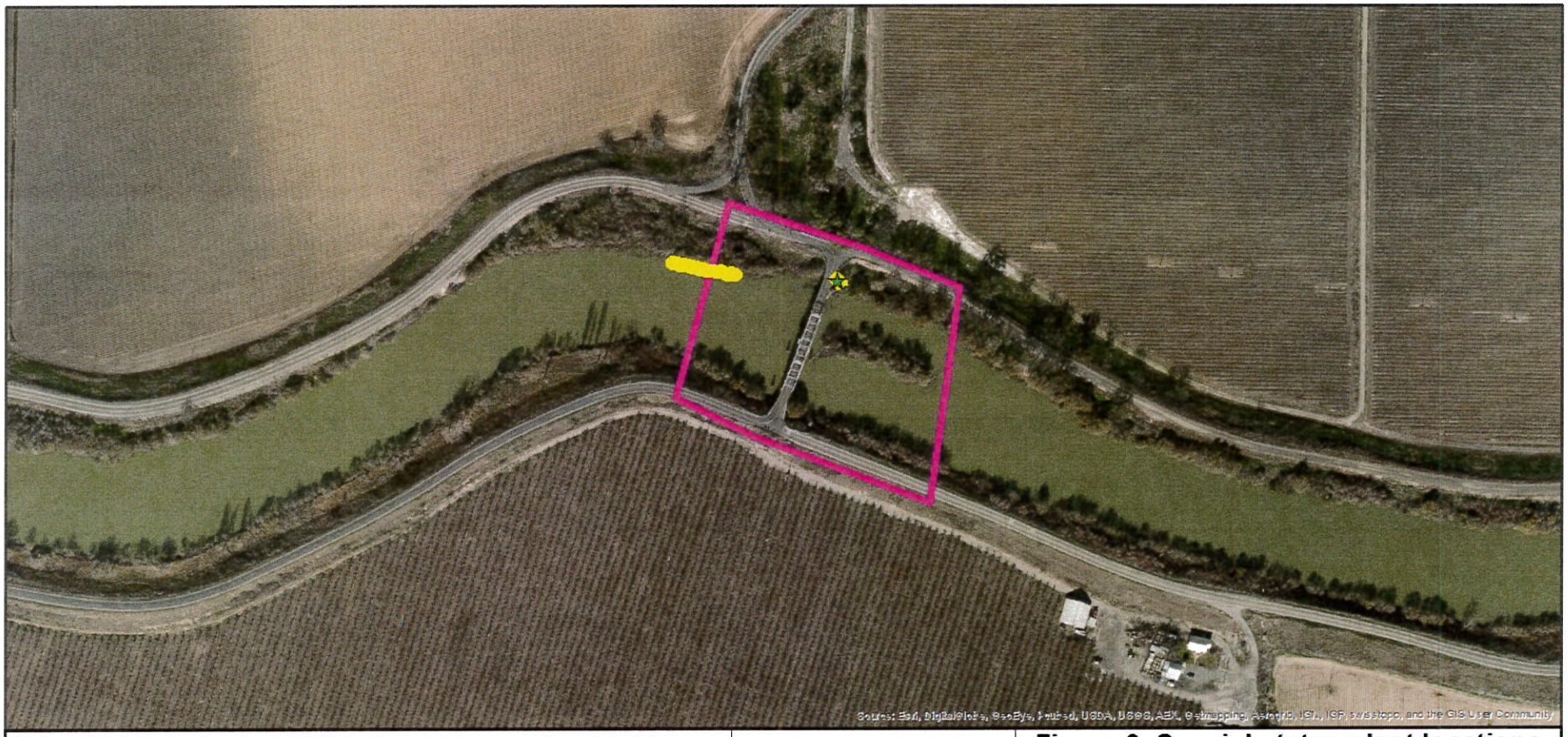
Several locations for woolly rose-mallow are known from the vicinity of the PSA. The closest occurrences are 2.8 and 3.5 miles north of the PSA. There are no documented records of woolly rose-mallow within 2 miles of the PSA. The sole CNDDB occurrence within the Liberty Island quad is occurrence #142.

A population of woolly rose-mallow was found on the north side of Miner Slough on top of a fallen log under the existing bridge (Figure 3). One plant was found in this location and it was in peak bloom.

4. Discussion

Two special-status plant species, Sanford's arrowhead and woolly rose-mallow, were found in the PSA during the special-status plant surveys in 2014. Sanford's arrowhead and woolly rose-mallow are designated as threatened (1B.1) by the CNPS, but have no state or federal designation. Both plant species were found in the tidal wetland along the northern shore of Miner Slough.

No federal or state-listed species were observed within the PSA during the protocol-level plant surveys.



0 295 590 Feet

N

Figure 3. Special-status plant locations

- Woolly Rose Mallow
- Sanford's Arrowhead
- Project Study Area (PSA)

Solano County
State Route 84 - PM 12.1

5. References

Baldwin, B.G., D.H. Goldman, D.J. Keil, R. Patterson, T.J. Rosatti, and D. Wilken. 2012. *The Jepson Manual Second Edition*. University of California Press.

CalFlora: *Information on California plants for education, research, and conservation*. 2014. Berkeley, California. The CalFlora Database: http://www.calflora.org

California Department of Fish and Wildlife (CDFW). 2000. *Guidelines for assessing the effects of proposed projects on rare, threatened and endangered plants and natural communities*. May 8, 2000. Available at: http://www.dfg.ca.gov/whdab/pdfs/guideplt.pdf

California Department of Fish and Wildlife (CDFW). 2014. *California Natural Diversity Database (CNDDB)*. Version 5.1.0. Wildlife and Habitat Data Analysis Branch. June 2014.

California Native Plant Society (CNPS). 2001. *Botanical Survey Guidelines*. California Native Plant Society. June 2, 2001.

California Native Plant Society (CNPS). 2014. *Inventory of rare and endangered plants of California*. Accessed at: http://www.cnps.web.aplus.net/cgi-bin/inv/inventory.cgi

Natural Resources Conservation Service (NRCS). 2014a. *Web Soil Survey*. Available online at: http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm. Accessed on: March 4, 2014.

Natural Resources Conservation Service (NRCS).2014b. *National List of Hydric Soils*. Available online at: http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/use/hydric/. Accessed on: March 4, 2014.

Sacramento River Watershed Program. 2014. *Sacramento River Basin*. Sacramento River Watershed Program. Available online at: http://www.sacriver.org/aboutwatershed/roadmap/sacramento-river-basin. Accessed on: March 4, 2014.

Sawyer, J.O., Keeler-Wolf, T., and J.M. Evens. 2008. *A Manual of California Vegetation*. California Native Plant Society Press. Sacramento, CA.

United States Department of Agriculture (USDA). 2014a. Natural Resources Conservation Service. *Soil Survey for Solano County, Web Soil Survey 2.0 National Cooperative Soil Survey*. Available online at: http://websoilsurvey.nrcs.usda.gov/app/

United States Department of Agriculture (USDA). 2014b. Natural Resources Conservation Service. *Official Soil Series Descriptions*. Available online at: https://soilseries.sc.egov.usda.gov/osdname.asp.

U.S. Fish and Wildlife Service (USFWS). 1996. *Guidelines for conducting and reporting botanical inventories for federally listed, proposed, and candidate plants*. Accessed at: http://www.fws.gov/ sacramento/es/Survey-Protocols-Guidelines/Documents/Listed_plant_survey_guidelines.pdf.

United States Fish and Wildlife Service (USFWS). 2014. *National Wetlands Inventory*. Available online at: http://www.fws.gov/wetlands/Data/Mapper.html.

U.S. Fish and Wildlife. 2014. *Official Species List for Isleton, Rio Vista, Birds Landing, Clarksburg, Saxon, Liberty Island, Courtland, Dozier and Dixon U.S. Geological Survey (USGS) quadangles*. Accessed June 3, 2013.

Wiken, E., Francisco, J.N., and G. Griffith. 2011. *North American Terrestrial Ecoregions – Level III*. Commission for Environmental Cooperation, Montreal, Canada.

Western Regional Climate Center. 2014. *Clarksburg, California: Western Regional Climate Center*. Available at: http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca1784. Accessed March 4, 2014.

Appendix A: Vascular Plant Species Observed within the Study Area

Vascular Plant Species Observed within the Study Area

Family	Scientific Name	Common Name	Nativity	Invasive
Adoxaceae	*Sambucus nigra ssp. caerulea*	Elderberry	N	
Agavaceae	*Agave americana*	Century plant	X	
Alismataceae	*Sagittaria sanfordii*	Sanford's arrowhead	N	
Apiaceae	*Conium maculatum*	Poison hemlock	X	M
Apiaceae	*Foeniculum vulgare*	Fennel	X	H
Apiaceae	*Scandix pecten-veneris*	Venus' needle	X	
Apiaceae	*Torilis arvensis*	Hedge parsley	X	M
Asteraceae	*Artemisia douglasiana*	Mugwort	N	
Asteraceae	*Bidens frondosa*	Sticktight	N	
Asteraceae	*Helenium puberulum*	Sneezeweed	N	
Asteraceae	*Helminthotheca echioides*	bristly oxtongue	X	L
Asteraceae	*Lactuca serriola*	Wild lettuce	X	
Asteraceae	*Pseudognaphalium luteoalbum*	Cudweed	X	
Asteraceae	*Senecio vulgaris*	Common groundsel	X	
Asteraceae	*Silybum marinum*	Milk thistle	N	
Betulaceae	*Alnus rhombifolia*	Alder	N	
Boraginaceae	*Myosotis laxa*	Bay forget me not	X	
Brassicaceae	*Capsella bursa-pastoris*	Shepherd's purse	X	
Brassicaceae	*Lepidium latifolium*	Pepperweed	X	H
Brassicaceae	*Raphanus sativa*	Radish	X	
Convolvulaceae	*Convolvulus arvensis*	Field bindweed	X	
Cyperaceae	*Carex sp*	Carex	N	
Cyperaceae	*Cyperus eragrostis*	Tall sedge	N	
Cyperaceae	*Schoenoplectus*	Bulrush	N	
Equisetaceae	*Equisetum arvense*	Common horsetail	N	
Equisetaceae	*Equisetum hymale*	Scouring rush	N	
Fabaceae	*Acacia longifolia*	Golden wattle	X	

Fabaceae	*Trifolium repens*	White clover	X	
Geraniaceae	*Erodium cicutarium*	Redstem filaree	X	L
Hypericaceae	*Hypericum perforatum*	St. John's wort	X	M
Iridaceae	*Iris pseudacorus*	Water iris	X	L
Juglandaceae	*Juglans californica*	Black walnut	N	
Juncaceae	*Juncus patens*	Common rush	N	
Lamiaceae	*Lycopus americanus*	Bugleweed	N	
Lamiaceae	*Mentha arvensis*	Field mint	N	
Lythraceae	*Lythrum salicaria*	Purple loosestrife	X	H
Lythraceae	*Punica granatum*	Pomegranate	X	
Malvaceae	*Malva neglecta*	Dwarf mallow	X	
Malvaceae	*Malva parviflora*	Common mallow	X	
Malvaceae	*Hibiscus lasiocarpos* var. *occidentalis*	Woolly rose-mallow	N	
Moraceae	*Ficus carica*	Fig	X	M
Oleaceae	*Fraxinus latifolium*	Oregon ash	N	
Onagraceae	*Epilobium ciliatum*	Willowherb	N	
Onagraceae	*Ludwigia peploides*	Floating water primrose	N	H
Plantaginaceae	*Veronica persica*	Birdeye speedwell	X	
Poaceae	*Avena sativa*	Oats	X	M
Poaceae	*Bromus catharticus*	Rescuegrass	X	
Poaceae	*Bromus diandrus*	Ripgut brome	X	M
Poaceae	*Cynodon dactylon*	Bermuda grass	X	M
Poaceae	*Festuca arundinaceae*	Tall fescue	X	M
Poaceae	*Festuca perennis*	Italian ryegrass	X	M
Poaceae	*Hordeum murinum*	Foxtail barley	X	M
Poaceae	*Paspalum dilatatum*	Dallisgrass	X	
Poaceae	*Phalaris spp.*	Canarygrass	X	
Poaceae	*Triticum aestivum*	Wheat	X	
Polygonaceae	*Persicaria maculosa*	Spotted lady's thumb	X	
Polygonaceae	*Polygonum*	Knotweed	X	

	aviculare			
Polygonaceae	*Rumex crispus*	Curly dock	X	L
Rosaceae	*Rubus ursinus*	Blackberry	N	
Rubiaceae	*Gallium aparine*	Bedstraw	N	
Salicaceae	*Salix exigua*	Narrowleafed willow	N	
Sapindaceae	*Acer negundo*	Box elder	N	
Typhaceae	*Typha latifolia*	Cattail	N	
Urticaceae	*Urtica dioica ssp. Holosericea*	Hoary nettle	N	
Viscaceae	*Phoradendron serotinum ssp. tomentosum*	Pacific mistletoe	N	
Vitaceae	*Parthenocissus quinquefolia*	Virginia creeper	X	
Vitaceae	*Vitis californica*	Wild grape	N	

Nativity
N=native
X=non-native
Cal-IPC classifications
M=Moderate
L=Limited
H=High

Appendix B: Soil Maps

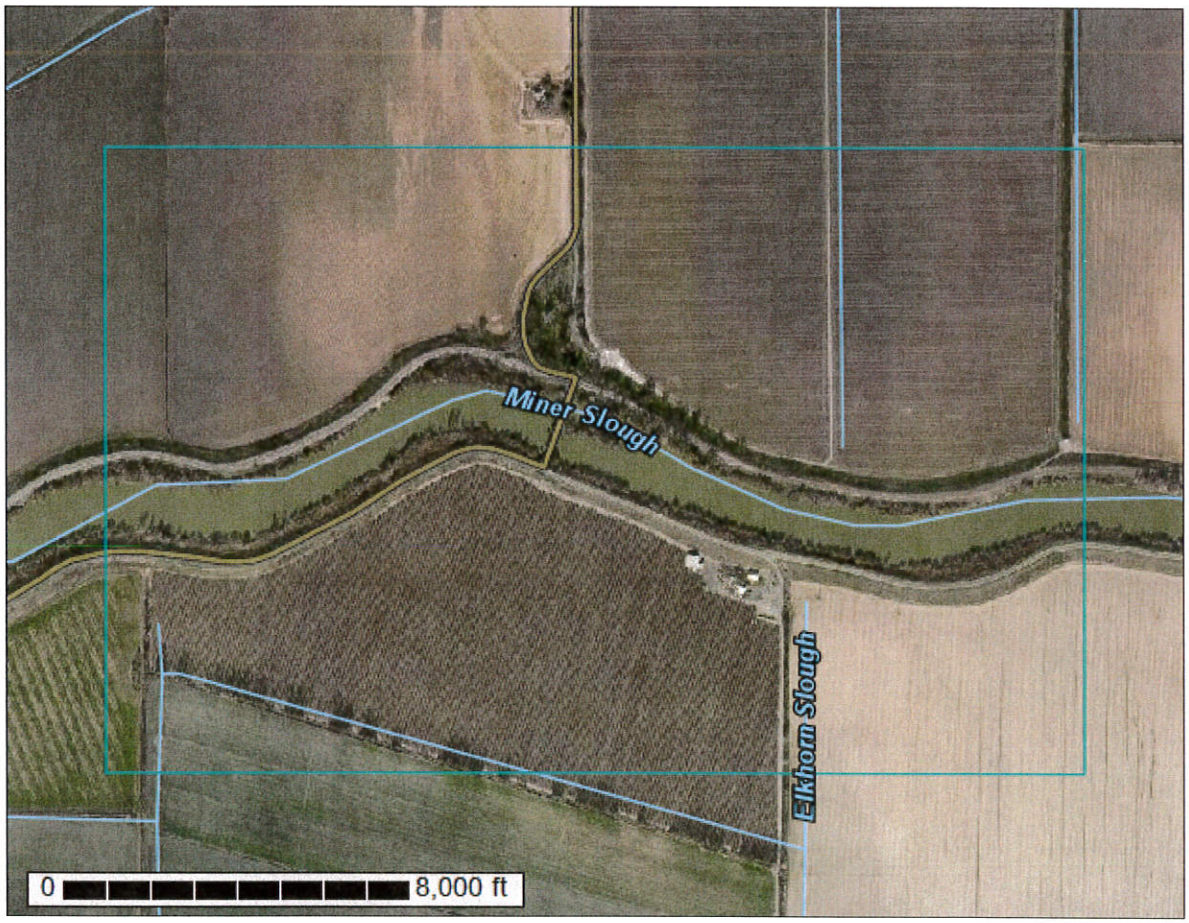
United States Department of Agriculture

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



May 1, 2014

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.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means

for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

Preface.....2
How Soil Surveys Are Made.....5
Soil Map.....7
Soil Map.....8
Legend.....9
Map Unit Legend.....10
Map Unit Descriptions.....10
Solano County, California.....12
Cm—Columbia fine sandy loam.....12
Sa—Sacramento silty clay loam.....13
Sd—Sacramento clay.....14
Va—Valdez silt loam drained.....15
W—Water.....16
References.....17

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.

Custom Soil Resource Report
Soil Map

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.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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 6, Nov 26, 2013

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**
Cm	Columbia fine sandy loam	94.1	36.9%
Sa	Sacramento silty clay loam	111.2	43.6%
Sd	Sacramento clay	0.0	0.0%
Va	Valdez silt loam drained	27.2	10.7%
W	Water	22.4	8.8%
Totals for Area of Interest		**254.9**	**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

Cm—Columbia fine sandy loam

Map Unit Setting

Elevation: 0 to 10 feet
Mean annual precipitation: 16 to 18 inches
Mean annual air temperature: 61 to 63 degrees F
Frost-free period: 260 to 280 days

Map Unit Composition

Columbia and similar soils: 85 percent
Minor components: 15 percent

Description of Columbia

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
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 48 to 60 inches
Frequency of flooding: Rare
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water capacity: Moderate (about 8.3 inches)

Interpretive groups

Farmland classification: Prime farmland if irrigated
Land capability classification (irrigated): 2s
Land capability (nonirrigated): 4e
Hydrologic Soil Group: A

Typical profile

0 to 16 inches: Fine sandy loam
16 to 23 inches: Fine sandy loam
23 to 55 inches: Stratified sand to silt loam
55 to 60 inches: Silty clay loam

Minor Components

Ryde

Percent of map unit: 5 percent
Landform: Marshes

Valdez

Percent of map unit: 5 percent

Landform: Alluvial fans

Egbert

Percent of map unit: 5 percent

Sa—Sacramento silty clay loam

Map Unit Setting

Elevation: 0 to 10 feet
Mean annual precipitation: 16 to 20 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 250 to 270 days

Map Unit Composition

Sacramento and similar soils: 85 percent
Minor components: 13 percent

Description of Sacramento

Setting

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

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
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 36 to 48 inches
Frequency of flooding: Rare
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water capacity: Moderate (about 8.7 inches)

Interpretive groups

Farmland classification: Prime farmland if irrigated
Land capability classification (irrigated): 2w
Land capability (nonirrigated): 4w
Hydrologic Soil Group: C

Typical profile

0 to 15 inches: Silty clay loam
15 to 60 inches: Clay

Minor Components

Sacramento

Percent of map unit: 8 percent
Landform: Basin floors

Egbert

Percent of map unit: 5 percent
Landform: Basin floors

Sd—Sacramento clay

Map Unit Setting

Elevation: 0 to 10 feet
Mean annual precipitation: 16 to 20 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 250 to 270 days

Map Unit Composition

Sacramento and similar soils: 85 percent
Minor components: 15 percent

Description of Sacramento

Setting

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

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
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 36 to 48 inches
Frequency of flooding: Rare
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water capacity: Moderate (about 8.1 inches)

Interpretive groups

Farmland classification: Prime farmland if irrigated
Land capability classification (irrigated): 2w
Land capability (nonirrigated): 4w
Hydrologic Soil Group: C

Typical profile

0 to 27 inches: Clay
27 to 60 inches: Clay

Minor Components

Clear lake

Percent of map unit: 5 percent
Landform: Basin floors

Egbert

Percent of map unit: 5 percent
Landform: Basin floors

Sacramento

Percent of map unit: 3 percent
Landform: Basin floors

Ryde

Percent of map unit: 2 percent
Landform: Basin floors

Va—Valdez silt loam drained

Map Unit Setting

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

Map Unit Composition

Valdez and similar soils: 85 percent
Minor components: 15 percent

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

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
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
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water capacity: High (about 10.4 inches)

Interpretive groups
Farmland classification: Prime farmland if irrigated
Land capability classification (irrigated): 2w
Land capability (nonirrigated): 4w
Hydrologic Soil Group: C

Typical profile
0 to 12 inches: Silt loam
12 to 60 inches: Silt loam

Minor Components

Columbia
Percent of map unit: 10 percent

Unnamed, loam
Percent of map unit: 5 percent

W—Water

Map Unit Composition
Water: 100 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

Appendix C: Representative Photos

Photo 1: VIEW FROM UPSTREAM OF THE EXISTING SR 84 MINER SLOUGH BRIDGE LOOKING DOWNSTREAM (SEPTEMBER 2013).

PHOTO 2: FROM DOWNSTREAM OF EXISTING SR 84 MINER SLOUGH BRIDGE LOOKING UPSTREAM (SEPTEMBER 2013).

PHOTO 3: RIPARIAN VEGETATION ALONG MINER SLOUGH (SEPTEMBER 2013).

PHOTO 4: FROM BRIDGE LOOKING DOWNSTREAM (SEPTEMBER 2013).

PHOTO 5: FROM BRIDGE LOOKING UPSTREAM (SEPTEMBER 2013).

PHOTO 6. FROM BRIDGE LOOKING UPSTREAM AT ISLAND VEGETATION (MARCH 2014).

M e m o r a n d u m

Flex your power!
Be energy efficient!

Date: May 12, 2015

To: File

File: 04-SOL-84
PM 12.1
EA 0G660
EFIS 0400000343

From: **Erik Schwab**
Associate Environmental Planner
Office of Biological Sciences and Permits

Subject: Protocol Level Plant Surveys for the Two New Areas North and West of the Miner Slough Bridge

Additional protocol level plant surveys were conducted on March 5 and April 16, 2015 in two new areas just north of the bridge, and west of the bridge on private property. The new three acre area north of the bridge was a former home site (buildings are gone) but now consists of choking weedy invasive grasses such as *Avena fatua*, *Bromus hordeaceous*, and *Bromus diandrus,* and broadleaved weedy vegetation that includes C*onium maculatum, Marva parviflora,* and *Erodium cicutarium.* Trees on the property were *Juglans nigra, Ficus carica,* and *Olea europaea*.

The second new area west of the bridge is a 0.25 acre parcel on private property, on Ryer Road, which includes a home/farm house. The surveyed area on this property was highly disturbed and completely denuded of any plant life. Soil was obviously compacted from vehicles (trucks and tractors) driving across the property.

