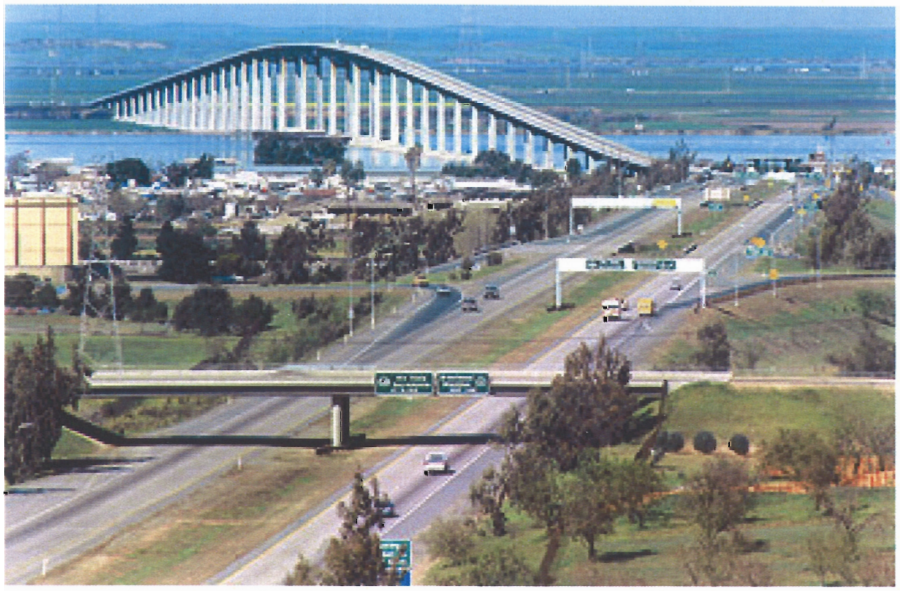
Antioch Bridge Seismic Retrofit Project

DISTRICT 4 – CC –160, PM 0.8/1.3,
SAC –160, PM 0.0/1.3
1A5210



Initial Study with
Mitigated Negative Declaration (CEQA)
and Environmental Assessment (NEPA)

04-CC-160, PM 0.8/1.3
10-SAC-160, PM 0.0/1.3
Expenditure Authorization 1A5210

The environmental review, consultation, and any other action required in accordance with applicable Federal laws for this project is being, or has been, carried out by Caltrans under its assumption of responsibility pursuant to 23 U.S.C. 327.

Prepared by:

Caltrans

September 2009

General Information About This Document

What's in this document?

The California Department of Transportation (Department), as assigned by the Federal Highway Administration (FHWA), has prepared this Initial Study/Environmental Assessment, which examines the potential environmental impacts of the alternatives being considered for the proposed project located on SR 160 in Contra Costa and Sacramento Counties. The document describes why the project is being proposed, alternatives for the project, the existing environment that could be affected by the project, the potential impacts from each of the alternatives, and the proposed avoidance, minimization, and/or compensation measures.

Changes or revisions in the text are marked with a vertical line in the margin.

What happens next?

Caltrans may (1) give environmental approval to the proposed project, (2) undertake additional environmental studies, or (3) abandon the project. If the project were given environmental approval and funding were appropriated, Caltrans could design and construct all or part of the project.

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: Howell Chan, P.O. Box 23660, Mail Station-8B, Oakland, CA 94623-0660; (510) 286-5623 Voice, or use the California Relay Service TTY number, (510) 286-4454.

4-CC-160, PM 0.8/1.3
04-SAC-160, PM 0.0/R1.3
EA 1A5210

On State Route 160 from Contra Costa County PM 0.8 to PM 1.3 at the Contra Costa/Sacramento County Line, and from Sacramento County PM 0.0 to PM 1.3, on Sherman Island

INITIAL STUDY with MITIGATED NEGATIVE DECLARATION (CEQA) and ENVIRONMENTAL ASSESSMENT (NEPA)

Submitted Pursuant to: (State) Division 13, Public Resources Code
(Federal) 42 USC 4332(2)(C)

Prepared by
THE STATE OF CALIFORNIA
Department of Transportation

9-2-09
Date of Approval

Bijan Sartipi
District Director
District 4

State of California
Department of Transportation

SCH Number: 2009062022
04-CC-160, PM 0.8/1.3
04-SAC-160, PM 0.0/1.3
EA 1A5210

Mitigated Negative Declaration (CEQA)

Pursuant to: Division 13, Public Resources Code

Project Description

The California Department of Transportation (the Department) proposes to seismically retrofit the Antioch Bridge. This project is located in Contra Costa and Sacramento Counties and is necessary to meet current safety standards based on the seismic performance criteria of "No Collapse".

Determination

This Mitigated Negative Declaration (MND) is included to give notice to interested agencies and the public that it is the Department's intent to adopt an MND for this project. This does not mean that the Department's decision regarding the project is final. This MND is subject to modification based on comments received by interested agencies and the public.

The Department has prepared an Initial Study/Environmental Assessment and determines from this study that the proposed project would not have a significant effect on the environment for the following reasons:

- The project will not significantly affect fish, plant life or wildlife; nor will it significantly affect any threatened or endangered species.
- There will be no significant impacts upon the aesthetic features of the area.
- The project will not significantly affect any important farmland, any floodplain or any wetlands.
- No historic or archaeological sites or structures of architectural or engineering significance will be affected.
- The project will not affect neighborhoods, social, cultural, or educational facilities, or the economy of the area.
- The potential for geologic or seismic hazards will not be increased by the project.
- The project is compatible with local, regional and state land use planning and will not introduce any new patterns of land use or any growth in the area. It will not alter present patterns of traffic circulation or movement.
- There will be no impacts on noise, air, and water quality. The project will not change the rate of use of any natural resources.

Bijan Sartipi
District Director
District 4
California Department of Transportation

9-2-09
Date

CALIFORNIA DEPARTMENT OF TRANSPORTATION

FINDING OF NO SIGNIFICANT IMPACT (FONSI)

for
Antioch Bridge Seismic Retrofit Project
(EA 1A5210)

The California Department of Transportation (Caltrans) has determined that the Build Alternative will have no significant impact on the human environment. This FONSI is based on the attached EA, dated September 2009, which has been independently evaluated by Caltrans and determined to adequately and accurately discuss the need, environmental issues, and impacts of the proposed project and appropriate mitigation measures. It provides sufficient evidence and analysis for determining that an EIS is not required. Caltrans takes full responsibility for the accuracy, scope, and content of the attached EA.

The environmental review, consultation, and any other action required in accordance with applicable Federal laws for this project is being, or has been, carried-out by Caltrans under its assumption of responsibility pursuant to 23 U.S.C. 327.

9-2-09
Date

BIJAN SARTIPI
District Director
Caltrans District 4

Summary

The California Department of Transportation (the Department) proposes to seismically retrofit the Antioch Bridge, which is part of Route 160 and connects the city of Antioch in eastern Contra Costa County to Sherman Island in Sacramento County.

The purpose of the project is to retrofit the existing bridge to meet the current safety standards. Significant revisions in seismic design criteria, implemented through the Seismic Retrofit Program, required reevaluation of the Antioch Bridge's seismic integrity. A vulnerability study was initiated in 2004. Geotechnical investigations were conducted in 2006-2007, and a design strategy meeting a "No Collapse" safety standard was completed in August 2008.

The Antioch Bridge Seismic Retrofit Project spans roughly 2 miles of State Route 160, from Contra Costa County PM 0.8 (the southerly project limit), to Sacramento County PM 1.3 (the northern project limit, on Sherman Island). The bridge connects the communities of Antioch and Oakley on the south bank of the San Joaquin River to Sherman Island, and spans the 3600 ft width of the river and over 4000 ft of Sherman Island before touching down just north of Mayberry Slough.

The land uses at the south end of the Antioch Bridge are mostly industrial parks and marinas. The bridge spans over right of way that the State of California leases to the East Bay Regional Park District for the Antioch/Oakley Regional Shoreline Park and fishing pier. There are few residences along SR 160 in this area. Sherman Island at the north end of the bridge is used primarily for agricultural purposes.

Impacts to the following species may occur as a result of the proposed project.

- The federal and state endangered delta smelt
- The federally and state endangered Sacramento River winter run Chinook salmon, federally and state threatened Central Valley spring run Chinook salmon, federally threatened green sturgeon, federally threatened Central Valley steelhead, National Marine Fisheries Service (NMFS) species of concern and state species of special concern Central Valley fall run and late fall run Chinook salmon
- The state and federally threatened giant garter snake including habitat loss and temporary displacement
- Upland areas that are potentially suitable habitat for the western pond turtle and burrowing owl, both of which are state species of special concern
- The California sea lion and Pacific harbor seal

The project would result in temporary impacts to US Army Corps of Engineers (USACE) jurisdictional wetlands and jurisdictional irrigation ditches.

Emergent wetlands located along the southern shore of the San Joaquin River would be directly affected by shading as a result of installation of the temporary marine trestle, and

also temporary impacts to the state listed rare Mason's lilaeopsis and the California Native plant Society List 1B species Suisun Marsh aster.

The Department will require on site restoration for impacts to wetland habitats. If onsite mitigation is unavailable or infeasible, the Department will pursue nearby offsite locations through the purchase of appropriate habitat or mitigation bank credits. The Department may participate in preservation and restoration effort to compensate for impacts to wetlands and other waters of the U. S., to delta smelt rearing, feeding and movement habitat, and giant garter snake habitat. Additional preservation and restoration may be necessary to compensate for impacts to federally listed species.

There will be no cultural resources, air quality, hazardous materials, water quality, or community impacts resulting from this project.

Anticipated permits for this project include a Section 1602 Lake and Streambed Alteration Agreement California Department of Fish and Game (CDFG), a (CDFG; Section 2081 (b) of the California Fish and Game Code) for incidental take of giant garter snake and delta smelt, a Clean Water Act (CWA) Section 404 Nationwide Permit from the U. S. Army Corps of Engineers (USACE); a CWA Section 401 Water Quality Certification permit from the Regional Water Quality Control Board (RWQCB); a Biological Opinion with a Federal Endangered Species Act (FESA) Section 7 incidental take statement from the U. S. Fish and Wildlife Service (USFWS). A Biological Opinion with and an Incidental Take Statement and an Incidental Harassment Authorization (Marine Mammal Protection Act) from NOAA

The no project alternative will have none of the impacts of the build alternative, but would leave the bridge vulnerable to damage and closure after a major earthquake.

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Chapter 1-Proposed Project

1.1 Introduction

The California Department of Transportation (Caltrans) and the Bay Area Toll Authority (BATA) propose to retrofit the Antioch Bridge (#28-0009) to meet current seismic safety design standards. The Antioch Bridge is part of State Route (SR) 160 and connects Antioch in eastern Contra Costa County to Sherman Island in Sacramento County. The bridge connects the communities of Antioch and Oakley on the south bank of the San Joaquin River to Sherman Island, and spans the 3600 ft width of the river and over 4000 ft of Sherman Island before touching down just North of Mayberry Slough (Fig. 1).

This project is neither in the 2009 regional Transportation Plan (Transportation 2035) nor the 2008 Transportation Improvement Program.

1.2 Background

Built in 1978, the bridge is 9,437 ft long, and accommodates one lane of traffic in each direction and includes narrow accommodation for bicyclists and pedestrians. The bridge features two structural elements, the "Main Structure" and the "Slab Span Structure." The Main Structure is 8,650 ft in length and consists of forty spans varying in length from 135 ft to 460 ft for the channel crossing. The superstructure of the Main Structure consists of a 43.5 ft wide concrete deck supported by 2 steel girders that vary in depth from 8 ft to 25 ft. The girders rest on concrete bent cap beams. Most of the bent cap beams are hollow. The columns are then supported on driven pile-type footings. The exterior piles are battered at a 3:1 inclination and the interior piles are vertical.

The seismic retrofit of Antioch Bridge is necessary for the bridge to meet current safety standards. The construction of Antioch Bridge was completed in 1978 and its seismic design was based on the criteria developed after the San Fernando Earthquake of 1971. Studies in the early 1990s determined that the bridge had sufficient seismic resistant features, and minor vulnerabilities in a major earthquake. The Loma Prieta Earthquake of 1989 prompted Caltrans to implement the Seismic Retrofit Program, and after the Northridge Earthquake of 1994, implemented Phase Two of the program, which included the retrofit of seven state-owned toll bridges, including Antioch Bridge. Significant revisions of the seismic design criteria, implemented through the Seismic Retrofit Program, required a reevaluation of Antioch Bridge's seismic integrity. A vulnerability study was initiated in 2004. Geotechnical investigations were conducted in 2006-2007, and a design strategy, meeting a No Collapse safety standard, was completed in August 2008.

1.3 Project Purpose and Need

The purpose of the Antioch Bridge Seismic Safety Retrofit Project is to provide a seismically upgraded vehicular crossing for current and future users that will continue to:

- Provide for the safety of bridge users during a maximum credible earthquake (MCE); and

- Improve operational and safety designs to meet current standards to the greatest extent possible.
- Maintain the current vehicular capacity.
- Connect the cities of Antioch and Oakley in eastern Contra Costa County to Sherman Island in Sacramento County.

The existing Antioch Bridge does not meet current operational seismic safety design standards. Improvements to the existing Bridge are needed to address seismic safety deficiencies and current safety design standards. The proposed seismic retrofit project would meet the current performance standards in the event of a (MCE).

Maximum Credible Earthquake

The MCE is the maximum earthquake predicted to affect a given location based on the known lengths of the active faults in the vicinity. An MCE on either the San Andreas or Hayward fault would be expected to inflict far greater damage to the Antioch Bridge than was experienced from the 1989 Loma Prieta earthquake. This is due to the potential for the epicenter of an event on either the San Andreas or Hayward fault to be nearer the bridge, as well as the expected greater magnitude of the MCE compared to that of the Loma Prieta earthquake (magnitude 7.1). It is estimated that an MCE with a 8 magnitude would generate in excess of 30 times more energy than the Loma Prieta earthquake. The feasibility of reopening the existing Antioch Bridge to traffic following a MCE would be limited or precluded without the seismic safety improvements proposed.

The MCE on each of these faults is defined as the largest earthquake that appears to be reasonably capable of occurring based on current geological knowledge. The probability of an MCE occurring on one of these faults is approximately one in four over the next two to three decades.

On the basis of research conducted following the 1989 Loma Prieta earthquake, U.S. Geological Survey (USGS) and other scientists conclude that there is a 70 percent probability of at least one magnitude 6.7 or greater quake on faults in the San Francisco Bay region, capable of causing widespread damage before 2030. Major quakes may occur in any part of this rapidly growing region. This emphasizes the urgency for all communities in the Bay region to continue preparing for earthquakes. The controlling fault for the Antioch Bridge is the Coast Ranges-Sierran Block Boundary Zone fault. It is located less than 3 kilometers west/southwest of the bridge, and has a MCE of 7.0.

1.4 Project Description

The Antioch Bridge Seismic Retrofit Project spans roughly 2 miles of State Route 160, from Contra Costa County PM 0.8 to Sacramento PM 0.0 to PM 1.3, on Sherman Island (Fig. 2).

The Antioch Bridge Seismic Retrofit Project area occupies roughly 62 acres, including 7.5 acres on the south shore of the San Joaquin River in Contra Costa County, 21 acres of the San Joaquin River, and 33.5 acres on Sherman Island in Sacramento County.

The proposed retrofit elements to the bridge include the following:

- Installation of steel cross bracing between columns to stiffen the superstructure cross frames (Pier 12 to Pier 31).
- Installation of bracing to existing cross frames at the bent caps (Pier 2 to Pier 40).
- Replacement of the existing elastomeric bearings with isolation bearings (Abutment 1 to Pier 41).
- Removal of the existing curtain walls and retrofit of all the columns within the slab span structure (Bent 42 to Abutment 71).

Proposed construction access includes temporary upland access roads, barge access in the main channel, temporary contractor staging and lay down area, and a temporary marine trestle on the south end as described below:

- Construction of a temporary marine trestle with an approximate length of 910-ft and a width of 25-ft will be constructed from the south bank of the San Joaquin River to Pier 11 to allow construction access to the piers in the shallow water area. The trestle platform is expected to be approximately 5-ft above the mean higher-high water mark (MHHW). Caltrans biologists and engineers worked closely to define the parameters of constructing the temporary marine trestle. The two main methods used to install piles are impact and vibratory pile driving. An impact hammer is a large metal ram that is usually attached to a crane. A vertical support holds the pile in place and the ram is repeatedly dropped or forced downward. The energy is then transferred to the pile, which is driven into the riverbed. The ram is typically lifted by mechanical, air steam, diesel, or hydraulic power sources. Vibratory pile driving is achieved by means of a variable eccentric vibrator attached to the head of the pile. The pile driving machine is lifted and positioned over the pile by means of an excavator or crane, and is fastened to the pile by a clamp and/or bolts and then driven into the substrate by vibration, over a period of several minutes. Therefore, unlike impact hammers, which produce intense bangs with rapid raise of acoustic energy noises generated. Vibratory pile driving has a lower intensity but longer duration over a longer time period. Pile driving during the Antioch Bridge Retrofit Project will primarily involve vibratory pile driving with only 1 pile per day driven with an impact hammer to test substrate resistance. It is anticipated that 4-6 piles per day will be driven with a vibratory hammer.
- A work window of August 01- November 30 will be in place to avoid winter run Chinook salmon, Central Valley spring run Chinook salmon, longfin smelt, and to minimize potential impacts on delta smelt.
- Construction of a temporary access road on the south shore, which runs adjacent and parallel to the bridge to access the temporary marine trestle.
- Construction of a temporary access road from the southernmost bridge support on Sherman Island (Pier 22) to the last bridge support south of Mayberry Slough (Pier 38) will provide construction access for retrofit work.
- Construction of temporary access roads parallel to the slab span structure on both sides, north of Mayberry Slough, will facilitate removal of the curtain walls from the slab span structure and reinforce existing columns and abutments.
- Permanent widening of an existing access road along Mayberry Slough will provide access to the piers north of Mayberry Slough.

- Temporary staging (one main temporary staging area and one lay down area) near the north end of the bridge; two staging areas between bridge piers on Sherman Island near Piers 29, 30, and 31 north to the access road; and the existing paved areas on the south side of the bridge.

ALTERNATIVES

Build Alternative

This project is a seismic retrofit of the existing bridge and thus, there is only the one Build Alternative, as presented above in the project description.

No-Build

Environmental law requires identification of a no build alternative to use as a baseline for evaluation of construction alternatives. If the bridge seismic retrofit is not constructed, the existing Route 160/Antioch Bridge retains the existing facility without any improvements. The No Build Alternative will not upgrade the bridge to current seismic standards.

Project Cost and Funding Sources:

The preliminary cost for the Antioch Bridge Seismic Retrofit Project is estimated at $279 million dollars. The main funding source for the project is BATA toll funds.

1.5 Permits and Approvals Needed

This project will require several permits, agreements, and concurrence from the resource agencies:

- Biological Opinion with Incidental Take Statement for potential impacts to Central Valley steelhead and southern populations of green sturgeon from NOAA's National Marine Fisheries Service (NMFS), (Federal Endangered Species Act which protects endangered plants and animals)
- Biological Opinion with Incidental Take Statement (USFWS) for delta smelt and giant garter snake. (Federal Endangered Species Act which protects endangered animals)
- Section 1602 Lake and Streambed Alteration Agreement (CDFG; Section 1601 of the Fish and Game Code)
- Section 2081 (b) Incidental Take Permit for giant garter snake and delta smelt of the (CDFG 2081 of the Fish and Game Code)
- Section 401 Water Quality Certification (RWQCB; Section 401 of the Clean Water Act)
- Section 404 Nationwide Permit (USACE; Section 404 of the Clean Water Act)
- Incidental Harassment Authorization (IHA) application, National Oceanic Atmospheric Administration's (NOAA's) National Marine Fisheries Service (NMFS). Under the Marine Mammal Protection Act (MMPA), the taking of marine mammals without a permit or exemption from NMFS is prohibited. The term "take" under the MMPA means, "to harass, hunt, capture, kill or collect, or attempt to harass, hunt,

capture, kill or collect." Except with respect to certain activities not relevant here, the MMPA defines "harassment" as "...any act of pursuit, torment, or annoyance which (a) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (b) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering but which does not have the potential to injure a marine mammal or marine mammal stock in the wild [Level B harassment]." In order to obtain an exemption from the MMPA's prohibition on taking marine mammals, a citizen of the United States who engages in a specified activity (other than commercial fishing) within a specified geographic region must obtain an incidental take authorization (ITA) under section 101(a)(5)(A) or (D) of the MMPA. An ITA shall be granted if NMFS finds that the taking of small numbers of marine mammals of a species or stock by such citizen will have a negligible impact on the affected species or stock(s) and will not have an immitigable adverse impact on the availability of the species or stock(s) for subsistence uses. NMFS may also prescribe, where applicable the permissible methods of taking and other means of affecting the least practicable impact on the species or stock and its habitat (i.e., mitigation, monitoring and reporting of such takings). ITAs may be issued as either (1) Letters of Authorization (LOAs) or (2) IHAs, the latter applicable when there is no potential for serious injury and/or mortality or where any such potential can be negated through required mitigation measures. Caltrans is applying for an IHA application.

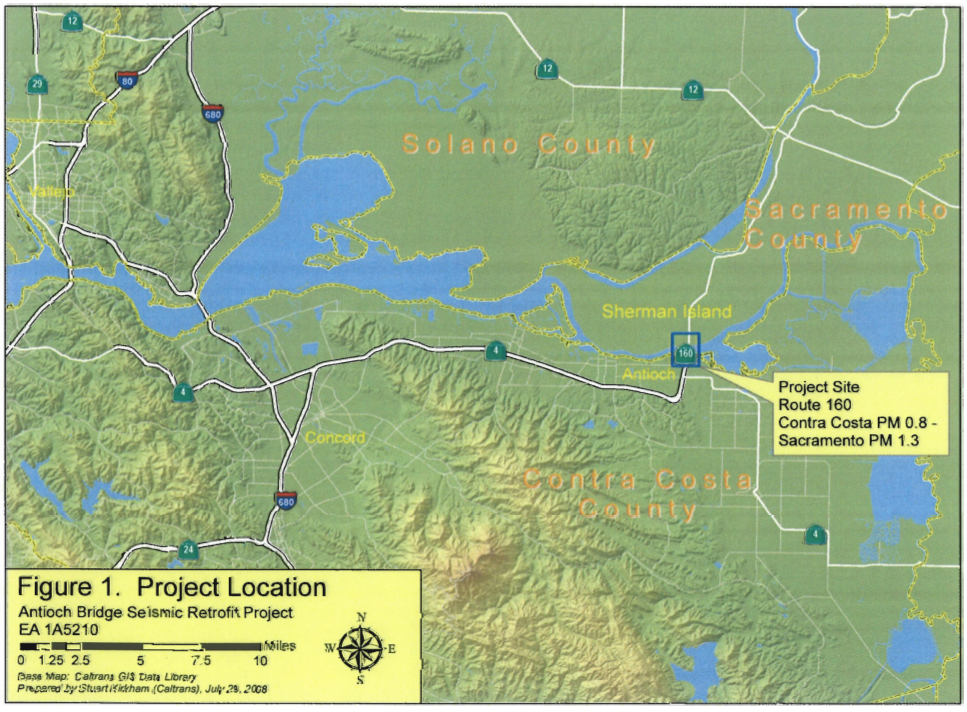

Figure 1 – Project Location Map

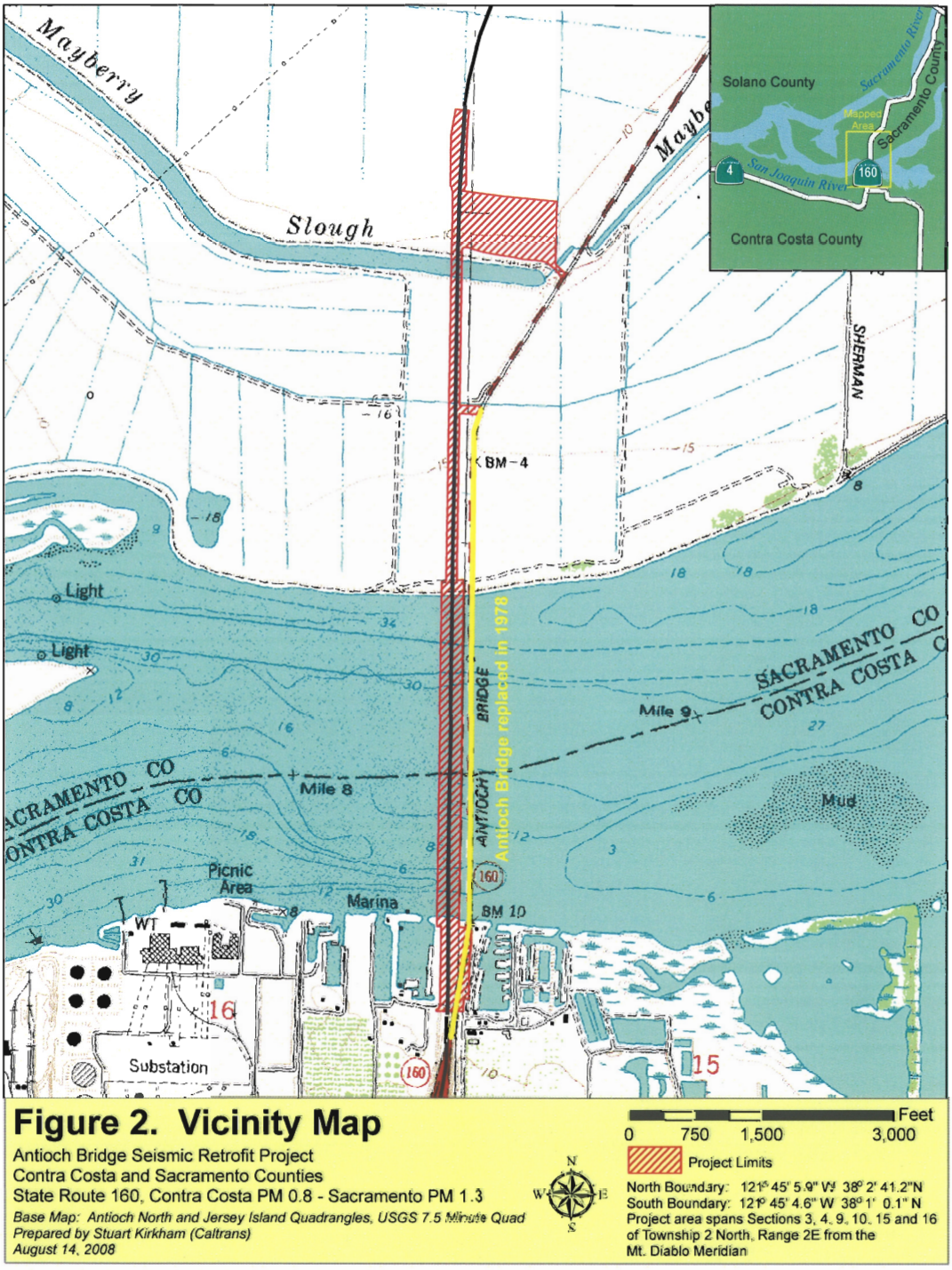

Figure 2 - Vicinity Map

Chapter 2 – Affected Environment, Environmental Consequences, and Avoidance, Minimization &/OR Mitigation Measures

This chapter describes the environmental resources of the project areas and how the resources would be affected by the proposed project. Potential environmental impacts of the proposed project and recommended avoidance, minimization and mitigation measures are discussed. Chapter 2 also discusses and addresses issues of concern pursuant to the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA) that provides the basis for responses to the CEQA Checklist Form. Please see Appendix A for the CEQA Checklist.