Table 1: ***Special Status Potentially in the New Areas***

Scientific Name	Common Name	Status Fed/State/CNPS	Result
Astragalus tener var. ferrisiae	Ferris' milk-vetch	None/None/1B.1	Not found during surveys. Closest CNDDB occurrence is 8 miles away.
Astragalus tener var. tener	Alkali milk-vetch	None/None/1B	Not found during surveys. Closest CNDDB occurrence is 8 miles away.
Atriplex cordulata var. cordulata	heartscale	None/None/1B.2	Not found during surveys. Closest CNDDB occurrence is 8 miles away.
Atriplex depressa	brittlescale	None/None/1B.2	Not found during surveys. Closest CNDDB occurrence is 10 miles away.
Atriplex joaquinana	San Joaquin spearscale	None/None/1B.2	Not found during surveys. Closest

			CNDDB occurrence is 6 miles away from 1891.
Atriplex persistens	vernal pool smallscale	None/None/1B.2	Not found during surveys. Closest CNDDB occurrence is 11 miles away.
Brasenia schreberi	watershield	None/None/2B.3	Not found during surveys. Closest CNDDB occurrence is 7 miles away and is from 1976.
Carex comosa	bristly sedge	None/None/2B.1	Not found during surveys. Closest CNDDB occurrence is 6 miles away.
Centromadia parryi ssp. parryi	pappose tarplant	None/None/1B.2	Not found during surveys. Closest CNDDB occurrence is 14 miles away from 1933.
Cicuta maculata var. bolanderi	Bolander's water-hemlock	None/None/2B.1	Not found during surveys. Closest CNDDB occurrence is 6 miles away.
Downingia pusilla	dwarf downingia	None/None/2B.2	Not found during surveys. No vernal pools found in PSA. Closest CNDDB occurrence is 9 miles away.
Fritillaria liliacea	fragrant fritillary	None/None/1B.2	Not found during surveys. Closest CNDDB occurrence is 9 miles away.
Fritillaria pluriflora	adobe-lily	None/None/1B.2	Not found during surveys. Closest occurrence is 14 miles away and is from 1920.
Gratiola heterosepala	Boggs Lake hedge-hyssop	None/Endangered/1B.2	Not found during surveys. Closest CNDDB occurrence is 8 miles away.
Hibiscus lasiocarpus var. occidentalis	Woolly rose-mallow	None/None/2	Not found during surveys. However, it was detected nearby within the BSA in 2002, but not in the new areas.
Juglans hindsii	Northern California black walnut	None/None/1B.1	Not found during surveys. Closest CNDDB occurrence is 3 miles away, but is known to be extirpated. Next closest population is 32 miles away.
Isocoma arguta	Carquinez goldenbush	None/None/1B.1	Not found during surveys. Minimal

			grassland found in PSA. Closest CNDDB occurrence is 9 miles away.
Lathyrus jepsonii var. jepsonii	Delta tule pea	None/None/1B.2	Not found during surveys. Closest CNDDB occurrence is 2 miles away. Was found in neighboring Lindsay Slough.
Legenere limosa	legenere	None/None/1B.1	Not found during surveys. No vernal pools found in BSA. Closest CNDDB occurrence is 9 miles away.
Lepidium latipes var. heckardii	Heckard's pepper-grass	None/None/1B.2	Not found during surveys. Closest CNDDB occurrence is 4 miles away.
Lilaeopsis masonii	Mason's lilaeopsis	None/None/1B.1	Not found during surveys. CNDDB occurrences within 1.5 miles of BSA. Was found in neighboring Lindsay Slough
Limosella australis	Delta mudwort	None/None/2B.1	Not found during surveys. Closest CNDDB occurrence is 4 miles away.
Navarretia leucocephala ssp. bakeri	Baker's navarretia	None/None/1B.1	Not found during surveys. Vernal pools not found in BSA. Closest CNDDB occurrence is 8 miles away.
Neostapfia colusana	Colusa grass	Threatened/Endangered/1B.1	Not found during surveys. No vernal pools found in BSA. Closest CNDDB occurrence is 10 miles away.
Plagiobothrys hystriculus	bearded popcornflower	None/None/1B.1	Not found during surveys. Vernal pools not found in PSA. Closest CNDDB occurrence is 8 miles away.
Sagittaria sanfordii	Sanford's arrowhead	None/None/1B.2	Not found during surveys. However, it was detected within the BSA in 2002, but not within the new areas.
Scutellaria lateriflora	side-flowering skullcap	None/None/2B.2	Not found during surveys. Closest CNDDB occurrence is 7

			miles away.
Sidalcea keckii	Keck's checkerbloom	Endangered/None/1B.1	Not found during surveys. Minimal woodland and grassland in BSA. Closest CNDDB occurrence is 12 miles away and from 1892 and 1943.
Symphyotrichum lentum	Suisun Marsh aster	None/None/1B.2	Not found during surveys. Closest CNDDB occurrence is within 1.3 miles. Found in neighboring Lindsay Slough.
Trifolium hydrophilum	saline clover	None/None/1B.2	Not found during surveys. Closest CNDDB occurrence is 7 miles away.
Tuctoria mucronata	Crampton's tuctoria or Solano grass	Endangered/Endangered/1B.1	Not found during surveys. No vernal pools found in BSA. Closest CNDDB occurrence is 10 miles away.

Results:
Surveys were completed to look for special status plants (Table 1) in the two new areas. Due to the concentration of invasive grassy weedy plants north of the bridge, no special status species were located or identified. The second location west of the bridge, on private property, also did not yield any special status plants. This site did not yield any special status plants because the soil at this site is highly disturbed/compacted from vehicles traversing the site.

If you have any questions please contact Erik Schwab at (510) 286-5627 or Christopher States at (510) 286-7185.

cc: Christopher States
Erik Schwab
David Lungren

Appendix E Valley Elderberry Longhorn Beetle Habitat Assessment

Miner Slough Bridge Repair Project

Valley Elderberry Longhorn Beetle Habitat Assessment

State Route (SR) 84
Solano County, California

04-SOL-84-PM 12.1

Caltrans District 04
EA 0G660/PIN 04-0000-0343

August 2014

For individuals with sensory disabilities, this document is available in Braille, large print, on audiocassette, or computer disk. To obtain a copy in one of these alternate formats, please call or write to Caltrans, Attn: Christopher States, District 4, 111 Grand Avenue, Oakland CA 94612, (510) 286-7185 Voice, or use the California Relay Service TTY number, (800) 735-2929.

Miner Slough Bridge Repair Project

Valley Elderberry Longhorn Beetle Habitat Assessment

State Route (SR) 84
Solano County, California

04-SOL-84, PM 12.1

Caltrans District 04
EA 0G660/PIN 04-0000-0343

August 2014

U.S. DEPARTMENT OF TRANSPORTATION
Federal Highway Administration, and
STATE OF CALIFORNIA
Department of Transportation

Prepared By: _____ Date: 8/28/14
Jeanette Weisman
(510) 587-7724
CH2M HILL
Oakland, CA

Reviewed By: _____ Date: 8-29-14
Erik Schwab, Associate Environmental Planner-Biologist
(510) 286-5627
Office of Biological Sciences and Permits
District 4, Oakland
California Department of Transportation

Approved By: _____ Date: 8-29-14
Signed for
Christopher States, District Branch Chief
(510) 286-7185
Office of Biological Sciences and Permits
District 4, Oakland
California Department of Transportation

Table of Contents

List of Abbreviated Terms vii
Chapter 1 Introduction 1
1.1 Project Description 1
1.2 Site Conditions 2
1.3 VELB Natural History 2
Chapter 2 Methods 7
2.1 Field Methodology and Data Collection 7
2.2 Other Information Reviewed 7
2.3 Field Investigation 7
Chapter 3 Results 13
3.1 Background 13
3.2 Project Site Habitat Conditions 13
3.3 Record Locations 14
3.4 Survey Results 14
3.5 Conclusion 15
Chapter 4 References 17

List of Tables

Table 1 Elderberry Plants Observed Onsite 14

List of Figures

Figure 1 Project Location 3
Figure 2 CNDDB Valley Elderberry Longhorn Beetle Occurrences 9
Figure 3 Project Survey Area and Elderberry Location 11

List of Appendices

Appendix A CNDDB Element Occurrence Records for Valley Elderberry Longhorn Beetle within the Liberty Island and Courtland USGS 7.5 Minute Quadrangles

Appendix B USFWS Threatened and Endangered Species List for the Liberty Island USGS 7.5 Minute Quadrangle

Appendix C Representative Photographs

List of Abbreviated Terms

Caltrans	California Department of Transportation
CDFW	California Department of Fish and Wildlife
CNDDB	California Natural Diversity Database
ft	feet
FR	Federal Register
PM	Post Mile
SR	State Route
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VELB	valley elderberry longhorn beetle

Chapter 1 Introduction

CH2M HILL Biologists Jeanette Weisman and Holly Barbare conducted a reconnaissance survey for the California Department of Transportation's (Caltrans') Miner Slough Bridge Repair Project (the Project) located approximately 13 miles north of Rio Vista in Solano County, California on April 23, 2014. The bridge is located at post mile (PM) 12.1 on State Route (SR) 84. The purpose of the survey was to evaluate the potential for the federally threatened valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) (VELB) to occur within the Project's impact area. This report presents a review of the habitat assessment methods and findings.

1.1 Project Description

Caltrans proposes to repair or replace the bridge on SR 84 over Miner Slough. The site is located within Section 1, Township 5 North, Range 3 East on the U.S. Geological Survey (USGS) Liberty Island, California 7.5 minute quadrangle.

SR 84 traverses the Sacramento-San Joaquin delta area as a levee road. It is a north-south, two-lane conventional highway that runs adjacent to agriculture, as well as limited residential, commercial, and industrial land. The Miner Slough Bridge is located approximately 13 miles north of Rio Vista in Solano County. Figure 1 depicts the regional vicinity and site location.

The 2007 Structure Replacement and Improvements Needs (STRAIN) Report indicates a need to replace the bridge superstructure. There are checks and cracks in the spans which may decrease the weight-carrying capability of the bridge as they expand over time.

The purpose of the Project is to maintain the connectivity to and from Ryer Island via the Miner Slough Bridge on SR 84 by rehabilitating the existing structure. Rehabilitation can be accomplished by repairing it or replacing it with a new bridge. Repairing the bridge would include replacement of its superstructure. On the other hand, if the replace alternative is chosen, a new bridge would be constructed on a new alignment with improvements such as lanes and shoulders of standard width, standard vertical clearance, and flares at each end providing extra width for truck turning movements.

1.2 Site Conditions

The bridge spans Miner Slough on SR 84 within the Sacramento/San Joaquin River Delta. It is a rural area consisting largely of agricultural fields. The banks of the slough are dominated by riparian vegetation, with some open areas with riprap and an access road adjacent to the bridge along the north bank of Miner Slough. Below the edge of the banks the slough has been left in a relatively undisturbed state.

1.3 VELB Natural History

Longhorn beetles (family *Cerambidae*) are characterized by somewhat elongate, cylindrical bodies with long antennae, often more than 2/3 of the body length. VELBs are relatively stout-bodied.

Males range in length from about 1/2 to nearly 1 inch (measured from the front of the head to the end of the abdomen) with antennae about as long as their bodies. Females are slightly more robust than males, measuring about 3/4 to 1 inch, with somewhat shorter antennae. Adult males have red-orange elytra (wing covers) with four elongate spots. The red-orange faded to yellow on some museum specimens. Adult females have dark colored elytra.

Distribution

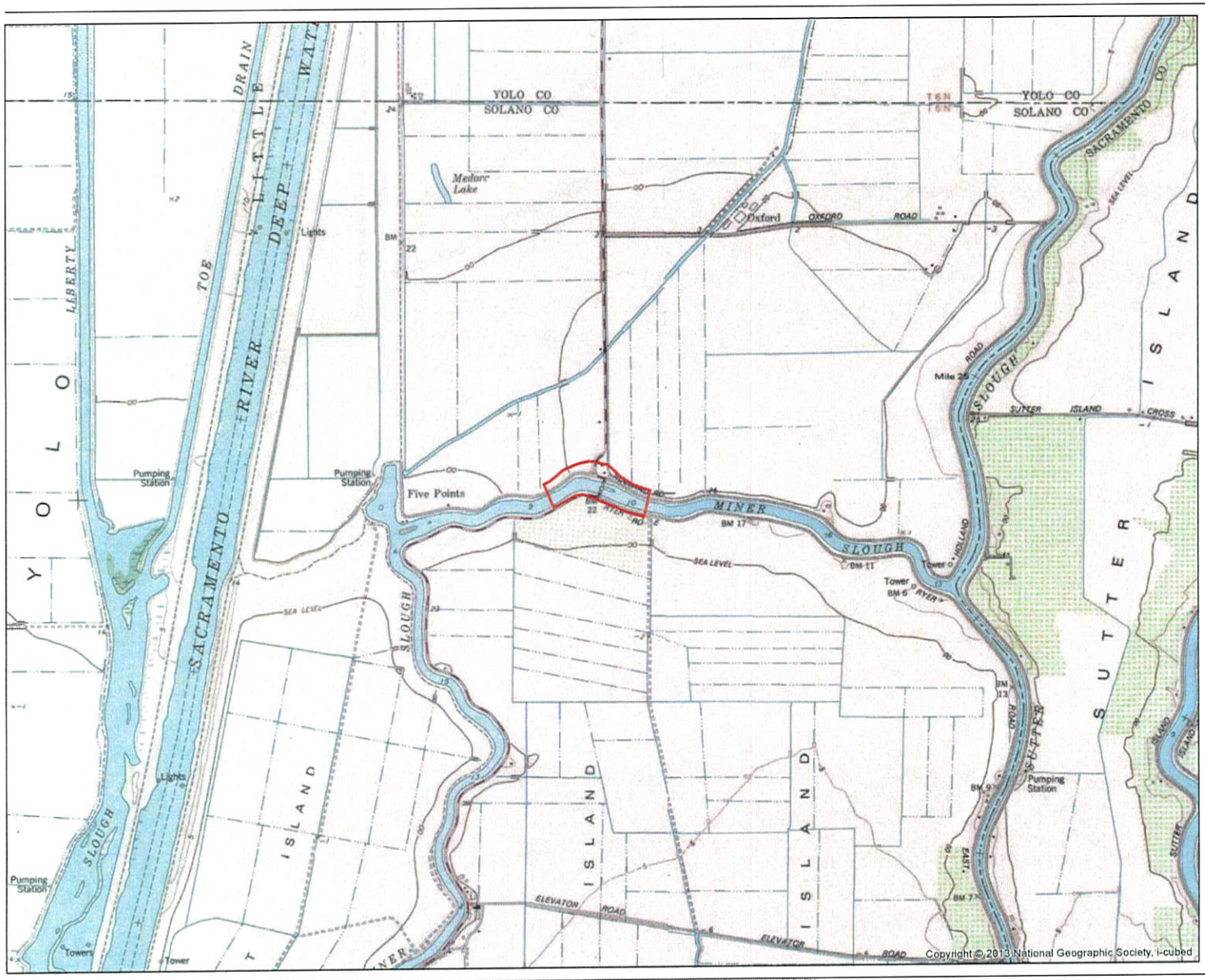
At the time of listing in 1980, the beetle was known from 10 occurrences in three locations: the American River, Putah Creek, and Merced River (U.S. Fish and Wildlife Service [USFWS] 1980). The area of current known VELB occupancy has been expanded to include 31 counties from Shasta County to Kern County (USFWS 1999 and 2012).

Habitat Requirements

To serve as habitat, host elderberry plants must have stems that are one inch or greater in diameter at ground level. Use of the plants by the animal is rarely apparent. Frequently, the only exterior evidence of the shrub's use by the beetle is an exit hole created by the larva just before the pupal stage.

Reproduction

There are four stages in the animal's life: egg, larva, pupa and adult. The species is nearly always found on or close to its elderberry host plant. Females lay their eggs on the bark or leaves. Larvae hatch and burrow into the stems. The larval stage may last one to two years, after which the larvae burrow out of the elderberry stem, enter the



VICINITY MAP

LEGEND

Project Limits

0 2,000 4,000 Feet

FIGURE 1
Project Location
Miner Slough Bridge Repair
EA 04-0G660 , SR SOL84 PM 12.1
Solano County, California

pupal stage, and transform into adults. Adults are active from March to June, feeding and mating.

Population Threats

Extensive destruction of California's Central Valley riparian forests has occurred during the last 150-200 years due to agricultural and urban development. According to some estimates, riparian forest in the Central Valley has declined by as much as 89 percent during that time period. The VELB, though wide-ranging, experienced a long-term decline due to human activities that have resulted in widespread alteration and fragmentation of riparian habitats, and to a lesser extent, upland habitats, which support the beetle (USFWS 2012).

The primary threats to survival of the beetle at the time of its listing in 1980 include:

- Loss and alteration of habitat by agricultural conversion
- Inappropriate grazing practices
- Levee construction, stream and river channelization, removal of riparian vegetation, and rip-rapping of shoreline
- Non-native animals such as the Argentine ant, which may eat the early phases of the beetle
- Recreational, industrial and urban development
- In addition, insecticide and herbicide use in agricultural areas and along road right-of-ways may be factors limiting the beetle's distribution
- The age and quality of individual elderberry shrubs/trees and stands as a food plant for beetle may also be a factor in its limited distribution

Chapter 2 Methods

2.1 Field Methodology and Data Collection

Field methodology followed USFWS's Conservation Guidelines for the Valley Elderberry Longhorn Beetle (USFWS 1999). Data collected included general habitat notes; elderberry (*Sambucus* spp.; the VELB's host plant) locations, stem sizes and observations; and digital photographs. Surveyors also searched for VELB and VELB holes along elderberry.

2.2 Other Information Reviewed

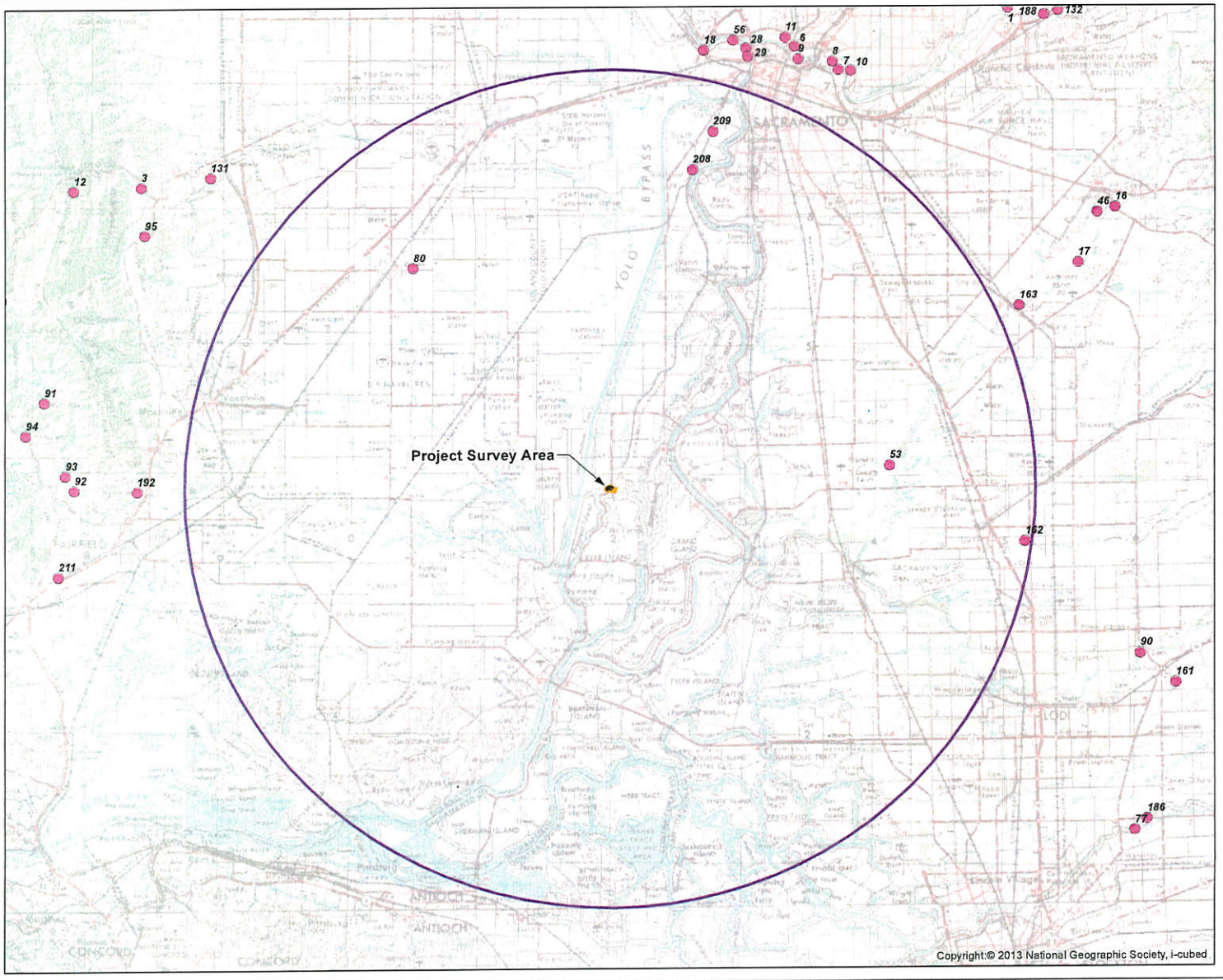
The following resources were checked for VELB occurrences in the Project vicinity:

- California Natural Diversity Database (CNDDB) (California Department of Fish and Wildlife [CDFW] 2014) for the Project's Liberty Island 7.5 minute USGS Quadrangle and adjacent Courtland Quadrangle (see Figure 2 and Appendix A).
- USFWS Sacramento Fish and Wildlife Office's online endangered species database for the Project's 7.5 minute Liberty Island USGS Quadrangle (USFWS 2014) (see Appendix B).

2.3 Field Investigation

A field assessment of the Project survey area (Figure 3), which is based on mapping provided by Caltrans, was conducted on April 23, 2014 by CH2M HILL Biologists Holly Barbare and Jeanette Weisman. The surveyors traversed the survey area searching for elderberry, which is the host plant for the federally threatened valley elderberry longhorn beetle, focusing on the riparian habitat along the banks of the slough.

Noted attributes included riparian vegetation conditions, general structure, and bank conditions. Elderberry stems were measured for diameter at ground level and were searched for holes that might indicate VELB occupancy.