Based on the results of technical studies that examined impacts to environmental resources, the Department of Transportation (Department) as the lead state agency, has determined that the appropriate level of CEQA document for this project is an Initial Study. The Department, assigned NEPA responsibilities by Federal Highway Administration (FHWA), has determined that the appropriate level of NEPA document is an Environmental Assessment.

The proposed project would not significantly affect the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory. The mitigation measures identified and described in this document for the proposed project will minimize the impacts to the environment to a level below significance.

As part of the scoping and environmental analysis conducted for the project, environmental issues in Table 1 were considered, but no adverse impacts were identified. Consequently, there is no further discussion regarding these issues in this document.

Table 1: No Adverse Impact Determinations Summary of the Build Alternative

AGRICULTURAL RESOURCES	The project will not convert farmland to non-agricultural use. Temporary use of current agriculture lands will be returned to existing conditions.
AIR QUALITY	This project qualifies for an exception from regional (40 CFR 93.127) conformity requirements.
GEOLOGY AND SOILS	The Bay Area is seismically active, and the Department routinely conducts detailed geotechnical studies and develops project specific construction features to minimize seismic risks. Project level seismic analysis includes a preliminary geotechnical report to determine soil conditions and local earthquake fault characteristics; and a design report recommending protective measures to be incorporated into final project design. Design recommendations are prepared in accordance with the following document: California Division of Mines and Geology Guidelines for Evaluating and Mitigating Seismic Hazards.
HAZARDS AND HAZARDOUS MATERIALS	The project will not result in any increased hazards or hazardous materials risks during or after construction; any hazardous materials determined to be present in the project area found will be encapsulated or disposed of in accordance with applicable federal and state regulations.
HYDROLOGY AND WATER QUALITY	The project will not violate any water quality standards or waste discharge requirements. It will not substantially deplete groundwater supplies or alter existing drainage patterns.
LAND USE AND PLANNING	This project conforms to city and county general plans.
MINERAL RESOURCES	The project does not conflict with resource recovery plans or operations in the vicinity.
NOISE	The project will not cause or contribute to a substantial long-term increase in traffic noise or ground vibration levels because there will be no increase in traffic capacity. Standard practices will be used to minimize construction noise impacts.
POPULATION AND HOUSING	The project will not induce unplanned population growth, either directly or indirectly. Existing housing and businesses will not be displaced.
PUBLIC SERVICES	The project will not affect provision of existing public services or measurably increase the need for new or physically altered governmental facilities in order to maintain acceptable service ratios, response times or other performance objectives for any public service. Standard Department management practices will preclude substantial adverse impacts during construction.
RECREATION	The project will not directly or indirectly reduce the permanent recreational value of any public or private properties.

TRANSPORTATION/TRAFFIC	The project will not cause an increase in traffic that is substantial in relation to the traffic load and capacity of the existing highway. It does not conflict with plans, or programs for bicycling or other alternative transportation means.
CULTURAL RESOURCES	Cultural resources refer to all historical and archaeological resources, regardless of significance. No adverse impacts were identified within the area of potential effect (APE). Therefore, further consultation with the State Historic Preservation Officer (SHPO) will not be required for this project.
UTILITIES AND SERVICES	Existing utilities and services will not be adversely affected by construction and will be restored to pre-existing conditions or better afterwards. Standard Caltrans procedures for coordinating temporary service disruptions during construction are considered adequate for this project.
MANDATORY FINDINGS OF SIGNIFICANCE (CEQA)	The project seismically upgrades an existing facility, does not substantially increase existing highway capacity, is consistent with the adopted regional transportation plan, and includes preventive measures to preclude environmental damage during construction. The project, therefore, will not degrade the quality of the environment. It will not cause or contribute to adverse cumulative environmental impacts or cause substantial adverse effects on human beings, either directly or indirectly.
FLOODPLAIN	There will be no impacts to floodplains. Measures to minimize floodplain impacts and to preserve/restore any beneficial floodplain values will be implemented in the project.
CLIMATE CHANGE	The project does not increase capacity or alter travel patterns. Consequently, there will be no permanent impacts to the climate.

The no build alternative also has none of the impacts from Table 1 but there would be safety concerns and potential economic impacts if the bridge was damaged or destroyed.

2.1. Human Environment

2.1.1. VISUAL/AESTHETICS

Regulatory Setting

The National Environmental Policy Act of 1969 as amended (NEPA) establishes that the federal government use all practicable means to ensure all Americans safe, healthful, productive, and aesthetically (emphasis added) and culturally pleasing surroundings (42 U.S.C. 4331[b][2]). To further emphasize this point, the Federal Highway Administration in its implementation of NEPA (23 U.S.C. 109[h]) directs that final decisions regarding projects are to be made in the best overall public interest taking into account adverse environmental impacts, including among others, the destruction or disruption of aesthetic values.

Likewise, the California Environmental Quality Act (CEQA) establishes that it is the policy of the state to take all action necessary to provide the people of the state "with...enjoyment of aesthetic, natural, scenic and historic environmental qualities." (CA Public Resources Code Section 21001[b])

Affected Environment

The visual character of the project setting is typical of the Sacramento River Delta shoreline. The shores are lined with tidal marshland transitioning to grassland dotted with native and non-native trees and shrubs. The river separates the rolling foothills of Mount Diablo in Contra Costa County from the rural flatlands of the Sacramento Delta. Waterfront development varies from undeveloped to recreational to industrial.

Environmental Consequences

The project as a whole will result in a small change to the visual character of the bridge, with no adverse visual impacts to key viewers. The character of the existing bridge structure will not block scenic views or vistas. The visual impact of the project is considered moderate since the visual change will be low but the viewer response is expected to be moderate. Temporary impacts resulting from construction staging activities to the Antioch-Oakley Regional Park will be restored to preconstruction conditions.

Avoidance, Minimization and/or Mitigation Measures

New column cross bracing shall be colored to give the appearance of weathered steel. The new features would visually blend and appear integral with the overall bridge structure. Replacement of any park features such as pathways, planting and irrigation disrupted by construction will be restored to pre-project conditions immediately following construction. Please see Appendix K for a visual simulation of the proposed project.

2.2 Physical Environment

2.2.1 WATER QUALITY AND STORM WATER RUNOFF

Regulatory Setting

Section 401 of the Clean Water Act (CWA) requires water quality certification from the State Water Resources Control Board (SWRCB) or from a Regional Water Quality Control Board (RWQCB) when the project requires a CWA Section 404 permits. Section 404 of the CWA requires a permit from the U.S. Army Corps of Engineers (Corps) to discharge dredged or fill material into waters of the United States.

Along with CWA Section 401, CWA Section 402 establishes the National Pollutant Discharge Elimination System (NPDES) permit for the discharge of any pollutant into waters of the United States. The federal Environmental Protection Agency has delegated administration of the NPDES program to the SWRCB and nine RWQCBs. The SWRCB and RWQCB also regulate other waste discharges to land within California through the issuance of waste discharge requirements under authority of the Porter-Cologne Water Quality Act.

The SWRCB has developed and issued a statewide NPDES permit to regulate storm water discharges from all Department activities on its highways and facilities. Department construction projects are regulated under the Statewide permit, and projects performed by other entities on Department right-of-way (encroachments) are regulated by the SWRCB's Statewide General Construction Permit. All construction projects over 1 acre require a Storm Water Pollution Prevention Plan (SWPPP) to be prepared and implemented during construction. Department activities less than 1 acre require a Water Pollution Control Program.

Affected Environment

This project is within the Central Valley Regional Water Quality Control Board (RWQCB) jurisdiction (Region 5), which is responsible for implementation of state and federal water quality protection laws and regulations in the vicinity of the project site. A 401 Water Quality Certification from Region 5, RWQCB is anticipated because of the retrofit work on the bridge as San Joaquin River flows below it.

Environmental Consequences

Storm Water — The Department has performed studies to monitor and characterize highway storm water runoff throughout the State. Pollutants of Concern in Caltrans runoff found from the "Final Report of the Caltrans BMP Retrofit Pilot Program," were phosphorus, nitrogen, copper (total or dissolved), lead (total or dissolved), zinc (total or dissolved), sediments, general metals (unspecified metals), and litter. Some sources of these pollutants are natural erosion, phosphorus from tree leaves, combustion products from fossil fuels, trash and falling debris from motorists, and the wearing of break pads.

Ground Water — Groundwater may be encountered during excavation work and pile work for the bridge trestle. Early discussion will need to be initiated regarding the handling and

disposal of groundwater water during construction. The groundwater will need to be tested for potential contamination as a part of the Hazardous Waste Site Investigation. Handling and disposal of the groundwater will be based on the level of contaminants reported in the Caltrans Site Investigation Report.

Avoidance, Minimization and/or Mitigation Measures

According to the Department's NPDES permit and the Construction General Permit, Best Management Practices (BMPs) will be incorporated to reduce the discharge of pollutants during construction, as well as permanently, to the Maximum Extent Practicable (MEP). These BMPs fall into four categories, Temporary Construction Site BMPs, Design Pollution Prevention BMPs, Permanent Treatment BMPs, and Maintenance BMPs.

(a) Construction Site BMPs

Construction Site BMPs are implemented during construction activities to reduce pollutants in storm water discharges throughout construction. Temporary silt fence, concrete washout, stockpile cover, stabilized construction entrance/exit and temporary soil stabilizers are some of the temporary erosion and water pollution control measures that may be utilized in combination to prevent and minimize soil erosion and sediment discharges during construction. Given that the anticipated soil disturbance is greater than 0.4 hectares (1 acre), Storm Water Pollution Prevention Plan (SWPPP) will be developed during construction. This document will address the deployment of various erosion and water pollution control measures that are required commensurate to changing construction activities.

(b) Permanent Design Pollution Prevention BMPs

Design Pollution Prevention BMPs are permanent measures to improve storm water quality by reducing erosion, stabilize disturbed soil areas, and maximize vegetated surfaces. Erosion control measures will be provided on all disturbed areas to the extent feasible. These measures can utilize a combination of source and sediment control measures to prevent and minimize erosion from soil disturbed areas. Source controls can utilize erosion control netting in combination with hydroseeding.

The biodegradable netting is effective in providing good initial mechanical protection while seed applied during the hydroseeding operation germinates and establishes itself. Other forms of source control such as tacked straw may also be used when applicable. Sediment controls such as biodegradable fiber rolls can be used to retain sediments and to help control runoff from disturbed slope areas. These measures would be investigated during the design phase.

Outlet protection and velocity dissipation devices placed at the downstream end of culverts and channels are also Design Pollution Prevention BMPs that reduce runoff velocity and control erosion and scour. The need of these devices for this project would also be further investigated during the design phase.

(c) Permanent Treatment BMPs

Treatment BMPs are permanent devices and facilities to address storm water runoff. Department approved Treatment BMPs include Biofiltration Swales/Stripes, Infiltration Basins, Detention Basins, Traction Sand Traps, Dry Weather Flow Diversions, Media Filters,

Gross Solids Removal Devices (GSRDs), Multi-chamber Treatment Trains, and Wet Basins. The above mentioned treatment measures, the most common types used in district-4 are biofiltration Swales/Stripes, Infiltration Basins, Detention Basins, Media Filters, and Multi-chamber Treatment Trains.

The proposed project does not discharge pollutants identified as Target Design Constituents (TDC) into any water bodies under the EPA's 303 (d) list. Should there be any need for treatment BMPs will be considered in the order for general pollutant removal.

The project creates less than 1 acre of new impervious surfaces and therefore is not required to consider permanent treatment BMPs.

2.3 Biological Environment

This section of the environmental document addresses the concerns surrounding plant and animal species, special-status species, regulated habitats and wetland and Waters of the U.S. as they relate to the build alternative of the proposed project. All permanent and temporary affected areas and values provided in this report are based upon preliminary design data.

The no-build alternative will have none of the concerns regarding plant and animal species. However, if the bridge should collapse because of a seismic event, there could be adverse biological impacts associated with the changed or collapsed bridge structure, repair work and replacement of the bridge.

2.3.1 NATURAL COMMUNITIES

Regulatory Setting

This section of the document discusses natural communities of concern. The focus of this section is on biological communities, not individual plant or animal species. This section also includes information on wildlife corridors and habitat fragmentation. Wildlife corridors are areas of habitat used by wildlife for seasonal or daily migration. Habitat fragmentation involves the potential for dividing sensitive habitat and thereby lessening its biological value.

Habitat areas that have been designated as critical habitat under the Federal Endangered Species Act are discussed below in the Threatened and Endangered Species section 2.3.5. Wetlands and other waters are also discussed below in section 2.3.2.

Affected Environment

The following studies were conducted for the project:

Wetland delineation. Field Surveys were conducted on June 26, June 27 and July 2, 2008 to identify potential wetlands and other waters. The survey methodology followed USACE's 1987 Wetland Delineation Manual (Environmental Laboratory, 1987) and the Arid West Region Supplement (USACE, 2006).

Rare plant surveys. Protocol level surveys for 20 late blooming plant species were conducted in August 2008, and spring season surveys were conducted on April, May, 2009,and June 2009. The botanical survey methods followed the methodology established in the following guidelines:

- The California Department of Fish and Game's "Guidelines for Assessing the Effects of Proposed Projects on Rare, Threatened, and Endangered Plants and Natural Communities" (CDFG 2000);
- The California Native Plant Society's "Botanical Survey Guidelines" (CNPS 2001); and
- The U.S. Fish & Wildlife Service's "Guidelines For Conducting And Reporting Botanical Inventories For Federally Listed, Proposed And Candidate Plants." (USFWS 1996).

Burrowing owl surveys. Surveys were performed in October 2008, March 2009, May 2009, and June 2009 following the 1993 California Burrowing Owl Consortium "Burrowing Owl Survey and Mitigation Guidelines" (California Burrowing Owl Consortium, 1993).

Giant Garter Snake surveys. Surveys were conducted in August 2008 following the protocols outlined by the USFWS Programmatic Consultation with the USACE, 1997.

Hydroaccoustic analysis. Analysis was conducted in 2008 and 2009.

Submerged Aquatic Vegetation Survey. Aquatic specialist Eric Drake of Entrix, Inc. conducted this survey on December 17, 2008.

Seven habitat types/land cover types were found in the 62-ac proposed project area and are discussed briefly below in order of abundance.

Irrigated Pasture

Irrigated pasture makes up approximately 28.5 ac of the proposed project area. This habitat type is flooded periodically to provide green forage for cattle. It is an extremely disturbed habitat and is dominated primarily by Bermuda grass and several non-native species.

Open Water

The San Joaquin River, Mayberry Slough, and an unnamed irrigation ditch reflect the open water and are approximately 21.5 ac of the proposed project area.

Landscaped

This area is found solely in the public park located at the base of the Antioch Bridge at the southern shore of the San Joaquin River.

Developed

These areas are the paved parking lot, paved and gravel roads, outbuildings, and SR 160 where the bridge descends to the ground.

Ruderal

Ruderal habitat makes up approximately 1 acre of the proposed project area, and consists of the levee slopes along the San Joaquin River and Mayberry Slough. These areas are highly disturbed and were mowed during the August survey.

Coastal Brackish Marsh

This habitat is in the tidal zone along the southern bank of the San Joaquin River and the banks of Mayberry Slough. Special-status plant species observed in this habitat type includes Mason's lilaeopsis and Suisun marsh aster, both of which are rare plants in the proposed project area and found in the same location.

Himalayan Blackberry Stands

These can be extremely dense and upward of 10 feet tall in some locations. Himalayan blackberries are present along the property fences and are the dominant vegetation.

Environmental Consequences

There is within the proposed project area sufficient habitat for various common and special-status wildlife species despite being in an area that is highly modified. The park on the south shore is landscaped and dominated by non-native landscape and ruderal species, with the exception of a narrow fringe wetland on the shore of the San Joaquin River.

Sherman Island on the north has been drastically altered from its natural state. Originally a tidal marshland, the area was converted to agriculture and is currently used for grazing. Much of the area within the project area is flood-irrigated once every 10 days. Non-native plants represent the dominant vegetation in the project area.

The project will have temporary impacts due to construction related activities to the natural communities listed in the affected environment section above.

Avoidance, Minimization and/or Mitigation Measures

All feasible and practical measures will be undertaken to avoid or minimize impacts to natural sensitive habitat types. These will include:

- Design modifications that allow the Department to avoid sensitive habitat and reduce the impact below the level of significance will be included.
- Sensitive terrestrial habitats observed within the temporary work area will be designated as an environmentally sensitive area (ESA) and fenced with orange construction fencing and signed.
- The location of all ESAs will be shown on project construction drawings and monitored during construction.
- Please see section 2.3.5 for a more comprehensive discussion of the proposed projects avoidance, minimization and mitigation measures.

2.3.2 WETLANDS AND OTHER WATERS

Regulatory Setting

Wetlands and other waters are protected under a number of laws and regulations. At the federal level, the Clean Water Act (33 U.S.C. 1344) is the primary law regulating wetlands and waters. The Clean Water Act regulates the discharge of dredged or fill material into waters of the United States, including wetlands. Waters of the United States include navigable waters, interstate waters, territorial seas and other waters that may be used in interstate or foreign commerce. To classify wetlands for the purposes of the Clean Water Act, a three-parameter approach is used that includes the presence of hydrophytic (water-loving) vegetation, wetland hydrology, and hydric soils (soils subject to saturation/inundation). All three parameters must be present, under normal circumstances, for an area to be designated as a jurisdictional wetland under the Clean Water Act.

Section 404 of the Clean Water Act establishes a regulatory program that provides that no discharge of dredged or fill material can be permitted if a practicable alternative exists that is less damaging to the aquatic environment or if the nation's waters would be significantly degraded. The Section 404 permit program is run by the U.S. Army Corps of Engineers (USACE) with oversight by the Environmental Protection Agency (EPA).

The Executive Order for the Protection of Wetlands (E.O. 11990) also regulates the activities of federal agencies with regard to wetlands. Essentially, this executive order states that a federal agency, such as the Federal Highway Administration, cannot undertake or provide assistance for new construction located in wetlands unless the head of the agency finds: 1) that there is no practicable alternative to the construction and 2) the proposed project includes all practicable measures to minimize harm.

At the state level, wetlands and waters are regulated primarily by the Department of Fish and Game (CDFG) and the Regional Water Quality Control Boards (RWQCB). In certain circumstances, the Coastal Commission or the Bay Conservation and Development Commission may also be involved. Sections 1600-1607 of the Fish and Game Code require any agency that proposes a project that will substantially divert or obstruct the natural flow of or substantially change the bed or bank of a river, stream, or lake to notify CDFG before beginning construction. If CDFG determines that the project may substantially and adversely affect fish or wildlife resources, a Lake or Streambed Alteration Agreement will be required. The tops of the stream or lake banks, or the outer edge of riparian vegetation usually define CDFG jurisdictional limits, whichever is wider. Wetlands under jurisdiction of the USACE may or may not be included in the area covered by a Streambed Alteration Agreement obtained from the CDFG.

The Regional Water Quality Control Boards were established under the Porter-Cologne Water Quality Control Act to oversee water quality. The RWQCB also issues water quality certifications in compliance with Section 401 of the Clean Water Act. Please see the Water Quality section for additional details.

Affected Environment

Emergent wetlands are located along the south bank of the San Joaquin River and the north and south banks of Mayberry Slough. Species such as hardstem bulrush, dallis grass, and rushes characterize the emergent wetland along the south bank of the San Joaquin River. The emergent wetland areas along Mayberry Slough are characterized by dense hardstem bulrush.

Seasonal wetlands are adjacent to some of the excavated irrigation/drainage ditches. Vegetation in these areas is characterized by Bermuda grass, perennial pepperwood and Italian ryegrass, with alkali sida, strawberry clover, cocklebur, rabbitsfoot grass, poison hemlock, milk thistle and patches of water smartweed also present.

Please see appendix L for a detailed map of wetlands and other waters in the project study area.

Environmental Consequences

There are no expected permanent impacts to emergent wetlands. Temporary impacts along the south shore of the San Joaquin River would result from the construction of the temporary marine trestle and include shading of 0.001 acre of emergent wetland and 0.011 acre of open water from the placement of temporary piles.

Avoidance, Minimization and/or Mitigation Measures

A temporary marine trestle will span the emergent wetland on the south bank of the San Joaquin River, and no permanent impacts to the wetland community are anticipated, although shading of the community will occur. On the north and south banks of Mayberry Slough, no temporary or permanent structures are planned, and the only construction activities will be to install the isolation bearings by jacking the deck from the existing foundations. No temporary or permanent impacts to these emergent wetlands are anticipated. Access roads will be removed upon completion of the project in order to reduce project impacts. The area to the north of Mayberry Slough includes a jurisdictional wetland and contractor access to the area will be restricted to avoid impacts to the wetland. There is a small trestle structure planned that will span the water feature which will be removed upon completion of the project. The staging area is located in an upland area and will be demarcated with environmentally sensitive area (ESA) fencing. Impacts to irrigation ditches have been avoided as much as possible. Impacts to the larger open-water feature/irrigation ditch habitat will be avoided by spanning the water feature with a small, at-grade trestle, which will be removed upon completion of the project. Modifications to bed and bank, or fill into the waters, is not anticipated.

Jurisdictional wetlands are expected to be restored at a 1:1 ratio onsite through a combination of disking, to reduce surface compaction, and reseeding of native species. Restoration will also be achieved by removing the temporary trestles used to span the irrigation ditches.

2.3.3 PLANT SPECIES

Regulatory Setting

The U.S. Fish and Wildlife Service (USFWS) and California Department of Fish and Game (CDFG) share regulatory responsibility for the protection of special-status plant species. "Special-status" species are selected for protection because they are rare and/or subject to population and habitat declines. Special status is a general term for species that are afforded varying levels of regulatory protection. The highest level of protection is given to threatened and endangered species; these are species that are formally listed or proposed for listing as endangered or threatened under the Federal Endangered Species Act (FESA) and/or the California Endangered Species Act (CESA). Please see the Threatened and Endangered Species Section 2.3.5 in this document for detailed information regarding these species.

This section of the document discusses all the other special-status plant species, including CDFG fully protected species and species of special concern, USFWS candidate species, and non-listed California Native Plant Society (CNPS) rare and endangered plants.

The regulatory requirements for FESA can be found at United States Code 16 (USC), Section 1531, et. seq. See also 50 CFR Part 402. The regulatory requirements for CESA can be found at California Fish and Game Code, Section 2050, et. seq. Department projects are also subject to the Native Plant Protection Act, found at Fish and Game Code, Section 1900-1913, and the California Environmental Quality Act, Public Resources Code, Sections 2100-21177.

Affected Environment

The special-status plant surveys identified two special-status plants, Mason's lilaeopsis and Suisun Marsh aster, in the emergent wetland on the south shore of the San Joaquin River (Table 2). No special-status plants were observed in the BSA north of the San Joaquin River.

Mason's Lilaeopsis

Mason's lilaeopsis (*Lilaeopsis masonii*) is a small, rhizomatous perennial in the carrot family that was listed as a California Rare species in 1979. It is also a California Native Plant Society List 1B.1 species.

Mason's lilaeopsis has prostrate, creeping stems with tufts of cylindrical thread-like leaves up to 3 inches long. The inconspicuous white flowers occur in open umbels from April through November. This species is found in intertidal marshes and along stream banks at elevations near sea level.

Several plants were found along the southern shore of the San Joaquin River directly under the Antioch Bridge and within the Antioch/Oakley Regional Shoreline Pier Park. The plant was found in both the vegetative and the blooming life stage. The occurrence is in an area that will be spanned by the temporary marine trestle.

Suisun Marsh Aster

Suisun Marsh aster is a rhizomatous perennial herb in the family Asteraceae. It blooms from May through November. 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 brackish marsh habitats. Suisun Marsh aster is threatened by habitat alteration and loss, erosion, and possibly by herbicide application.

Several flowering plants were found along the southern shore of the San Joaquin River directly under the Antioch Bridge and within the Antioch/Oakley Regional Shoreline Pier Park. The species occurs in an area that will be spanned by the temporary marine trestle.

Environmental Consequences

Shading caused by installation of the temporary trestle, with expected impacts to several individual plant species, would directly impact approximately 915 square ft of the emergent wetland.

Scientific Name	Common Name	Status[1]	Specific Habitat Present/ Absent	Species Presence/ Absence[2]	Rationale
Lilaeopsis masonii	Mason's Lilaeopsis	CNPS	P	P	Historic occurrences near project in CNDDB. Habitat present. Specimens observed during the 2008/2009 rare plant surveys.
Symphyotrichum lentum	Suisun Marsh Aster	CNPS	P	P	Observed in project site during 2008/2009 rare plant surveys

Table 2: Plant Species of Concern Within Project Study Limits

Status

CNPS	California Native Plant Society	FSC	Federal species of concern
FC	Federal candidate	FT	Federal threatened
FE	Federal endangered	SE	State endangered
FPE	Federal proposed endangered	Ssc	State species of concern
FPT	Federal proposed threatened	ST	State threatened
A	Absent		
P	Present—general habitat is present		

Avoidance, Minimization and/or Mitigation Measures

The location of the temporary marine trestle cannot be altered; therefore, some impact to Suisun Marsh aster habitat and Mason's lilaeopsis habitat is unavoidable. The design of the trestle will span the emergent wetland, which will limit impact to temporary shading of the emergent wetland, thereby avoiding direct destruction of individuals of the species. Caltrans has been in consultation with CDFG to finalize a strategy from several options to avoid, minimize and mitigate for impacts to Mason's lilaeopsis and Suisun Marsh aster. Options include, but are not limited to translocation, seed collection, propagation, and monitoring the extant and translocated populations. The final strategy will be presented in the 1602 Lake and Streambed Alteration Agreement from CDFG.

2.3.4 ANIMAL SPECIES

Regulatory Setting

Many state and federal laws regulate impacts to wildlife. The U.S. Fish and Wildlife Service (USFWS), NOAA's National Marine Fisheries Service (NMFS) and the California Department of Fish and Game (CDFG) are responsible for implementing these laws. This section discusses the potential impacts and permit requirements associated with special status wildlife that is not listed or proposed for listing under the state or federal Endangered Species Act. Please see the Threatened and Endangered Species section 2.3.5 in this document for detailed information regarding these species. All other special status animal species are discussed here, including CDFG fully protected species and species of special concern, and USFWS or NOAA's NMFS candidate species.

Federal laws and regulations pertaining to wildlife include the following:

- National Environmental Policy Act
- Migratory Bird Treaty Act
- Fish and Wildlife Coordination Act
- Marine Mammal Protection Act
- Magnuson-Stevens Fisheries Conservation and Management Act

State laws and regulations pertaining to wildlife include the following:

- California Environmental Quality Act
- Sections 1601 – 1603 of the Fish and Game Code
- Section 4150 and 4152 of the Fish and Game Code

In addition to state and federal laws regulating impacts to wildlife, there are often local regulations (example: county or city) that need to be considered when developing projects. If work is being done on federal land (BLM or Forest Service, for example), then those agencies' regulations, policies, and Habitat Conservation Plans are followed.

Affected Environment

The proposed project would result in impacts to aquatic and terrestrial habitat. Within the San Joaquin River, impacts include disturbance of the substrate and temporary loss of habitat, both within the water column and to the river bottom as the result of installing the piles and the associated noise and vibration due to the construction of the temporary marine trestle. Impacts to terrestrial habitat would result from compaction of the soil at the temporary access roads and staging areas. On the south shore, impacts would result from shading from the temporary marine trestle.

Impacts from the project include displacement of sediment during the vibration of piles and from the potential drift and settlement outside the project limits.

The species and their habitats, as well as, the potential impacts and avoidance and minimization efforts, are described and presented below. A complete list of animal species known to be found near the project area can be found in Appendix E. A table of special-status species and critical habitat can also be found in Appendix C.

Chinook Salmon (Central Valley Fall, Late-Fall Run)

From their known life history characteristics, spawning and rearing of the adult Central Valley fall-run and late fall-run Chinook salmon occurs in the upper reaches of the Sacramento River watershed. The presence of Central Valley fall-run and late fall-run Chinook salmon in the action area can only be inferred during the upstream migration of adults and the downstream migration of juveniles.

Sacramento Perch

No aquatic surveys were conducted for the Project. However, given that Sacramento perch prefer freshwater, this species is inferred to be absent during the August 1 to November 30 in-water work window for construction of the temporary marine trestle. During this work window, salinity levels are likely to be sufficiently high to preclude species that are strictly freshwater species.

Sacramento Splittail

Based on existing information, this species is expected to be present in the area during the August 1 to November 30-in-water-work window for constructing the temporary marine trestle. The Sacramento splittail can tolerate the salinity levels present during this time.

Western Pond Turtle

Western pond turtles range throughout the state of California, from southern coastal California and the Central Valley, east to the Cascade Range and Sierra Nevada. The two subspecies, northwestern and southwestern, are believed to integrate over a broad range in the Central Valley.

Burrowing Owl

Burrowing owls typically occupy annual and perennial grasslands with sparse or nonexistent tree or shrub canopies. In California, burrowing owls are found in close association with

California ground squirrel burrows, which provide them with year-round shelter and seasonal nesting habitat. Burrowing owls also use human-made structures such as culverts, debris piles, or openings beneath pavement as shelter and nesting habitat. Suitable habitat was found to occur within the project area.

California Sea Lion

The U.S. California sea lion population is distributed between the U.S./Mexico border and extends northward into Canada. The population abundance estimate for this stock is between 141,842 (minimum population estimate) to 238,000 animals (extrapolated from 2005 pup count; NMFS 2007). The estimated average rate of annual increase between 1975 and 2005 was 6.25 percent per year (NMFS 2007). Because the estimated annual human-related mortality and serious injury of California sea lions (e.g., fisheries) is less than estimated maximum removal levels (e.g., potential biological removal), the stock is not classified as "strategic" under the MMPA. California sea lions sporadically use the western Sacramento-San Joaquin Delta to forage for prey.

Since at least 1987, sea lions have been observed occupying the docks near Pier 39 in San Francisco, approximately 54.0 mi from the project site. Pier 39 has now become a regular haul-out site for California sea lions. Currently, no other California sea lion haul-out sites have been identified in the Bay, its estuary or the Sacramento-San Joaquin Delta. Approximately 85 percent of the animals hauled out at the Pier 39 site are males, and no pupping has been observed at this site or any other site in the Bay.

No known hauls out sites occur in the vicinity of the Project. During the designated August 1 to November 30 designated work window for installing the temporary marine trestle, California sea lions will likely be absent, as they are still in the breeding season and will be located further south, in the Channel Islands (CDFG 1990). Beginning in September, the likelihood of sea lions foraging in the San Joaquin River Delta increases, as males are beginning to return from the Channel Island rookeries at this time (CDFG 1990).

Pacific Harbor Seal

Harbor seals are widely distributed in the North Pacific Ocean. These seals do not make extensive pelagic migrations, but do sometimes travel 180 –310 miles (300-500 km) on occasion to find food or suitable breeding areas. In California, seal haul-outs are widely distributed on mainland and offshore islands, including intertidal sandbars, mudflats, near-shore rocky outcroppings and beaches. This stock of harbor seals is not considered "depleted" under the MMPA or listed as an endangered or threatened species under the Endangered Species Act. Because the estimated annual human-related mortality and serious injury of harbor seals (e.g., fisheries) in California is less than estimated maximum removal levels, the stock is not classified as "strategic" under the MMPA. In 1994 The California harbor seal stock had an estimated size of 34,233 (NMFS2005). Between 1982 and 1995, the population growth rate of the California stock averaged 3.5 percent (NMFS 2005). A statistic regression shows a decrease in production rates, but the decline is not statistically significant.

Harbor seals are present in the Bay year-round and use it for foraging, resting and reproduction. Haul-out locations are used as resting sites and are important to the health of

harbor seals. The pupping and molting seasons however, are considered a critical period for harbor seals. The numbers of harbor seals on haul-out sites fluctuates throughout the year, but peaks generally occur during pupping and molting. The closest haul-out used for pupping near the action is 45.5 miles away. Pile driving would not occur during pupping season.

The three closest haul-out sites to the project location are at Castro Rocks (45.5 miles), Corte Madera (45.75 miles), and Yerba Buena Island (53.5 miles). Although, the area of the Delta where the Project occurs falls within the limits of the range of harbor seals, no known haul out sites have been identified in the vicinity of the Project. Potential occurrences of harbor seals would be limited to transient individuals in search of food foraging upstream into the San Joaquin River.

Cliff Swallow and Barn Owl

The cliff swallow is protected by the Federal Migratory Bird Treaty Act (MBTA). This species is found throughout California, except in high mountains and the desert. An open habitat for foraging, a vertical surface beneath an overhang for attaching the nest, a supply of mud that has the proper consistency for nest building and a body of fresh water for drinking are critical elements necessary for its survival. The species nests in cliffs as well as bridges and buildings. Cliff swallows spend the winter months in South America and migrate to California to breed. Arrival dates can vary greatly because of weather conditions. The first migrants usually appear in northern California by early March.

The Federal MBTA also protects the barn owl. This species is highly adaptable, lives in urban and rural environments, and in temperate and tropical regions nearly worldwide. Barn owls roost in sheltered areas such as buildings bridges and trees. They are year-round residents in California, but also migrate to other parts of the United States.

Environmental Consequences

Adult and juvenile Central Valley fall-run and late fall-run Chinook salmon may be migrating through the action area during the August 1 to November 30 in-water work window. By utilizing sound attenuation measures during proof-testing of piles with an impact hammer, injury or mortality to Central Valley fall-run and late fall-run Chinook salmon is not anticipated.

Impacts to Sacramento perch are not anticipated, the Sacramento perch prefers freshwater and is inferred to be absent during the August 1-November 30 in-water work window. During this timeframe, the historic salinity levels have been sufficiently high to preclude species that are strictly freshwater species

Potential impacts to Sacramento splittail include injury and/or mortality, temporary habitat loss, and/or temporary displacement due to the construction of the temporary marine trestle. Measures to minimize these impacts associated with pile driving are discussed in section 2.3.5 avoidance minimization and mitigation measures.

No impacts to the aquatic pond turtle habitat on Sherman Island are expected. However, the project will affect some upland areas that are potentially suitable for the western pond turtle. Therefore, impacts may include temporary habitat loss and temporary displacement.

The project could potentially displace an unknown number of burrowing owls if present, if they are within the proposed project area. If burrowing owls are found during pre-construction, mitigation measures will be coordinated with CDFG

Any potentially active nests present within the proposed project area will be removed outside of nesting season (February-August).

Potential impacts from noise associated with the construction of the temporary marine trestle to marine mammals could occur within the project area. NOAA's NMFS considers that underwater sound pressure levels (SPLs) above 190 dB (impulse) could cause injury (Level A harassment) to harbor seals and sea lions. NOAA's NMFS also uses 120 dB RMS for non-impulse noise (vibratory hammer) for Level B harassment. The effects of elevated SPLs on marine mammals, in general, also have the potential to cause annoyance, disruption of echolocation, masking, avoidance of an area, habitat abandonment, aggression, pup/calf abandonment, tissue rupture and hearing loss (Level B behavioral harassment). NMFS uses the received level of 160 dB as the onset of behavioral harassment (Level B) for marine mammals from impulse noise, such as sounds produced from impact pile driving. Please see Appendix J for results of the hydro-acoustic analysis conducted by Illingworth and Rodkin 2009 to determine the distance of a marine mammal at risk of entering a 190 dB zone.

The use of vibratory pile driving has the benefit of having lower impact to marine mammal species in the vicinity of the proposed project area, since the instantaneous sound pressure levels are lower when compared to noise from impact hammers.

In addition to waterborne noise, pinnipeds may be subject to harassment (Level B harassment) or injury (Level A harassment) due to airborne noise if sufficiently loud. The closest haul outs are over 40 miles away, so in-air noise is impacts are not anticipated. When not in water, harbor seals are most sensitive to sounds ranging from about 2 kHz to 20 kHz with thresholds between 40 and 50 dB. California sea lions have a slightly greater sensitivity and higher frequency cut-off than harbor seals. Sea lions are typically sensitive to sounds from approximately 1 to 20 kHz with a threshold of 30 to 50 dB.

The most likely impact to marine mammals from the pile installation would be disruption of their feeding patterns as individual sea lions or harbor seals pass through the area in pursuit of food. Temporary hearing loss is possible for those pinnipeds that enter zone of Level B harassment, but permanent hearing loss or other harm is not anticipated due to monitoring efforts.

Level B harassment to marine mammals could potentially occur, which is why the department is applying for an IHA application. We anticipate very few if any marine mammals will actually be present, and our attenuation, hydroacoustic monitoring and visual

monitoring for marine mammals will insure that injury or mortality (Level A harassment) will not likely occur.

The construction work in the river will have an impact to fish by noise, disturbance of sediment, potential changes in foraging areas and habitat. This may also affect marine mammals that forage for these fish. There will be no anticipated adverse impacts to marine mammal foraging due to the low likelihood of mortality and the brief time period each day during which fish behavior would be disrupted by pile installation.

Avoidance, Minimization and/or Mitigation Measures

The avoidance, minimization and/or mitigation measures employed to protect the State and federally listed species in the following section will protect Central Valley fall-run and late fall-run Chinook salmon, Sacramento Perch, Sacramento Splittail, and marine mammals.

The avoidance and minimization efforts that protect Giant Garter Snake, in the following threatened and endangered species section, will also avoid and minimize potential impacts to Western Pond Turtle.

If burrowing owls are detected within 250 feet of the project limits, avoidance and minimization measures may include seasonal avoidance, monitoring, and potentially burrow exclusions. Burrow exclusions would only occur during the months of December or January, prior to the beginning of the breeding season. Given that permanent impacts to the area are minimal, and further fragmentation and development will not result from the project, cumulative effects of the project on burrowing owl are not anticipated.

The Department is currently exploring several options for avoidance and minimization for migratory bird species nesting on the bridge. 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 their nests.

Avoidance and minimization efforts for marine mammals will be coordinated in conjunction with NOAA's National Marine Fisheries Service. Caltrans is preparing an Incidental Harassment Authorization (IHA) application for potential impacts to marine mammals. The IHA will outline measures to minimize impacts. These measures will include the combination of using attenuation on impact proof-testing of piles, hydro-acoustic monitoring and implementing biological monitors during all active pile driving to watch for marine mammals passing through the construction zone. Construction will be halted if a marine mammal is at risk of entering a 190 dB (estimated at 75ft) zone of hydro-acoustic effect (Level A harassment) around the pile being proofed with the impact hammer. Appendix G contains the NOAA's NMFS Biological Opinion with measures to protect marine wildlife.

General construction restrictions and mitigation measures are as follows:

- An in-water work window of August 1 to November 30 has been established during formal Section 7 consultation with NMFS and the USFWS.
- Sound pressure levels will be minimized by placing construction parameters on the temporary marine trestle:
- All piles will be installed by utilizing a vibratory hammer;
- Load testing ("proofing") will be done using an impact hammer on one pile per day;
- A sound attenuation system will be used on the piles undergoing load testing with an impact hammer; and
- All piles will be limited to a maximum of 24-in diameter and constructed of hollow steel shell.
- Biological monitors will be in place during all active pile driving to watch for marine mammals passing through the construction zone, and construction will be halted if a marine mammal is at risk of entering the 190 dB RMS re: 1 □Pa (estimated at 75-ft) zone of hydro-acoustic effect around the pile that is being proofed with the impact hammer.

Suggested means of monitoring and reporting are as follows:

- A minimum of three biologically-trained on-site individual(s), approved in advance by NMFS Southwest Regional Office, to monitor the area for marine mammals before, during and after pile installation activities from boats.
- Monitors will enforce the safety zone corresponding to the 190 dB RMS re: 1 □Pa zone. Pile driving will not begin until the safety zone is clear of marine mammals and will be stopped in the event that marine mammals enter the safety zone.
- The National Marine Fisheries Service will be informed immediately of any changes or deletions to any portions of the monitoring plan.
- For all in-water temporary pile-installation one three-person observer team will visually monitor each pile-driving site from boats. Although not anticipated, if multiple sites are in operation, more than one observer team will be utilized.
- Westward-facing access platforms on Pier 19 and between Piers 20 and 21 may be utilized as aerial observation, pending safety clearance.
- Observations will be made with binoculars during daylight hours.
- Pre-Activity Monitoring: At least 30 minutes prior to the start of all in-water temporary pile-installation segments, marine mammal monitor(s) will conduct observations on the number, type(s), location(s), and behaviors of marine mammals in the designated safety zone, as well as other areas near pile driving sites. Marine mammal monitoring will continue during pile installation interruptions of less than 30 minutes. If pile driving ceases for 30 minutes or more and a marine mammal is sighted within the designated safety zone(s) prior to the commencement of pile installation, the observer(s) will notify the Resident Engineer (or other authorized individual) immediately.
- Monitoring during Activity: During all in-water temporary pile-installation marine mammal monitor(s) will conduct and record observations on marine mammals in the vicinity of the pile installation sites and pay particular attention to designated safety zones.

- Post-Activity Monitoring: For a minimum of 30 minutes after in-water temporary pile-installation stops, marine mammal monitor(s) will conduct observations of the project area and record information on the number, type(s), location(s), and behavior of marine mammals and pay attention to designated safety zones.
- Monitoring under Low Light Condition: In late afternoon and/or early evening when light condition is low, marine mammal monitor(s) will use infrared (IR) scopes to conduct observation of the project area.
- During the baseline monitoring period and activity monitoring periods, qualified visual observers will record the Date and time that pile-driving begins or ends, weather parameters, Tide state and water currents, visibility, species, numbers, and, if possible, sex and age class, of marine mammals, distance from pile-driving activities to marine mammals, locations of all marine mammal observations, and other human activity in the area.

2.3.5 THREATENED AND ENDANGERED SPECIES

Regulatory Setting

The primary federal law protecting threatened and endangered species is the Federal Endangered Species Act (FESA): 16 United States Code (USC), Section 1531, et seq. See also 50 CFR Part 402. This act and subsequent amendments provide for the conservation of endangered and threatened species and the ecosystems upon which they depend. Under Section 7 of this act, federal agencies, such as the Federal Highway Administration, are required to consult with the U.S. Fish and Wildlife Service (USFWS) and NOAA's National Marine Fisheries Service (NMFS) to ensure that they are not undertaking, funding, permitting or authorizing actions likely to jeopardize the continued existence of listed species or destroy or adversely modify designated critical habitat. Critical habitat is defined as geographic locations critical to the existence of a threatened or endangered species. The outcome of consultation under Section 7 is a Biological Opinion or an incidental take permit. Section 3 of FESA defines take as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect or any attempt at such conduct."

California has enacted a similar law at the state level, the California Endangered Species Act (CESA), California Fish and Game Code, Section 2050, et seq. CESA emphasizes early consultation to avoid potential impacts to rare, endangered, and threatened species and to develop appropriate planning to offset project caused losses of listed species populations and their essential habitats. The California Department of Fish and Game (CDFG) is the agency responsible for implementing CESA. Section 2081 of the Fish and Game Code prohibits "take" of any species determined to be an endangered species or a threatened species. Take is defined in Section 86 of the Fish and Game Code as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill." CESA allows for take incidental to otherwise lawful development projects; for these actions an incidental take permit is issued by CDFG. For projects requiring a Biological Opinion under Section 7 of the FESA, CDFG may also authorize impacts to CESA species by issuing a Consistency Determination under Section 2080.1 of the Fish and Game Code.

Affected Environment

A description of the species and their habitats, as well as the potential impacts and avoidance and minimization efforts, are presented below. A table of special-status species and critical habitat can also be found in Appendix C.

Delta Smelt

No aquatic surveys for delta smelt were conducted. However, because the project area lies within designated critical habitat, presence of this species is inferred. Impacts are not anticipated because the species is unlikely to be found within the project area due to life history characteristics.

Hydro-acoustic modeling was performed to analyze potential impacts to aquatic species during pile installation for the temporary marine trestle. The results of the hydro-acoustic modeling analysis are presented in Appendix J.

Longfin Smelt

Longfin smelt could be directly affected by the temporary loss of habitat due to the installation of the temporary piles and temporary shading of the shallow water habitat from the temporary trestle. Presence of longfin smelt is inferred during the in-water work window only during the month of November, when it migrates through the project area seeking freshwater to spawn in. No mortality to longfin smelt will occur if the temporary marine trestle can be installed before November 1, as it will be absent from the project area during that time.

Hydro-acoustic modeling was performed to analyze potential impacts to aquatic species during pile installation for the temporary marine trestle. The results of the hydro-acoustic modeling analysis are presented in Appendix J.

Chinook Salmon (Central Valley Spring Run)

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.

Chinook Salmon (Sacramento River Winter Run)

From their known life history characteristics, during the August 1 – November 30 proposed in-water work window for constructing the temporary marine trestle, adult Sacramento River winter-run Chinook salmon are spawning in the upper regions of the Sacramento River basin and are not likely to be present in the Project area. Should the construction work period needed for installing the temporary trestle extend into November, then adult Sacramento River winter-run Chinook salmon may be, but are unlikely to be present within the Project limits.

Central Valley Steelhead

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, during the August 1 to November 30 in-water work window. Therefore, Central Valley steelhead are expected to be present within the action area during the in-water work window.

Green Sturgeon

Younger aged juveniles are likely to be present in the action area during the August 1 to November 30 in-water work window, as salinity during this window will likely be too low for older aged juveniles, and water temperatures will be too warm for larvae.

Giant Garter Snake

Giant Garter Snake (GGS) occurs in areas with freshwater wetlands, low-gradient streams and sloughs, ponds, waterways, and adjacent uplands. It has also adapted to human-made habitats, such as drainage canals, irrigation ditches, and rice fields. During the active season, GGS generally remain in close proximity to wetland habitats, but can move at least 800 ft into upland areas. Individual GGS have been observed moving a total of 5 miles, over several days, from their original wetland habitat into new wetland areas, due to unsuitable conditions in their original habitat.