VICINITY MAP

LEGEND

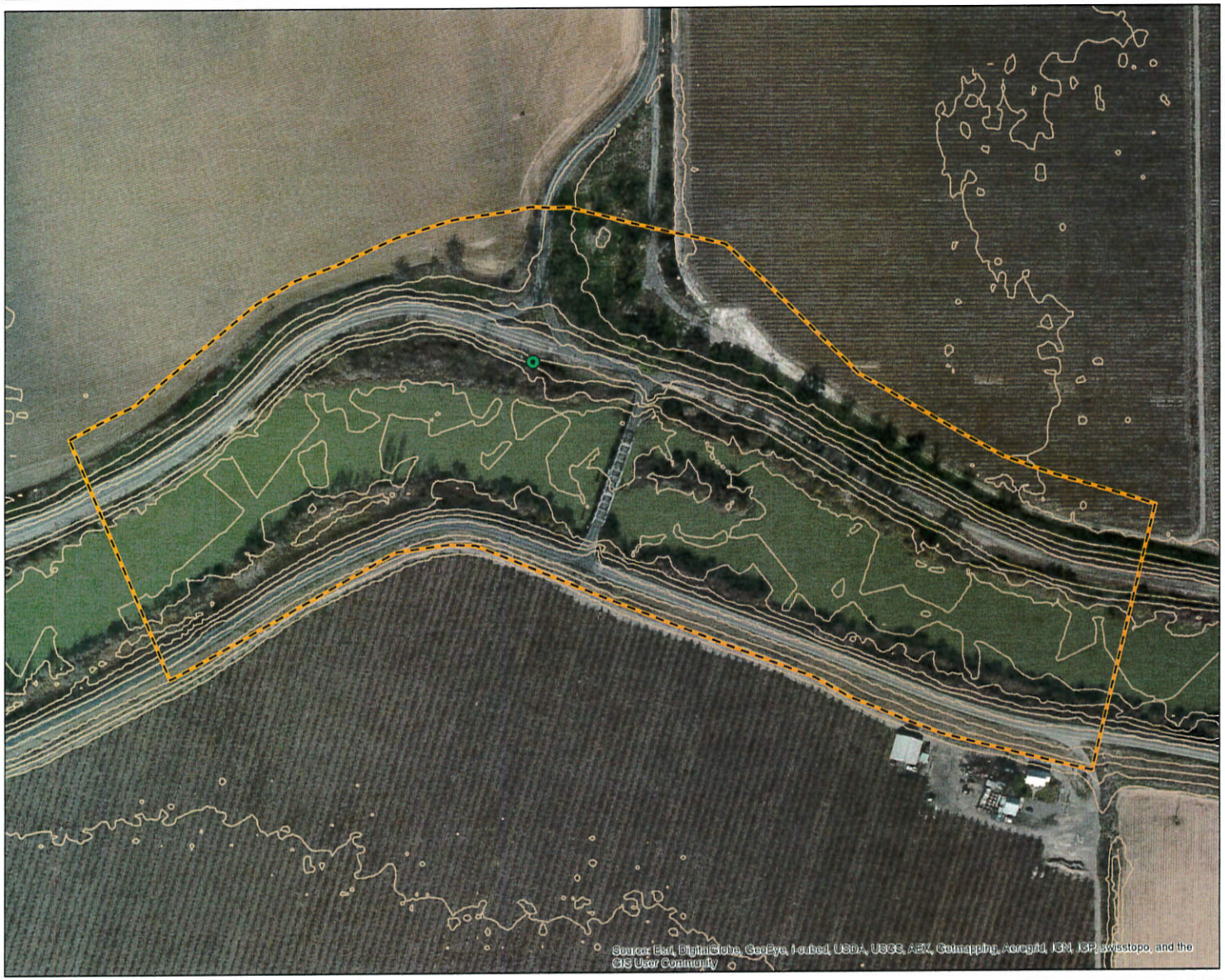
- Project Survey Area
- 20 Miles From Project Area
- Valley elderberry longhorn beetle

Note:
CNDDB version June 2014.
The occurrences shown on this map represent the known locations of the species listed here as of the date of this version. There may be additional occurrences or additional species within this area which have not yet been surveyed and/or mapped. Lack of information in the CNDDB about a species or an area can never be used as proof that no special status species occur in an area.

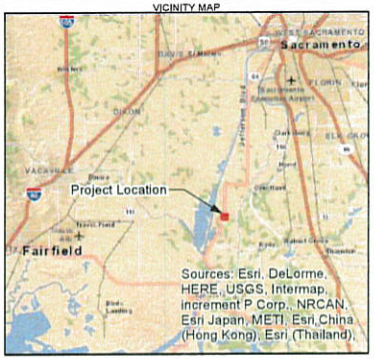
N

0 4 8 Miles

FIGURE 2
CNDDB Valley Elderberry Longhorn Beetle Occurrences
Miner Slough Bridge Repair
EA 04-0G660 , SR SOL84 PM 12.1
Solano County, California



VICINITY MAP



LEGEND

- Project Survey Area
- Elderberry location (cluster of 4 plants)
- 5 Foot Elevation Contours

N

0 200 400 Feet

FIGURE 3
Project Survey Area and Elderberry Location
Miner Slough Bridge Repair
EA 04-0G660 , SR SOL84 PM 12.1
Solano County, California

Chapter 3 Results

3.1 Background

The VELB was federally listed as a threatened species under the federal Endangered Species Act on August 8, 1980 (45 FR 52804). The Valley Elderberry Longhorn Beetle Recovery Plan was completed on June 28, 1984 (USFWS 1984). Critical habitat has been designated in two areas along the American River in the Sacramento metropolitan area: (1) the Sacramento Zone and (2) the American River Parkway Zone. In addition, an area along Putah Creek, Solano County, and the area west of Nimbus Dam along the American River Parkway, Sacramento County, are considered essential habitat, according to the Valley Elderberry Longhorn Beetle Recovery Plan (USFWS 1984). This animal is found only in association with its host plant, elderberry shrubs. These critical habitat units and essential habitat areas within the American River Parkway and Putah Creek support large numbers of mature elderberry shrubs with extensive evidence of use by the beetle.

A Five Year Status Review for the beetle completed in September 2006 (USFWS 2006) found that the number of sightings of the beetle has increased since the listing, and that protection of habitat supporting the beetle has substantially reduced the primary threats to the species. In 2012 USFWS proposed to remove the beetle from the list of endangered and threatened species (USFWS 2012).

3.2 Project Site Habitat Conditions

The majority of the survey area along Miner Slough was characterized by riparian vegetation. Common riparian species observed were willow (*Salix* spp.), tree of heaven (*Ailanthus altissima*), box elder (*Acer negundo*), white alder (*Alnus rhombifolia*), Fremont cottonwood (*Populus fremontii*), and walnut (*Juglans* sp.). Ruderal vegetation was present throughout much of the corridor, extending from the roadside to the riparian edge at varying distances. These areas were dominated by nonnative grasses and forbs such as wild oats (*Avena* sp.), rip-gut brome (*Bromus diandrus*), Italian rye grass (*Festuca perennis*), vetch (family *Fabaceae*), thistle (*Silybum marianum* and *Cirsium* spp.), and Himalayan blackberry (*Rubus armeniacus*). Patches of the native horsetail (*Equisetum* sp.) were also present along both the north and south banks of Miner Slough. Some open-unvegetated - patches existed along the bank, where riprap and gravel were present. The upland sides of the road were bordered by ruderal grassland which transitioned to agricultural fields,

adjacent roads, and residences. Representative pictures of habitat within the survey area are shown in Appendix C, Representative Photographs.

3.3 Record Locations

The closest VELB record noted in the CNDDB is approximately 13 miles away from the Project along the Cosumnes River in Sacramento County (occurrence #53). There are five other CNDDB VELB records that are farther away but fall within 20 miles of the Project, as shown in Figure 2 and Appendix A. The closest federally designated critical habitat unit is approximately 26 miles northeast of the Project.

3.4 Survey Results

The proposed Project falls within the known range of VELB but not within its designated critical habitat (USFWS 1980).

Biologists observed four elderberry plants in the north-central portion of the survey area on the north bank of Miner Slough west of the bridge (Figure 3). These mature, woody trees were clustered in a small area and are represented as one point on Figure 3, due to limited satellite reception. Data on the four elderberry plants are provided below in Table 1.

The elderberry trees were situated as part of a mature riparian canopy, and were estimated to be approximately 25 feet (ft) tall. This section of the riparian corridor was a mix of nonnative and native species. Species included the invasive tree of heaven and natives such as box elder, white alder, and willow. The understory was sparse but included wild oats, and mugwort (*Artemisia* sp.). The riparian corridor is bordered by ruderal roadside vegetation with nonnative ripgut brome, wild oats, wild radish (*Raphanus* sp.), black mustard (*Brassica nigra*), and thistle species.

Table 1 Elderberry Plants Observed Onsite

Location	Riparian/ Non-riparian	Stem Size (Maximum Diameter at Ground Level) (inches)	Exit Holes on Shrub? (Y/N)*
1	Riparian	6.9	N
2	Riparian	7.5	N
3	Riparian	3.9	N
4	Riparian	3.5	N

Note:The four locations are clustered in a single area as shown on Figure 3.

The elderberry trees were searched for exit holes, though none were observed and no VELB were observed during the survey.

The elderberry shrubs are located on the west side of SR 84, approximately 215 ft from the bridge. Based on findings of the Programmatic Biological Opinion (BO) for VELB (USFWS 1997), the Project will have no effect if direct or indirect actions from the Project occur more than 100 ft from the elderberry.

3.5 Conclusion

A small cluster of mature elderberry plants were observed within the survey area, along the north bank of Miner Slough approximately 215 ft west of the bridge. No exit holes were observed on these trees. However, because exit holes are not always visible (they may be plugged with pith or otherwise difficult to distinguish), it is difficult to determine VELB absence. Therefore, VELB avoidance and minimization measures are recommended if the elderberry plants fall within 100 ft of the Project impact area.

Chapter 4 References

California Department of Fish and Wildlife (CDFW). 2014. California Natural Diversity Database (CNDDB). Location summary reports for Valley Elderberry Longhorn Beetle within 20 miles of the Project. June 2014. Wildlife and Habitat Data Analysis Branch, California Department of Fish and Wildlife. Sacramento.

U.S. Fish and Wildlife Service (USFWS). 1980. Listing the valley elderberry longhorn beetle as a threatened species with critical habitat. Friday, August 8, 1980. Sacramento, California. Federal Register 45:52803-52807.

_____. 1984. Valley Elderberry Longhorn Beetle Recovery Plan. Portland, Oregon. 62 pp.

_____. 1999. Conservation Guidelines for the Valley Elderberry Longhorn Beetle. Available online at: http://www.fws.gov/sacramento/es/Survey-Protocols-Guidelines/Documents/velb_conservation.pdf.

_____.1997. Formal Programmatic Consultation Permitting Projects with Relatively Small Effects on the Valley Elderberry Longhorn Beetle Within the Jurisdiction of the Sacramento Field Office, California. Available online at: http://www.dot.ca.gov/ser/downloads/MOUs/velb_coe_programmatic.pdf.

_____. 2006. Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*). Five-year review: summary and evaluation. Sacramento, California. 28 pp.

_____. 2012. Endangered and Threatened Wildlife and Plants; Removal of the Valley Elderberry Longhorn Beetle From the Federal List of Endangered and Threatened Wildlife, Proposed Rule. Tuesday, October 2, 2012. Federal Register 77: 60238-60276.

_____. 2014. Quick Species List for Liberty Island USGS Quadrangle. Federal Endangered and Threatened Species that Occur in or May be Affected by Projects in the Counties and/or U.S.G.S. 7½ Minute Quads Requested. Sacramento Fish and Wildlife Office.

Appendix A CNDDB Element Occurrence Records for Valley Elderberry Longhorn Beetle within 20 Miles of the Project

OCCNUMBER	OBJECTID	QUAD	COUNTY	ACCURACY	PRESENCE	SITEDATE	LOCATION	ECOLOGICAL	GENERAL_	Dist in Miles to Project
163	5	Elk Grove	SAC	nonspecific area	Presumed Extant	1984XXXX	ALONG COSUMNES RIVER, NEAR WILTON.			19.6000004
162	8	Galt	SAC	nonspecific area	Presumed Extant	1984XXXX	ALONG DRY CREEK, EAST OF GALT			18.7999992
53	20	Bruceville	SAC	1/5 mile	Presumed Extant	19870423	ONETO TRACT, 2.25 MI E OF FRANKLIN FIELD, ALONG COSUMNES RIVER.		ONE STAND, CONSISTING OF A FEW MEDIUM-SIZED PLANTS, IS PROPOSED FOR LEVEE MAINTENANCE WORK.	12.8999996
208	26	Sacramento West	YOL	80 meters	Presumed Extant	20050513	0.3 MILE NORTH OF THE INTERSECTION OF SOUTH RIVER ROAD AND BURROWS AVENUE, ON THE WEST SIDE OF THE SACRAMENTO RIVER.	RIPARIAN GROWING ALONG STEEP BANKS OF AGRICULTURAL CANAL; DOMINATED BY BLUE ELDERBERRY, HIMILAYAN BLACKBERRY, BULL THISTLE, HORSETAIL, MUSTARD, POISON OAK, WILLOWS & OAK TREES. NEW STEMS IN TEMPORARY CONSTRUCTION EASEMENT SLATED FOR REMOVAL	THREATENED BY AGRICULTURE-RELATED PESTICIDE DRIFT, HERBICIDE USE NEAR ELDERBERRIES AND SEWER CONSTRUCTION.	15.6000004
209	28	Sacramento West	YOL	80 meters	Presumed Extant	20060517	0.6 MILE NNE OF THE INTERSECTION OF DAVIS ROAD & HARMON AVENUE, WEST SACRAMENTO.	HABITAT CONSISTS OF A SINGLE ELDERBERRY BUSH GROWING WITH WILLOWS AND HIMILAYAN BLACKBERRY.	THREATENED BY HERBICIDE SPRAYING BY THE RAILROAD COMPANY & PROPOSED DEVELOPMENT ON THE EAST SIDE OF THE RD-900 CANAL.	17.6000004
80	35	Dixon	SOL	80 meters	Presumed Extant	19910619	DUDLEY CREEK, JUST EAST OF PEDRICK ROAD, 0.1 MILE NORTH OF DIXON AVENUE, JUST EAST OF DIXON.	HABITAT CONSISTS OF ELDERBERRIES (SAMBUCUS MEXICANA) GROWING ALONG THE FENCE OF A RESIDENCE, ADJACENT TO AN AGRICULTURAL FIELD.		14

Appendix F Giant Garter Snake Survey

Miner Slough Bridge Replacement Project

Giant Garter Snake Survey

Solano County, California
04-SOL-84-PM 12.1/12.2
EA 0G660/ID 0400000343

September 2014

Caltrans

Giant Garter Snake Survey
Miner Slough Bridge Replacement Project, Solano, California

04-Sol-84-PM 12.1/12.2
EA 0G660/ID 0400000343

September 2014

STATE OF CALIFORNIA
Department of Transportation (Caltrans)

Prepared By: _____ Date: 9-10-14
Erik Schwab, District Biologist
(510) 286-5999
Office of Biological Sciences and Permits
District 4, Oakland
California Department of Transportation

Reviewed By: _____ Date: 9/10/14
Andrew Amacher, PhD, District Biologist
(510) 622-8727
Office of Biological Sciences and Permits
District 4, Oakland
California Department of Transportation

Signed for: Approved by: _____ Date: 9/10/14
Christopher States, District Branch Chief
(510) 286-7185
Office of Biological Sciences and Permits
District 4, Oakland
California Department of Transportation

For individuals with sensory disabilities, this document is available in Braille, large print, on audiocassette, or computer disk. To obtain a copy in one of these alternate formats, please call or write to Caltrans, Attn: Chris States, Office of Biological Sciences and Permits, 111 Grand Avenue, Oakland, CA 94623-0660; (510) 286-7185 Voice, or use the California Relay Service TTY number, (800) 735-2929.

Summary

The California Department of Transportation (Caltrans) proposes to replace the existing Miner Slough Bridge on State Route 84 over Miner Slough. The Miner Slough Bridge Replacement Project is located north of the City of Rio Vista at post mile (PM) 12.1 in Solano County.

The 2007 STRAIN (Structure Replacement and Improvements Needs) Report indicates a need to replace the bridge superstructure. The deck surface in all spans continuously exhibits refractory cracks caused by the differential deflection of its parallel wooden planks, which deteriorate into spalls that create pavement voids. There are checks and cracks in all spans which may decrease the weight carrying capability of the bridge as they break. The levee and roadway fill material are slumping near Abutment 12 exposing timber piles and resulting in roadway settlement.

The purpose of the project is to maintain the connectivity to and from Ryer Island through the Miner Slough Bridge on State Route 84 by rehabilitating the existing structure. Rehabilitation can be accomplished by repairing it or replacing it with a new bridge. Repairing the bridge would include replacement of its superstructure. If the replacement alternative is chosen, a new bridge would be constructed on a new alignment with improvements such as: lanes and shoulders of standard width, standard vertical clearance, and flares at each end providing extra width for truck turning movements.

Potential giant garter snake (*Thamnophis gigas*) habitat was assessed using a list of 25 variables in the project area. The giant garter snake is both state and federally listed as threatened. We surveyed habitat in the area 300 ft. upstream and downstream of the existing bridge. The habitat surrounding the Miner Slough Bridge was determined to be marginal for giant garter snakes. No giant garter snakes were observed during the survey.

Combined with historical and recent locality records, the presence of marginal habitat indicates a potential for giant garter snakes to occur in the project area.

Table of Contents

Summary iv

Chapter 1 Introduction and Regional Setting 1
1.1 Introduction 1
1.2 Project Location 1
1.3 Project Description 1
1.3.1 Project Area and Work Areas 2
1.4 Environmental Setting 2

Chapter 2 Species Background 5

Chapter 3 Study Methods 7
3.1 Introduction 7
3.2 Biologist Qualifications 7
3.3 Database Searches 7
3.4 Field Survey Protocols. 8

Chapter 4 Results and Discussion 11
4.1 Results 11
4.2 Discussion 12
4.3 Avoidance and Minimization Measures 12

Chapter 5 References 13

Tables

Table 1. Habitat assessment characteristics 8

Figures

Figure 1. Project Vicinity 3
Figure 2. Project Study Area 4
Figure 3. Giant Garter Snake CNDDB Occurrences 9
Figure 4. Habitat Types 10

Appendices

Appendix A – Representative Photographs
Appendix B & C – Example Habitat Evaluation Forms and Instructions
Appendix D – Habitat Evaluation Form for Miner Slough

List of Abbreviated Terms

°F	degrees Fahrenheit
ac	acre
BMP	best management practice
PSA	Project Study Area
Caltrans	California Department of Transportation
CCC	Central California Coast
CDFW	California Department of Fish and Wildlife
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
CRLF	California red-legged frog
dbh	diameter at breast height
DPS	distinct population segment
ESA	environmentally sensitive area
FESA	Federal Endangered Species Act
ft^2	square feet
MBGR	metal beam guard rail
MBTA	Migratory Bird Treaty Act
NES	Natural Environment Study
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
PCE	primary constituent element
PM	post mile
Project	Miner Slough Bridge Replacement Project
PVC	polyvinyl chloride

ROW	right-of-way
RSP	rock slope protection
RWQCB	Regional Water Quality Control Board
SR	State Route
STRAIN	Structures Replacement and Improvement Needs
SWPPP	stormwater pollution prevention plan
TCE	temporary construction easement
UCIPM	University of California Integrated Pest Management
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
yd^3	cubic yard(s)

Chapter 1 Introduction and Regional Setting

1.1 Introduction

This report describes the giant garter snake habitat survey for the Miner Slough Bridge Project conducted on April 9, 2014. This survey assessed the habitat potential for the area under and adjacent to the existing bridge.

The project area is located northeast of the City of Rio Vista on State Route (SR) 84 at PM 12.1 (Figure 1). It includes the Miner Slough Bridge which traverses the active channel of Miner Slough and adjacent lands. The study area for the 2014 survey, shown in Figure 2, consists of a roughly rectangular area of 6.2 acres. It includes all of the existing Caltrans right of way (ROW) and some adjacent private lands that may be used for project-related activities. Caltrans proposes to repair or replace the existing bridge.

1.2 Project Location

The Miner Slough Bridge is located northeast of the City of Rio Vista on SR 84 at post mile PM 12.1 in Solano County (Figure 1). The project area is located adjacent to the active channel of Miner Slough, which is a tributary of the Sacramento River. The project is in Rancho Los Ulpinos Land Grant in the Liberty Island United States Geological Survey (USGS) 7.5-minute topographic quadrangle. The Miner Slough Bridge is located at 38.29000 degrees north latitude and 121.63167 degrees west longitude (North American Datum 1983).

1.3 Project Description

Caltrans proposes to replace the existing Miner Slough Bridge on State Route 84 over Miner Slough. The 2007 STRAIN Report indicates a need to replace the bridge superstructure. The deck surface in all spans continuously exhibits refractory cracks caused by the differential deflection of its parallel wooden planks, which deteriorate into spalls that create pavement voids. There are checks and cracks in all spans which may decrease the weight.

The existing bridge is 367 feet (ft.) long and is composed of three sections with timber planks decks and a 2-inch thick asphalt concrete (AC) wearing surface. The 191-ft center steel truss swing span is on a reinforced concrete cylindrical swing pier, with reinforced concrete rest piers. The two approach spans are of timber stringers on timber cap and pile bents with abutments of reinforced concrete on timber piles.

1.3.1 Project Area and Work Areas

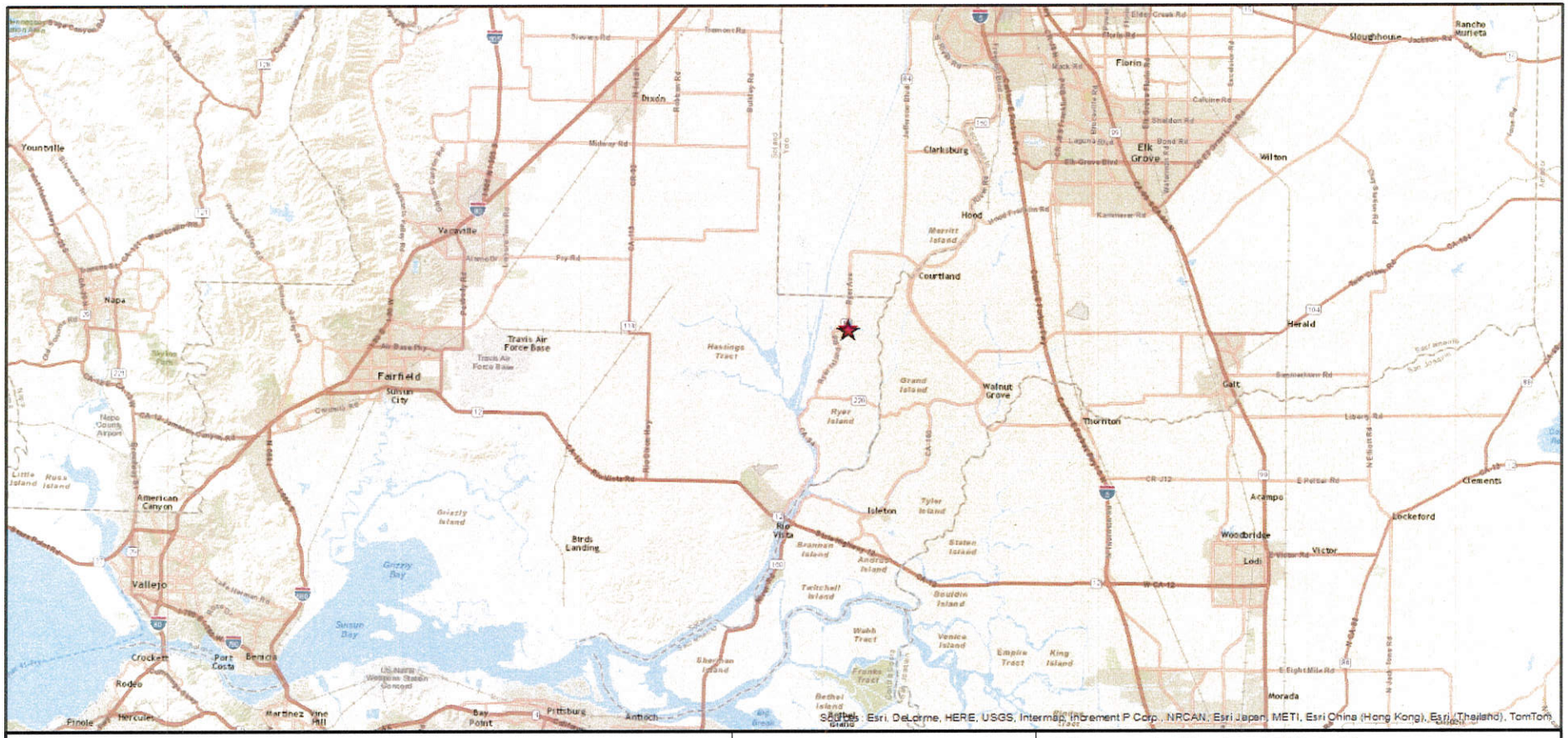
The project footprint includes Caltrans right of way (ROW) and is approximately 2.5 acres.