Environmental Consequences

Impacts to delta smelt may occur as a result of project construction. Impacts could result from peak sound pressures caused by the impact hammer and also from the vibratory hammer. Impacts may also occur from shading of shallow water habitat due to the construction of the temporary marine trestle. Project activities affecting delta smelt will affect all other fish species listed below.

Impacts of the project to longfin smelt include temporary loss of spawning habitat through loss of substrate due to the installed piles and shading that reduces vegetation upon which to attach the eggs. Incidental take is possible if construction of the temporary marine trestle extends into November.

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

No impacts to winter run Chinook salmon are anticipated because the species is unlikely to be found within the project area due to life history characteristics

The August 1 to November 30-in-water work window occurs during the upstream migration of adult Central Valley steelhead. Peak and cumulative sound pressure levels associated with proof-testing the piles has the potential to injure or kill migrating adult and juvenile steelhead Harassment of migrating adult and juvenile steelhead from underwater noise is likely to occur. The peak sound levels from piles being proofed and/or from cumulative sound levels may affect any rearing or migrating Central Valley steelhead juveniles that may be present during pile driving over the course of a working day. However, the proposed avoidance and minimization measures will minimize the likelihood of potential adverse effects and mortalities in these cases.

Impacts to critical habitat are limited to loss of foraging habitat and substrate from the installation of the temporary piles, a total of approximately 0.011 ac of critical habitat estimated as 160 piles of 24-in diameter. These impacts are minimal and temporary and will not appreciably diminish the ability of southern green sturgeon to forage. The piles from the temporary trestle will not impede the ability of green sturgeon to reach their spawning habitat, as the 25-ft spacing between piles will allow for passage.

Impacts to potentially suitable GGS habitat would occur in areas of upland habitat. The majority of these direct impacts would result from temporary access roads and construction staging on Sherman Island. The temporary access roads would affect approximately 1.10 ac of upland habitat on Sherman Island, and temporary staging would affect approximately 1.12 ac of potentially suitable upland habitat for this species. The permanent widening of the access road north of Mayberry Slough would affect approximately 0.22 ac of potentially suitable GGS habitat. On the south bank of Mayberry Slough, habitat has been designated as marginally suitable for GGS. The total area of upland habitat that would be directly affected is approximately 2.44 ac.

Avoidance, Minimization and/or Mitigation Measures

The biological sensitivity of the habitats and resources that occur within the action area were identified early in the Project. Caltrans biologists coordinated closely with 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. A Biological Opinion from NOAA's NMFS, and USFWS are provided in Appendices F and G respectively for any clarification regarding avoidance minimization and/or mitigation measures.

The avoidance and minimization and/or mitigation measures incorporated into the proposed project for threatened and endangered fish include:

- Work in the San Joaquin River will be restricted to low-flow periods between August 1 to November 30 when delta smelt in the Central Zone of the delta are less likely to be present, per guidance provided by the USFWS and NOAA's NMFS during the informal and formal consultation process
- Requiring the contractor to install all temporary piles for the temporary marine trestle with a vibratory pile driver (hammer)

- Proofing of piles with an impact hammer will be limited to one pile per day during the installation of the trestle, and a sound attenuation system will be used on piles that are proof tested with the impact hammer
- Limiting pile size to a maximum diameter of less than 24"inches
- Hydro-acoustic monitoring to ensure sound pressures remain within the authorized range. As soon as in-water pile driving commences, underwater sound measurements must be collected to determine 190 dB safety zones for marine mammals around each in water, permanent pile driving site. A written report on the sound measurements collected and analyzed to determine the safety zones around each in-water, permanent pile-driving site must be completed and submitted to NOAA's NMFS. Real time monitoring shall be conducted to ensure that underwater sound levels analyzed in NOAA's NMFS biological opinion (150dB RMS, 187 dB accumulated SEL, and 206dB peak SPL) are not exceeded. For all in-water temporary pile-installation one three-person observer team will visually monitor each pile-driving site to watch for marine mammals passing through the construction zone. Construction will be halted if a marine mammal is at risk of entering a 190 dB (estimated at 75ft) zone of hydro-acoustic effect around the pile that is being proofed with the impact hammer.
- The Department proposes to compensate for direct impacts to delta smelt and longfin smelt at a 3:1 ratio by purchasing credit either through a USFWS and CDFG approved mitigation location
- The Department proposes to offset the project effects to Central Valley steelhead by purchasing a 0.1 ac credit from a NOAA Fisheries approved mitigation bank, pursuant to their commitments under federal highways policies on mitigating effects to natural resources

The Department will implement the following measures to avoid and minimize and/or mitigate potential effects to GGS.

All ground-disturbing 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), of temporary access roads 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 occur, and mortality to any individuals of the species during hibernation due to construction activities is not anticipated.

- The Department will mitigate the approximately 2.22 ac of direct impact to giant garter snake upland habitat from the temporary access roads and temporary contractor staging area by performing onsite restoration at a 2:1 ratio, and mitigating offsite at a 1.1:1 ratio at a USFWS and CDFG approved mitigation location
- 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 in of soil will be performed prior to applying the hydroseed mix.

- The approximately 0.22 ac of direct impact to giant garter snake upland habitat due to the permanent road widening will be offset at a ratio of 3:1 by purchasing land through a USFWS and CDFG approved mitigation location
- A qualified biologist shall monitor construction-related activities at the proposed project site to ensure no unauthorized take of federally listed species or destruction of their habitat. The biologist shall be available for monitoring through all phases of construction and, if a GGS is encountered, the biologist shall have the authority through communication with the resident engineer to stop construction in the immediate area until appropriate corrective measures have been completed. Snakes encountered during construction activities shall be allowed to move away from the area on their own. The biologist shall notify the USFWS immediately if any listed species are found on-site, 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 Service immediately by telephone at 916/ 414-6600 and by electronic mail or written letter addressed to the Chief, Endangered Species Division, within three (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 Endangered Species Act, and an explanation of the relevant terms and conditions of this 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 to ensure that GGS is not within the work area. The project area shall be re-inspected by the monitoring biologist whenever a lapse in construction activity of two 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, 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 a SWPPP and a Water Pollution Control Program, will be implemented to minimize effects to the snake during construction. Best management practices will be implemented to prevent sedimentation from entering environmentally sensitive areas (ESAs) 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 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 the 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-mile-per-hour 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. The Department 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 environmentally sensitive areas 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 Endangered Species Act of 1973, as amended. 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 restored to their pre-project conditions. An area subject to "temporary" disturbance includes any area that is disturbed during the project, but that, after project completion, will not be subject to further disturbance and has the potential to be re-vegetated. All snake habitats subject to temporary ground disturbances, including storage and staging areas and temporary roads, will be restored. These areas shall be re-contoured, if appropriate, and re-vegetated with appropriate locally collected native plant species to promote restoration of the area to pre-project conditions. Appropriate methods and plant species used to re-vegetate such areas will be determined on a site-specific basis. Restoration work may include replanting emergent vegetation. Refer to the Service's *Guidelines for the Restoration and/or Replacement of Giant Garter Snake Habitat* (USFWS, 1996a). A written

report shall be submitted to the Service within ten (10) working days of the completion of construction at the project site.

The Department will restore the site to pre-construction conditions and 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 the Service upon the completion of the restoration implementation and 1 year after the restoration implementation. Monitoring reports should include photo-documentation, when restoration was completed, what materials were used, specified plantings, and justifications of any substitutions to the Service-recommended guidelines.

2.3.6 INVASIVE SPECIES

Regulatory Setting

On February 3, 1999, President Clinton signed Executive Order 13112 requiring federal agencies to combat the introduction or spread of invasive species in the United States. The order defines invasive species as "any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem whose introduction does or is likely to cause economic or environmental harm or harm to human health." Federal Highway Administration guidance issued August 10, 1999 directs the use of the state's noxious weed list to define the invasive plants that must be considered as part of the NEPA analysis for a proposed project.

Affected Environment

Due to the highly disturbed nature of the area on both the north and south ends of the bridge, introduction of invasive species is not anticipated.

Environmental Consequences

Through the successful implementation of avoidance and minimization efforts, the project will have no adverse impact from noxious weeds on sensitive communities.

Avoidance, Minimization and/or Mitigation Measures

In compliance with the Executive Order on Invasive Species, E.O. 13112, and subsequent guidance from the Federal Highway Administration, the landscaping and erosion control included in the project will not use species listed as noxious weeds. In areas of particular sensitivity, extra precautions will be taken if invasive species are found in or adjacent to the construction areas. These include the inspection and cleaning of construction equipment and eradication strategies to be implemented should an invasion occur.

2.4 CONSTRUCTION IMPACTS

The project will have temporary impacts upon the Antioch/Oakley Regional Shoreline Park. Part of the west side of the park will be unavailable for use to protect the safety of park users. A path and a table-bench will be relocated until the completion of construction. Other features of the park within the construction zone will be covered and protected during

construction. Upon completion of construction, the park will be returned to pre-construction condition.

The project will also have temporary impacts to the grazing area on Sherman Island at the north end of the bridge. Cattle movement under the bridge will be limited by fencing and if it affects the movement to watering areas, temporary facilities will be provided.

Construction activities on the bridge deck will be performed at night and will only require short-period closure of one lane on the bridge, and no need for detours to alternate routes and facilities.

A temporary marine trestle with an approximate length of 910-ft and a width of 25-ft will be constructed from the south bank of San Joaquin River to Pier 11 to allow construction access to the piers in the shallow water area. The trestle platform is expected to be approximately 5 feet above the mean higher-high water. The passage of boats from the adjacent marinas beneath the temporary trestle will not be adversely affected. Lighting and buoys will be used to enable boats to navigate safely beneath the temporary trestle and bridge.

A temporary staging and lay down area has been identified north of Mayberry Slough, in a fallow upland field dominated by ruderal species. The staging area covers approximately 6 ac outside State right of way on the east side of the bridge .A layer of crushed rock overlying geotextile fabric, approximately 6-in thick, for drivability, will cover the area. Silt fence, fiber rolls and/or small earthen berms will be installed along the north and east side of the staging area to direct runoff away from the wetlands to the north and east. At the completion of the Project, the silt fence, along with the ESA fencing, berm, crushed rocks and geotextile fabric will be removed and the site will be restored to pre-existing condition.

Two temporary contractor staging areas have been identified. One located between Piers 29 and 30, will occupy approximately 0.17 ac and measure 115-ft long by 65-ft wide. The other, on Sherman Island and between Pier 31 and the permanently extended access road, will occupy approximately 0.12 ac and measure 81-ft long by 65-ft. These temporary staging areas will be overlaid with geotextile fabric and a crushed rock layer, approximately four feet in depth.

At the south end of the bridge, the contractor will use existing paved areas for staging. An ESA fence will be placed along the west side of the access road to protect the drainage ditch that borders the right of way.

Chapter 3 – Comments and Coordination

Early and continuing coordination with the general public and appropriate public agencies is an essential part of the environmental process to determine the scope of environmental documentation, the level of analysis, potential impacts and mitigation measures and related environmental requirements. Agency consultation and public participation for this project have been accomplished through a variety of formal and informal methods, including: project development team meetings, and interagency coordination meetings.

During the preparation of this document, the following agencies were consulted:

- U.S. Army Corps of Engineers
- U.S. Fish and Wildlife Service
- California Department of Fish and Game
- State Historic Preservation Officer
- NOAA's National Marine Fisheries Service
- U.S. EPA
- State Water Resources Control Board
- Regional Water Quality Control Board
- State Lands Commission
- California Department of Conservation

A Public Notice of the availability of the Draft Environmental Document with a comment period from June 2, 2009 to July 3, 2009 was advertised.

The Draft Environmental Document was made available for review at the following locations, and also at the Caltrans website at: www.dot.ca.gov/dist4.envdocs.htm.

Caltrans District 4
Office of Environmental Analysis
111 Grand Avenue
Oakland, CA 94623
(510) 286-6198

Rio Vista Library
44 South Second St.
Rio Vista CA 94571

Antioch Library
501 W 18th Street
Antioch, CA 94509

Oakley Public Library
1050 Neroly Road
Oakley, CA 94561

A formal public hearing on this project was held on June 23, 2009 at Rio Vista Chamber of Commerce from 6pm to 9pm.

A second formal hearing was held the following night of June 24, 2009 at Antioch Public High School from 6pm to 9pm.

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COMMENTS AND RESPONSES

The following comments were submitted by letters, phone or email to Caltrans during the comment period from June 02, 2009, to July 03, 2009. Caltrans considered comments and, when appropriate prepared written responses.

NOAA's National Marine Fisheries Service

(Note: NOAA's NMFS provided annotated comments; the sections to which their comments apply may not be fully referenced below.)

Comment: I don't see mention of marine mammals [in the summary]. Please include all affected marine mammal species.

Response: Please see revised text in the summary.

Comment: Where is the discussion on cumulative impacts, a topic that should be considered under NEPA? Are there any other past, present, or forseeable future actions in the area with individually insignificant, but, when combined with this action, cumulatively significant impacts?

Response: There are no other present or foreseeable projects of the department or other entities in the vicinity of this bridge at this time. The land uses open space and agriculture at the ends of the bridges have been and are expected to remain the same. Consequently, there are no actions that, combined with this action, will have cumulatively significant impacts.

Comment: When is the project scheduled to begin and when will in-water work begin? Please describe any restricted work windows, if applicable.

Response: The in-water work will start from the beginning order of work with the construction of the temporary trestle. A work window of August 1- November 30 as per the incidental take permit from the USFWS will be in place to avoid winter run Chinook salmon, Central Valley spring run Chinook salmon, longfin smelt, and to minimize the take of delta smelt. Please see revised text in section 1.4.

Comment: Because noise from impact and vibratory hammer has the potential to harass marine mammals, there should be a discussion on how trestles are installed, to what depth, timing, and other information related to impact and vibratory hammering (see EA Guidance document prepared by NMFS for this action). When and why are

any work windows established? Much information can also be found in the IHA application.

Response: Please see the revised text in section 1.4 regarding trestle installation and vibratory hammering. A work window of August 1- November 30 as per the incidental take statement from the USFWS will be in place to avoid winter run Chinook salmon, Central Valley spring run Chinook salmon, longfin smelt, and to minimize the take of delta smelt.

Comment: Please describe this Alternative in more detail. Why is the protocol for the proposed action the way it is? Are there other Alternatives considered but eliminated. For example, from the IHA application, it appears Caltrans is using mostly vibratory pile driving for certain reasons. What are these reasons. You could explain something like " Initially impact pile driving was the chosen method of all pile installation; however, based on consultation with NMFS, to reduce environmental impacts on listed salmon, vibratory pile driving will be the main method of pile installation....."

Response: No other build alternatives were considered. The current project scope was developed, after examining variations of work elements, in an attempt to reduce all impacts to especially to listed species within the project area to a level of insignificance. Please see the revised text in section 1.4 regarding trestle installation and vibratory hammering.

Comment: Technically it is NOAA's National Marine Fisheries Service (NMFS).

Response: The text has been revised throughout the document and will not be addressed again.

Comment: This is the first mention in the document about marine mammals. They should be mentioned somewhere before this section.

Response: Please see the revised text in the Summary; marine mammals are addressed in this section.

Comment: It would be helpful to describe the purpose of each Act and why these permits are necessary. For example, "Under the MMPA, the taking of marine mammals without a permit or exemption from NMFS is prohibited. The term "take" under the MMPA means "to harass, hunt, capture, kill or collect, or attempt to harass, hunt, capture, kill or collect." Except with respect to certain activities not relevant here, the MMPA defines "harassment" as "...any act of pursuit, torment, or annoyance which (a) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (b) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering but which does not have the potential to injure a marine mammal or marine mammal stock in the wild [Level B harassment]." In order to obtain an exemption from the MMPA's prohibition on taking marine mammals, a citizen of the United States who engages in a specified activity (other than commercial fishing) within a

specified geographic region must obtain an incidental take authorization (ITA) under section 101(a)(5)(A) or (D) of the MMPA. An ITA shall be granted if NMFS finds that the taking of small numbers of marine mammals of a species or stock by such citizen will have a negligible impact on the affected species or stock(s) and will not have an immitigable adverse impact on the availability of the species or stock(s) for subsistence uses. NMFS may also prescribe, where applicable the permissible methods of taking and other means of affecting the least practicable impact on the species or stock and its habitat (i.e., mitigation, monitoring and reporting of such takings). ITAs may be issued as either (1) Letters of Authorization (LOAs) or (2) IHAs, the latter applicable when there is no potential for serious injury and/or mortality or where any such potential can be negated through required mitigation measures. Caltrans is applying for an IHA...

Response: Comment noted, please see revised text in section 1.5

Comment: What is a "small" change? Two sentences later you in say "Visual change will be low but the viewing response is expected to be moderate." What does all that mean? That impact would be moderate. Not only does that sentence not give any specifics on what the change is but also seems to contradict the first sentence saying it is "small."

Response: As shown in Appendix K, the visual change is the cross bracing added to the existing bridge. This is a small physical change since it adds an element to the existing bridge that does not block views and can blend into the existing structural elements. The moderate impact is referencing the expected viewer response to this change. Since this change will not block views or change the character of the landscape, it is expected that the viewer response will be moderate.

Comment: What would be an example of adverse visual impacts?

Response: An adverse visual impact would involve a high level of viewer response to visual change such that architectural design and landscape treatment cannot mitigate the impacts. An example could be a project that blocks a scenic vista.

Comment: **In general, impacts to the physical habitat marine mammal utilize is just as important to describe as the direct impacts to the animals themselves. For each section (e.g., water quality) the link b/w the impact/lack of impact should be related back to the wildlife species, which inhabit it.**

Response: We acknowledge the interrelationship of human, physical and natural environmental issues, but we prefer to discuss issues related to marine mammals in the natural environment section.

Comment: It appears that water quality will be negatively affected from construction as the following sections vaguely describe that the project will lead to an increase in runoff containing lead, metals, litter, etc. as well as the potential for leaking contaminated groundwater. What is the impact of water degradation/pollution (as a result of the

proposed action) having on wildlife (for purposes of NMFS- marine mammals and fish) present within the action area?

Response: The potential adverse impacts to storm water and groundwater will be avoided and minimized by the departments BMP's, and there will be no adverse impacts to marine mammals.

Comment: Will this netting be used? How does the use of the specified BMPs minimize impact to wildlife and EFH in the action area?

Response: Yes the Department will include this information into our non-standard special provisions (NSSP's) for the construction contract.

We have determined that biodegradable netting is more protective of wildlife as compared to other non-biodegradable netting. The netting will not remain in the environment, thereby not posing an entanglement hazard.

Comment: What are the Target Design Constituents (if long list, summarize)? How do these TDC affect wildlife. Why does the project not discharge TDC and what does that mean to wildlife within the action area (for example, they are not being exposed to them therefore they should not be subjected to the impacts of TDC- which should be listed above.

Response: A Target Design Constituent is a pollutant that has been identified during Departmental runoff characterization studies to be discharging with a load or concentration that commonly exceeds allowable standards and which is considered treatable by currently available Department-approved Treatment BMPs. The potential adverse impacts will be avoided and minimized by the implementing the Departments BMP's, so that water standards will be maintained and there will be no adverse impacts to marine mammals.

Comment: Add Marine Mammal Protection Act. Section 2.3.4

Response: Please see revised text in section 2.3.4

Comment: Isn't there also habitat degradation in the form in introduced noise into the aquatic environment? It is unclear how habitat is lost. Please describe. Section 2.3.4

Response: Please see revised text in section 2.3.4.

Comment: Why is disturbance to bottom substrate, as described above, a direct impact but displacement of sediments an indirect impact. It seems that vibrating piles into the ground directly results in displacing sediment. Also, please describe what is meant by "potential drift and settlement outside the project limits." Do you mean the current carries those sediments that are suspended in the water column outside of the project limits? And if so, what does all the mean for the environment (i.e., what are the

consequences of sediment disturbance, drift, and the settling of those sediments elsewhere)?

Response: text has been revised in section 2.3.4.

Comment: This statement about aquatic surveys should be expressed in a general section. Why were they not conducted? Is there certain assurance species present are already known? What other information (e.g., reports, scientific literature) was used, in general, to discern which species, including marine mammals, are potentially present within the action area and during which seasons?

Response: Presence of species is already known, as are their migratory patterns; from this the presence of fish species is inferred.

Comment: I recommend taking the full discussion from the IHA application and inserting here along with any other site specific information on marine mammals within the action area.

Response: Please see the revised text in section 2.3.4.The information in the environmental document is meant for the general public as well as the regulatory agencies and summarizes technical studies. Changes have been made, where appropriate, in the environmental document to provide more information from the draft IHA application. The information developed for the IHA application is of a technical nature that is more appropriate only in the IHA application.

Comment: For purposes of adopting this EA, NMFS must see that the information contained is sufficient for our NEPA analysis. This information should include population sizes (see Stock Assessment Reports), how they are using the habitat, general estimated density of marine mammals in the action area, information on hearing (since noise in the primary source of harassment for this project). Also, if they are foraging in the action area, what are prey- then in the environmental consequences section, a discussion on impacts to prey should be included.

Response: Please see the revised text in section 2.3.4.The information in the environmental document is meant for the general public as well as the regulatory agencies and tends to summarize technical studies. Changes have been made where appropriate in the environmental document. Please see associated technical studies for a more detailed discussion.

Comment: It should be specified that they [California Sea Lion] are not listed as depleted and that they are not listed under the ESA. Same for harbor seals. Populations numbers and potential biological removal (PBR) levels should be discussed.

Response: Please see the revised text in 2.3.4.

Comment: All cited literature; pers. comms, etc should be referenced. What is the use of habitat within the action area? A discussion could be included on how CSLs and harbor seals use the Bay in general but also, what is specific use in the action area? Specific site use should be stressed.

Response: See Appendix M

Comment: references? Specific to the action area, how do pinnipeds use that habitat and what studies have been conducted there, if any. What do studies/anecdotal evidence suggests about frequency of use, manner of use, and how essential the action area habitat is to the species.

Response: Please see revised text in section 2.3.4. The information in the environmental document is meant for the general public as well as the regulatory agencies and tends to summarize technical studies. Please see associated technical studies for a more detailed discussion.

Comment: How far does "vicinity" go? Where are the haul-out/rookeries in relation to the action area?

Response: Please see revised text in section 2.3.4.

Comment: Reference? Forage on what? How important is the action area habitat for foraging?

Response: Please see revised text in section 2.3.4.

Comment: It is unclear how Caltrans came to the determinations of level of impacts on wildlife nor is there a description of why there is no impact, where applicable. It is not sufficient to simply state there are no impacts.

Response: The Departments goal is to have minimal or no impacts on wildlife. In consultation with USFWS and NOAA's National Marine Fisheries Service, the Department will implement measures, that are feasible and effective, to protect wildlife potentially present in work area to the greatest extent possible.

Comment: How does the fact that they are actually going to be in the passing through the action area during the work window relate to the determination that sound levels will not affect individuals? It seems this fact that they are present would indicate there will be an effect because they will be exposed to such noise. What does "cumulative sound level" mean? Why would sound not affect individuals? Isn't there an BiOp for both bridge [Antioch and Dumbarton] actions concluding that there will be take; therefore, there is an effect?

Response: Please see revised text in section 2.3.4.

Comment: Although not related to marine mammals, again, this is an example of the lack of description about how or why the project will result in these impacts. What part of the project is causing these impacts?

Response: Please see revised text in section 2.3.4.

Comment: Where does 55 meters come from? What is so special about this distance? I'm assuming is has to do with NMFS harassment levels but nowhere are these discussed. Please explain Level A and Level B harassment; how isopleths distances were calculated, estimated number of marine mammals, by species, would be harassed. Again, I recommend taking the discussion in the application and inserting here. There should be justification for and a summary of Caltrans determinations on the level of impact to marine mammals (e.g., significant, not significant, are impacts short-term, long-term, etc.).

Response: Please see revised text in section 2.3.4.

Comment: This section should provide a description of the anticipated environmental consequences of the proposed action (i.e., the Build Alternative) and the No Action Alternative (i.e., No Build) on the resources described in the affected environment section. See other Caltrans EAs for action, which included impacts to marine mammals for guidance.

Response: Please see revised text in section 2.3.4.

Comment: Again, what are the impacts to marine mammals (specifics), why are those impacts resulting from the project (i.e., what aspects of the work is causing these impacts), and what do the impacts have on individuals and stock as a whole. There is no discussion of how Caltrans came to this determination therefore there is no way to justify/make this statement.

Response: Please see revised text in section 2.3.4.

Comment: I am only making comments specific to marine mammals here but in general, this environmental impacts section is highly lacking. What are the sources of the impacts (e.g., noise from hammering, vessels, equipment; pollution, sedimentation, etc.). Impacts could mean anything and need to be identified (e.g, TTS, abandonment of the area, temporary displacement, interruption of foraging, breeding, pupping, injury, mortality, etc.).

Response: Please see revised text in section 2.3.4.

Comment: Discuss impacts in air (90/100 dB threshold for harbor seals and CSL, respectively) vs. in-water (120dB (non-pulse)/160db)pulse)/190db (Level A)).

Response: Please see revised text in section 2.3.4. The information in the environmental document is meant for the general public as well as the regulatory agencies and tends to summarize technical studies.

Comment: What about vibratory hammer? A discussion of NMFS threshold levels from pulsed noise (e.g., impact hammer) and non-pulse noise (e.g., vibratory hammer) should be incorporated. It should be highlighted that the impact hammer is only being used for one load bearing test per day.

Response: Please see revised text in section 2.3.4.

Comment: Are sound attenuation devices (e.g., bubble curtains) being used. If so, which ones, and if not, why.

Response: Please see revised text in section 2.3.4.

Comment: NMFS has an IHA application on file. Should this be returned? Are you preparing a new one?

Response: Caltrans is in the process of resubmitting the formal IHA application.

Comment: As with above, these measures should be identified. What will the measures prevent (e.g., injury, mortality?) and how will they minimize impacts? Primary use of vibratory hammer (i.e., operation protocol) will also minimize impacts, correct. Soft starts, delaying hammering if marine mammals are sighted prior to pile driving, etc.-all these should be addressed.

Response: Please see revised text in section 2.3.4.

Comment: How will visual monitoring minimize impacts? The discussion on how visual monitoring of safety zones should be included. Please also discuss reporting marine mammal sightings?

Response: Please see revised text in section 2.3.4.

Comment: Avoid and minimize what?

Response: Please see revised text in section 2.3.4.

Comment: I will not make comments here specific to fish but again, this entire section does not describe the how and why of impacts. Although for purposes of NMFS Silver Spring office, we would adopt this EA if the Final EA is sufficient for issuing take of marine mammals, we must also consider the impacts to fish as a prey resource for marine mammals, especially because it appears both bridge locations are foraging areas for pinnipeds. In the Environmental Consequences section under Marine Mammals, please describe what the impacts to fish are, in summary, and if those direct impacts to

fish will indirectly impact marine mammals (i.e., if it will result in a measurable decline in prey abundance or directly impact marine mammals by the seals avoiding the action area and thereby loosing the opportunity to forage within the action area.

Response: Please see revised text in section 2.3.4.

Comment: Although more information on how each measure will minimize impacts needs to be discussed, I recommend modeling the marine mammal mitigation and minimization section after this or at least a discussion in that section referring to how mitigation measures set in place for fish will also reduce impact to marine mammals and why.

Response: Please see revised text in section 2.3.4.

Comment: How will hydro-acoustic monitoring be conducted? Is it real time to implement changes to construction should sound levels be outside of the "authorized range." What is the "authorized range?" If sound levels are above the range, what would be done?

Response: Please see revised text in section 2.3.4.

Comment: It is unclear how having a biologist survey the construction area will minimize impacts, what the biologist will survey for, and what the result of the survey means for the proposed action.

Response: Please see revised text in section 2.3.5.

Comment: Is marine mammal monitoring part of this survey?

Response: This section is referring strictly to vegetation monitoring.

Comment: This should be discussed within the body of the document in the marine mammal/fish section. No-where is this discussed and it is the most relevant information. Also, where did these numbers come from (i.e., how were they calculated)? A discussion on NMFS thresholds and what each mean (e.g., what does 120dB represent) should be in the MM section.

Response: Please see revised text in section 2.3.4, and appendix J.

<u>Department of Fish and Game</u>

Comment: The IS/EA states on page 41 that 1 acre of longfin/delta smelt habitat will be impacted as a result of the proposed project. The Incidental Permit (ITP) application states that 1.1 acres of longfin/delta smelt habitat will be impacted. The CEQA

document should be changed to reflect the impact numbers stated in the ITP application.

Response: Please see revised text in section 2.3.5.

Comment: On page 37, burrowing owls are discussed. Caltrans should submit for Department of Fish and Game (Department) approval, an exclusion plan that includes all survey data and a detailed proposal of how exclusion activities will be implemented. Depending on the extent and duration of burrow exclusion, compensatory mitigation may be necessary and should be determined in consultation with the Department

Response: The Department has supplied protocol level surveys, which have shown no owl present.1993 protocols show no owl present during breeding season survey. A winter pre-construction survey will be preformed; should owls be found, the CDFG would be contacted.

Comment: Impacts to Rare Plants need to be minimized and mitigated for under CEQA. Caltrans should design a monitoring plan in consultation with the Department for the rare plants that will be shaded by the temporary trestle. The monitoring plan should include a mitigation contingency plan in the event that the plants do not survive.

Response: Caltrans has been in consultation with CDFG to finalize a strategy from several options to avoid, minimize and mitigate for impacts to Mason's lilaeopsis and Suisun Marsh aster. Options include, but are not limited to translocation, seed collection, propagation, and monitoring the extant and translocated populations. The final strategy will be presented in the 1602 Lake and Streambed Alteration Agreement from CDFG.

City of Antioch

Comment: We are pleased to see that construction will take place during non-commute hours and that full bridge closure will not be necessary. However, I was unable to locate the anticipated start and duration of the project. Please forward this information and continue to keep the City updated on any changes to the schedule or project description.

Response: Anticipated start date for this project is July 2010 and anticipated project completion is December 2012.

County of Sacramento

Comment: It is not clear in the document as to how the construction will affect traffic patterns in Sacramento County. The County would request that construction hours be limited to off peak commute hours.

Response: Impact to traffic patterns will be restricted to off peak hours and no full bridge closures are anticipated.

Contract requires contractor to perform a photo survey prior to any construction activities. At the end of the project, any damaged roadway as a result of contractor's activities will be restored to existing condition or better. There is money currently set aside in the project to handle any potential damages.

Comment: It is not clear in the document as to how the construction will affect structural roadway sections in Sacramento County. The County would request that Caltrans make all necessary repairs to any damaged roadways in Sacramento County.

Response: Contract requires contractor to perform a photo survey prior to any construction activities. At the end of the project, any damaged roadway as a result of contractor's activities will be restored to existing condition or better. There is money currently set aside in the project to handle any potential damages.

Central Valley Flood Protection Board

Comment: Staff for the Department of Water Resources has reviewed the subject document and provides the following comments:

The proposed project is located within the jurisdiction of the Central Valley Flood Protection Board (Formerly known as The Reclamation Board). The Board is required to enforce standards for the construction, maintenance and protection of adopted flood control plans that will protect public lands from floods. The jurisdiction of the Board includes the Central Valley, including all tributes and distributaries of the Sacramento River and the San Joaquin River, and designated floodways (Title 23 California Code of Regulations (CCR), Section 2).

A Board permit is required prior to starting the work within the Board's jurisdiction for the following:

The placement, construction, reconstruction, removal, or abandonment of any landscaping, culvert, bridge, conduit, fence, projection, fill, embankment, building, structure, obstruction, encroachment, excavation, the planting, or removal of vegetation, and any repair or maintenance that involves cutting into the levee (CCR Section6);

Existing structures that predate permitting or where it is necessary to establish the conditions normally imposed by permitting. The circumstances include those where responsibility for the encroachment has not been clearly established or ownership and use have been revised (CCR Section 6);

A vegetation plan including, but not limited to the sites, vegetation type (i.e. common and scientific name), number, planting spacing and irrigation method that will be within each project area (CCR Section 131). Supporting studies would include a hydraulic analysis on the impacts to the free flow of water as result of the vegetative planting.

The permit application and Title 23 CCR can be found on the Central Valley Flood Protection Board's website at http://www.cvfpb.ca.gov/. Contact your local, federal and state agencies, as other permits may apply.

Response: The department will work with Central Valley Flood Protection Board to secure any permits that are required for this project.

Copies of letters and emails received are provided on the following pages.

STATE OF CALIFORNIA – THE RESOURCES AGENCY ARNOLD SCHWARZENEGGER, GOVERNOR

CENTRAL VALLEY FLOOD PROTECTION BOARD
3310 El Camino Ave., Rm. LL40
SACRAMENTO, CA 95821
(916) 574-0609 FAX: (916) 574-0682
PERMITS: (916) 574-0685 FAX: (916) 574-0682

July 3, 2009

Howell Chan
California Department of Transportation, District 4
P.O. Box 23660, MS-8B
Oakland, CA 94623-0060

Dear Mr. Chan:

State Clearinghouse (SCH) Number: 2009062022
Mitigated Negative Declaration
Antioch Bridge Seismic Retrofit Project

Staff for the Department of Water Resources has reviewed the subject document and provides the following comments:

The proposed project is located within the jurisdiction of the Central Valley Flood Protection Board (Formerly known as The Reclamation Board). The Board is required to enforce standards for the construction, maintenance and protection of adopted flood control plans that will protect public lands from floods. The jurisdiction of the Board includes the Central Valley, including all tributaries and distributaries of the Sacramento River and the San Joaquin River, and designated floodways (Title 23 California Code of Regulations (CCR), Section 2).

A Board permit is required prior to starting the work within the Board's jurisdiction for the following:

- The placement, construction, reconstruction, removal, or abandonment of any landscaping, culvert, bridge, conduit, fence, projection, fill, embankment, building, structure, obstruction, encroachment, excavation, the planting, or removal of vegetation, and any repair or maintenance that involves cutting into the levee (CCR Section 6);

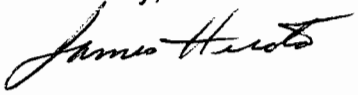
- Existing structures that predate permitting or where it is necessary to establish the conditions normally imposed by permitting. The circumstances include those where responsibility for the encroachment has not been clearly established or ownership and use have been revised (CCR Section 6);

- A vegetation plan including, but not limited to the sites, vegetation type (i.e. common and scientific name), number, planting spacing and irrigation method that will be within each project area (CCR Section 131). Supporting studies would include a hydraulic analysis on the impacts to the free flow of water as result of the vegetative plantings.

The permit application and Title 23 CCR can be found on the Central Valley Flood Protection Board's website at http://www.cvfpb.ca.gov/. Contact your local, federal and state agencies, as other permits may apply.

If you have any questions please contact me at (916) 574-0651 or by email jherota@water.ca.gov.

Sincerely,



James Herota
Staff Environmental Scientist
Floodway Protection Section
Division of Flood Management

cc:

Governor's Office of Planning and Research
State Clearinghouse
1400 Tenth Street, Room 121
Sacramento, CA 95814

COMMUNITY DEVELOPMENT *P.O. Box 5007, Antioch, CA 94531-5007*

June 22, 2009

Mr. Howell Chan
Caltrans District 4
P.O. Box 23600, MS-8B
Oakland, CA 94623-0660

Re: Antioch Bridge Seismic Retrofit Project

Dear Mr. Chan:

Thank you for forwarding the Mitigated Negative Declaration for the above referenced project to the City of Antioch. The City has no comments on the environmental document. We are pleased to see that construction will take place during non-commute hours and that full bridge closure will not be necessary. However, I was unable to locate the anticipated start and duration of the project. Please forward this information and continue to keep the City updated on any changes to the schedule or project description.

I can be reached at 925.779.7038 or twehrmeister@ci.antioch.ca.us.

Sincerely,

T. Wehrmeister

Tina Wehrmeister
Deputy Director of Community Development

cc: Honorable Mayor and City Council
Jim Jakel, City Manager
Joe Brandt, Director of Community Development/City Engineer
Ron Bernal, Director of Public Works
Phil Harrington, Director of Capital Improvements

Building Services Phone (925)779-7065 – Fax (925)779-7034
Planning Services Phone (925)779-7035 – Fax (925)779-7034
Neighborhood Improvement Phone (925)779-7042 – Fax (925)779-7034
Residential Rental Inspection Phone (925)779-6167 – Fax (925)779-7034
Land Development/Engineering Phone (925)779-7035 – Fax (925)779-7034

Municipal Services Agency

Department of Transportation
Michael J. Penrose, Director

Terry Schutten, County Executive
Paul Hahn, Agency Administrator

County of Sacramento

June 14, 2009

Mr. Howell Chan
Caltrans District 4
P.O. Box 23600, MS-8B
Oakland, CA 94623-0660

SUBJECT: REVIEW OF ANTIOCH BRIDGE SEISMIC RETROFIT PROJECT INITIAL STUDY WITH PROPOSED MITIGATED NEGATIVE DECLARATION AND ENVIRONMENTAL ASSESSMENT

Dear Mr. Chan:

The Sacramento County Department of Transportation has performed a cursory review of the report identified above dated May 2009. Thank you for the opportunity to review this document. We have the following comments:

- It is not clear in the document as to how the construction work will affect traffic patterns in Sacramento County. The County would request that construction hours be limited to off peak commute hours.

- It is not clear in the document as to how the construction work will affect structural roadway sections in Sacramento County. The County would request that Caltrans make all necessary repairs to any damaged roadways in Sacramento County.

If you have any questions please call me at 874-7052.

Sincerely,

Matthew G. Darrow
Senior Transportation Engineer

MGD

Cc: Supervisor Nottoli – Board
Mike Penrose – DOT
Steve Hong – IFS

"Melissa Escaron"
<MESCARON@dfg.ca.gov>
07/02/2009 09:15 AM

To "Zachary Gifford" <zachary_gifford@dot.ca.gov>
cc "Melissa Escaron" <MESCARON@dfg.ca.gov>
bcc
Subject burrowing owl comments on IS/Neg Dec/EA for Antioch Bridge

History: This message has been forwarded.

Hello Zachary- On page 37, burrowing owls are discussed. Caltrans should submit for Department of Fish and Game (Department) approval, an exclusion plan that includes all survey data and a detailed proposal of how exclusion activities will be implemented. Depending on the extent and duration of burrow exclusion, compensatory mitigation may be necessary and should be determined in consultation with the Department- Melissa

Melissa Escaron
Staff Environmental Scientist
California Department of Fish and Game
Cell: 707.339.0334
mescaron@dfg.ca.gov

"Melissa Escaron "
<MESCARON@dfg.ca.gov>
06/30/2009 03:35 PM

To <zachary_gifford@dot.ca.gov>
cc "Melissa Escaron" <MESCARON@dfg.ca.gov>, <howell_chan@dot.ca.gov>, <stuart_kirkham@dot.ca.gov>
bcc
Subject IS/Neg Dec/EA for Antioch Bridge

History: This message has been replied to.

Hello Zachary- As the Fish and Game liaison to Caltrans, I have been working with Stuart Kirkham to assess wildlife impacts for this project. The IS/EA states on page 41 that 1 acre of longfin/delta smelt habitat will be impacted as a result of the proposed project. The Incidental Permit (ITP) application states that 1.1 acres of longfin/delta smelt habitat will be impacted. The CEQA document should be changed to reflect the impact numbers stated in the ITP application. Thank you- Melissa

Melissa Escaron
Staff Environmental Scientist
California Department of Fish and Game
Cell: 707.339.0334
mescaron@dfg.ca.gov

"Melissa Escaron "
<MESCARON@dfg.ca.gov>
07/14/2009 03:15 PM

To "Melissa Escaron" <MESCARON@dfg.ca.gov>, <zachary_gifford@dot.ca.gov>
cc <David.Lundgren@CH2M.com>, "Debbie HULTMAN" <DHULTMAN@dfg.ca.gov>, <christopher_states@dot.ca.gov>,
bcc

Subject Antioch Bridge CEQA comment rare plants

Zachary- I am writing regarding the Initial Study for the Antioch Bridge Seismic Retrofit Project. Impacts to Rare Plants need to be minimized and mitigated for under CEQA. Caltrans should design a monitoring plan in consultation with the Department for the rare plants that will be shaded by the temporary trestle. The monitoring plan should include a mitigation contingency plan in the event that the plants do not survive. Thank you- Melissa

Melissa Escaron
Staff Environmental Scientist
California Department of Fish and Game
Cell: 707.339.0334
mescaron@dfg.ca.gov

Chapter 4 - List of Preparers

Project Development Team (PDT)

Office of Program/Project Management:
Mo Pazooki, Project Manager

Headquarters
Mike Thomas, Project Design Coordinator

Office of Design SHOPP:
Sudhir K. Pawar, Project Engineer

Office of Engineering Services, Geotech:
Steven Kakihara, Senior Engineer
David Nesbitt, Transportation Engineer

Office of Engineering Services, Hydraulics:
Joseph Peterson, District Hydraulics Engineer
Carlos Mora, Transportation Engineer

Office of Toll Bridge Design:
Steven Hulsebus, District Division Chief, Toll Bridge Program
John Uozumi, Office Chief
Sid Pawar, Senior Transportation Engineer
Humayun Syed, Associate Transportation Engineer
Trinh Lai, Associate Transportation Engineer
Jerri Fabian, Transportation Engineer

DES Structures:
Yong-Pil Kim, Senior Bridge Engineer
David Tenorio, Senior Bridge Engineer, Construction Support
Rafael Salazar, Transportation Engineer

Office of Traffic Management:
Lenka Pleskotova, Transportation Engineer

Office of Highway Operations:
Ofer Brender, Transportation Engineer

Office of Construction:
Mario Jerez, Transportation Engineer
Frank Guros, Transportation Engineer
Jessie Acedillo, Transportation Electrical Engineer

Project Support:
Francisco Padilla
David Eldridge, Senior Scheduler

Office of Landscape Architecture:
Jeanne Gorham, District Branch Chief
Chris Else, Landscape Associate

Office of Environmental Engineering:
Glenn Kinoshita, Senior Transportation Engineer, Air and Noise Branch
Charles Smith, Senior Transportation Engineer, Hazardous Waste Branch

Office of Water Quality:
Hardeep Takar, Office Chief
Khaliq Taheri, Transportation Engineer

Office of Environmental Analysis:
Melanie Brent, Office Chief
Howell Chan, Senior Environmental Planner
Zachary Gifford, Associate Environmental Planner
Ngoc Bui, Associate Environmental Planner
Oliver Ibrien, Associate Environmental Planner
Craig Jung Associate Environmental Planner

Office of Biological Sciences and Permits:
Christopher States, Senior Environmental Planner
Stuart Kirkham, Associate Environmental Planner

Office of Cultural Resources Studies:
Katherine Rose, Environmental Planner (Architectural History)
Michelle Squyer, Environmental Planner (Architectural History)
Maureen Zogg, Environmental Planner (Architectural History)

Right of Way Project Management & Relocation Services:
Sean Molloy, Senior Right of Way Agent
David Keba, Associate Right of Way Agent

Office of Acquisition and Utilities Services:
Leo Munneke, Right of Way Agent

Bay Area Toll Authority:
Jason Weinstein
Steve Thoman

Consultants:
Maria Sedghi, URS
Behrouz Bozorgnion, CAlTROP
Aarti Joshi, CH2MHILL
David Lundgren, CH2MHILL

Chapter 5 – Distribution List

Antioch City Council	**Oakley City Council**
Mayor James D. Davis P.O. Box 5007 Antioch, CA 94531-5007	Mayor Carol Rios 3231 Main Street Oakley, CA 94561
Mayor Pro Tem Mary Helen Rocha P.O. Box 5007 Antioch, CA 94531-5007	Vice Mayor Pat Anderson 3231 Main Street Oakley, CA 94561
Council Member Brian Kalinowski P.O. Box 5007 Antioch, CA 94531-5007	Council Member Bruce Connelley 3231 Main Street Oakley, CA 94561
Council Member Reginald L. Moore P.O. Box 5007 Antioch, CA 94531-5007	Council Member Jim Frazier 3231 Main Street Oakley, CA 94561
Council Member Martha Parsons P.O. Box 5007 Antioch, CA 94531-5007	Council Member Kevin Romick 3231 Main Street Oakley, CA 94561
Rio Vista City Council	
Mayor Jan Vick One Main Street Rio Vista, CA 94571	Council Member Janith Norman One Main Street Rio Vista, CA 94571
Vice Mayor Ron Jones One Main Street Rio Vista, CA 94571	Council Member Sam Richards One Main Street Rio Vista, CA 94571
Council Member Jack Krebs One Main Street Rio Vista, CA 94571	
Sacramento Board of Supervisor	**Contra Costa Board of Supervisor**
Vice Chair Roger Dickinson, District 1 700 H Street, Suite 2450 Sacramento, CA 95814	John M. Gioia, District 1 11780 San Pablo Ave., Suite D El Cerrito, CA 94530

Jimmie Yee, District 2 700 H Street, Suite 2450 Sacramento, CA 95814	Gayle B. Uilkema, District 2 651 Pine Street, Room 108A Martinez, CA 94553
Chair Susan Peters, District 3 700 H Street, Suite 2450 Sacramento, CA 95814	Mary N. Piepho, District 3 1200 Central Blvd., Suite B Brentwood, CA 94513
Roberta MacGlashan, District 4 700 H Street, Suite 2450 Sacramento, CA 95814	Susan A. Bonilla, District 4 2151 Salvio St.,Suite R Concord, CA 94520
Don Nottoli, District 5 700 H Street, Suite 2450 Sacramento, CA 95814	Federal D. Glover, District 5 315 E. Leland Rd. Pittsburg, CA 94565
Dianne Feinstein, US Senator One Post Street, Suite 2450 San Francisco, CA 94104	Barbara Boxer, US Senator 1700 Montgomery Street, Suite 240 San Francisco, CA 94111
Ellen O. Tauscher, Congressman (D-10) 420 West Third Street Antioch, CA 94509	Dan Lungren, Congressman (R-3) 2339 Gold Meadow Way, Suite 220 Gold River, CA 95670
Mark DeSaulnier, State Senator, D 7 1350 Treat Blvd., Suite 240 Walnut Creek, CA 94597	Lois Wolk, State Senator, D 5 31 E. Channel Street, Room 440 Stockton, CA 95202
Tom Torlakson, 11th Assembly District 815 Estudillo Street Martinez, CA 94553	Joan Buchanan, 15th Assembly District 2694 Bishop Drive, Suite 275 San Ramon, CA 94583
Library	**Library**
Rio Vista Library 44 South Second Street Rio Vista, CA 94571	Oakley Public Library 1050 Neroly Road Oakley, CA 94561
Antioch Library 501 W 18th Street Antioch, CA 94509	

Residential (north side)	**Residential (north side)**
McKinnon, Mary L Trust 10061 River Mist Way Rancho Cordova, CA 95670	State of California P.O. Box 388 Sacramento, CA 95812
Williams Living Trust 1978 Willow Spring Road Morgan Hill, CA 95037	State of California 1419 9th Street 431 Sacramento, CA 95812
Don Ratts 16 Cherry Street Petaluma, CA 94952	State of California 1416 9th Street 431 Sacramento, CA 95814
Stockton Port District P.O. Box 2089 Stockton, CA 95201	Forestar USA Real Estate Group Inc. 235 Montgomery Street San Francisco, CA 94104
Residential (south side)	**Residential (south side)**
Christian A. Lauritzen III, Lauritzen Yacht Harbor 115 Lauritzen Lane Oakley, CA 94561	Harbor Master, New Bridge Marina 6325 Bridgehead Road Antioch, CA 94509
J.M. Tap 1485 Main Street 202 C Saint Helena, CA 94574	State of California 4001 N Wilson Way Stockton, CA 95205
Wallace & Judith Gibson Trust P.O. Box 20697 El Sobrante, CA 94820	Kiewit Construction Group Inc 1000 Kiewit PLZ, Omaha, NE 68131
Linda McDanaiel 3307 Wilbur Ave Antioch, CA 94509	Sportsmen Inc P.O. Box 518 Antioch, CA 94509
EL Du Pont De Memours & Co. P.O. Box 1039 Wilmington, DE 19899	Fleming, Virginia H TR Trust 415 Fleming Lane Antioch, CA 94509
Antioch Trailer Storage 2120 American Canyon Road American Canyon, CA 94503	Retzloff Properties LLC 5041 Blum Road Martinez, CA 94553