The project area spans across Miner Slough in a low-density agricultural area where the majority of the vegetation consists of native riparian forest with a mix of native and non-native species in the understory. A dense tree canopy formed by species such as white alder (*Alnus rhombifolia*), arroyo willow (*Salix lasiolepis*), and box elder (*Acer negundo*) shades the river banks. The understory vegetation includes wild grape (*Vitus californica*), poison hemlock (*Conium maculatum*), mugwort (*Artemesia douglasiana*), and Himalayan blackberry (*Rubus armeniacus*). On the upland slope vegetation consists of black walnut (*Juglans californica*), oats (*Avena sativa*), Himalayan blackberry, scouring rush (*Equisetum hymale*), and ripgut brome (*Bromus diandrus*). Please refer to Appendix A for representative site photos.

1.4 Environmental Setting

The project is located in the Central California Valley Ecoregion (Commission for Environmental Cooperation (CEC) 2011). The natural plant communities for this ecoregion are mainly chaparral and oak woodlands, with grasslands occurring in some locations (CEC 2011). In addition, some valley oak (*Quercus lobata*) savanna, riparian woodlands of oak, willow (*Salix spp.*), western sycamore *(Platanus racemosa),* cottonwood *(Populus fremontii)*, and tule marsh *(Typha latifolia*) occur (CEC 2011). The natural plant communities are alkali sink, foothill woodland, freshwater marsh, and valley grassland (CEC 2011).

The project study area (PSA), the area containing the project footprint plus an additional 300 ft. upstream and downstream of the existing bridge, is in a low-density area containing three main habitat types: valley foothill riparian, annual grassland, and agricultural land (Mayer and Laudenslayer 1988; Figure 2). Valley foothill riparian habitat is present throughout the Miner Slough riparian corridor and annual grassland habitat is found on the exterior of the road. In addition, cropland and pasture is associated with the rural residential development bordering the riparian corridor and SR 84.



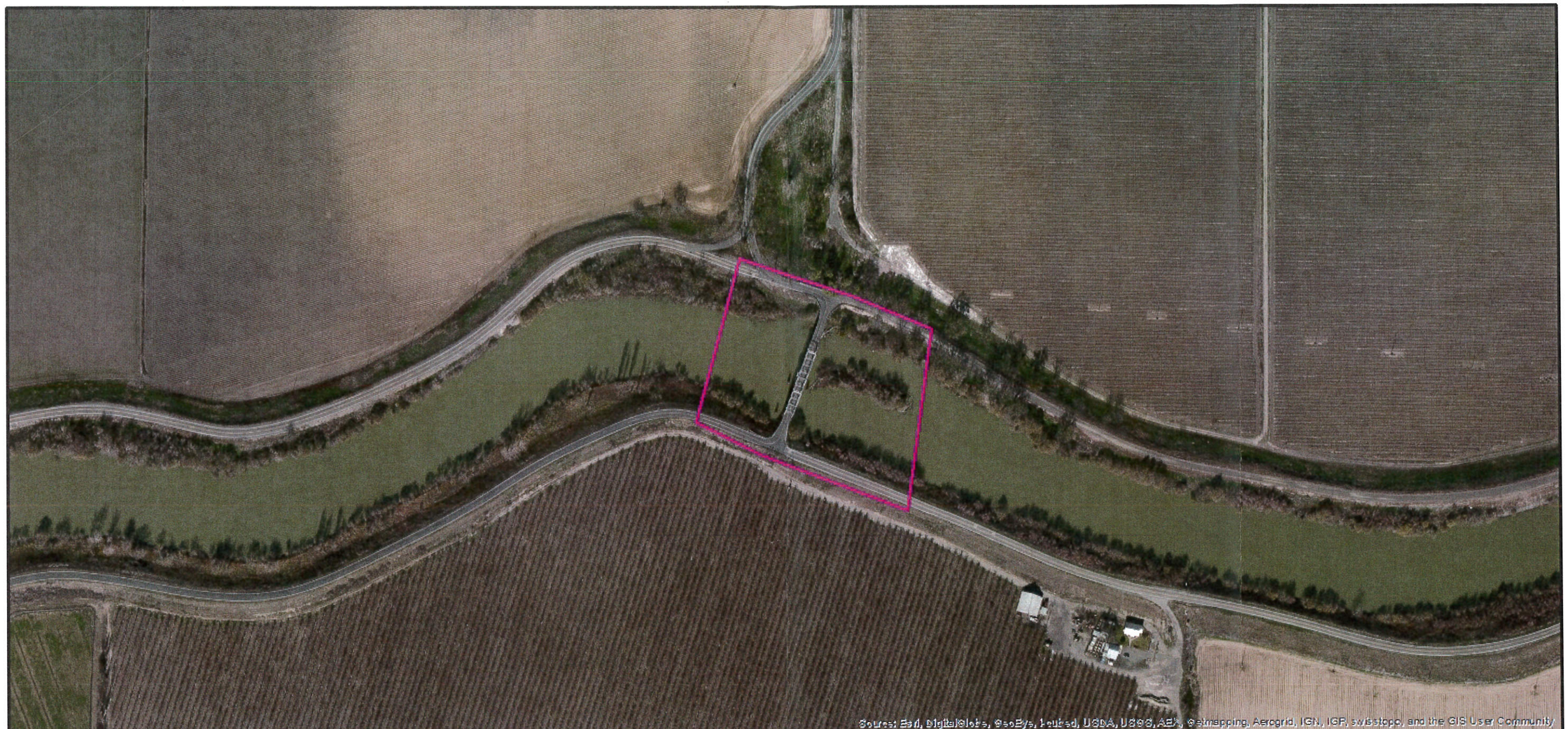
0 5 10 Miles

N

Figure 1. Project Vicinity

★ Miner Slough Bridge

Solano County
State Route 84 - PM 12.1



0 350 700 Feet

N

Figure 2. Project Study Area

Project Study Area (PSA)

Solano County
State Route 84 - PM 12.1

Chapter 2 Species Background

Distribution

Historically, giant garter snakes (GGS) ranged from northern Butte County to Kern County (USFWS 2012). Nine populations of GGS are known in California. The GGS populations north of the Delta Basin are thought to be relatively stable while the population in the San Joaquin Valley appears to be in serious and notable decline. Surveys from 2003 to 2011 have found the following numbers of individuals in specific sites: 57 (Yolo Wildlife Area), 45 (Volta Wildlife Area), 170-195 (Badger Creek), 46 (Conaway Ranch), and 87-250 (Natomas Basin) (USFWS 2012). Density ranges from 8 snakes per hectare (Badger Creek) to 1.7 snakes per hectare (Natomas Basin). Surveys conducted suggest populations at Burrell/Lanare and Liberty Farms in Yolo County have been extirpated (Hansen 2008b, USFWS 2012). Trapping surveys at 15 locations in Solano County found no giant garter snakes (Wylie and Martin 2004, 2005). These locations were considered to have potential giant garter snake habitat (Wylie and Martin 2004, 2005).

Habitat Requirements

GGS is native to the wetlands of the Sacramento and San Joaquin valleys in California's Central Valley. They inhabit marshes, sloughs, ponds, small lakes, low gradient streams, and other waterways and agricultural wetlands, such as irrigation and drainage canals, rice fields, and the adjacent uplands (USFWS 2012). Habitat consists of adequate water during the snake's active season, emergent herbaceous wetland vegetation for escape and foraging habitat, grassy banks and openings in waterside vegetation for basking, and higher elevation upland habitat for cover and refuge from flooding.

Reproduction

GGS become sexually active at age three for males and age five for females. GGS breed in March and April. Females brood young internally and give birth to live young in late July through early September (USFWS 2012). During the late fall and winter months, GGS are inactive or have reduced activity.

Behavior

GGS is one of the largest garter snakes, reaching an average total length of 63.7 inches (USFWS 2012). GGS are active in the summer season (April to October) and hibernate underground in burrows in the winter season (November to March). In the active season GGS are found primarily in aquatic habitat, and are found most often under vegetative cover

(Wylie 2010). GGS bask in bulrush (*Carex spp.*), cattails (*Typha spp.*), shrubs overhanging water, floating vegetation, and grassy banks (USFWS 1999). In the summer, GGS use burrows up to 165 ft. from the marsh edge. In response to disturbance, GGS retreat to or dive under water, remain motionless, or retreat underground. In cooler months, GGS may retreat into burrows, riprap, or vegetation (USFWS 1999). In the winter, GGS have been documented to use burrows as far as 820 ft. from aquatic habitat.

Movement

Giant garter snakes move little during daily activity. They usually remain in close proximity to wetland habitats, but have been found up to 820 ft. from the edge of aquatic habitat (USFWS 1999). GGS have been shown to move an average of 0.25 mile between small lateral ditches although some individuals have moved as far as 0.5 mile in one day (USFWS 1999).

Ecological Relationships

The diet of GGS consists mainly of small fishes, tadpoles, and frogs (USFWS 1999). GGS have been observed eating carp (*Cyprinus carpio*), mosquito fish (*Gambusia affinis*), bullfrogs (*Rana catesbeiana*), Sacramento blackfish (*Orthodox microlepidus*), and Pacific tree frogs (*Hyla regilla*). Predators of GGS include raccoons (*Procyon lotor*), striped skunks (*Mephitis mephitis*), opossums (*Didelphis virginiana*), foxes (*Vulpes vulpes*, *Urocyon cinereoagentius*), northern harriers (*Circus cyaneus*), egrets (*Ardea alba*, *Egretta thula*), bitterns (*Botaurus lentiginosus*), and great blue herons (*Ardea herodius*) (USFWS 1999). GGS may coexist with the valley garter snake (*Thamnophis sirtalis fitchi*) and western terrestrial garter snake (*Thamnophis elegans*).

Population Threats

Threats to GGS include urbanization, habitat fragmentation and population isolation, flood control and canal maintenance, agricultural practices, wetland management for waterfowl, non-native plants, and water transfers (USFWS 2012).

Compatible Land Uses

The highest density of GGS is found in areas with natural, perennial marshes, but they have been known to live in areas managed for other types of land use. Giant garter snakes have been shown to persist in areas dominated by rice, by foraging in flooded rice fields in the cover of the rice plants (Wylie et al. 2010). Irrigation canals are commonly used by GGS.

Seasonal wetlands managed for waterfowl are not ideal habitat for GGS if there is no aquatic habitat available during the active (summer) season.

Chapter 3 Study Methods

3.1 Introduction

The PSA for the 2014 survey, shown in Figure 2, consists of a roughly rectangular area of 6.2 acres. It includes all of the existing Caltrans ROW and some adjacent private lands that may be used for project-related activities. The project footprint covers approximately 2.5 ac. The PSA includes the project footprint plus an additional 300 ft. upstream and downstream of the existing bridge, for a total of 5 ac. The PSA was examined using the CNDDB database (CDFW 2014) to determine the proximity of GGS occurrences to the project footprint. The project footprint was assessed in the field to determine overall habitat quality of the site for GGS.

3.2 Biologist Qualifications

Whitney Brennan worked as a biological science technician for U.S. Geological Survey in Dixon, California in 2008 under the supervision of Glenn Wylie. For this position, she tracked ten GGS using radio telemetry, evaluated vegetation and habitat attributes at GGS locations, set up and checked funnel traps, and recorded physical characteristics of GGS individuals that were captured.

3.3 Database Searches

On March 25, 2014, Caltrans biologist Whitney Brennan reviewed the California Department of Fish and Wildlife (CDFW) California Natural Diversity Database (CNDDB) for occurrences of GGS within ten miles of the project footprint (CNDDB, CDFW 2014; Figure 3).

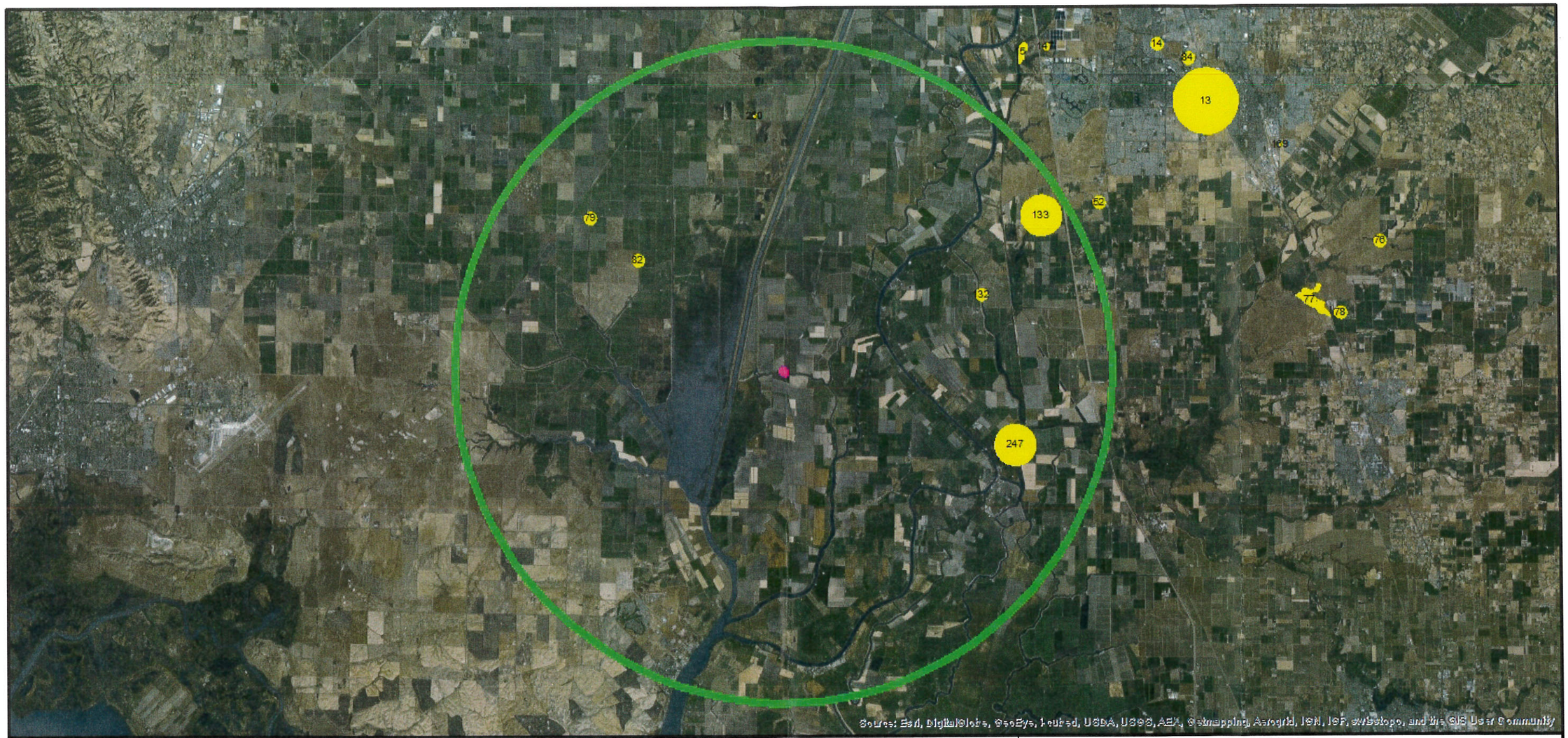
The United States Forest Service EVEG map GIS layer was used to assess the potential habitat types within Miner Slough and the surrounding upland area. The Programmatic Formal Consultation for U.S. Army Corps of Engineers 404 permitted projects defines GGS upland habitat as 218 linear feet of bankside habitat which incorporates adjacent uplands to a width of 200 ft. from the edge of bank (USFWS 2004). A 200 ft. buffer of upland on both sides of Miner Slough was assessed for habitat type and suitability (Figure 4).

3.4 Field Survey Protocols

A site visit was conducted on April 9, 2014 by Caltrans biologist Whitney Brennan to assess the habitat within the PSA for its potential to support GGS. Habitat was assessed using the methods developed by Hansen (2008a) which were modified from the USFWS (1999) Draft Recovery Plan for the Giant Garter Snake. Both banks of Miner Slough from 300 ft. upstream to 300 ft. downstream of the existing bridge were surveyed in the field to determine the overall habitat quality score for the PSA. The data sheet and classification system used can be found in Appendix B. The possible habitat classifications were unsuitable, marginal or suitable (Table 1; Hansen 2008a).

Table 1. Habitat assessment characteristics (adapted from Hansen 2008a)

Habitat Value	**Point Range**	**Description**
Suitable	14-19	Characterized by all of the features necessary to support permanent populations of garter snakes, including: 1) sufficient water during the active summer season to supply cover and food such as small fish and amphibians; 2) emergent, herbaceous aquatic vegetation accompanied by vegetated banks to provide basking and foraging habitat; 3) bankside burrows, holes and crevices to provide short-term aestivation sites; 4) high ground or upland habitat above the annual high-water mark to provide cover and refugia from floodwaters during the dormant winter season.
Marginal	7-13	Characterized by any combination of those features listed above needed to support transient giant garter snakes on a temporary basis, or to act as connective corridors between areas of more stable or desirable habitat. This habitat need only possess the water, vegetation, and refugia required to provide minimal coverage for dispersing snakes. Marginal habitat is incapable of supporting permanent populations of giant garter snakes and is typically ephemeral, providing no permanent source of prey.
Unsuitable	0-6	Devoid of the water, vegetation, and refugia necessary to support giant garter snakes for a meaningful time. Such habitat is generally composed of large rivers, lakes, gunite drains or temporary swales that possess no water during the active spring and summer seasons. As such, unsuitable habitat corridors are no more likely to support giant garter snakes than any other non-aquatic environment, and if they do so, they do so only by chance. Transient features, such as shallow trenches and furrows intended only to direct winter runoff, typically do not persist through the remainder of the season, do not provide the aquatic habitat necessary to support giant garter snakes for a meaningful time, and should therefore be assigned to this category. However, because transient features still exhibit characteristics such as winter water, bank sun, and bank or upland vegetation, they can accumulate the number of points necessary to qualify as marginal habitat in this evaluation scheme.



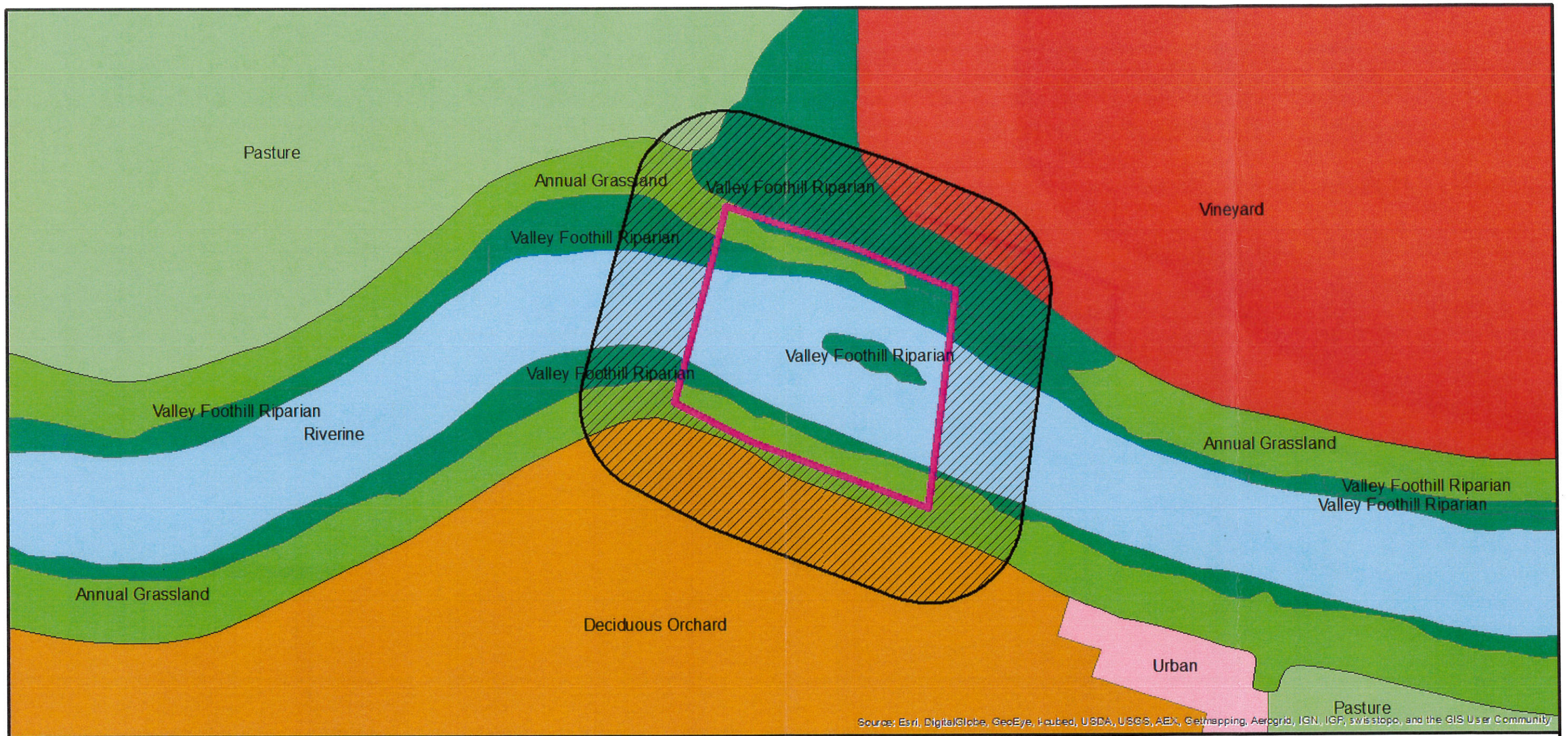
0 4 8
Miles

N

Figure 3.GGS CNDDB Occurrences

Project Study Area (PSA)
10MileBuffer
Giant Garter Snake Occurrences

Solano County
State Route 84 - PM 12.1



0 295 590 Feet

N

Figure 4. Habitat Types

Project Study Area (PSA)

200 ft. Buffer of PSA

Solano County
State Route 84 - PM 12.1

Chapter 4 Results and Discussion

4.1 Results

There are six giant garter snake CNDDB occurrence records within 10 miles of the project site (CDFW 2014). The closest occurrence (#82) is 5.4 miles away (one individual was observed in 1987 and an unknown number were observed in 1994 in an agricultural canal surrounded by pastures). The next closest occurrence (#242) is from 1992 when an unknown number of GGS were observed near Snodgrass Slough. The third occurrence (#79) is from 1987 in a canal crossing Swan Rd; one adult was observed. The fourth occurrence (#132) was discovered in Snodgrass Slough in 1986 and 1987. The fifth occurrence (#133) was found in Stone Lake in 1986 and 1987. The sixth occurrence (#250) is of an adult GGS captured at the Pope Ranch Mitigation/Conservation bank in the Yolo Bypass in 2008. Occurrences #79 and 82 are located within the Liberty Farms population of GGS in the Yolo Basin that is presumed extirpated based on recent studies (USFWS 2012).