Wiley, Michael R & Kimberly TR Trust P.O. Box 678 Oakley, CA 94561	Grady, Daniel M & Shari D TR Trust 3361 Pebble Beach Court Fairfield, CA 94534
Whalen, John E & Lillian A TR Trust 6003 Horsemans Canyon Drive Walnut Creek, CA 94595	Delta Diablo Sanitation Dist. 2500 Pittsburg Antioch Hwy Antioch, CA 94509
Nor-Cal Readymix Inc 1330 Post Oak Blvd 2330 Houston, TX 77056	GWF Power Systems Company 4300 Railroad Avenue Pittsburg, CA 94565
Alegre, Frank C SR & Helen TR Trust 2000 Edgewood Drive Lodi, CA 95242	Bierly, Leon R & Joann P.O. Box 20697 El Sobrante, CA 94820
Jason Weinstein, BATA 101 Eight Street Oakland, CA 94607	Douglas Johnson, MTC 101 Eight Street Oakland, CA 94607
John Cleckler, US Fish & Wildlife Service 2800 Cottage Way Room, W-2605 Sacramento, CA 95825	Monica Gutierrez, National Marine Fisheries Sacramento Area Office 650 Capitol Mall, Suite 8-300 Sacramento, CA 95814-4706
Melissa Escaron, Cal. Dept. of Fish & Game Bay Delta Region P.O. Box 47 Yountville, CA 94599	Susan Bransen, CTC 1120 N Street Room 2221 (MS-52) Sacramento, CA 95814
RWQCB State Clearing House	DELTA PROTECTION COMM. State Clearing House
Sergio Huerta, East Bay Regional Park Dist. 2950 Peralta Oaks CT. Oakland, CA 94605-0381	Gregory Tholen, ABAG 939 Ellis Street, 6th floor San Francisco, CA 94109

Appendix A - CEQA Checklist

Supporting documentation of all CEQA checklist determinations is provided in Chapter 2 of this Initial Study/Environmental Assessment. Documentation of "No Impact" determinations is provided at the beginning of Chapter 2. Discussion of all impacts, avoidance, minimization, and/or compensation measures under the appropriate topic headings in Chapter 2.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
I. AESTHETICS -- Would the project:				
a) Have a substantial adverse effect on a scenic vista?	❒	❒	❒	X
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	❒	❒	❒	X
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	❒	❒	❒	X
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	❒	❒	❒	X
II. AGRICULTURE RESOURCES: In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Dept. of Conservation as an optional model to use in assessing impacts on agriculture and farmland. Would the project:				
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	❒	❒	❒	X

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	❒	❒	❒	X
c) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use?	❒	❒	❒	X
III. AIR QUALITY -- Where available, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations. Would the project:				
a) Conflict with or obstruct implementation of the applicable air quality plan?	❒	❒	❒	X
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	❒	❒	❒	X
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?	❒	❒	❒	X
d) Expose sensitive receptors to substantial pollutant concentrations?	❒	❒	❒	X
e) Create objectionable odors affecting a substantial number of people?	❒	❒	❒	X
IV. BIOLOGICAL RESOURCES -- Would the project:				
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	❒	X	❒	❒

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Game or US Fish and Wildlife Service?	❐	x	❐	❐
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	❐	x	❐	❐
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	❐	x	❐	❐
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	❐	❐	❐	x
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	❐	❐	❐	x
V. CULTURAL RESOURCES -- Would the project:				
a) Cause a substantial adverse change in the significance of a historical resource as defined in § 15064.5?	❐	❐	❐	x
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to § 15064.5?	❐	❐	❐	x
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	❐	❐	❐	x
d) Disturb any human remains, including those interred outside of formal cemeteries?	❐	❐	❐	x

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
VI. GEOLOGY AND SOILS -- Would the project:				
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:	❐	❐	❐	X
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	❐	❐	❐	X
ii) Strong seismic ground shaking?	❐	❐	❐	X
iii) Seismic-related ground failure, including liquefaction?	❐	❐	❐	X
iv) Landslides?	❐	❐	❐	X
b) Result in substantial soil erosion or the loss of topsoil?	❐	❐	❐	X
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?	❐	❐	❐	X
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?	❐	❐	❐	X
e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	❐	❐	❐	X

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
VII. HAZARDS AND HAZARDOUS MATERIALS -- Would the project:				
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	❒	❒	❒	X
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	❒	❒	❒	X
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	❒	❒	❒	X
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	❒	❒	❒	X
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?	❒	❒	❒	X
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?	❒	❒	❒	X
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	❒	❒	❒	X

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	❐	❐	❐	X
VIII. HYDROLOGY AND WATER QUALITY -- Would the project:				
a) Violate any water quality standards or waste discharge requirements?	❐	❐	❐	X
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a levelwhich would not support existing land uses or planned uses for which permits have been granted)?	❐	❐	❐	X
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?	❐	❐	❐	X
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?	❐	❐	❐	X
e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	❐	❐	❐	X
f) Otherwise substantially degrade water quality?	❐	❐	❐	X

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	❒	❒	❒	X
h) Place within a 100-year flood hazard area structures which would impede or redirect flood flows?	❒	❒	❒	X
i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	❒	❒	❒	X
j) Inundation by seiche, tsunami, or mudflow?	❒	❒	❒	X
IX. LAND USE AND PLANNING - Would the project:				
a) Physically divide an established community?	❒	❒	❒	X
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	❒	❒	❒	X
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	❒	❒	❒	X
X. MINERAL RESOURCES -- Would the project:				
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	❒	❒	❒	X
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	❒	❒	❒	X

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XI. NOISE -- Would the project result in:				
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	❐	❐	❐	X
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	❐	❐	❐	X
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	❐	❐	❐	X
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	❐	❐	X	❐
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	❐	❐	❐	X
f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	❐	❐	❐	X
XII. POPULATION AND HOUSING -- Would the project:				
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	❐	❐	❐	X
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	❐	❐	❐	X

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	❒	❒	❒	X
XIII. PUBLIC SERVICES				
a) Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:				
Fire protection?	❒	❒	❒	X
Police protection?	❒	❒	❒	X
Schools?	❒	❒	❒	X
Parks?	❒	❒	❒	X
Other public facilities?	❒	❒	❒	X
XIV. RECREATION				
a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	❒	❒	❒	X

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?	❐	❐	❐	X
XV. TRANSPORTATION/TRAFFIC -- Would the project:				
a) Cause an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume to capacity ratio on roads, or congestion at intersections)?	❐	❐	❐	X
b) Exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways?	❐	❐	❐	X
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?	❐	❐	❐	X
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	❐	❐	❐	X
e) Result in inadequate emergency access?	❐	❐	❐	X
f) Result in inadequate parking capacity?	❐	❐	❐	X
g) Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., bus turnouts, bicycle racks)?	❐	❐	❐	X
XVI. UTILITIES AND SERVICE SYSTEMS -- Would the project:				

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	❒	❒	❒	X
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	❒	❒	❒	X
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	❒	❒	❒	X
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	❒	❒	❒	X
e) Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	❒	❒	❒	X
f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	❒	❒	❒	X
g) Comply with federal, state, and local statutes and regulations related to solid waste?	❒	❒	❒	X
XVII. MANDATORY FINDINGS OF SIGNIFICANCE				
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	❒	❒	❒	X

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulativelyconsiderable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?	❐	❐	❐	x
c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	❐	❐	❐	x

Appendix B - Title VI Policy Statement

DEPARTMENT OF TRANSPORTATION
OFFICE OF THE DIRECTOR
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Flex your power!
Be energy efficient!

January 14, 2005

TITLE VI
POLICY STATEMENT

The California Department of Transportation under Title VI of the Civil Rights Act of 1964 and related statutes, ensures that no person in the State of California shall, on the grounds of race, color, national origin, sex, disability, and age, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity it administers.

WILL KEMPTON
Director

Appendix C - Special–Status Species and Critical Habitat With the Potential to Occur in the BSA

Special Status Species and Critical Habitat With the Potential to Occur in the BSA					
Scientific Name	Common Name	State, Federal Status[1]	Specific Habitat Present/ Absent[2]	Species Presence/ Absence[2]	Rationale
Hypomesus transpacificus	delta smelt	ST, FT	P	IP	Salt water – fresh water mixing zone (2 ppt salinity) present during part of the year
Hypomesus transpacificus Designated Critical Habitat	delta smelt		P	P	Includes all waters of the Delta, including the San Joaquin River.
Spirinchus thaleichthys	Longfin smelt	Ssc, FPT	P	IP	Likely to be upgraded to threatened status in 2009. Presence within this region of the Delta recorded in the CDFG 20 mm trawl surveys
Oncorhynchus tshawytscha	Sacramento River winter-run Chinook salmon	SE, FE	P	IP	BSA lies within the area of possible occurrence
Oncorhynchus tshawytscha Designated Critical Habitat	Sacramento River winter-run Chinook salmon		P	P	Delta waters on Sherman Island, but excluding the San Joaquin River
Oncorhynchus tshawytscha	Central Valley spring-run Chinook salmon	ST, FT	P	IP	BSA lies within the migratory pathway of the run.
Oncorhynchus tshawytscha Designated Critical Habitat	Central Valley spring-run Chinook salmon		P	P	Delta waters on Sherman Island, but excluding the San Joaquin River
Oncorhynchus tshawytscha	Central Valley fall-run and late fall-run Chinook salmon	Ssc, Fsc	P	IP	BSA lies within the migratory pathway of the run.
Oncorhynchus mykiss irideus	Central Valley steelhead	Ssc, FT	P	IP	BSA lies within the migratory pathway of the species
Oncorhynchus mykiss irideus Designated Critical Habitat	Central Valley steelhead		P	P	Defined as being, in part, all waters of the Delta, including the San Joaquin River.
Acipenser medirostris	Green sturgeon	Ssc, FT	P	IP	Species has been observed in the San Joaquin River
Designated Critical	Green sturgeon		P	P	Scheduled to come into

Special Status Species and Critical Habitat With the Potential to Occur in the BSA

Scientific Name	Common Name	State, Federal Status[1]	Specific Habitat Present/ Absent[2]	Species Presence/ Absence[2]	Rationale
Habitat					effect 6/2009
Thamnophis gigas	Giant garter snake	ST, FT	P	IP	Historic occurrence on Sherman Island, near Antioch Bridge recorded in CNDDB. Suitable habitat is present.
Clemmys marmorata	Western pond turtle	Ssc	P	IP	Range extends throughout the Delta
Actinemys marmorata marmorata	Northwestern pond turtle	Ssc	P	IP	Southern extent of range extends partially into Delta, with some overlap of Clemmys marmorata
Zalophus californianus	California sea lion	MMPA	P	P	Corpse Observed floating against Sherman Island Rip-Rap
Athene cunicularia	Western burrowing owl	Ssc	P	IA	Protocol-level surveys will be conducted in 2009. Flood irrigation regime likely displaces ground squirrels, and hence the owls, from BSA.
Lilaeopsis masonii	Mason's lilaeopsis	SR	P	P	Historic occurrences near Project in CNDDB. Habitat present. Speciesobserved during the 2008 rare plant surveys.
Symphyotrichum lentum	Suisun marsh aster	CNPS List 1B	P	P	Observed in BSA during 2008 rare plant surveys.
Eschscholzia rhombipetala	Diamond-petaled California poppy	CNPS List 1B.1	P	TBD	Valley and foothill grassland; rare plant surveys will be conducted in 2009
Fritillaria liliacea	Fragrant fritillary	CNPS List 1B.2	P	IA	Valley and foothill grassland; rare plant surveys will be conducted in 2009
Hibiscus lasiocarpus	Woolly rose-mallow	CNPS List 2.2	P	A	Marshes and swamps; No specimens identified in the 2008 rare plant surveys.
Plagiobothrys hystriculus	Bearded popcorn-flower	CNPS List 1B.1	P	IA	Valley and foothill grassland; rare plant surveys will be conducted in 2009
California macrophylla	Round-leaved filaree	CNPS List 1B.1	P	A	Valley and foothill grassland; No specimens identified in the 2008 rare plant surveys.

Special Status Species and Critical Habitat With the Potential to Occur in the BSA

Scientific Name	Common Name	State, Federal Status[1]	Specific Habitat Present/ Absent[2]	Species Presence/ Absence[2]	Rationale
Sagittaria sanfordii	Sanford's arrowhead	CNPS List 1B.2	P	IA	Marshes and swamps; rare plant surveys will be conducted in 2009
Trifolium depauperatum var. hydrophilum	Saline clover	CNPS List 1B.2	P	IA	Marshes and swamps; rare plant surveys will be conducted in 2009
Tropidocarpum capparideum	Caper-fruited tropidocarpum	CNPS List 1B.1	P	IA	Valley and foothill grassland; rare plant surveys will be conducted in 2009

CNPS California Native Plant Society
List 1A Plants presumed extinct in California
List 1B Plants rare, threatened or endangered in California or elsewhere
List 2 Plants rare, threatened or endangered in California but more common elsewhere
SE State endangered
SR State rare
Ssc State species of concern
ST State threatened

FC Federal candidate
FE Federal endangered
FPE Federal proposed endangered
FPT Federal proposed threatened
Fsc Federal species of concern
FT Federal threatened
MMPA Marine Mammal Protection Act

[2] Presence/Absence:
A Absent
P Present—general habitat is present

IA Inferred Absent
IP Inferred Present
TBD To be determined

Appendix D - Plant Species Lists

Scientific Name	Common Name	Status[1]	Specific Habitat Present/ Absent	Species Presence/ Absence[2]	Rationale
Oenothera deltoides ssp. *howellii*	Antioch Dunes Evening Primrose	SE, FE	A	A	Endemic to Antioch Dunes
Lasthenia conjugens	Contra Costa Goldfields	FE	A	IA	Occurs in vernal pool habitats
Erysimum capitatum var. *angustatum*	Contra Costa Wallflower	SE, FE	A	IA	Endemic to Antioch Dunes
Eryngium racemosum	Delta button-celery	SE	A	IA	Requires seasonally inundated clay floodplains
Cordylanthus mollis ssp. *mollis*	Soft Bird's Beak	FE, CNPS	P	A	Historic sightings recorded in CNDDB near Antioch Bridge. Rare Plant surveys did not locate any in 2008.
Cordylanthus mollis ssp. *hispidus*	Hispid Bird's Beak	CNPS	P	A	Suitable habitat marginal, nearest sightings distant, and not identified in 2008 rare plant surveys
Symphyotrichum lentum	Suisun Marsh Aster	CNPS	P	P	Observed in project site during 2008 rare plant surveys
Blepharizonia plumosa	Big Tarplant	CNPS	A	A	Project area too low and wet to be suitable habitat. No specimens observed on site during 2008 rare plant surveys
Lilaeopsis masonii	Mason's Lilaeopsis	SR	P	P	Historic occurrences near project in CNDDB. Habitat present. Specimens observed during the 2008 rare plant surveys.

Limosella subulata	Delta Mudwort	CNPS	P	A	No specimens found during the 2008 rare plant surveys
Atriplex depressa	Brittlescale	CNPS	A	A	No recorded occurrences in Delta east of the Coastal Ranges. No specimens identified during the 2008 rare plant survey
Isocoma arguta	Carquinez Goldenrush	CNPS	P	A	Historic occurrences recorded on north side of Sherman Island in CNDBB. No specimens were identified during the 2008 rare plant surveys.
Lathyrus jepsonii var. *jepsonii*	Delta Tule Pea	CNPS	P	A	Historic occurrences throughout Delta and on Sherman Island recorded in CNDDB. No specimens identified in project area during 2008 rare plant surveys
Atriplex cordulata	Heartscale	CNPS	A	A	Requires sandy soils. No recorded historic occurrences in the Delta east of the Coast Ranges in the CNDDB. No specimens identified during the 2008 rare plant surveys.
Hibiscus lasiocarpus	Wooly Rose Mallow	CNPS	P	A	Historic occurrences recorded in CNDDB throughout the Delta. No specimens identified in the 2008 rare plant surveys

Cirsium hydrophilum var. *hydrophilum*	Suisun Thistle	FE, CNPS	A	A	Salt marsh not present on site. Historic occurrences in CNDDB confined to Suisun Marsh. No specimens identified in the 2008 rare plant surveys
Amsinckia grandiflora	Large-Flowered Fiddleneck	SE, FE	A	A	Occurs at elevations between 275-550 m, and requires cismontane habitat. No specimens identified in the 2008 rare plant surveys
Cordylanthus nidularius	Mt. Diablo Bird's Beak	SR	A	A	Endemic to Mt. Diablo. Grows in chaparral on serpentine rock at high elevations. No specimens identified in the 2008 rare plant surveys
Sanicula saxatilis	Rock Sanicle	SR	A	A	Endemic to Mt. Diablo. Grows in chaparral at high elevation. No specimens identified in the 2008 rare plant surveys
Cryptantha hooveri	Hoover's cryptantha	CNPS	A	A	Presumed extinct in California. Limited to Antioch Dunes in region. No specimens identified in the 2008 rare plant surveys

California macrophylla	round-leaved filaree	CNPS	A	A	Occurs in cismontane woodland above 15 m elevation. No recorded historic occurrences in the Delta east of the Coast Ranges in the CNDDB. No specimens identified in the 2008 rare plant surveys
Eriogonum truncatum	Mt. Diablo buckwheat	CNPS	A	A	Occurs in chaparral and coastal scrub at high elevations. No recorded historic occurrences in the Delta east of the Coast Ranges in the CNDDB. No specimens identified in the 2008 rare plant surveys
Eschscholzia rhombipetala	diamond-petaled California poppy	CNPS	A	A	Occurs in valley and foothill grasslands above sea level. No recorded historic occurrences in the Delta east of the Coast Ranges in the CNDDB. No specimens identified in the 2008 rare plant surveys
Juglans hindsii	Northern California black walnut	CNPS	A	A	Occurs in riparian woodlands above sea level. No specimens identified in the 2008 rare plant surveys
Legenere limosa	Legenere	CNPS	A	A	Occurs in vernal pools. No specimens identified in the 2008 rare plant surveys

Madia radiata	Showy golden madia	CNPS	A	A	Occurs in adobe clay in grasslands and shrubs above 25 m elevation. No specimens identified in the 2008 rare plant surveys
Plagiobothrys hystriculus	Bearded popcorn-flower	CNPS	A	A	Occurs in vernal pools and wet areas between 10-50 m elevation. No specimens identified in the 2008 rare plant surveys
Tropidocarpum capparideum	Caper-fruited tropidocarpum	CNPS	A	A	Occurs in valley and foothill grassland in alkaline clays above sea level. No specimens identified in the 2008 rare plant surveys
Arctostaphylos manzanita ssp. *laevigata*	Contra Costa manzanita	CNPS	A	A	Occurs on rocky slopes in chaparral above 500m elevation. No recorded historic occurrences in the Delta east of the Coast Ranges in the CNDDB. No specimens identified in the 2008 rare plant surveys
Astragalus tener var. *tener*	alkali milk-vetch	CNPS	A	A	Occurs in alkali playa, vernal pools and valley and foothill grasslands above sea level. No recorded historic occurrences in the Delta east of the Coast Ranges in the CNDDB. No specimens identified in the 2008 rare plant surveys

Atriplex joaquiniana	San Joaquin spearscale	CNPS	A	A	Occurs in alkali wetlands above sealevel. Recorded historic occurrences lie on margins of the Delta east of the Coast Ranges in the CNDDB No specimens identified in the 2008 rare plant surveys
Calochortus pulchellus	Mt. Diablo fairy-lantern	CNPS	A	A	Occurs on wooded and brush slopes above 200 m elevation. No recorded historic occurrences in the Delta east of the Coast Ranges in the CNDDB. No specimens identified in the 2008 rare plant surveys
Calystegia atriplicifolia ssp. *buttensis*	Butte County morning-glory	CNPS	A	A	Occurs in lower montane coniferous forests above 600 m. . No specimens identified in the 2008 rare plant surveys
Campanula exigua	Chaparral harebell	CNPS	A	A	Occurs in chaparral on serpentine rocky slopes above 300 m. Historic occurrences recorded in the CNDDB for the region are restricted to Mt. Diablo. No specimens identified in the 2008 rare plant surveys

Centromadia parryi ssp. *parryi*	Pappose tarplant	CNPS	A	A	Occurs in vernally mesic sites above sea level. Historic occurrences recorded in the CNDDB lie on the northern perimeter of Suisun Marsh. No specimens identified in the 2008 rare plant surveys
Delphinium californicum ssp. *interius*	Hospital Canyon larkspur	CNPS	A	A	Occurs in cismontane woodland and chaparral above 225 m. No recorded historic occurrences in the Delta east of the Coast Ranges in the CNDDB. No specimens identified in the 2008 rare plant surveys.
Eriastrum brandegeeae	Brandegee's eriastrum	CNPS	A	A	Occurs in cismontane woodland and chaparral above 345 m. Historic occurrences recorded in the CNDDB for the region are restricted to Mt. Diablo. No specimens identified in the 2008 rare plant surveys

Fritillaria liliacea	Fragrant fritillary	CNPS	A	A	Occurs on serpentine clay soils above sea level. Historic occurrences recorded in the CNDDB are restricted to the west aspect of the Coastal Ranges within the region and Jepson Prairie. No specimens identified in the 2008 rare plant surveys
Helianthella castanea	Diablo helianthella	CNPS	A	A	Occurs in chaparral/oak woodland in rocky soils above 25 m elevation. No recorded historic occurrences in the Delta east of the Coast Ranges in the CNDDB. No specimens identified in the 2008 rare plant surveys.
Hesperolinon breweri	Brewer's western flax	CNPS	A	A	Occurs in chaparral and grassland in rocky serpentine soil above 30 m. No recorded historic occurrences in the Delta east of the Coast Ranges in the CNDDB. No specimens identified in the 2008 rare plant surveys.

Malacothamnus hallii	Hall's bush-mallow	CNPS	A	A	Occurs in chaparral above 10 m. Historic occurrences recorded in the CNDDB for the region are restricted to Mt. Diablo. No specimens identified in the 2008 rare plant surveys.
Phacelia phacelioides	Mt. Diablo phacelia	CNPS	A	A	Occurs in chaparral and cismontane woodlands on rocky surfaces above 500 m. Historic occurrences recorded in the CNDDB for the region are restricted to Mt. Diablo. No specimens identified in the 2008 rare plant surveys.
Sagittaria sanfordii	Sanford's arrowhead	CNPS	P	A	Occurs in freshwater ponds, ditches and marshes. No specimens identified in the 2008 rare plant surveys.
Streptanthus albidus ssp. *peramoenus*	most beautiful jewel-flower	CNPS	A	A	Chaparral, grassland and cismontane woodland on serpentine outcrops above 120 m. No recorded historic occurrences in the Delta east of the Coast Ranges in the CNDDB. No specimens identified in the 2008 rare plant surveys.

Triquetrella californica	coastal triquetrella	CNPS	A	A	Occurs on coastal bluffs and coastal bluff scrub above 10 m. Historic occurrences recorded in the CNDDB for the region are restricted to Mt. Diablo. No specimens identified in the 2008 rare plant surveys.
Arctostaphylos auriculata	Mt. Diablo manzanita	CNPS	A	A	Occurs in chaparal on sandstone above 120 m. No recorded historic occurrences in the Delta east of the Coast Ranges in the CNDDB. No specimens identified in the 2008 rare plant surveys.
Streptanthus hispidus	Mt. Diablo jewel-flower	CNPS	A	A	Occurs in chaparral or grasslands on rocky outcrops above 275 m. Historic occurrences recorded in the CNDDB for the region are restricted to Mt. Diablo. No specimens identified in the 2008 rare plant surveys.
Carex comosa	Bristly Sedge	CNPS	P	A	Occurs in marshes and swamps and Delta islands below sea level. No specimens identified in the 2008 rare plant surveys.

Anomobryum julaceum	slender silver moss	CNPS	A	A	Occurs in a variety of forested landscapes on damp rock and soil above 100 m. Historic occurrences recorded in the CNDDB for the region are restricted to the Mt. Diablo area. No specimens identified in the 2008 rare plant surveys.
Carex vulpinoidea	brown fox sedge	CNPS	A	A	Occurs in marshes and swamps above 30 m elevation. No specimens identified in the 2008 rare plant surveys.
Didymodon norrisii	Norris' beard moss	CNPS	A	A	Occurs in mesic forest and woodlands on bare rock above 600 m. Historic occurrences recorded in the CNDDB for the region are restricted to Mt. Diablo. No specimens identified in the 2008 rare plant surveys.
Downingia pusilla	dwarf downingia	CNPS	A	A	Occurs in vernal pools and along their margins. No specimens identified in the 2008 rare plant surveys.