No giant garter snakes were observed during the field survey. Using the habitat evaluation and scoring form, the habitat in the project footprint received a score of "8" (Appendix C). This falls into the "marginal" habitat category (Table 1).

Within the boundaries of the Miner Slough Bridge Project, potential habitat consists of the banks of the slough. At the time of analysis approximately 517 linear feet (lf) of potential habitat were present on each side of Miner Slough within the boundaries of the PSA. This entire potential habitat is considered marginal.

Overall, Miner Slough provides a source of water that is available year round. The banks are generally sunny and there is some terrestrial vegetation available on the banks and in adjacent uplands that provide cover for GGS. Although no burrows were observed during the field visit, there were cracks in the soil that could be used as refuge. On the north side of the slough, there is slow-flowing water over soil, silt, or mud along the bank. The south side of the slough had slightly less suitable habitat because the Slough is lined with rock slope protection (RSP) for erosion control. The adjacent land contained row crops, which are unsuitable for GGS. Predators of GGS, such as introduced gamefish, native snake species, raptors, herons, and raccoons may limit GGS presence in Miner Slough. Disturbance from recreational boating and fishing in Miner Slough may also affect the likelihood of GGS presence in the project area.

4.2 Discussion

Combined with historical and recent locality records, the presence of marginal habitat indicates a potential for giant garter snakes to occur in the project area. Although no GGS occurrences have been found within 5 miles of the PSA, the project is within the historic and currently recognized range of the species. In addition, it is located within the range of the GGS Delta Basin population (USFWS 2012) and GGS have been found in areas of similar habitat conditions. Because surveys have not been conducted within the area, there is insufficient information to discount its presence. Standard minimization and avoidance measures should be implemented to offset potential impacts.

4.3 Avoidance and Minimization Measures

It is recommended that the standard avoidance and minimization guidelines from the programmatic consultation for U.S. Army Corps of Engineers 404 permitted projects (USFWS 2004) and a previous biological opinion for the Antioch Bridge Seismic Retrofit Project (USFWS 2009) be implemented, where practicable, to minimize potential effects to GGS.

Chapter 5 References

Hansen, E.C. 2008a. *Evaluations of Giant Garter Snake (Thamnophis gigas) habitat and consideration of potential species impacts for the Antioch Bridge Seismic Retrofit Project, Sacramento County and Contra Costa County, California.* November 12, 2008. Unpublished. 25 pp.

Hansen, E. 2008b. *Implementation of priority 1, priority 2, and priority 3 recovery tasks for giant garter snake (Thamnophis gigas) – continuing surveys in Merced County,California, with an extension to northern Fresno County.* April 15, 2008. Unpublished.

U.S. Fish and Wildlife Service (USFWS). 2004. *Programmatic formal consultation for U.S. Army Corps of Engineers 404 permitted projects 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.* U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office. 1-1-F-97-149.

U.S. Fish and Wildlife Service (USFWS). 2009. *Biological Opinion for the Antioch Bridge Seismic Retrofit Project in Contra Costa and Sacramento Counties, California (Caltrans EA 1A5210) on the Threatened Delta Smelt, the Threatened Giant Garter Snake, and the Critical Habitat for the Delta Smelt.* Sacramento. 53 pages.

U.S. Fish and Wildlife Service (USFWS). 2012. *Giant Garter Snake (Thamnophis gigas) 5-Year Review: Summary and Evaluation.* Sacramento Fish and Wildlife Office. Sacramento, CA. September 2006.

Wylie, G. and L. Martin. 2005. *Surveys for Giant Garter Snakes in Solano County: 2005 Report.* USGS-BRD, Western Ecological Research Center, Dixon Field Station. 24 pp.

Wylie, G. D. and L. Martin. 2005. *Giant garter snake survey results for the Wildlands, Inc.Ridgecut Property.* U. S. Geological Survey, Biological Resources Division, Dixon Field Station, Dixon, California. March 2005.

Wylie, G.D., M.L. Casazza, C.J. Gregory, and B.J. Halstead. 2010. *Abundance and sexual size dimorphism of the giant garter snake (Thamnophis gigas) in the Sacramento Valley of California.* Journal of Herpetology 44(1): 94-103.

Appendix A Representative Photographs

Photo 1: VIEW FROM UPSTREAM OF THE EXISTING SR 84 MINER SLOUGH BRIDGE LOOKING DOWNSTREAM (SEPTEMBER 2013)

PHOTO 2: FROM DOWNSTREAM OF EXISTING SR 84 MINER SLOUGH BRIDGE LOOKING UPSTREAM (SEPTEMBER 2013).

PHOTO 3: RIPARIAN VEGETATION ALONG MINER SLOUGH (SEPTEMBER 2013)

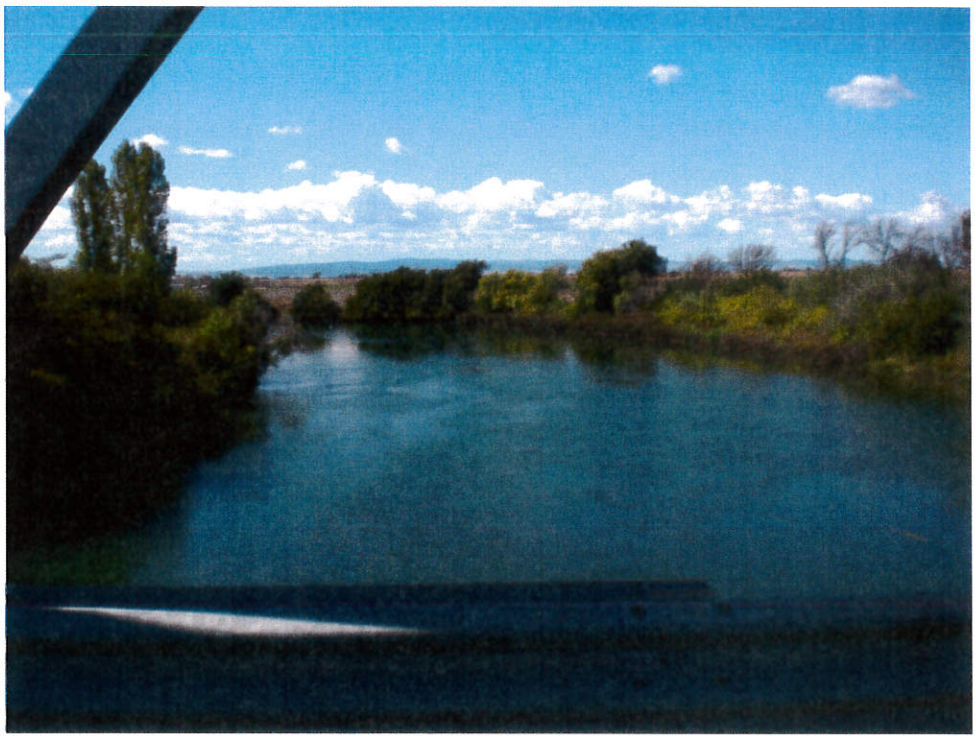


PHOTO 4: FROM BRIDGE LOOKING DOWNSTREAM (SEPTEMBER 2013)

PHOTO 5: FROM BRIDGE LOOKING UPSTREAM (SEPTEMBER 2013)

PHOTO 6. FROM BRIDGE LOOKING UPSTREAM AT ISLAND VEGETATION (MARCH 2014)

APPENDIX B: Habitat Evaluation and Scoring form for Geographic Information Systems

HABITAT EVALUATION AND SCORING FORM FOR GEOGRAPHIC INFORMATION SYSTEMS (GIS)

Giant Garter Snake (*Thamnophis gigas*)

Site Name:_____ **Site ID:**_____
GeneralCharacteristic:_____ **Permanent/Transient**[1]

USGS 7.5' Topo Quad_____ **Township**_____ **Range**_____

Surveyor/Affiliation: _____ **Date(s):** _____

Scores: 0=absent/none 1=present/low (0-25%) 2=moderate (25-75%) 3=high (75-100%)

Factor	Score
1. Still or slow-flowing water over silt substrate	+ ( )[2]
2. Flowing water over sand, gravel, rock or cement substrate	-- ( )[2]
3. Water available[3]	
a) Winter only (runoff) or sporadic availability	+ ( )[2]
b) April through October only (e.g. irrigation)	+ ( )[2]
c) All year (e.g. perennial marsh or channel)	+ ( )[2]
4. Banks are sunny	+ ( )
5. Banks shaded by overstory vegetation	-- ( )
6. Aquatic or emergent vegetation present	+ ( )
7. Terrestrial vegetation present	
a) On banks	+ ( )
b) In adjacent uplands	+ ( )
8. Subterranean retreats present[3]	
a) In banks	+ ( )[2]
b) In adjacent uplands	+ ( )[2]
9. Prey fish present	+ ( )[2]
10. Introduced gamefish present	-- ( )[2]
11. Prey amphibians present	+ ( )[2]
12. Site subject to severe seasonal or tidal flooding	-- ( )[2]
13. Adjacent land use[3]	
a) Rice, marsh, or wetland	+ ( )[2]
b) Upland	+ ( )[2]
c) Row Crop or horticultural	-- ( )[2]
d) Urban or developed public area	-- ( )[2]
14. Disturbance due to human recreational or maintenance activities	-- ( )[2]
15. Connectivity to known populations of GGS	+ ( )[2]

[1] *transient habitat designation results in a total adjusted score of 0 points*
[2] *indicates presence/absence only*
[3] *factors within these fields are scored cumulatively*

Total: [ ]

Adjusted Total[1]**:** [ ]

APPENDIX C: Instructions for Completing the Habitat Evaluation and Scoring form for Geographic Information Systems

INSTRUCTIONS FOR COMPLETING THE HABITAT EVALUATION AND SCORING FORM FOR GEOGRAPHIC INFORMATION SYSTEMS (GIS)

Giant Garter Snake (*Thamnophis gigas*)

1. Still or slow-flowing water over silt substrate

This category is checked if bank habitat adjacent to water is composed of soil, silt, or mud in flows no greater than 3 mph. Water in this category will often be dark or murky rather than clear, of the type observed in marshes, sloughs, or irrigation canals. This category is determined by presence or absence only and receives a positive score.

2. Flowing water over sand, gravel, rock or cement substrate

This category is checked if channel or bank habitat is composed of an impermeable substrate of the type listed above defining this category, and includes the presence of bank side cinders or fine concrete riprap placed for erosion control. Water in this category will often be clear, associated with flows exceeding 3 mph, of the type typically observed in flowing streams or rivers where silt or sediment will not persist. This category is determined by presence or absence only and receives a negative score.

3. Water available:

a) Winter only (runoff) or sporadic availability
b) April through October only (e.g. irrigation)
c) All year (e.g. perennial marsh or channel)

Factors in this category are based upon the persistence of all water within 200 feet of observed habitat. Factors in this category are cumulative, are determined by presence or absence only, and receive positive scores.

4. Banks are sunny

This category is checked if bank habitat adjacent to water receives direct sunlight. Availability of sunlight is determined by the ability of GGS to access sun for basking, and does not include areas where vegetation or topography prevents such access. This category receives positive scores determined by percentage of sunlight present. Percentage classes and corresponding point values are included on the Habitat Evaluation and Scoring Form.

5. Banks shaded by overstory vegetation

This category is checked if bank habitat adjacent to water receives shade obstructing direct sunlight. This category is designed to complement and weight category 4, and receives negative scores determined by percentage of shade present. Percentage classes and corresponding point values are included on the Habitat Evaluation and Scoring Form.

6. Aquatic or emergent vegetation present

This category is checked if bank side aquatic habitat is characterized by aquatic vegetation which persists above the water level (*e.g.* cattails, bulrushes, primrose or hyacinth). This category receives positive scores determined by the percentage of aquatic vegetation present. Percentage classes and corresponding point values are included on the Habitat Evaluation and Scoring Form.

7. Terrestrial vegetation present
a) On banks
b) In adjacent uplands

This category is checked if bank habitat or adjacent uplands within 200 feet of aquatic habitat are characterized by vegetation (*e.g.* grasses, brush, low shrubs or Himalayan blackberry). This category receives positive scores determined by the percentage of terrestrial vegetation present. Percentage classes and corresponding point values are included on the Habitat Evaluation and Scoring Form.

8. Subterranean retreats present
a) In banks
b) In adjacent uplands

This category is checked if bank habitat or adjacent uplands within 200 feet of aquatic habitat are characterized by burrows, holes, or cracks either in the soil or under debris. Factors within this category are cumulative, are determined by presence or absence only, and receive positive scores.

9. Prey fish present

This category is checked if small aquatic prey fish (*e.g.* carp, mosquitofish, or blackfish) are present within aquatic habitat. This category is determined by presence or absence only and receives a positive score.

10. Introduced gamefish present

This category is checked if large, predatory gamefish (*e.g.* black bass, striped bass, channel catfish) are present within aquatic habitat. This category is determined by presence or absence only and receives a negative score.

11. Prey amphibians present

This category is checked if amphibians (e.g. bullfrog, treefrog, red-legged frog) are present within or near aquatic habitat. Note that toads do not constitute preferred prey for the giant garter snake and are not included when scoring this category. This category is determined by presence or absence only and receives a positive score.

12. Site subject to severe seasonal or tidal flooding

This category is checked if habitat is subject to prolonged inundation of upland terrestrial habitat by seasonal floodwaters or persistent tidal flows. This category is determined by presence or absence only and receives a negative score.

13. Adjacent land use

a) Rice, marsh, or wetland
b) Upland
c) Row Crop or horticultural
d) Urban or developed public area

Factors in this category are based upon dominant land use within 200 feet of observed habitat. Factors in this category are cumulative, are determined by presence or absence only and receive positive or negative scores indicated on the Habitat Evaluation and Scoring Form.

14. Disturbance due to human recreational or maintenance activities

This category is checked if habitat is subject to prolonged or regular intense disturbance by human recreational or maintenance activities (*e.g.* fishing, boating, walking, or farming, mowing, burning, or scraping of bankside vegetation). Activities are considered regular if they occur more than 50% of the time between March and November. This category is determined by presence or absence only and receives a negative score.

15. Connectivity to known populations of GGS

Because the distribution of giant garter snakes within the Sacramento-San Joaquin River Delta is poorly understood, both overland and hydrologic connectivity of known populations to drainages within the project vicinity are assumed.

APPENDIX D: Habitat Evaluation Form for Miner Slough

HABITAT EVALUATION AND SCORING FORM FOR GEOGRAPHIC INFORMATION SYSTEMS (GIS)

Giant Garter Snake (*Thamnophis gigas*)

Site Name: Miner Slough **Site ID:** MS
GeneralCharacteristic: Slough **Permanent/Transient**[1] Permanent

USGS 7.5' Topo Quad Liberty Island **Township** _____ **Range** Rancho Los Ulpinos Land Grant

Surveyor/Affiliation: Whitney Brennan/Caltrans **Date(s):** April 9, 2014

Scores: 0=absent/none 1=present/low (0-25%) 2=moderate (25-75%) 3=high (75-100%)

Factor	Score
1. Still or slow-flowing water over silt substrate	+(1)[2]
2. Flowing water over sand, gravel, rock or cement substrate	-- (1)[2]
3. Water available[3]	
a) Winter only (runoff) or sporadic availability	+(0)[2]
b) April through October only (e.g. irrigation)	+(0)[2]
c) All year (e.g. perennial marsh or channel)	+(1)[2]
4. Banks are sunny	+(1)
5. Banks shaded by overstory vegetation	-- (3)
6. Aquatic or emergent vegetation present	+(2)
7. Terrestrial vegetation present	
a) On banks	+(3)
b) In adjacent uplands	+(2)
8. Subterranean retreats present[3]	
a) In banks	+(1)[2]
b) In adjacent uplands	+(0)[2]
9. Prey fish present	+(1)[2]
10. Introduced gamefish present	-- (1)[2]
11. Prey amphibians present	+(1)[2]
12. Site subject to severe seasonal or tidal flooding	-- (0)[2]
13. Adjacent land use[3]	
a) Rice, marsh, or wetland	+(0)[2]
b) Upland	+(1)[2]
c) Row Crop or horticultural	-- (1)[2]
d) Urban or developed public area	-- (0)[2]
14. Disturbance due to human recreational or maintenance activities	-- (1)[2]
15. Connectivity to known populations of GGS	+(1)[2]

[1] *transient habitat designation results in a total adjusted score of 0 points*
[2] *indicates presence/absence only*
[3] *factors within these fields are scored cumulatively*

Total: 8

Adjusted Total[1]**:**

Appendix G Analysis of Potential Underwater Construction Noise

State Route 84 Miner Slough Bridge Number 23-0035 Replacement Project

Analysis of Potential Underwater Construction Noise

04-Sol-084 – PM12.1/12.2
EA – 04-0G660
EFIS – 0400000343

April 14, 2015

Prepared for

David Lundgren
CH2M HILL
155 Grand Avenue, Suite 800
Oakland, CA 94612

Prepared by

Keith Pommerenck

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality
423 4th Street, Suite 1
Marysville, California 95901

Contract: 04A149
Task Order: No. 01

DRAFT

Executive Summary

This report summarizes the results of a noise assessment of possible construction activities related to the replacement of the Miner Slough Bridge on State Route (SR) 84 in Solano County about 30 miles southwest of Sacramento, California. The purpose of this assessment is to predict construction noise levels to be used by California Department of Transportation (Caltrans) staff to address concerns and questions raised about the potential project effects on sensitive habitat and aquatic species. The assessment focuses on predicting underwater noise levels from pile-driving activities. There are two components to the analysis—first, the construction of the new bridge; secondly, the construction of the temporary trestles, falsework structure, and cofferdams. Results of this assessment are summarized as follows:

- New bridge: Driving of small-diameter steel shell piles (2 feet in diameter) at Pier 3 in a cofferdam could generate underwater maximum peak sound pressure levels of about 200 decibels (dB) at 33 feet from the pile. Sound levels could be much lower in very shallow (i.e., less than 3 feet deep) portions of the slough. Pile-driving activities at Pier 4 will be conducted near the slough and would generate groundborne vibration that could produce underwater noise. Pile-driving activities conducted on land near water bodies have been found to transmit low-frequency sound into the water. The mechanisms for transmitting this sound into the water are complex and difficult, if not impossible, to predict. It is anticipated that substantial sounds transmitted into the water from pile driving would only occur where the water is relatively deep (3 feet or greater). The maximum peak sound pressure levels of over 200 dB could be expected in the water. Driving of large-diameter steel shell piles (72 inches in diameter) at Pier 2 could generate maximum peak levels in excess of 214 dB at 33 feet. Vibratory installation of sheet piles for the cofferdam at Pier 3 are expected to generate root mean square (RMS) noise levels of 160 dB at 33 feet. The piles for the abutments are well outside the wetted channel and the levels generated from that pile driving are expected to be below the National Maine Fisheries Service (NMFS) interim thresholds.

- Temporary construction trestle: The new bridge construction will require the construction of a temporary work trestle. The driving of small steel shell piles between 15 and 36 inches could generate underwater maximum peak sound pressure levels between 200 and 210 dB at 33 feet from the pile. It is anticipated that substantial sounds transmitted into the water from pile driving would only occur in the deeper portions of the slough where the water is relatively deep (6 feet or greater). Driving of small steel shell piles on land near the slough is likely to result in peak sound pressure levels of less than 200 dB.

DRAFT

Introduction

Caltrans is planning the replacement of the Miner Slough Bridge No. 23-0035 on SR 84 in Solano County about 30 miles southwest of Sacramento, California at post mile (PM) 12.1/12.2. The existing bridge is a swing bridge with nonstandard geometry and very low annual average daily traffic (AADT) (336 in 2011) connecting Ryer Island in the Sacramento-San Joaquin River Delta to the mainland over Miner Slough. One Build Alternative is proposed, which is a bridge replacement alternative. The proposed replacement project involves construction of a new bridge, building a temporary work trestle, and demolition of the existing bridge. The portions of the project that will impact the noise in the river include impact driving pile installation for permanent steel shell piles at bridge Pier 4 and impact driven pile installation for small-diameter steel shell piles for both abutments and Piers 2 and 3, as well as installation of temporary piles for false work, temporary piles for a temporary pier, temporary piles for trestles, and sheet piles (to be vibrated in) for cofferdams within the river channel.

This study is an assessment of potential underwater noise levels generated by planned construction activities involved with replacement of the SR 84 Miner Slough Bridge. The study was requested to aid Caltrans biologists in assessing noise impacts to fisheries and is focused on providing the following information:

- Range of underwater noise levels from pile driving conducted within and near the Miner Slough

Our assessment is based on information provided by Caltrans staff consisting of a location map, draft layout sheets, estimated pile-driving data, a review of potential construction activities to be conducted at the site, a review of related studies, the modeling, and a semi-quantitative analysis of underwater noise levels. This study assesses the underwater noise levels associated with potential pile-driving activities as experienced at the identified noise sensitive areas noted previously. The study does not address environmental impacts associated with the project.

Underwater Sounds from Pile Driving

Fundamentals of Underwater Noise

Sound is typically described by the *pitch* and *loudness*. *Pitch* is the height or depth of a tone or sound, depending on the relative rapidity (*frequency*) of the vibrations by which it is produced. *Loudness* is intensity of sound waves combined with the reception characteristics of the auditory system. Intensity may be compared with the height of an ocean wave in that it is a measure of the amplitude of the sound wave.

In addition to the concepts of pitch and loudness, several noise measurement scales are used to describe sound. A *decibel (dB)* is a unit of measurement describing the amplitude of sound; a dB is equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. For underwater sounds, a reference pressure of 1 *micropascal* (*μPa*) is commonly used to describe sounds in terms of dB. Therefore, 0 dB on the decibel scale would be

DRAFT

a measure of sound pressure of 1 μPa. Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 dB represents a tenfold increase in acoustic energy, while 20 dB is 100 times more intense, 30 dB is 1,000 times more intense, etc.

When a pile-driving hammer strikes a pile, a pulse is created that propagates through the pile and radiates sound into the water, the ground substrate, and the air. Sound pressure pulse as a function of time is referred to as the waveform. In terms of acoustics, these sounds are described by the peak pressure, the *root mean square* (*RMS) pressure*, and the *sound exposure level (SEL).* The peak pressure is the highest absolute value of the measured waveform, and can be a negative or positive pressure peak. For pile-driving pulses, RMS level is determined by analyzing the waveform and computing the average of the squared pressures over the time that comprise that portion of the waveform containing the vast majority of the sound energy.[1] The pulse RMS has been approximated in the field for pile-driving sounds by measuring the signal with a precision sound-level meter set to the "impulse" RMS setting, and is typically used to assess impacts to marine mammals. Another measure of the pressure waveform that can be used to describe the pulse is the sound energy itself. The total sound energy in the pulse is referred to in many ways, such as the "total energy flux."[2] The "total energy flux" is equivalent to the un-weighted SEL for a plane wave propagating in a free field, a common unit of sound energy used in airborne acoustics to describe short-duration events referred to as dB re:1μPa2-sec. Peak pressures and RMS sound pressure levels are expressed in dB re:1μPa. The total sound energy in an impulse accumulates over the duration of that pulse. Figure 1 illustrates the descriptors used to describe the acoustical characteristics of an underwater pile-driving pulse. Table 1 includes the definitions of terms commonly used to describe underwater sounds.

The variation of instantaneous pressure over the duration of a sound event is referred to as the waveform. Studying the waveforms can provide an indication of rise time; however, rise time differences are not clearly apparent for pile-driving sounds due to the numerous rapid fluctuations that are characteristic to this type of impulse. A plot showing the accumulation of sound energy over the duration of the pulse (or at least the portion where much of the energy accumulates) illustrates the differences in source strength and rise time. An example of the characteristics of a typical pile-driving pulse is shown in Figure 1.

DRAFT

[1] Richardson, Greene, Malone, and Thomson, *Marine Mammals and Noise,* Academic Press, 1995 and Greene, personal communication.

[2] Finerran, et. al., *Temporary Shift in Masked Hearing Thresholds in Odontocetes after Exposure to Single Underwater Impulses from a Seismic Watergun*, Journal of the Acoustical Society of America, June 2002.

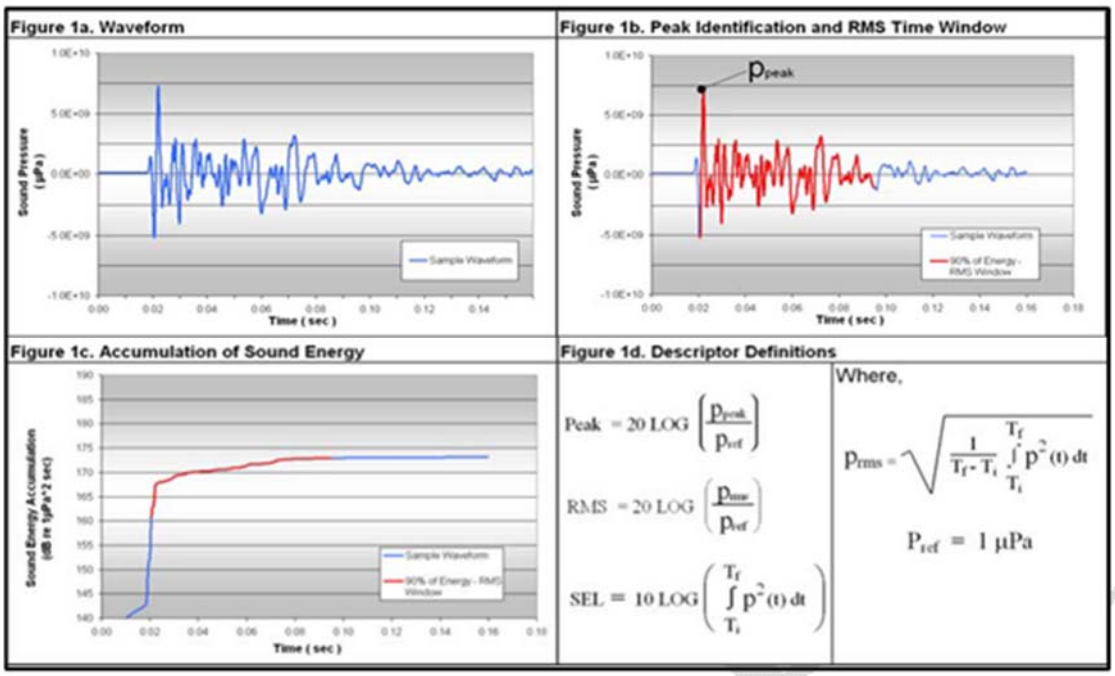


Figure 1 – Characteristics of a Pile-driving Pulse

DRAFT

Table 1 – Definitions of Underwater Acoustical Terms

Term	Definition
Decibel (dB)	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20 micropascals (µPa) and 1 µPa for underwater.
Equivalent Noise Level (L_{eq})	The average noise level during the measurement period, expressed in dB.
L_{01}, L_{10}, L_{50}, L_{90}	The sound levels that are exceeded 1, 10, 50, and 90 percent of the time during the measurement period, expressed in dB.
Peak Sound Pressure, Unweighted	Peak sound pressure level based on the largest absolute value of the instantaneous sound pressure. This pressure is expressed in this report as dB (referenced to a pressure of 1 µPa) but can also be expressed in units of pressure, such as µPa or pounds per square inch (psi).
Root Mean Square (RMS) Sound Pressure Level	The average of the squared pressures over the time that comprise that portion of the waveform containing 90 percent of the sound energy for one pile-driving impulse, expressed in dB re 1 µPa.[3] This is the criterion used by the National Marine Fisheries Service to measure sound impacts from construction projects. This RMS method is then used to develop the Peak Sound Pressure and Cumulative SEL criteria.
Sound Exposure Level (SEL)	Proportionally equivalent to the time integral of the pressure squared and is described in this report in terms of dB re:1 μPa^2 sec over the duration of the impulse. Similar to the unweighted SEL standardized in airborne acoustics to study noise from single events.
Cumulative SEL	Measure of the total energy received through a 1-day pile-driving event (here defined as the pile driving that occurs during 1 day or a maximum of three piles), expressed in A-weighted dB.
Waveform	A graphical plot illustrating the time history of positive and negative sound pressure of individual pile strikes, shown as a plot of µPa over time (e.g., µPa per second).
Frequency Spectrum	A graphical plot illustrating the distribution of sound pressure versus frequency for a waveform, dimension in RMS pressure and defined frequency bandwidth, expressed in terms of dB over the given frequency range.

SEL is an acoustic metric that provides an indication of the amount of acoustical energy contained in a sound event. For pile driving, the typical event can be one pile-driving pulse or many pulses, such as pile driving for one pile or for 1 day of driving multiple piles. Typically, SEL is measured for a single strike and a cumulative condition. The cumulative SEL associated with the driving of a pile can be estimated using the single-strike SEL value and the number of pile strikes through the following equation:

$$SEL_{CUMULATIVE} = SEL_{SINGLE\ STRIKE} + 10 \log (\#\ of\ pile\ strikes)$$

[3] The underwater sound measurement results obtained during the Pile Installation Demonstration Project indicated that most pile-driving impulses occurred over a 50- to 100-millisecond (msec) period. Most of the energy was contained in the first 30 to 50 msec. Analysis of that underwater acoustic data for various pile strikes at various distances demonstrated that the acoustic signal measured using the standard "impulse exponential-time-weighting" (35-msec rise time) correlated to the RMS (impulse) level measured over the duration of the impulse.

DRAFT

For example, if a single-strike SEL for a pile is 165 dB and it takes 1,000 strikes to drive the pile, the cumulative SEL is 195 A-weighted dB (165 dB + 30 dB = 195 dB), where 10 * $Log_{10}(1000)$ = 30.

Underwater Sound Thresholds

Underwater sound affects to fish are discussed below. In this report, peak pressures and RMS sound pressure levels are expressed in decibels re 1 μPa. Sound exposure levels are expressed as dB re:1μPa^2-sec.

Fish

A Fisheries Hydroacoustic Workgroup (FHWG) consisting of transportation officials, resources agencies, the marine construction industry (including Ports), and experts was formed in 2003 to address the underwater sound issues associated with marine construction. The first order of business was to document all that was clearly known about the effects of sound on fish, which was reported in "The Effects of Sound on Fish."[4] This report provided recommended preliminary guidance to protect fish. A graph showing the relationship between the SEL from a single pile strike and injurious effects to fish based on size (i.e., mass) was presented. Fish with a mass of about 0.03 gram were expected to have no injury for a received SEL of a pile strike below 194 dB and suffer 50 percent mortality at about 197 dB. The report also described possible effects to the auditory system (i.e., auditory tissue damage and hearing loss) based on a received dose of sound. The recommendations were frequency dependent, based on the hearing thresholds of fish, or most sensitive auditory bandwidths. For salmonids, hearing effects would be expected at or near the thresholds for injury based on the single strike SEL. A further investigation into the effects of pile-driving sounds on fish was also recommended.

Caltrans commissioned a subsequent report to provide additional explanation of, and a practical means to apply, injury criteria recommended in The Effects of Sound on Fish. This report is entitled "Interim Criteria for Injury of Fish Exposed to Pile Driving Operations: A White Paper."[5] The White Paper recommended a dual criterion for evaluating the potential for injury to fish from pile-driving operations. The dual approach considered that a single pile strike with high enough amplitude, as measured by zero to peak (either negative or positive pressure), could cause injury. A peak pressure threshold for a single strike was recommended at 208 dB. In 2007, Carlson et al. provided an update to the White Paper in a memo titled "Update on Recommendation for Revised Interim Sound Exposure Criteria for Fish during Pile Driving Activities."[6] In this memorandum, they propose criteria for each of the three following effects on fish: (1) hearing loss due to temporary threshold shift, (2) damage to auditory tissues, and (3) damage to non-auditory tissues. These criteria vary due to the mass of the fish and if the fish is a hearing specialist or hearing

[4] Hastings, M and A. Popper. 2005. The Effects of Sound on Fish. Prepared for the California Department of Transportation. January 28 (revised August 23).
[5] Popper, A., Carlson, T., Hawkins, A., Southall, B. and Gentry, R. 2006. Interim Criteria for Injury of Fish Exposed to Pile Driving Operations: A White Paper. May 14.
[6] Carlson, T, Hastings, M and Poper, A. 2007. Memo to Suzanne Theiss, California Department of Transportation, Subject: Update on Recommendations for Revised Interim Sound Exposure Criteria for Fish during Pile Driving Activities. December 21.

DRAFT

generalist. In preparing this update, Dr. Mardi Hastings summarized information from some current studies in a report titled "Calculation of SEL for Govoni et al. (2003, 2007) and Popper et al. (2007) Studies."

On June 12, 2008, NMFS; the U.S. Fish and Wildlife Service; California, Oregon, and Washington Departments of Transportation; California Department of Fish and Wildlife; and U.S. Federal Highway Administration generally agreed in principle to interim criteria to protect fish from pile-driving activities, as shown in Table 2. Note that the peak pressure criterion of 206 dB was adopted (rather than 208 dB), as well as accumulated SEL criteria for fish smaller than 2 grams. NMFS interpretation of the interim criteria is described by Woodbury and Stadler (2009).[7]

Table 2 – Adopted Impact Pile-driving Acoustic Criteria for Fish

Interim Criteria for Injury	Agreement in Principle
Peak	206 dB for all size of fish
Cumulative SEL	187 dB for fish size of two grams or greater 183 dB for fish size of less than two grams
Note: Behavior effects threshold = 150 dB RMS.	

The primary difference between the adopted criteria and previous recommendations is that the single-strike SEL was replaced with a cumulative SEL over 1 day of pile driving. NMFS does not consider sound that produces an SEL per strike of less than 150 dB to accumulate and cause injury. The adopted criteria listed in Table 2 are for pulse-type sounds (e.g., pile driving) and does not address sound from vibratory driving of piles; there are no acoustic thresholds that apply to the lower amplitude noise produced by vibratory pile driving. In fact, the acoustic thresholds developed for fish only apply to impact pile driving.

The Bureau of Ocean Energy Management (BOEM; formerly Minerals Management Service), Caltrans, and National Cooperative Highway Research Program/Transportation Research Board have funded studies to identify the onset of injury to fish from impact pile driving. One of the goals of these studies was to provide quantitative data to define the levels of impulsive sound that could result in the onset of barotrauma injury to fish.[8] Laboratory simulation of pulse-type pile-driving sounds enabled careful study of the barotrauma effects to Chinook salmon. The neutrally buoyant juvenile fish were exposed to impulsive sounds and subsequently evaluated for barotrauma injuries. Significant barotrauma injuries were not observed in fish exposed to 960 pulses at 180 dB SEL per pulse or 1,920 pulses at 177 dB per pulse. In both exposures, the resulting accumulated SEL was 210 dB SEL. Results of these studies are under review. At this time, the criteria in Table

[7] Stadler, J. and Woodbury, D. 2009. Assessing the effects to fishes from pile driving: Application of new hydroacoustic criteria. Proceedings of inter-noise 2009, Ottawa, Canada. August 23–26.
[8] Halvorsen MB, Casper BM, Woodley CM, Carlson TJ, Popper AN (2012) Threshold for Onset of Injury in Chinook Salmon from Exposure to Impulsive Pile Driving Sounds. PLoS ONE 7(6): e38968. oi:10.1371/journal.pone.0038968.

DRAFT

2 are used by NMFS to judge impacts to fish. Potential behavior impacts that might occur above 150 dB RMS are not used to restrict pile driving.

Underwater Noise Levels from Construction

The primary type of activity that has the potential to elevate underwater noise levels is the installation of piles. There are two basic methods that are proposed to install piles, including vibrating and impact driving. For this project, the piles are planned to be installed with using either a diesel impact hammer or a vibratory hammer.

Pile Driving

There are basically two different and distinct structures that will be constructed for the bridge replacement project—a temporary work trestle and the new structure. For the new structure, the water pile installations will consist of sheet piles for a cofferdam, small-diameter steel shell piles driven within the cofferdam, and two 72-inch steel shell piles that will be impact driven for Pier 4. Approximately 88 sheet piles will be vibrated, 25 24-inch steel pipe piles will be vibrated in then driven to final tip elevation with an impact hammer, and the 72-inch steel shell piles will be impact driven in. The remainder of piles for the new bridge structure will be installed outside the wetted channel. These piles consist of 24-inch piles for both abutments and the 72-inch steel shell pile for Pier 2.

The temporary trestle structure will be designed by the contractor at a later date. However, it is estimated that the trestle will have a width of 35 to 40 feet with a superstructure of timber decking, steel stringers, prefabricated steel bent caps, and a safety rail. The bents (approximately 24 to 32) will be spaced approximately 25 to 40 feet apart. It is anticipated that 15- to 36-inch diameter steel shell piles will be driven or vibrated and will be spaced 5 to 10 feet apart. The number of piles may range from 150 to 400. Each pile will be approximately 50 to 75 feet in length. Because there are no plans for this temporary trestle, it was assumed to use the worst case of the estimated design for the assessment. This would assume that the piles are impact driven and the bent spacing would be 25 feet, using 36-inch steel shell piles spaced along the stringer at 5-foot intervals. This would equate to approximately 12 bents with 9 piles per bent, or a total of 108 36-inch steel shell piles for the temporary trestle. Approximately 72 of the piles will be in the wetted channel and the remainder will be driven on land at both sides of the slough. The water depth where the temporary trestle pile will be driven ranges from 2 to 10 feet deep.

Pile driving in the water causes sound energy to radiate directly into the water by vibrating the pile between the surface of the water and the riverbed, and indirectly as a result of groundborne vibration at the riverbed. Airborne sound does not make a substantial contribution to underwater sound levels because of the attenuation at the air/water interface. Pile driving near the river would generate low-frequency groundborne vibration that could cause localized sound pressures in the water that are radiated from the streambed. A minimum water depth is required to allow sound to propagate. For pile-driving sounds, the minimum depth is 3 to 6 feet. Low-frequency vibration

DRAFT

caused by pile driving would propagate through the ground only and couple to the water at the sloughbed.

Due to the complexity of the environment (shallow and slow moving water), it is not possible to accurately predict underwater sound pressures from pile-driving activities that may occur near the river. The likelihood of pile driving causing high widespread sound levels is low, given the shallowness of the water and types and sizes of piles under consideration for this project. The water surface is a pressure release zone. Underwater sound measurements have shown that levels are considerably lower in the top 3 feet. Levels are typically highest in the deepest portions of the water column. In deeper water (i.e., 30 feet or deeper), levels are fairly uniform with depth except in the top 6 feet, where they decrease with decreasing depth. In portions of the slough that are 6 feet or less in depth, low sound pressure levels are expected.

New Miner Slough Bridge

The project proposes to build a new swing bridge about 100 feet west of existing alignment. The new bridge will have standard features with a 12-foot travel way and 8-foot shoulder in each direction. The vertical clearance of proposed structure will be standard 15 feet. The project would require construction of a temporary trestle bridge, a control-house structure on the levee, and a viaduct on the levee to accommodate maintenance parking for the control house. The project will construct three steel-reinforced cast concrete piers to support the bridge—one central pivot pier (Pier 3) and independent piers (2 and 4) that support the approach spans, and also support the swing span when it is not in operation. A cap will be constructed of steel-reinforced cast concrete over each foundation, over which the pier itself will be constructed. Each pier will be built on a cast-in-steel-shell (CISS) foundations.

For Pier 3, a 44- by 44-foot cofferdam will be constructed to facilitate the pile driving and the construction of caps and the pier. The cofferdam is constructed by driving 24-inch sheet piles 30 feet into the streambed using vibratory hammers. The piles will be tall enough so that the tops reach 5 feet above the surface of the water and placed adjacent to each other to form a void from which water can be evacuated. The cofferdam is then dewatered and the area inside the base of the cofferdam excavated to about 2 feet below the footing elevation. A 2-foot-deep seal course of poured concrete is placed at the base of the cofferdam to aid in dewatering and prevents construction material from escaping through the base of the cofferdam.

For Piers 2 and 4, 72-inch CISS piles will be driven without cofferdams into the streambed using impact hammers, and the pile shells drilled out, leaving a plug of native material at the bottom. Further extensions without trestles, attached to the trestle-supported extensions of the temporary bridge, will be used to guide the piles into their correct locations, and to capture material brought out of the shells by the drilling.

On the levees, at the ends of each approach span, a row of 28 24-inch piles with a 65.5-foot-long by 8-foot-wide concrete cap will be constructed. The area will be excavated to a depth of 5 feet for 60 feet to construct a trench 5 feet wide. Seventy-foot-long CISS piles will be driven into the

DRAFT

trench, drilled out, and filled with rebar and concrete. The 65.5-foot-long by 8-foot-wide and 5-foot-deep cap will be constructed over the tops of the piles to support the approach span. Table 3 shows the size and number of piles for each pier and the abutments.

Table 3 – Number and Types of Piles for Foundation

	Pier 3	***Piers 2 and 4***	***Abutments 1 and 5***
Number of piles	25	4	56
Depth of piles	100 feet	100 feet	70 feet
Diameter of pile	24 inches	72 inches	24 inches

Four large-diameter steel shell piles will be either directly installed in the river or near the water's edge and will be installed using both vibratory and impact driving. The remainder of the piles installed at Pier 3 and both abutments will be either installed on land away from the water or in a de-watered cofferdam.

Cofferdam Sheet Metal Piles

Typically, sheet piles for cofferdams are driven using a vibratory hammer. Not a lot of information exists on the noise levels from driving sheet piles with a vibratory hammer. Measurements were made at Ten Mile River north of Fort Bragg, California, and at the East Fork of the Salmon River Bridge near Challis, Idaho, when a vibratory hammer was used to drive sheet piles. At Challis, some of the same piles were later driven to the final tip elevation using a hydraulic impact hammer. The peak sound pressure generated from the use of the vibratory hammer was 170 dB at 33 feet and when a hydraulic impact hammer was used the peak sound pressure was 179 dB. At that project, the sound pressure generated by the vibratory hammer was approximately 9 dB lower than that generated by the impact hammer.

Pier 3 will have a cofferdam constructed using sheet piles prior to installing the 24-inch steel shell piles for the foundation of the center-pivot foundation. The sheet piles driven for Pier 3 will have a fish harassment distance of 128 feet. Table 4 shows the sound levels and distance to the appropriate NMFS criteria for this project.

Table 4 – Distances to Various NMFS Criteria for Vibrating in Steel Sheet Piles

Location	***Distance to Water***	***Peak***	***RMS***	***SEL***	***Distance to 150 dB RMS Criterion***
Pier 3	0 feet (Center of Slough)	175 dB	160 dB	160 dB	128 feet

DRAFT

Foundation Piles

All the piles will be installed in the same manner, vibrated in part of the way and then driven to final tip elevation using an impact hammer. Table 5 shows the levels for the attenuated and unattenuated impact pile driving. Piles driven on land such as the piles at the abutments and Pier 4 are driven on land and as such there was no attenuation used. Levels used were derived from the Caltrans Guidance Manual and the 2012 Hydroacoustic Compendium [9] and are shown in Attachment A. Maps showing the effect area associated with the 183-dB cumulative SEL and 187-dB cumulative SEL are shown in Attachment B.

Table 5 – Near-source Levels for Unattenuated and Attenuated Impact Pile Driving [A]

Pile Type	Peak (dB)		RMS (dB)		Single-strike SEL (dB)	
	Unattenuated	Attenuated	Unattenuated	Attenuated	Unattenuated	Attenuated
Abutment 1 – 2-foot Steel Shell Piles on Land	179	N/A	159	N/A	150	N/A
Pier 2 – 6-foot Steel Shell Piles in Water	214	204	199	189	189	179
Pier 3 – 2-foot Steel Shell Piles in Cofferdam	200	190	185	175	172	162
Pier 4 – 6-foot Steel Shell Piles On Land	204	N/A	185	N/A	175	N/A
Abutment 5 – 2-foot Steel Shell Piles on Land	172	N/A	185	N/A	146	N/A

[A] Near-source is considered 33 feet from pile.
N/A = not applicable

72-inch Steel Shell Piles

Piers 2 and 4 each have two 72-inch steel shell piles that will be impact driven. Pier 2 is on the south side of Miner Slough in shallow water while Pier 4 is on the north side of the slough on land, approximately 16 feet from the water. Typically, there are two primary means of installing a large-diameter pile—first would be using a vibratory hammer, and secondly, the use of a large impact hammer to drive the pile to the final tip elevation. The distances to the various NMFS thresholds were calculated for both an unattenuated pile and assuming a 10-dB reduction with a bubble ring for the attenuated piles. Because the piles at Pier 4 are on land, additional attenuation was not

[9] Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish, California Department of Transportation, February 2009.

DRAFT

considered for these piles. Table 5 shows the levels used, Table 6 shows the unattenuated distance to the various NMFS criteria, and Table 7 shows the attenuated distance to the various NMFS criteria.

Table 6 – Computed Distances to NMFS Criteria for Unattenuated 72-inch Steel Shell Pile

Location	*Distance to 187-dB Cumulative SEL Criterion [A] (feet)*	*Distance to 183-dB Cumulative SEL Criterion [A] (feet)*	*Distance to 206-dB Peak Criterion (feet)*	*Distance to 150-dB RMS Criterion (feet)*
East of the Bridge				
Pier 2	2,191[B]	2,191[B]	98	2,191[B]
Pier 4	797	1,371	<33	1,798[B]
West of the Bridge				
Pier 2	630[B]	630[B]	98	630[B]
Pier 4	979	1,371	<33	1,968[2]

[A] Single-strike SELs below 150 dB do not accumulate to cause injury to fish.
[B] Constrained by the river channel.