Potamogeton zosteriformis	eel-grass pondweed	CNPS	P	A	Occurs in marshes and swamps above sea level. Historic occurrences recorded in the CNDBB in Delta islands below sea level. No specimens identified in the 2008 rare plant surveys.
Scutellaria galericulata	marsh skullcap	CNPS	P	A	Occurs in marshes and swamps above sea level. Historic occurrences recorded in the CNDBB in Delta islands below sea level. No specimens identified in the 2008 rare plant surveys.
Scutellaria lateriflora	side-flowering skullcap	CNPS	P	A	Occurs in marshes and swamps below sea level. Historic occurrences recorded in the CNDBB. No specimens identified in the 2008 rare plant surveys.
Senecio aphanactis	chaparral ragwort	CNPS	A	A	Occurs in cismontane woodland and coastal scrub above 20 m. No recorded historic occurrences in the Delta east of the Coast Ranges in the CNDDB. No specimens identified in the 2008 rare plant surveys.

Viburnum ellipticum	oval-leaved viburnum	CNPS	A	A	Occurs in chaparral, cismontane woodlands and lower montane coniferous forests above 215 m. Historic occurrences recorded in the CNDDB for the region are restricted to Mt. Diablo. No specimens identified in the 2008 rare plant surveys.

CNPS	California Native Plant Society
List 1A	Plants presumed extinct in California
List 1B	Plants rare, threatened or endangered in California or elsewhere
List 2	Plants rare, threatened or endangered in California but more common elsewhere
SE	State endangered
SR	State rare
Ssc	State species of concern
ST	State threatened

FC	Federal candidate
FE	Federal endangered
FPE	Federal proposed endangered
FPT	Federal proposed threatened
Fsc	Federal species of concern
FT	Federal threatened
MMPA	Marine Mammal Protection Act

Appendix E - Animal Species Lists

Scientific Name	Common Name	Status[1]	Specific Habitat Present/ Absent	Species Presence/ Absence[2]	Rationale
Hypomesus transpacificus	Delta Smelt	SE, FT	P	IP	Salt water – fresh water mixing zone (2 ppt salinity) present during part of the year
Designated Critical Habitat	Delta Smelt		P	P	Defined as being, in part, all waters of the Delta, including the San Joaquin River.
Spirinchus thaleichthys	Longfin Smelt	Ssc, FP	P	IP	Likely to be upgraded to threatened status in 2009. Presence within this region of the Delta recorded in the CDFG 20 mm trawl surveys
Oncorhynchus tshawytscha	Sacramento River Winter Run Chinook Salmon	SE, FE	P	IP	Project area lies within the area of possible occurrence
Designated Critical Habitat	Sacramento River Winter Run Chinook Salmon		P	P	Delta waters on Sherman Island, but excluding the San Joaquin River
Oncorhynchus tsawytscha	Central Valley Spring Run Chinook Salmon	ST, FT	P	IP	Project area lies within the path of the run.
Designated Critical Habitat	Central Valley Spring Run Chinook Salmon		P	P	Delta waters on Sherman Island, but excluding the San Joaquin River
Oncorhynchus tsawytscha	Central Valley Fall Run and Late Fall Run Chinook Salmon	Ssc, Fsc	P	IP	Project area lies within the path of the run.
Designated Critical Habitat	Central Valley Fall Run and Late Fall Run Chinook Salmon		P	P	Delta waters on Sherman Island, but excluding the San Joaquin River
Oncorhynchus mykiss irideus	Central Valley Steelhead	Ssc, FT	P	IP	Project area lies within the path of the run
Designated Critical Habitat	Central Valley Steelhead		P	P	Defined as being, in part, all waters of the Delta, including the San Joaquin River.
Acipenser medirostris	Green Sturgeon	Ssc, FT	P	IP	Species has been observed in the San Joaquin River

Designated Critical Habitat	Green Sturgeon		P	P	Scheduled to come into effect 6/2009
Archoplites interruptus	Sacramento Perch	Ssc	P	IP	Found in sloughs of the Central Valley. Historic siting recorded in CNDDB nearby
Pogonichthys macrolepidotus	Sacramento splittail	Ssc	P	IP	Occurs in Suisun Bay and Delta
Thamnophis gigas	Giant Garter Snake	ST, FT	P	IP	Historic occurrence on Sherman Island, near Antioch Bridge recorded in CNDDB. Suitable habitat is present.
Masticophis lateralis euryxanthus	Alameda whipsnake	ST, FT	A	IA	Restricted valley-foothill hardwood habitat of the Coast Ranges
Clemmys marmorata	Western Pond Turtle	Ssc	P	IP	Range extends throughout the Delta
Actinemys marmorata marmorata	Northwestern pond turtle	Ssc	P	IP	Southern extent of range extends partially into Delta, with some overlap of *Clemmys marmorata*
Anniella pulchra pulchra	Silvery Legless Lizard	Ssc, FSC	A	IA	Sand dune habitat not present
Phrynosoma coronatum (frontale population)	Coast (California) horned lizard	Ssc	A	IA	Project area lacks the loose soils it requires.
Rana draytonii	California Red-Legged Frog	Ssc, FT	A	IA	Critical habitat is not present. No historic occurrences recorded in the Delta east of the Coastal Ranges. Irrigation regime insures that the area does not experience dry season conditions and makes the area more suitable to bull frogs.
Ambystoma californiense	California Tiger Salamander	Ssc, FT	A	IA	Critical habitat is not present. No historic occurrences recorded in the Delta east of the Coastal Ranges. Irrigation regime insures that the area does not experience dry season conditions and makes the area more suitable to bull frogs.
Rallus longirosrtis obsoletus	California Clapper Rail	SE, FE	A	IA	Restricted to tidal marshes

Laterallus jamaicensis coturniculus	California Black Rail	ST, FSC	P	IA	Marginal habitat, not sufficient to support population
Sternula antillarum browni	California least tern	SE, FE	A	IA	No recorded sightings east of Suisun Marsh
Buteo swainsoni	Swainson's Hawk	ST	A	IA	Nesting habitat not present.
Riparia riparia	Bank Swallow	ST	A	IA	Requires vertical cliffs with fine sandy soils for burrows
Athene cunicularia	Burrowing Owl	Ssc, FSC	P	A	As of April 2009, surveys are currently underway, with no current indication that burrowing owls are present. Flood irrigation regime likely displaces ground squirrels, and hence the owls, from project area.
Asio flammeus	Short-eared Owl	Ssc	P	IA	Habitat is present, but grazing reduces nesting habitat. Local CNDDB sitings are concentrated in Suisun Marsh.
Charadrius montanus	mountain plover	Ssc	P		Prefers short vegetation, bare ground and flat topography, such as grazed areas.
Lanius ludovicianus	Loggerhead Shrike	Ssc, FSC	A	IA	Requires woodland habitat
Geothlypis trichas sinuosa	Saltmarsh Common Yellowthroat	Ssc, FSC	A	IA	Marginal habitat present at best. Foraging and nesting habitat only available in small swaths bordering Mayberry Slough and the large irrigation ditch.
Agelaius tricolor	Tricolored Blackbird	Ssc	A	IA	Although foraging habitat is present, nesting habitat is not – – no recorded occurrences in Delta in the CNDDB
Melospiza melodia maxillaris	Suisun Song Sparrow	Ssc	A	IA	Endemic to area around Suisun Bay
Reithrodontomys raviventris	Saltmarsh Harvest Mouse	SE, FE	A	IA	Saltmarsh and pickleweed are absent
Vulpes macrotis mutica	San Joaquin Kit Fox	ST, FE	A	IA	Outside of range; loose sandy soils for burrowing not present

Antrozous pallidus	pallid bat	Ssc	A	IA	Requires open dry habitats with rocky outcrops for roosting. No CNDDB records in the San Joaquin Delta
Lasiurus blossevillii	western red bat	Ssc	A	IA	In sufficient trees in the landscape mosaic. No indication that built structures provide habitat.
Sorex ornatus sinuosus	Suisun shrew	Ssc	A	IA	Suisun Marsh defines the easternmost edge of its range
Taxidea taxus	American badger	Ssc	A	IA	Requires dry, open shrubland with uncultivated vegetation
Apodemia mormo langei	Lange's Metalmark Butterfly	FE	A	IA	Restricted to Antioch Dunes. Host plant not present.
Callophrys mossii bayensis	San Bruno elfin butterfly	FE	A	IA	Restricted to higher elevations on Mt. Diablo
Desmocerus californicus dimorphus	Valley Elderberry Longhorn Beetle	FT	A	IA	Elderberry not present on site
Elaphrus viridis	Delta Green Ground Beetle	FT	A	A	Restricted to Jepson Prairie Vernal Pool edges
Branchinecta lynchi	Vernal Pool Fairy Shrimp	FT	A	A	Vernal pools not present on site
Branchinecta conservatio	Conservancy fairy shrimp	FE	A	IA	Vernal pools not present on site
Lepidurus packardi	Vernal Pool Tadpole Shrimp	FE	A	A	Vernal pools not present on site

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FC	Federal candidate
FE	Federal endangered
FPE	Federal proposed endangered
FPT	Federal proposed threatened
Fsc	Federal species of concern
FT	Federal threatened
MMPA	Marine Mammal Protection Act

Appendix F - Biological Opinion and Assessment Transmittal Letters to USFWS

DEPARTMENT OF TRANSPORTATION
OFFICE OF THE DIRECTOR
111 GRAND AVENUE
P.O. BOX 23660
OAKLAND, CA 94623-0660
PHONE (510) 286-5900
FAX (510) 286-6301
TTY 711

Flex your power!
Be energy efficient!

January 22, 2009

Mr. Ryan Olah
US Fish and Wildlife Service
2800 Cottage Way, -W-2605
Sacramento, CA 95825-1846
ATTN: John Cleckler

04-CC-160-KP 1.3/2.1 (PM 0.8/1.3)
03-SAC-160-KP 0/2.1 (PM 0/1.3)
EA 1A5210

Subject: Antioch Bridge Seismic Retrofit Project, Contra Costa and Sacramento Counties, California

Dear Mr. Olah:

Caltrans requests concurrence for its determinations for Delta smelt (*Hypomesus transpacificus*), longfin smelt (*Spirinchus thaleichthys*) and giant garter snake (*Thamnophis gigas*) for the Antioch Bridge Seismic Retrofit Project, as detailed in the Biological Assessment presented at the January 14, 2009 interagency meeting in Sacramento. Caltrans is acting as the NEPA lead agency under the provisions of the *Memorandum of Understanding* (MOU) *between the Federal Highway Administration and the California Department of Transportation Concerning the State of California's Participation in the Surface Transportation Project Pilot Delivery Program*, which became effective July 1, 2007. The MOU was signed pursuant to Section 6005 of the 2005 Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) which allows the Secretary of Transportation to assign, and the State of California to assume, responsibility for FHWA's responsibilities under NEPA as well as consultation and coordination responsibilities under other Federal environmental laws. As this project is covered by the Pilot Program MOU, FHWA has assigned and Caltrans has assumed FHWA responsibility for environmental review, consultation and coordination on this project. Please direct all future correspondence on this project to Caltrans.

We have enclosed an electronic copy of the BA for this project. A hard copy was delivered to Maral Kasparian (USFWS) for John Cleckler (USFWS) during an interagency meeting for the project held in Sacramento on January 14, 2009. If you or your staff have any questions or would like to discuss this matter further, feel free to phone me at (510) 622-8729 or Chris States (510) 286-7185.

Sincerely,

JEFFERY G. JENSEN SIGNED FOR
Office Chief
Office of Biological Sciences and Permits

cc: Mo Pazooki, Project Management
Christopher States, Office of Biological Sciences and Permits
Howell Chan, Environmental Analysis
Jim Richards, Deputy District Director, Environmental Planning and Engineering

JGJ/wsk

DEPARTMENT OF TRANSPORTATION
OFFICE OF THE DIRECTOR
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OAKLAND, CA 94623-0660
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TTY 711

Flex your power!
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March 19, 2009

Mr. Ryan Olah
US Fish and Wildlife Service
2800 Cottage Way, W-2605
Sacramento, CA 95825-1846
ATTN: John Cleckler

04-CC-160-KP 1.3/2.1 (PM 0.8/1.3)
03-SAC-160-KP 0/2.1 (PM 0/1.3)
EA 1A5210

Subject: Antioch Bridge Seismic Retrofit Project, Contra Costa and Sacramento Counties, California

Dear Mr. Olah:

This letter is in response to your February 12, 2009 letter of non-concurrence for our request for informal consultation for giant garter snake (*Thamnophis gigas*) and Delta smelt (*Hypomesus transpacificus*) for the Antioch Bridge Seismic Retrofit Project. After careful review of the information available for these species and the proposed project impacts, Caltrans requests to enter into formal consultation for these two species.

For the Delta smelt, we misunderstood the intention of the work window that was provided. In light of the clarification given in the letter of February 12, 2009, we have reevaluated the information for Delta smelt based on known occurrences, principle constituent elements of the critical habitat and life history of the species. The shallow brackish edgewaters of the San Joaquin River, present on the south shore within the project action area, provide rearing habitat for juvenile Delta smelt. Although the 2 parts per thousand (ppt) isohaline demarcating the mixing zone where juveniles rear is located further upstream from the project action area during the rearing time period for this species, the salinity levels in the river at this location are well within the tolerance levels for the species. With potential presence of the species in the action area and hydro-acoustic sound levels from pile driving activities expected to exceed 183 db SEL, Caltrans concurs that there is potential for "take" of the species, and we have revised our determination to *may affect, likely to adversely affect* Delta smelt.

Caltrans concurs with USFWS' determination on Delta smelt critical habitat.

For giant garter snake, we acknowledge that despite the infrequent occurrences of giant garter snake in the western Delta and the failure of subsequent surveys in the region to find any individuals of this species, there is a possibility that giant garter snake could occur in the project area during construction. The giant garter snake is capable of reaching Sherman Island, given the recorded occurrences and identification of habitat. However, its presence appears to be sporadic. Caltrans concurs that project activities could result in direct mortality

to individuals of the species, so "take" is possible. We have revised our determination to *may effect, likely to adversely affect* giant garter snake.

We would like some clarification on the statement from the February 12, 2009 letter stating, "Caltrans has not conducted any protocol botanical surveys of the action area and plans to begin protocol botanical surveys in spring 2009; therefore their effects assessment for listed plants has not been completed." Protocol surveys were conducted during the 2008 blooming season and are described in sections 3.2.5 and 5.4 of the Biological Assessment. The botanical survey report is included as Appendix D. Follow-on surveys will commence in spring 2009. There appears to have been some miscommunication over these protocol botanical surveys, and we would appreciate some clarification on what was intended by the statement.

We have enclosed our revised determinations for the giant garter snake and Delta smelt. These enclosed pages are intended to replace the ones currently in the Biological Assessment submitted on January 14, 2009. If you or your staff have any questions or would like to discuss this matter further, feel free to phone me at (510) 622-8729 or Chris States (510) 286-7185.

Sincerely,

JEFFERY G. JENSEN
Office Chief
Office of Biological Sciences and Permits

cc: Mo Pazooki, Project Management
Christopher States, Office of Biological Sciences and Permits
Howell Chan, Environmental Analysis
Jim Richards, Deputy District Director, Environmental Planning and Engineering

JGJ/wsk

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825-1846

In Reply Refer To:
81420-2008-F-1537-3

AUG 14 2009

Mr. James Richards
California Department Transportation
Division of Environmental Planning & Engineering
111 Grand Avenue
P.O. Box 23660
Oakland, California 94623-0660

Subject: 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 Critical Habitat for the Delta Smelt

Dear Mr. Richards:

This is in response to your March 19, 2009, request for formal consultation with the U.S. Fish and Wildlife Service (Service) on the proposed Antioch Bridge Seismic Retrofit Project in Contra Costa and Sacramento Counties, California. Your letter was received in this office on March 23, 2009, and included the request for formal consultation on the threatened Delta smelt (*Hypomesus transpacificus*) and its critical habitat and the threatened giant garter snake (*Thamnophis gigas*). This document represents the Service's biological opinion on the effects of the proposed action on these listed species and the designated critical habitat. This document has been prepared in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. § 1531 *et seq.*)(Act).

This biological opinion is based on: (1) a January 2009, Biological Assessment; (2) a July 16, 2008, field review; (3) revised compensation language provided on June 23, 2009; (4) Caltrans' July 14, 2009, response to the draft biological opinion; (5) miscellaneous correspondence and electronic mail (email) between the Service and the California Department of Transportation (Caltrans) from May 2008 to July 2009; and (6) other information available to the Service.

Consultation History

July 16, 2008	The Service attended a field meeting with Caltrans. David Kelley of the Service told Caltrans that potential giant garter snake habitat was within the action area. Peter Johnsen of the Service explained that delta smelt could be found in the action area at any time of the year but the August 1 to November 30 work window would be optimal to minimize effects.
September 10, 2008	The Service attended a pre-consultation meeting with Caltrans and other resource agencies.
November 5, 2008	The Service attended a pre-consultation meeting with Caltrans and other resource agencies.
January 14, 2009	The Service attended a pre-consultation meeting with Caltrans and other resource agencies. During the meeting Caltrans issued a copy of the January 2009 Biological Assessment.
January 26, 2009	The Service received a letter from Caltrans dated January 22, 2009, requesting concurrence on a not likely to adversely affect determination for the delta smelt and the giant garter snake.
February 12, 2009	The Service received sent a letter to Caltrans expressing the inability to concur with their determination. The Service recommended that Caltrans enter into formal consultation for the delta smelt and its critical habitat and the giant garter snake.
March 23, 2009	The Service received a letter from Caltrans requesting initiation of formal consultation for the delta smelt and the giant garter snake. Caltrans concluded that the delta smelt was likely to be affected due to the presence in the action area and the hydro-acoustic sound levels from pile driving activities that are expected to exceed 183 decibel (db) Sound Exposure Level (SEL).
March 25, 2009	Caltrans requested the Service issue a draft biological opinion.
March 30, 2009	Caltrans informed the Service in an email message that the project description was based on 65% design. Caltrans does not anticipate the final design to change the limits of the action area or the effects described in their January 2009 Biological Assessment.

April 6, 2009 Caltrans informed the Service in an email message that the total acreage of delta smelt shallow water habitat in the action area is 38.194 acres. The total acreage under the temporary marine trestle is 0.952 acres.

April 7, 2009 Caltrans informed the Service in an email message that the total acreage of what they had incorrectly identified as non-shallow water habitat in the action area within the San Joaquin River is 304.451 acres. Therefore the Service calculated the total acreage within delta smelt critical habitat as 342.645 acres (304.451 + 38.194).

April 8, 2009 The Service informed Caltrans via an email message that the accurate definition of delta smelt shallow water (SWH) habitat as the top 10 feet of the water column. Due to the overlapping shading of the proposed temporary marine trestle and the existing Antioch Bridge over head, the Service agreed to limit the shading effects associated with the proposed project to the outer trestle platform. According to the Service's calculations the acreage for the 910 foot long and 25 foot wide trestle would be 0.522 acres.

April 9, 2009 The Service sent Caltrans an email message summarizing our calculations of effects based on our definitions of habitat for the delta smelt and the giant garter snake as shown below:

1. Total action area = 383.645 acres (land + water).
2. Action area within the San Joaquin River= 342.645 acres.
3. The shaded area from the trestle = 0.522 acres (910 feet long x 25 feet wide) = effects to delta smelt SWH due to shading.
4. Substrate area occupied by trestle piers within SWH = 0.002 acres.
5. Land action area = 41.0 acres (7.5 acres on south shore + 33.5 acres on north shore/Sherman Island).
6. Aquatic giant garter snake habitat directly affected in the action area = 0.
7. Upland giant garter snake habitat within 200 feet of aquatic (winter refugia) = 2.44 acres.
8. Total giant garter snake habitat (winter refugia + upland dispersal) = 33.5 acres.

The Service also provided Caltrans with a copy of standard avoidance and minimization measures for the giant garter snake to provide guidance for appropriate compensation to offset permanent and temporary habitat loss.

April 22, 2009	The Service met with Caltrans and the California Department of Fish and Game to discuss the measures and conditions within the biological opinion that would be needed in order for the State to issue a consistency determination for the giant garter snake.
April 22, 2009	The Service was copied on an email message from Caltrans to the California Department of Fish and Game in which Caltrans referred to seeking compensation credits for the delta smelt at the proposed Liberty Island Conservation Bank and for the giant garter snake at the proposed Ridge Cut Conservation Bank.
May 6, 2009	The Service received a copy of a letter dated May 5, 2009, from Caltrans via an email message. In the letter, Caltrans agreed to accept the Service's definition of delta smelt SWH. However, Caltrans declined to modify their project description, effects analysis, or proposed compensation to reflect a correction of the inaccuracy. Caltrans also confirmed that the construction within giant garter snake habitat would encompass at least three activity seasons (defined as the calendar year period between May 1 and October 1). Caltrans has elected not to compensate for the effects to the listed snake as prescribed in the 1997 programmatic biological opinion (Service 1997).
May 11, 2009	Caltrans stated in their May 5, 2009, letter that their calculation and assessment of effects to the delta smelt were incorrect but declined to revise or request revision of their project description to reflect the change. Caltrans suggested in their May 5, 2009, letter that any necessary changes needed to their project description be addressed in the *Terms and Conditions* section of this biological opinion rather than Caltrans revising their project description. The Service received an email message from Caltrans on May 11, 2009, stating that they planned to modify their May 5, 2009, response.
May 20, 2009	The Service received an email message from Caltrans confirming that they reached an agreement with the California Department of Fish and Game that they would not pursue a consistency determination with this biological opinion. Instead Caltrans plans to seek a 2081 Incidental Take Permit with the State to address the California Department of Fish and Game's issues regarding the delta smelt and giant garter snake. This approach was also confirmed by Scott Wilson of the California Department of Fish and Game in a later email received on May 20, 2009.

May 20, 2009	The Service informed Caltrans that we were waiting for Caltrans' modified response, referenced on May 11, 2009, before continuing work on the draft biological opinion.
May 28, 2009	The Service received an email from Caltrans questioning their need to provide a modified response to their May 5, 2009, letter as they stated they would on May 11, 2009. In the May 28, 2009, email Caltrans referenced the Service's application of delta smelt SWH definition as an "alternative impact analysis assessment methodology." Caltrans incorrectly stated that all the necessary information needed to complete formal consultation was submitted on January 22, 2009. Caltrans' January 22, 2009, submittal included a request for informal consultation for both the delta smelt and the giant garter snake despite quantification of direct effects to both species and critical habitat for the delta smelt.
June 23, 2009	The Service received revised compensation language from Caltrans. The revised language was consistent with the guidance provided by the 1997 programmatic biological opinion for the giant garter snake and provided adequate compensation for the revised delta smelt shaded SWH value.
June 26, 2009	The Service issued a draft biological opinion (81420-2008-F-1537-2).
July 14, 2009	The Service received proposed conservation measures from Caltrans that addressed attenuation of hydroacoustic and turbidity effects on the delta smelt. The Service also received a request to finalize the biological opinion with the addition of these proposed measures.

BIOLOGICAL OPINION

Description of the Proposed Action

The following project description is based on information provided by Caltrans in their January 2009 Biological Assessment (Caltrans 2009). Caltrans and the Bay Area Toll Authority (BATA) propose a seismic safety retrofit of the Antioch Bridge crossing of the San Joaquin River on State Route 160 from north of the City of Antioch (Contra Costa County) to Sherman Island (Sacramento County). The affected roadway is roughly two miles long and connects the City of Antioch on the south bank of the San Joaquin River to Sherman Island on the north end. The bridge spans the 3,600-foot width of the San Joaquin River and over 4,000 feet of Sherman Island before touching down just north of Mayberry Slough. According to Caltrans, the project is intended to improve the seismic integrity of the Antioch Bridge by strengthening the bridge columns (or piers) and reducing the load of the roadway deck on those columns. The project is being conducted under the Caltrans Seismic Retrofit Program and will be referred to in the remainder of this biological opinion as the Antioch Bridge Seismic Retrofit Project.

According to a March 30, 2009 correspondence from Caltrans, the project description provided in the January 2009 Biological Assessment is based on 65% design. Caltrans will be required to reinitiate consultation when and if there are changes to the project description that exceed the effects described in this biological opinion.

Existing Infrastructure

Built in 1978, the Antioch Bridge is 9,437 feet long, and accommodates one lane of traffic in each direction and includes narrow accommodation for bicyclists and pedestrians. The bridge features two structural elements: the "Main Structure" and the "Slab Span Structure." The Main Structure is 8,650 feet long and consists of 40 spans (a section between two intermediate supports) varying in length from 135 to 460 feet. The superstructure of the Main Structure consists of a 43.5-foot wide concrete deck supported on two steel girders that vary in depth from 8 to 25 feet. The girders rest on concrete bent cap beams. Most of the bent cap beams are hollow. The columns are then supported on driven pile footings. The exterior piles are battered (installed at an angle) at a 3:1 inclination and the interior piles are vertical.