Table 7 – Computed Distances to Various NMFS Criteria for Attenuated 72-inch Steel Shell Pile

Location	*Distance to 187-dB Cumulative SEL Criterion [A] (feet)*	*Distance to 183-dB Cumulative SEL Criterion [A] (feet)*	*Distance to 206-dB Peak Criterion (feet)*	*Distance to 150-dB RMS Criterion (feet)*
East of the Bridge				
Pier 2	1,371	2,191[B]	<33	2,191[B]
Pier 4	797	1,371	<33	128
West of the Bridge				
Pier 2	630[B]	630[B]	<33	630[B]
Pier 4	797	1,371	<33	1,968[B]

[A] Single-strike SELs below 150 dB do not accumulate to cause injury to fish.
[B] Constrained by the river channel.

<u>24-inch Steel Shell Piles</u>

Abutments 1 and 5 each have 28 24-inch steel shell piles that will be impact driven in. Abutment 1 is on the south side of Miner Slough in approximately 56 feet from the water and Abutment 5 is on the north side of the slough on land, approximately 85 feet from the water. As with the larger-size piles, typically, there are two means of installing piles—first would the use of a vibratory hammer and, secondly, the use of an impact hammer to drive the pile to the final tip elevation. Because both abutments are out of the water on land, attenuation was not considered for these piles. Table 5 shows the levels used and Table 8 shows the distance to the various NMFS criteria.

DRAFT

Table 8 – Computed Distances to NMFS Criteria for 24-inch Steel Shell Abutment Piles

Location	*Distance to 187-dB Cumulative SEL Criterion [A] (feet)*	*Distance to 183-dB Cumulative SEL Criterion [A] (feet)*	*Distance to 206-dB Peak Criterion (feet)*	*Distance to 150-dB RMS Criterion (feet)*
East of the Bridge				
Abutment 1	46	79	<33	111
Abutment 5	<33	46	<33	98
West of the Bridge				
Abutment 1	46	79	<33	<33
Abutment 5	<33	46	98	<33
[A] Single-strike SELs below 150 dB do not accumulate to cause injury to fish.				

Pier 3 will be constructed in a cofferdam constructed out of 24-inch sheet piles. Table 9 shows the levels assuming that the piles are driven in a partially de-watered cofferdam. Table 10 shows the distances assuming the cofferdam is totally de-watered or using a bubble ring around the piles being driven. Table 5 shows the levels used for the analysis.

Table 9 – Computed Distances to NMFS Criteria for Unattenuated 24-inch Steel Shell Piles in Cofferdam

Location	*Distance to 187-dB Cumulative SEL Criterion [A] (feet)*	*Distance to 183-dB Cumulative SEL Criterion [A] (feet)*	*Distance to 206-dB Peak Criterion (feet)*	*Distance to 150-dB RMS Criterion (feet)*
East of the Bridge				
Pier 3	1,457	2,000 [B]	<33	2,000 [B]
West of the Bridge				
Pier 3	797 [B]	797 [B]	<33	797 [B]
[A] Single-strike SELs below 150 dB do not accumulate to cause injury to fish. *[B] Constrained by the river channel.*				

Table 10 – Computed Distances to NMFS Criteria for Attenuated 24-inch Steel Shell Piles in a Cofferdam

Location	*Distance to 187-dB Cumulative SEL Criterion [A] (feet)*	*Distance to 183-dB Cumulative SEL Criterion [A] (feet)*	*Distance to 206-dB Peak Criterion (feet)*	*Distance to 150-dB RMS Criterion (feet)*
East of the Bridge				
Pier 3	377	646	<33	971
West of the Bridge				
Pier 3	377	646	<33	797[B]
[A] Single-strike SELs below 150 dB do not accumulate to cause injury to fish. *[B] Constrained by the river channel.*				

DRAFT

Temporary Trestle

There will be two trestles on each end of bridge. The one on the south end will be approximately 86 feet long, and the other on the north end will be about 204 feet long. This will leave an opening of about 85 feet for traffic navigation between the two trestles. Each trestle will be a width of 35 feet to 40 feet with a superstructure of timber decking, steel stringers, and prefabricated steel bents and a safety railing. The bents will be spaced approximately 25 to 40 feet apart. These bents will be supported on piles varying from 15 to 36 inches in diameter. These piles have a spacing of 5 to 10 feet apart and may be driven by an impact hammer or through the use of a vibratory hammer. The number of piles is estimated to be approximately 125. Each pile will be approximately 50 to 75 feet long.

Based on the information provided, four options will be analyzed for the temporary trestle. All the trestles were assumed to be 40 feet wide, production was assumed to be one bent per day for all options, and all piles were assumed to be 75 feet in length and embedded in the ground 50 feet. The following is a summary of the assumptions used for the rest of the options:

1. Option A – Consists of using 15-inch steel shell piles for the foundation with the bent spacing set at the minimum distance of 25 feet and 10 piles per bent. This would require approximately 12 bents and approximately 120 piles.
2. Option B – Consists of using 24-inch steel shell piles for the foundation with the bent spacing set at the minimum distance of 30 feet and seven piles per bent. This would require approximately 10 bents and approximately 70 piles.
3. Option C – Consists of using 30-inch steel shell piles for the foundation with the bent spacing set at the minimum distance of 35 feet and five piles per bent. This would require approximately 9 bents and approximately 45 piles.
4. Option D – Consists of using 36-inch steel shell piles for the foundation with the bent spacing set at the minimum distance of 40 feet and four piles per bent. This would require approximately 8 bents and approximately 32 piles.

Driving of 36-inch shell steel piles in water could generate underwater maximum peak sound pressure levels of about 210 dB at 33 feet from the pile, while 15-inch steel shell piles could generate underwater maximum peak sound pressure levels of about 196 dB at 33 feet from the pile. Sound levels could be much lower in very shallow (i.e., less than 3-feet deep) portions of the slough. Pile-driving activities conducted near the slough would generate groundborne vibration that could produce underwater noise. Pile-driving activities conducted on land near water bodies have been found to transmit low-frequency sound into the water. The mechanisms for transmitting this sound into the water are complex and difficult, if not impossible, to predict. It is anticipated that substantial sounds transmitted into the water from pile driving would only occur in the deeper portions of the river where the water is relatively deep (6 feet or greater). Driving of small steel shell piles on land near the river is likely to result in peak sound pressure levels of less than 200 dB. Table 11 shows the distances to the various NMFS criteria for unattenuated pile installations.

DRAFT

Table 11 – Computed Distances to NMFS Criteria Unattenuated Pile Driving for Work Structures

Structure	Pile Type	Number of Piles per Day	Distance to 187-dB Cumulative SEL Criterion (feet)		Distance to 183-dB Cumulative SEL Criterion (feet)		Distance to 150-dB RMS Criterion (feet)		Distance to 206-dB Peak Criterion (feet)
			West	East	West	East	West	East	Both Directions
Option A – Main Work Trestle	15-inch	10	1,479	797[A]	2,000[A]	797[A]	2,000[A]	797[A]	<33
Option B – Main Work Trestle	24-inch	7	1,772	797[A]	2,000[A]	797[A]	2,000[A]	797[A]	<33
Option C – Main Work Trestle	30-inch	5	1,906	797[A]	2,000[A]	797[A]	2,000[A]	797[A]	<33
Option D – Main Work Trestle	36-inch	4	2,000[A]	797[A]	2,000[A]	797[A]	2,000[A]	797[A]	56

[A] *Maximum distance downstream 2,000 feet and upstream 797 feet due to curves in river.*

The distances to the various NMFS criteria can be reduced by attenuating the noise from the piles by the use of a bubble ring or similar method. Table 12 shows the distances to the various NMFS criteria for attenuated pile installations.

Table 12 – Computed Distances to NMFS Criteria Attenuated Pile Driving for Work Structures

Structure	Pile Type	Number of Piles per Day	Distance to 187-dB Cumulative SEL Criterion (feet)		Distance to 183-dB Cumulative SEL Criterion (feet)		Distance to 150-dB RMS Criterion (feet)		Distance to 206-dB Peak Criterion (feet)
			West	East	West	East	West	East	Both Directions
Option A – Main Work Trestle	15-inch	10	380	380	656	656	984	797[A]	<33
Option B – Main Work Trestle	24-inch	7	456	456	787	787	1,667	797[A]	<33
Option C – Main Work Trestle	30-inch	5	492	492	846	797[A]	1,909	797[A]	<33
Option D – Main Work Trestle	36-inch	4	646	646	1,112	797[A]	2,000[A]	797[A]	<33

[A] *Maximum distance downstream 2,000 feet and upstream 797 feet due to curves in river.*

Attenuation Methods

Air bubble curtains, either confined or un-confined, have been shown to reduce sound pressure levels for pile driving in water by up to about 10 to 20 dB within 984 feet of the pile. The amount of attenuation may be less, especially at distant locations from the pile, because of the contribution

DRAFT

of sound propagating through the bottom substrate. At the Benicia-Martinez Bridge and San Francisco-Oakland Bay Bridge Projects, at least 10 dB of sound reduction was obtained using bubble curtains. In some cases, up to 30 dB of attenuation was obtained. At the Humboldt Bay Seismic Retrofit Project, reductions of between 12 and 16 dB were achieved using either an unconfined bubble ring or a bubble ring in an isolation casing, with the best results being the unconfined bubble ring.

The design of the specific bubble ring configuration will depend on several factors, such as the depth of water and the water current, and must be designed individually for each project and location within the project. Air bubble curtain systems are used during production pile driving to reduce underwater sound pressures. Typically, a system consists of stacked rings to generate air bubbles throughout the entire water column surrounding the piles, even with currents. A bubble curtain system is generally composed of air compressor(s), supply lines to deliver the air, distribution manifolds or headers, perforated aeration pipes, and a frame. The frame is used to facilitate transportation and placement of the system, keep the aeration pipes stable, and provide ballast to counteract the buoyancy of the aeration pipes during pile-driving operations. Bubble curtain designs consist of single or multiple concentric layers of perforated aeration pipes (stacked vertically). Pipes in any layer are arranged in a geometric pattern, which will allow the pile-driving operation to be completely enclosed by bubbles for the full depth of the water column. The lowest layer of perforated aeration pipe is designed to ensure contact with the mud line without sinking into the bottom substrates. A proper combination of bubble density and close proximity of bubbles to the pile would be most effective. Numerous smaller bubbles are more effective because they displace more water between the bubbles. This pattern would have to be maintained throughout the water column.

Experimental results show that an encapsulated gas bubble curtain can provide substantial noise reduction ranging up to 40 dB, depending on frequency. Typically this technology focuses on reducing sound over a set frequency band rather than a broad band approach. The system would likely be designed to reduce sounds over the frequency range where pile driving produces the highest sounds. This system uses a curtain of encapsulated bubbles to shield either a noise source or a receiver. The only data available on the effectiveness of this system were gathered at a water treatment plant construction project in Lake Travis, Texas. This project was used as a source-of-opportunity in an experiment where a distant receiving area was shielded from incoming impulse sounds generated by the pile-driving events. The pile driving was approximately 1.55 miles from the receiving area. The piles being driven were composed of 48-inch-diameter steel pipe. The average measured peak-to-peak sound pressure level generated by the pile-driving events was 185 dB re:1μPa at a distance of 112 meters (367 feet) from the pile. The average sound pressure level at the receiving area 1.55 miles away was 150 dB re:1μPa, prior to treatment by the bubble screen. The peak pressures were observed in the 100- to 300-hertz frequency range. The data were

DRAFT

acquired over multiple hammer strikes on eight different piles.[10] The broadband reduction in sound level was not reported. The area where this project was undertaken was in a lake not a river environment with moving water. Because of this it is not reasonable to predict how effective the encapsulated bubble curtain would be in a shallow river environment due to a lack of demonstrated data from a similar environment. Based on this it was determined that the conservative approach would be to assume a 10-dB reduction, similar to a traditional bubble curtain system.

DRAFT

[10] Kevin M. Lee, Mark S. Wochner and Preston S. Wilson. UW132. Mitigation of low-frequency underwater anthropogenic noise using stationary encapsulated gas bubbles. Acoustical Society of America [DOI: 10.1121/1.4767960], Received 21 Sep 2012; published 2 Nov 2012, Proceedings of Meetings on Acoustics, Vol. 17, 070011 (2012).

Attachment A
Pile Driving Calculations

DRAFT

Unattenuated New Bridge Construction

New Bridge Structure	*Station*	*Pile Type*	*Pile Length (feet)*	*Number of Piles*	*Pile Location*	*Piles per Day*	*Estimated Blows per Pile (assumes piles driven to 90% of length)*	*Distance to Water (feet)*	*Peak (dB)*	*RMS (dB)*	*Single-strike SEL[1] (dB)*	*Cumulative SEL at 33 feet (dB)*
Abutment 1	M1 26+19.93	24-inch	65	28	On Land	7	1,170	56	179	159	150	189
Pier 2	M1 26+79.14	72-inch	100	2	In Water	2	1,620	0	214	199	189	224
Pier 3	M1 27+89.14	24-inch	100	25	In Coffer-dam	10	1,800	0	200	185	172	215
Pier 4	M1 28+99.14	72-inch	100	2	On Land	2	1,620	16	204	185	175	210
Abutment 5	M1 29+61.90	24-inch	65	28	On Land	7	1,170	85	172	158	146	185

[1] Single-strike SELs below 150 dB do not accumulate to cause injury to fish.

New Bridge Structure	*East of the Bridge (Upstream)*				*West of the Bridge (Downstream)*			
	Distance to 187-dB Cumulative SEL Criterion (feet)	*Distance to 183-dB Cumulative SEL Criterion (feet)*	*Distance to 150-dB RMS Criterion (feet)*	*Distance to 206-dB Peak Criterion (feet)*	*Distance to 187-dB Cumulative SEL Criterion (feet)*	*Distance to 183-dB Cumulative SEL Criterion (feet)*	*Distance to 150-dB RMS Criterion (feet)*	*Distance to 206-dB Peak Criterion (feet)*
Abutment 1	43	75	112	<33	43	75	112	<33
Pier 2	2,192[2]	2,192[2]	2,192[2]	98	630[2]	630[2]	630[2]	98
Pier 3	1,371	2,000[2]	2000[2]	<33	797[2]	797[2]	797[2]	<33
Pier 4	751	1,290	1,798[2]	<33	750	1,290	1,968[2]	<33
Abutment 5	<33	43	98	<33	<33	43	98	<33

[2] Constrained by the river channel.

DRAFT

Attenuated New Bridge Construction

New Bridge Structure	*Station*	*Pile Type*	*Pile Length (feet)*	*Number of Piles*	*Pile Location*	*Piles per Day*	*Estimated Blows per Pile (assumes piles driven to 90% of length)*	*Distance to Water (feet)*	*Peak (dB)*	*RMS (dB)*	*Single-strike SEL[1] (dB)*	*Cumulative SEL at 10 meters (dB)*
Abutment 1	M1 26+19.93	24-inch	65	28	On Land	7	1,170	56	***Piles on land and cannot be attenuated***			
Pier 2	M1 26+79.14	72-inch	100	2	In Water	2	1,620	0	204	189	179	214
Pier 3	M1 27+89.14	24-inch	100	25	In Coffer-dam	10	1,800	0	190	175	162	205
Pier 4	M1 28+99.14	72-inch	100	2	On Land	2	1,620	16	***Piles on land and cannot be attenuated***			
Abutment 5	M1 29+61.90	24-inch	65	28	On Land	7	1,170	85	***Piles on land and cannot be attenuated***			

[1] Single-strike SELs below 150 dB do not accumulate to cause injury to fish.

New Bridge Structure	*East of the Bridge (Upstream)*				*West of the Bridge (Downstream)*			
	Distance to 187-dB Cumulative SEL Criterion (feet)	*Distance to 183-dB Cumulative SEL Criterion (feet)*	*Distance to 150-dB RMS Criterion (feet)*	*Distance to 206-dB Peak Criterion (feet)*	*Distance to 187-dB Cumulative SEL Criterion (feet)*	*Distance to 183-dB Cumulative SEL Criterion (feet)*	*Distance to 150-dB RMS Criterion (feet)*	*Distance to 206-dB Peak Criterion (feet)*
Abutment 1	***Piles on land and cannot be attenuated***							
Pier 2	1,290	2,192[2]	2,192[2]	<33	630[2]	630[2]	630[2]	<33
Pier 3	354	607	971	<33	354	607	797[2]	<33
Pier 4	***Piles on land and cannot be attenuated***							
Abutment 5	***Piles on land and cannot be attenuated***							

[2] Constrained by the river channel.

DRAFT

Source Levels Used in Analysis of New Bridge

New Bridge	Station	Pile	Distance to water		Water Depth	Peak	RMS	SEL	Commnets
			Feet	Meters					
Abutement 1	M1 26+19.93	2 ft. Steel Shell	56	17	On Land	179	159	150	Willits Bypass
Pier 2	M1 26+79.14	6 ft. Steel Shell	0	0	4 feet	214	195	185	Feather River Bridge
Pier 3	M1 27+89.14	2 ft. Steel Shell	0	0	10 feet	200	185	172	Dewatered coffer dam
		Sheet Piles				205	189	179	Parson Slough
Pier 4	M1 28+99.14	6 ft. Steel Shell	16	5	On Land	204	Not Reported	175	Feather River Bridge 72" Land Based Piles 12 meters from Edge of water (measured at 16
Abutement 5	M1 29+61.90	2 ft. Steel Shell	85	26	On Land	172	158	146	Willits Bypass

DRAFT

Unattenuated Work Trestle

	Station	Pile Type	Driven Pile Length	Number Of Piles	Impact Drive	Blows Assumes 20 blows fer foot	Estimated Blows Per Pile	Piles per Day	Peak	RMS	Single Strike SEL	Distance Measured	Transmission Loss	Cumulative SEL @ 33 ft.	Distance to 187 dB Cumulative SEL Critera (feet)	Distance to 183 dB Cumulative SEL Critera (feet)	Distance to 150 dB RMS Critera (feet)	Distance to 187 dB Cumulative SEL Critera (feet)	Distance to 183 dB Cumulative SEL Critera (feet)	Distance to 150 dB RMS Critera (feet)	Distance to 206 dB Peak Critera (feet)
For the assessment - all piles were considered to be in the water and production was considered one bent per day.		15-inch Steel Shell	50	120	6,000	120,000	1000	10	196	180	170	20	17	210	1,479	2000 [1]	2000 [1]	797 [1]	797 [1]	797 [1]	<33
		24-inch. Steel Shell	50	70	3,500	70,000	1000	7	203	189	178	10	17	216	1,772	2000 [1]	2000 [1]	797 [1]	797 [1]	797 [1]	<33
		30-inch. Steel Shell	50	45	2,250	45,000	1000	5	205	190	180	10	17	217	1,906	2000 [1]	2000 [1]	797 [1]	797 [1]	797 [1]	<33
		36-inch. Steel Shell	50	32	1,600	32,000	1000	4	210	193	183	10	17	219	2000 [1]	2000 [1]	2000 [1]	797 [1]	797 [1]	797 [1]	56

[1] Constrained by river channel

Attenuated Work Trestle

	Station	Pile Type	Driven Pile Length	Number Of Piles	Impact Drive	Blows	Estimated Blows Per Pile	Piles per Day	Peak	RMS	Single Strike SEL	Distance Measured	Transmission Loss	Cumulative SEL @ 33 ft.	Distance to 187 dB Cumulative SEL Critera (feet)	Distance to 183 dB Cumulative SEL Critera (feet)	Distance to 150 dB RMS Critera (feet)	Distance to 187 dB Cumulative SEL Critera (feet)	Distance to 183 dB Cumulative SEL Critera (feet)	Distance to 150 dB RMS Critera (feet)	Distance to 206 dB Peak Critera (feet)
For the assessment - all piles were considered to be in the water and production was considered one bent per day.		15-inch Steel Shell	50	120	6,000	120,000	1000	10	186	170	160	20	17	200	382	656	985	382	656	797 [1]	<33
		24-inch. Steel Shell	50	70	3,500	70,000	1000	7	193	179	168	10	17	206	457	786	1,667	457	786	797 [1]	<33
		30-inch. Steel Shell	50	45	2,250	45,000	1000	5	195	180	170	10	17	207	492	846	1,908	492	797 [1]	797 [1]	<33
		36-inch. Steel Shell	50	32	1,600	32,000	1000	4	200	183	173	10	17	209	648	1113	2000 [1]	797 [1]	797 [1]	797 [1]	<33

[1] Constrained by river channel

Source Levels Used in Analysis of Temporary Trestle

Data Used	Job	Distance	Peak	RMS	SEL
14-inch	Richmond San-Rafael	66 feet	196	180	170
24-inch	Rodeo Dock	33 feet	203	189	178
30-inch	Richmond San-Rafael	33 feet	205	190	--
36-inch	Humboldt Bay	33 feet	210	193	183

DRAFT

Attachment B

Maps Illustrating the 183-dB and 187-dB Cumulative SELs Associated with Pile Driving

DRAFT

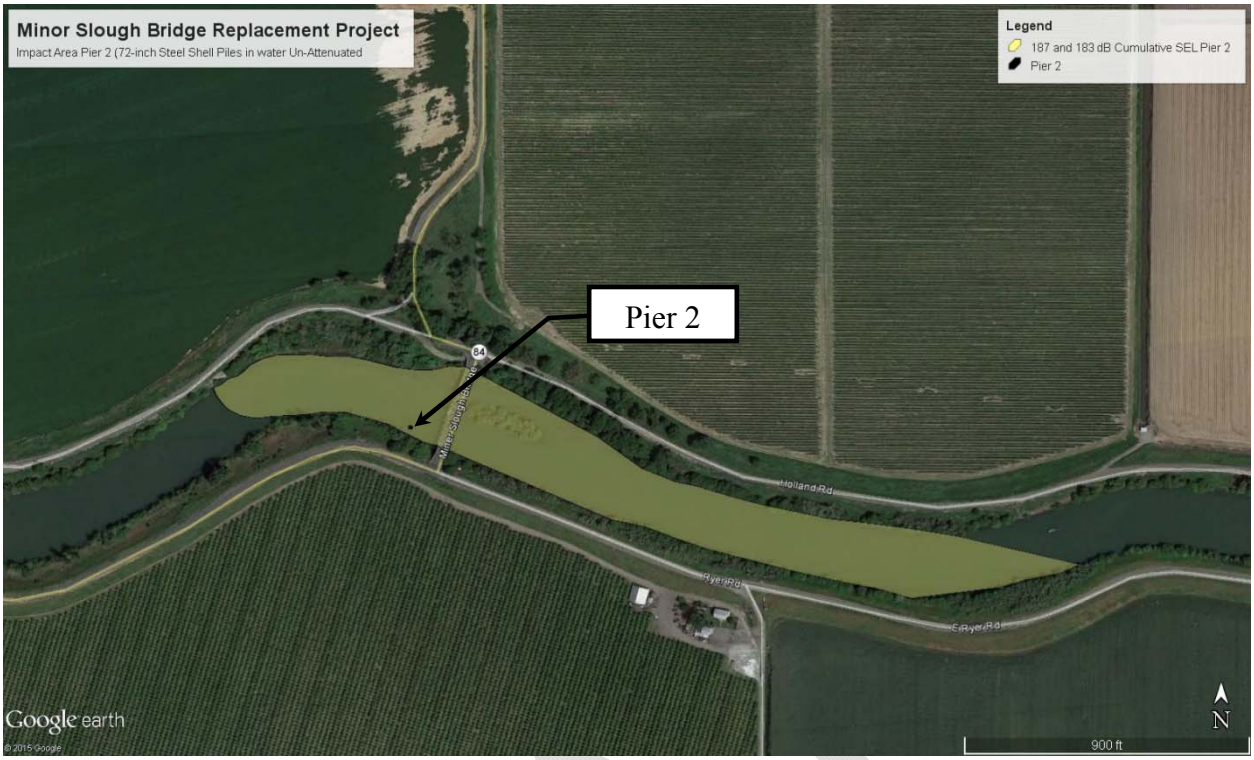


Figure 1 – Pier 2 Unattenuated 187- and 183-dB Cumulative SEL

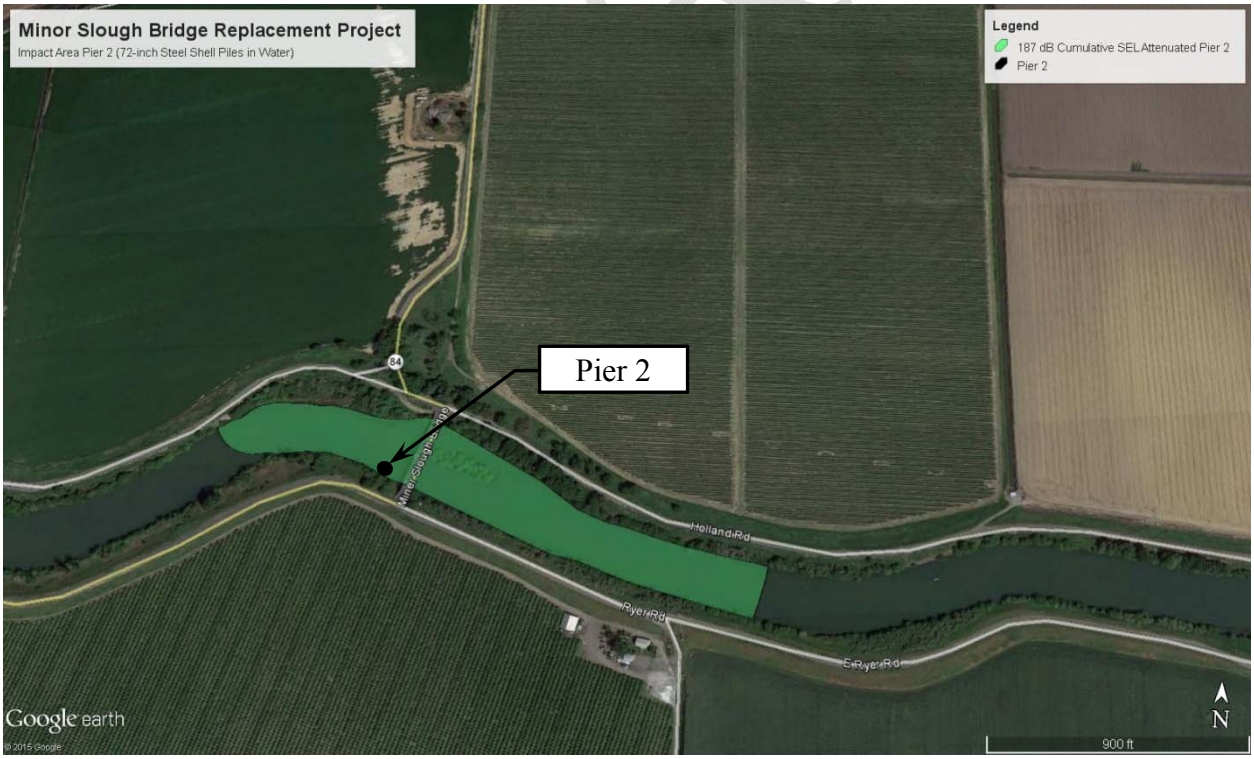


Figure 2 – Pier 2 Attenuated 187-dB Cumulative SEL

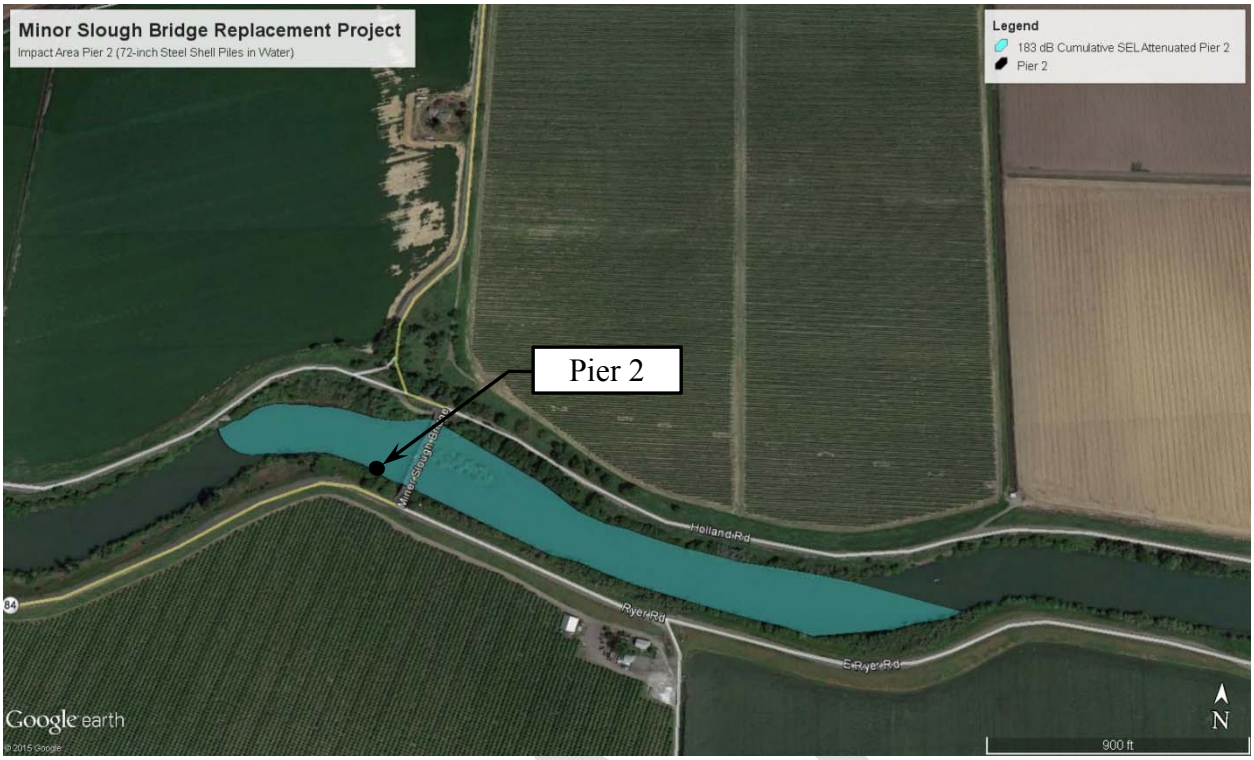


Figure 3 – Pier 2 Attenuated 183-dB Cumulative SEL

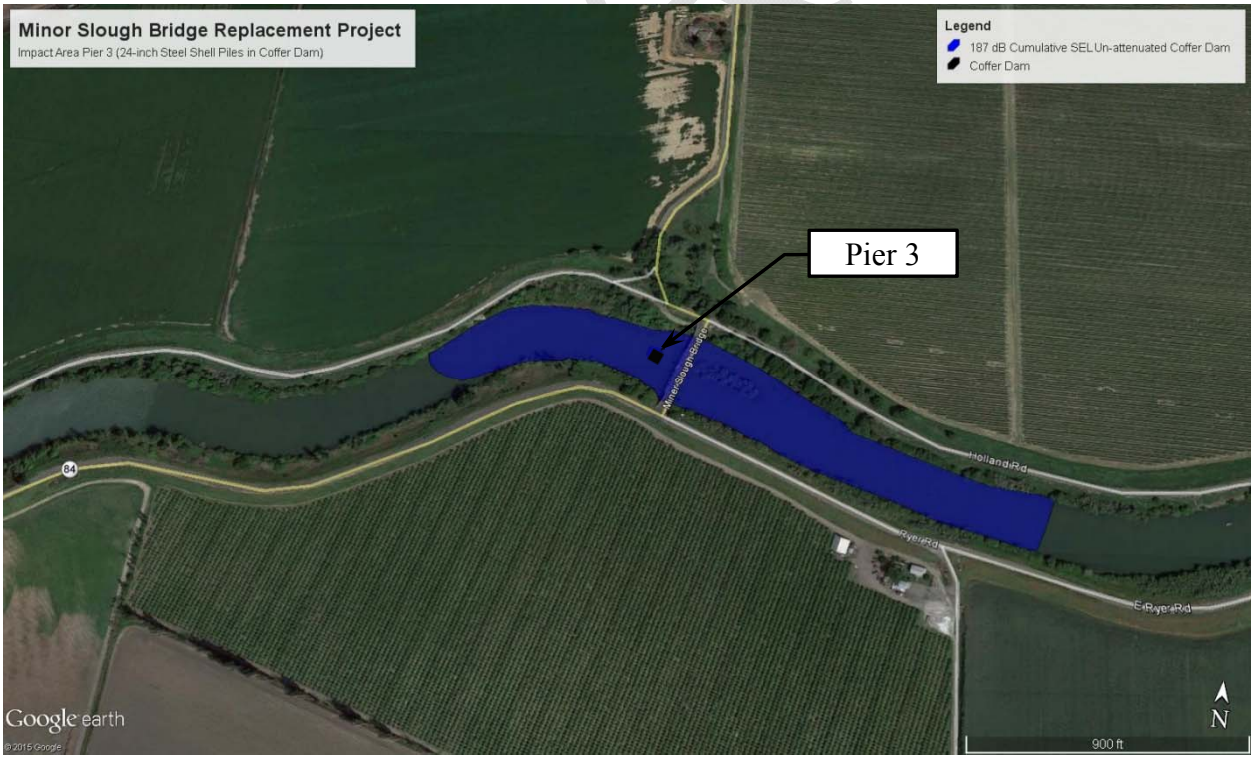


Figure 4 – Pier 3 Unattenuated 187-dB Cumulative SEL

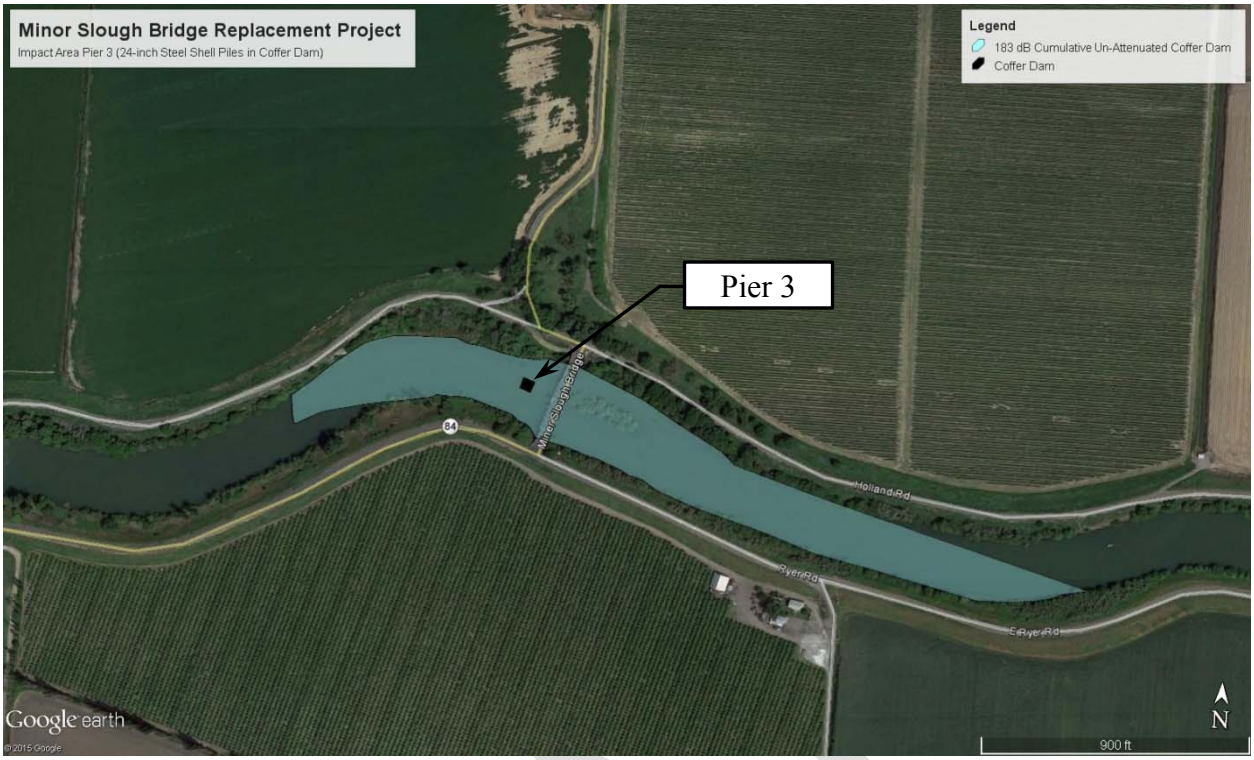


Figure 5 – Pier 3 Unattenuated 183-dB Cumulative SEL

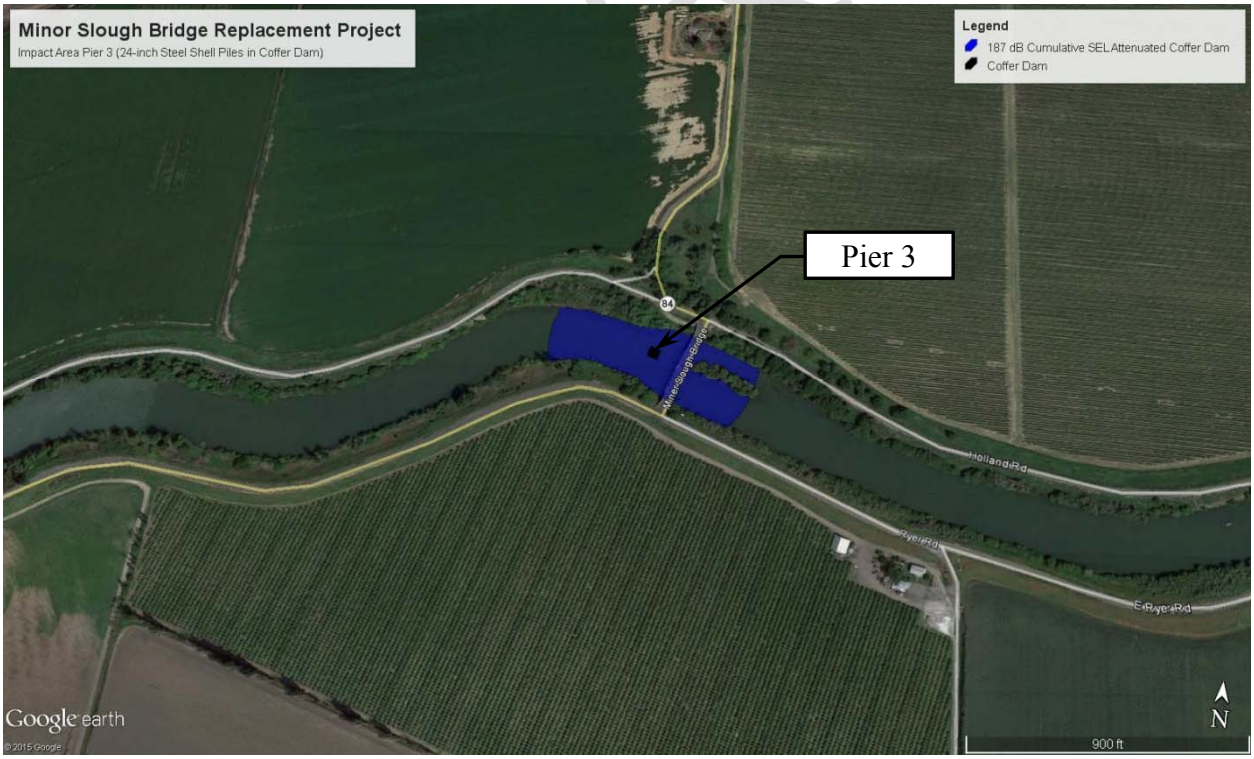


Figure 6 – Pier 3 Attenuated 187-dB Cumulative SEL

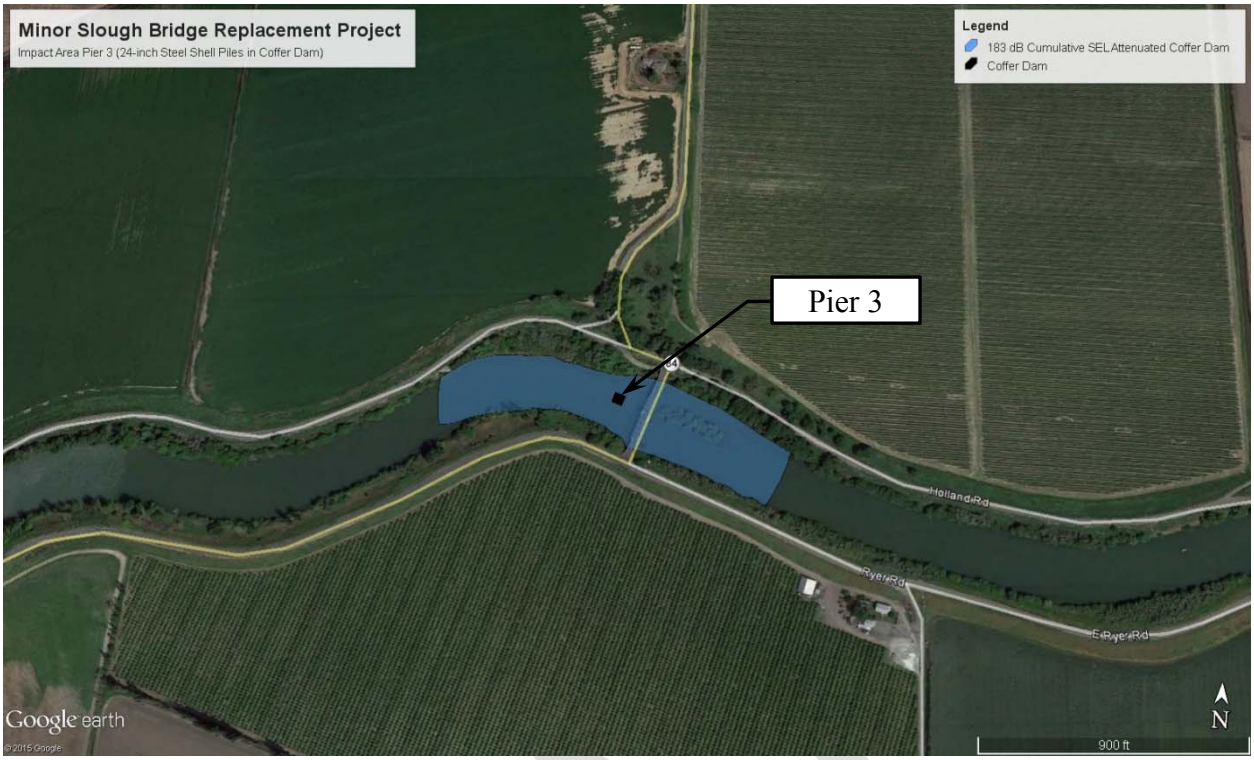


Figure 7 – Pier 3 Attenuated 183-dB Cumulative SEL

Figure 8 – Pier 4 (on Land) 187-dB Cumulative SEL

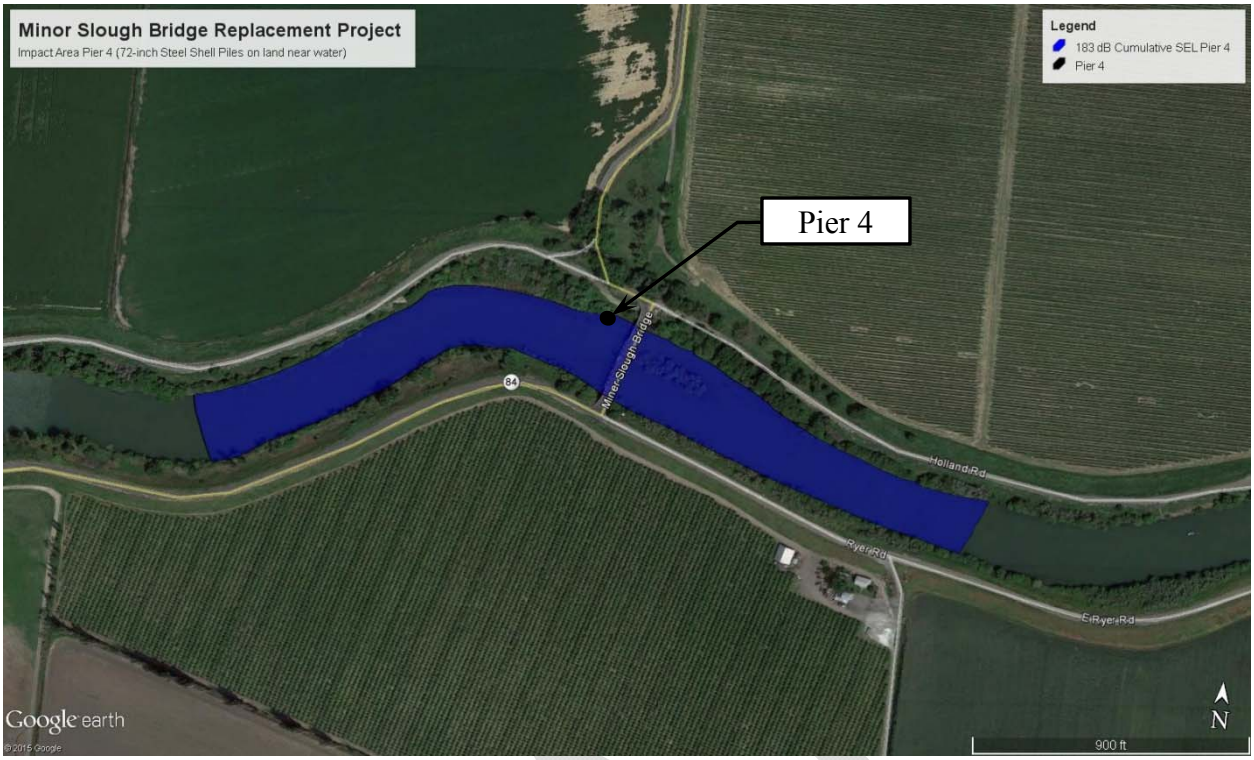


Figure 9 – Pier 4 (on Land) 183-dB Cumulative SEL

DRAFT