The Slab Span Structure is 787 feet long and consists of 30 spans supported by pile extensions with grade beams holding them at ground level. It extends north of Mayberry Slough to the point at which the bridge structure meets existing grade on Sherman Island. The sides of the structure in this area are enclosed with concrete slabs.

Construction Schedule

Construction is scheduled to begin in mid-2010 and end in late 2012.

Proposed Retrofit Elements and Construction Access

Proposed retrofit elements to the bridge include:

1. Installation of steel cross bracing between columns to stiffen the superstructure cross frames (Pier 12 to Pier 31).

2. Installation of bracing to existing cross frames at the bent caps (Pier 2 to Pier 40).

3. Replacement of the existing elastometric bearings with isolation bearings (Abutment 1 to Pier 41).

4. Removal of the existing curtain walls and retrofit of all the columns within the slab span structure (Bent 42 to Abutment 71).

Proposed construction access includes temporary upland access roads, barge access in the main channel of the San Joaquin River, and a temporary marine trestle on the south end as described below:

1. Construction of a temporary marine trestle to access the piers from the south shore of the San Joaquin River in Antioch to Pier 11.

2. Construction of a temporary access road on the south shore, which runs adjacent and parallel to the bridge, in order to access the temporary marine trestle.

3. Construction of a temporary access road from the southernmost bridge support on Sherman Island (Pier 22) to the last bridge support south of Mayberry Slough (Pier 38) to provide construction access for retrofit work.

4. Construction of temporary access roads parallel to the slab span structure on both sides, north of Mayberry Slough, to facilitate removal of the curtain walls from the slab span structure and reinforce existing columns and abutments.

5. Permanent widening of an existing access road along Mayberry Slough to access piers north of Mayberry Slough.

Action Area and Work Areas

The project limits, which include Caltrans right-of-way (ROW), the San Joaquin River, and temporary construction easements, cover approximately 383.645 acres, including 7.5 acres on the south shore of the San Joaquin River in Contra Costa County, 342.645 acres of the San Joaquin River, and 33.5 acres on Sherman Island in Sacramento County. The action area on Sherman Island utilized for proposed staging and access is owned and managed by the California Department of Water Resources (DWR). The action area, as defined in the January 2009, Biological Assessment, consists of the project's area of direct permanent and temporary effects including construction access, staging, and laydown areas. Caltrans does not anticipate areas of indirect effects. The action area also includes the project limit, plus an additional 285 feet around the temporary marine trestle, which represents the 183 decibel Sound Exposure Level (SEL) radius.

Proposed Terrestrial Work Areas

Temporary access roads. Temporary access roads are proposed in four locations: 1) one from Pier 22 to Pier 38 south of Mayberry Slough; 2) two north of Mayberry Slough on either side of the slab span structure; and 3) one on the south shore of the San Joaquin River to allow access to the south side of the trestle. In addition, two small trestles will be used to protect a drainage canal and drainage ditch as further described.

Caltrans plans to install a silt fence at the base of the temporary access roads as sediment control for the roadway, to minimize the potential for inadvertent encroachment of equipment and material into the surrounding area, and to minimize the potential for wildlife to enter the roadway. At completion of the project, the silt fence, geotextile fabric and crushed rock will be removed and the site will be restored to the preexisting condition.

Pier 22 to Pier 38: Caltrans has proposed a temporary access road within State ROW to provide access for work to all bridge columns south of Mayberry Slough (Pier 22 to Pier 38) on Sherman Island. The temporary access road will consist of placing geotextile fabric and an approximately 4 foot deep layer of crushed rock over the existing ground. The temporary access road will be approximately 24 feet wide along the travel surface, and will extend with 2:1 slopes to existing ground level. The base of the road will be approximately 40 feet wide at ground level and extend 3,300 feet, covering an estimated 4.45 acres. The temporary access road will stop at Mayberry Slough.

North of Mayberry Slough: Two additional temporary access roads, constructed of a 6 inch layer of crushed rock overlaying geotextile fabric, are proposed north of Mayberry Slough on both the west and east sides of the slab span structure. The access road on the west side will occupy 0.6 acres and will be 850 feet long by 36 feet wide; whereas, the access on the east side of the span will occupy 0.4 acres and be 850 feet long by 20 feet wide.

Small Trestles: Where the access road crosses the irrigation canal near Pier 32, a 24 foot wide temporary trestle will be installed to span the irrigation canal. The temporary trestle is intended to prevent additional load on the existing culvert and avoid the need for fill.

At the northern end of the bridge, a 24 foot wide temporary trestle will be installed to the west to span an irrigation/drainage ditch. The temporary trestle is intended to minimize disturbance to the existing irrigation ditch and wetland area.

Southern Access: On the south shore of the San Joaquin River at the south end of the temporary marine trestle, existing access roads and the Caltrans ROW will be utilized to access the trestle. The existing roads will require a widening from a 9 foot to a 24 foot width along a 650 foot length, and a 24 foot width extension along another 250 foot segment. The access preparation will be accomplished using a 6 inch layer of crushed rock overlaying geotextile fabric. The total expanded/extended area will be 0.364 acres. Caltrans plans to install an environmentally sensitive area fence along the west side of the access road to avoid effects to a drainage ditch that borders the ROW.

Temporary contractor staging and lay down area. Temporary staging areas include one main temporary staging and lay down area near the north end of the bridge; two staging areas between bridge piers on Sherman Island near Piers 29 and 30, and 31 north to the access road; and existing paved areas on the south side of the bridge.

Main staging and lay down area: Caltrans identified a temporary staging and lay down area north of Mayberry Slough, in a fallow upland field dominated by ruderal species. The staging area covers approximately 6 acres outside State ROW on the east side of the bridge. The area will be covered by a layer of crushed rock overlying geotextile fabric, approximately 6 inches thick, for drivability. Silt fence, fiber rolls and/or small earthen berms will be installed along the north and east side of the staging area to direct runoff away from the wetlands to the north and east. The staging and lay down areas will be kept 100 to 200 feet from the potential aquatic habitat for the giant garter snake habitat to the north and east. At the completion of the project, the silt fence, along with the environmentally sensitive area fencing, berm, crushed rocks, and geotextile fabric will be removed and the site will be restored to the existing condition.

Temporary staging areas between piers: Caltrans has identified two temporary contractor staging areas between bridge piers. One, located between Piers 29 and 30, will occupy approximately 0.17 acres and be 115 feet long by 65 feet wide. The other, on Sherman Island and between Pier 31 and the permanently extended access road, will occupy approximately 0.12 acres and be 81 feet long by 65 feet wide. The preparation of these temporary staging areas will consist of placing geotextile fabric and a crushed rock layer, approximately four feet in depth over the existing ground.

South side of the bridge: On the south end of the bridge, the contractor will use existing paved areas for staging. An environmentally sensitive area fence will be placed along the west side of the access road to protect the drainage ditch that borders the action area.

Permanent widening of access roads. The unpaved access road extending from the old Highway 84 to the staging area is currently 18 to 20 feet wide. Caltrans plans to widen this access road to 24 feet over a distance of approximately 1,200-feet in order to accommodate large construction equipment and trucks. Widening of this access road will include minor grading of the approximately 0.218 acre area and placing 6 inches of crushed rocks over the adjacent ground. The areas adjacent to this road currently consist of ruderal upland vegetation.

Proposed Aquatic Work Areas

Temporary marine trestle. A temporary marine trestle with an approximate length of 910 feet and a width of 25 feet will be constructed from the south bank of San Joaquin River to Pier 11 to allow construction access to the piers in the shallow water area. The trestle platform is expected to be approximately five feet above the Mean Higher-High Water.

Pile driving. The trestle will be constructed using approximately 160, 24-inch steel hollow shell piles that will be installed with a vibratory hammer. The design requires two 24-inch diameter steel shell piles of every 25 feet of trestle and around the piers. Caltrans estimates that the 160 piles will be driven to a depth of 50 feet and four to six piles and two to three sections of trestle would be installed per day. Water depths would range from the shore or mud during lower tides to approximately 10 feet. The piles would be vibrated in for approximately ten minutes per pile

and one pile each section will be driven with an impact hammer for approximately 20 blows per pile, to verify bearing capacity of the pile. This would equate to a maximum of 3,600 seconds of vibratory pile installation and 60 hammer strikes per day. Caltrans will proof test one pile per day using an impact hammer. At the completion of the project, the trestle along with the piles will be removed.

Barge work. Caltrans plans to use barges to retrofit Piers 12 to 21, which will include installation of mooring lines and temporary dolphins.

Proposed Superstructure Work

Superstructure work includes installation of steel cross bracings between columns, replacing the existing bearings with isolation bearings, and retrofitting the slab span columns as follows:

1. Installation of steel cross-bracing between columns to stiffen the superstructure from Pier 12 to Pier 31. Cross bracings will be anchored to the existing concrete columns with resin capsule anchors.

2. Installation of bracing to existing cross frames at the bents (Pier 2 to Pier 40).

3. Replacement of the existing elastometric bearings with isolation bearings (Abutment 1 to Pier 41).

4. Removal of the existing curtain walls and retrofitting of all the columns in the slab span structure by installing composite fiber jackets (Bent 42 to Abutment 71).

Caltrans will implement best management practices (BMPs) and exclusionary methods to prevent birds from nesting on the structure during construction. These may include exclusionary netting, potential hosing, and/or scheduling work around non-nesting periods.

Borrow and Disposal

According to Caltrans, the project will not require on-site borrow or disposal of excavated material. Gravel and rock will be imported for construction of the temporary access road and road widening. These materials will be removed upon completion of the project, and removal and disposal of this material will be implemented through contractors and subcontractors as part of the Caltrans standard BMPs and the Stormwater Pollution Prevention Plan (SWPPP). According to Caltrans, BMPs and SWPPP measures are a standard part of the plans and specifications for this project and are covered by the Regional Water Quality Control Boards' (RWQCB) 401 Water Quality Certification.

Proposed Avoidance and Minimization Measures

According to the January 2009 Biological Assessment and additional information provided on June 23, 2009, and July 14, 2009, Caltrans proposes to avoid, minimize, and compensate for effects to listed species by implementing the following measures:

Delta Smelt

1. In-water work will be restricted to the Service's recommended window of August 1 to November 30.

2. Caltrans will install all temporary piles for marine access with a vibratory hammer to minimize hydroacoustic effects. Maximum pile size will be limited to a 24-inch diameter.

3. Caltrans will proof-test one pile per day with an impact hammer. Daily proof-testing of piles will require 20 blows per day with an impact hammer. Caltrans will implement a sound pressure level attenuation system for all impact hammer pile driving activities. The attenuation system may include, but is not limited to one or a combination of the following methods:

    a. confined bubble-curtain,
    a. an unconfined bubble curtain,
    b. isolation casings, and/or
    c. wooden pile cushions.

    Caltrans will not begin pile driving until they have submitted and received approval for the final attenuation plan from the Service and the California Department of Fish and Game.

4. Turbidity levels produced by installation/removal of temporary piles will not exceed those permitted under the project SWPPP and construction activities will be halted if turbidity levels approach or exceed the acceptable criteria established by the RWQCB until turbidity levels return to within acceptable levels.

5. Compensation for the direct effects to 0.522 acres due to shallow water shading, substrate disturbance, and pile driving shall occur with either the purchase 1.57 acres of credit either through a Service and California Department of Fish and Game approved compensation bank, issuance of a letter of assurance indicating that sufficient funds have been set aside (such as in a separate EA) for future credit purchase, or an equivalent contribution to the Service in-lieu fund.

Giant Garter Snake

1. All ground-disturbing construction activity within giant garter snake habitat on Sherman Island will be conducted between May 1 and October 1. Given that all construction activity is confined to upland habitat (over-wintering and movement habitat), the laying of temporary access roads in giant garter snake 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.

2. A qualified biologist will inspect construction-related activities at the proposed project site to ensure that no unauthorized take of federally listed species or destruction of their habitat occurs. The biologist will be available for monitoring throughout all phases of construction that may result in adverse effects to the giant garter snake. Additionally, if a giant garter snake is encountered during construction, the biologist will 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 will be allowed to move away from the area on their own volition. The biologist will notify the Service immediately if any listed species are found on-site, and will submit a report, including date(s), location(s), habitat description, and any corrective measures taken to protect the species found. The biologist will be required to report any take of listed species to the Service immediately by telephone at (916) 414-6600 and by email or written letter addressed to Chris Nagano, Division Chief, Endangered Species Program, within three (3) working days of the incident.

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

4. At most, 24-hours prior to the commencement of construction activities, the Sherman Island portion of the project site will be surveyed for giant garter snake by a qualified biologist. The project area will be re-inspected by the monitoring biologist whenever a lapse in construction activity of two weeks or greater has occurred.

5. 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, potential

snake prey (i.e., fish and tadpoles) will be removed so that snakes and other wildlife are not attracted to the construction area.

6. BMPs, including a SWPPP, will be implemented to minimize effects to the snake during construction. Best management practices 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 environmentally sensitive areas, 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 environmentally sensitive areas.

7. Tightly woven fiber netting or similar material will be used for erosion control and other purposes at the project site to minimize the likelihood that giant garter snakes would become trapped or become entangled. This limitation will be communicated to the contractor using special provisions included in the bid solicitation package.

8. During construction operations, the number of access routes, number and size of staging areas, and the 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 will observe a 20-mile-per-hour 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.

9. 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 environmentally sensitive areas. Caltrans will ensure that contamination of habitat does not occur during such operations.

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

11. Prior to the commencement of construction activities, high visibility fencing will be erected within the action area to identify and protect these designated environmentally sensitive areas from encroachment of personnel and equipment. These areas will be avoided by all construction personnel. The fencing will 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-feet from the edge of potential aquatic habitat for the giant garter snake.

12. Signs will be posted every 50 feet along the edge of the environmentally sensitive areas, 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 Endangered Species Act of 1973, as amended. Violators are subject to prosecution, fines, and imprisonment." The signs will be clearly readable from a distance of 20 feet, and must be maintained for the duration of construction.

13. After construction activities are complete, any temporary fill or construction debris will be removed and disturbed areas restored to their pre-project conditions. An area subject to "temporary" disturbance includes any area that is disturbed during the project, but that, after project completion, will not be subject to further disturbance and has the potential to be re-vegetated. All giant garter snake habitats subject to temporary ground disturbances, including storage and staging areas and temporary roads, will be restored. These areas will be re-contoured, if appropriate, and re-vegetated with appropriate locally collected native plant species to promote restoration of the area to pre-project conditions. Appropriate methods and plant species used to re-vegetate such areas will be determined on a site-specific basis. Restoration work may include replanting emergent vegetation. Restoration will comply with the Service's *Guidelines for the Restoration and/or Replacement of Giant Garter Snake Habitat* (Service 1997). A written report will be submitted to the Service within ten (10) working days of the completion of construction at the project site.

14. Caltrans will restore the site to pre-construction conditions and monitor the project site for one (1) year following the completion of construction and restoration activities. Monitoring reports documenting the restoration effort will be submitted to the Service upon the completion of the restoration implementation and one (1) year after the restoration implementation. Monitoring reports will include photo-documentation, when restoration was completed, what materials were used, specified plantings, and justifications of any substitutions to the Service-recommended guidelines.

15. Compensation shall occur for permanent and temporary effects to the giant garter snake as prescribed in the programmatic biological opinion (Service 1997) in order to offset the permanent and temporal adverse effects to individual snakes.

    To be consistent with the programmatic, permanent effects to approximately 0.22 acres of upland giant garter snake habitat will be compensated with 0.66 acres of credit either through a Service and California Department of Fish and Game approved compensation bank or by providing a letter of assurance indicating that appropriate funds have been set aside (such as in a separate EA) for future credit purchase.

Restoration of the approximately 2.22 acres of direct effects from the temporary access roads and temporary contractor staging will be completed following three years of construction activities within the giant garter snake active season (May 1 to October 1). As prescribed by the programmatic, compensation for temporal effects shall occur with onsite restoration of the 2.22 acres along with 4.44 acres of off-site credit either through a Service and California Department of Fish and Game approved compensation bank or by providing a letter of assurance indicating that appropriate funds have been set aside (such as in a separate EA) for future credit purchase. If restoration of the 2.22 acres occurs in less than three active seasons, Caltrans will reinitiate consultation with the Service in order to compensate for temporal effects at the appropriate lower replacement ratio prescribed in the programmatic.

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.

Analytical Framework for the Jeopardy Determination

The following analysis relies on four components to support the jeopardy determination for the delta smelt and the giant garter snake: (1) the *Status of the Species*, which evaluates the species' rangewide condition, the factors responsible for that condition, and its survival and recovery needs; (2) the *Environmental Baseline*, which evaluates the condition of the species in the action area, the factors responsible for that condition, and the role of the action area in the species' survival and recovery; (3) the *Effects of the Action*, which determines the direct and indirect effects of the proposed Federal action and the effects of any interrelated or interdependent activities on the species; and (4) *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on the species.

In accordance with the implementing regulations for section 7 and Service policy, the jeopardy determination is made in the following manner: the effects of the proposed Federal action are evaluated in the context of the aggregate effects of all factors that have contributed to the species' current status and, for non-Federal activities in the action area, those actions likely to affect the species in the future, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the species in the wild.

The following analysis places an emphasis on using the range-wide survival and recovery needs of the species and the role of the action area in providing for those needs as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

Analytical Framework for the Adverse Modification Determination

This biological opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to delta smelt critical habitat.

The following analysis relies on four components to support the adverse modification determination: (1) the *Status of Critical Habitat*, which evaluates the range-wide condition of designated critical habitat for the delta smelt in terms of primary constituent elements (PCEs), the factors responsible for that condition, and the intended recovery function of the critical habitat overall, as well as the intended recovery function of discrete critical habitat units; (2) the *Environmental Baseline*, which evaluates the condition of the critical habitat in the action area, the factors responsible for that condition, and the recovery role of the critical habitat in the action area; (3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the PCEs and how that will influence the recovery role of affected critical habitat unit; and (4) *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on the PCEs and how that will influence the recovery role of affected critical habitat unit.

In accordance with Service policy and guidance, the adverse modification determination is made in the following manner: the effects of the proposed Federal action on critical habitat are evaluated in the context of the aggregate effects of all factors that have contributed to the current status of the critical habitat range-wide and, for non-Federal activities in the action area, those actions likely to affect the critical habitat in the future, to determine if the critical habitat would remain functional (or retain the current ability for the PCEs to be functionally established in areas of currently unsuitable but capable habitat) to serve the intended recovery role for the species with implementation of the proposed Federal action.

The following analysis places an emphasis on using the intended range-wide recovery function of delta smelt critical habitat and the role of the action area relative to that intended function as the context for evaluating the significance of effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the adverse modification determination.

Action Area

The action area is defined in 50 CFR § 402.02, as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." For the proposed action, the action area includes all land and water associated with the approximately 383.645 acre project footprint and roads (except for County roads, and State and Federal highways) and other areas accessed by project vehicles. This includes a 285-foot diameter around each temporary marine trestle to represent the 183 db SEL radius.

Status of the Species and Environmental Baseline

Delta Smelt

Delta smelt was federally listed as threatened on March 5, 1993, (58 FR 12854) (Service 1993a) and critical habitat was designated on December 19, 1994, (59 FR 65256) (Service 1994a). The delta smelt is included in the Sacramento-San Joaquin Delta Native Fishes Recovery Plan (Service 1996) and the Five Year Status Review for this species was completed on March 31, 2004 (Service 2004).

Delta smelt belong to the family Osmeridae, a more ancestral member of the order Salmoniformes which also includes the family Salmonidae (salmon, trout, whitefish, and graylings) (Moyle and Cech 1988). Delta smelt are slender-bodied fish with a small mouth and large eyes. Adults are typically 2.36–2.76 inches long (measured from tip of the snout to origin of the caudal fin) but can be up to 4.72 inches. Live delta smelt are nearly translucent with a steely-blue sheen to their sides. Some individuals have a chromatophore (cellular organelle containing pigment) between the mandibles. They have been described as unsteady, intermittent, slow speed swimmers that rely on a "stroke and glide" technique (Swanson and Cech 1995).

The delta smelt is a euryhaline fish (tolerate a wide range of salinities) endemic to the upper Sacramento-San Joaquin estuary. They occur in the Delta primarily downstream of Isleton on the Sacramento River, downstream of Mossdale on the San Joaquin River, and in Suisun Bay. They move into freshwater when spawning (ranging from January to July) and can occur in: (1) the Sacramento River as high as the confluence with the Feather River, (2) the Mokelumne River system, (3) the Cache Slough region, (4) the Delta, and, (5) Montezuma Slough, (6) Suisun Bay, (7) Suisun Marsh, (8) Carquinez Strait, (9) Napa River, (10) Napa Marsh, and 11) San Pablo Bay. It is not known if delta smelt in San Pablo Bay are a permanent population or if they are washed into the Bay during high outflow periods. Since 1982, the center of delta smelt abundance has been the northwestern Delta in the channel of the Sacramento River. In any month, two or more life stages (adult, larvae, and juveniles) of delta smelt have the potential to be present in Suisun Bay (California Department of Water Resources (DWR) and the Bureau of Reclamation (Reclamation) 1994; Moyle 1976; and Wang 1991). Delta smelt are also captured seasonally in Suisun Marsh.

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 68-71.6 Fahrenheit (°F) in summer. When not spawning, they tend to be concentrated near the zone where incoming salt water and out flowing freshwater mix. This rich productive area is referred to as the mixing zone, the 2 ppt isohaline, or X2. This area has the highest primary productivity and is where zooplankton populations (on which delta smelt feed) are usually most dense (Knutson and Orsi 1983; Orsi and Mecum 1986). At all life stages delta smelt are found in greatest abundance in the top 6.56 feet of the water column and usually not in close association with the shoreline.

The spawning season varies from year to year, and may occur from late winter (December) to early summer (July) and appears to peak in April and May (Wang 1991; Wang and Brown 1993 as cited in DWR and Reclamation 1994).

Delta smelt spawn in shallow, fresh, or slightly brackish water upstream of the mixing zone (Wang 1991). Most spawning occurs in tidally-influenced backwater sloughs and channel edgewaters (Moyle 1976, 2002; Wang 1986, 1991; Moyle et al. 1992). Although delta smelt spawning behavior has not been observed in the wild (Moyle et al. 1992), some researchers believe the adhesive, demersal eggs attach to substrates such as cattails, tules, tree roots, and submerged branches in shallow waters (Moyle 1976, 2002; Wang 1991).

Laboratory observations have indicated that delta smelt are broadcast spawners (DWR and Reclamation 1994) and eggs are demersal (sinks to the bottom) and adhesive, sticking to hard substrates such as: rock, gravel, tree roots or submerged branches, and submerged vegetation (Moyle 1976, 2002; Wang 1986). At 57.2-60.8 °F, embryonic development to hatching takes 9 -14 days and feeding begins 4-5 days later (R. Mager, UCD, unpublished data). Newly hatched delta smelt have a large oil globule that makes them semi-buoyant, allowing them to maintain themselves just off the substrate floor (R. Mager, UCD, unpublished data), where they feed on rotifers (microscopic crustaceans used by fish for food) and other microscopic prey. Once the swim bladder (a gas-filled organ that allows fish to maintain neutral buoyancy) develops, larvae become more buoyant and rise up higher into the water column. At this stage, 0.63-0.71 inches total length, most are presumably washed downstream until they reach the mixing zone or the area immediately upstream of it. Growth is rapid and juvenile fish are 1.57-1.97 inches long by early August (Erkkila et al. 1950; Ganssle 1966; Radtke 1966). By this time, young-of-year fish dominate trawl catches of delta smelt, and adults become rare. Delta smelt reach 2.17-2.76 inches standard length in 7-9 months (Moyle 1976, 2002). Growth during the next 3 months slows down considerably (only 0.12-0.35 inches total), presumably because most of the energy ingested is being directed towards gonadal development (Erkkila et al. 1950; Radtke 1966). There is no correlation between size and fecundity, and females between 2.32-2.76 inches standard lengths lay 1,200 to 2,600 eggs (Moyle et al. 1992). The abrupt change from a single-age, adult cohort during spawning in spring to a population dominated by juveniles in summer suggests that most adults die after they spawn (Radtke 1966 and Moyle 1976, 2002). However, in El Nino years when temperatures rise above 64.4 °F before all adults have spawned, some fraction of the unspawned population may also hold over as two-year-old fish and spawn in the subsequent year. These two-year-old adults may enhance reproductive success in years following El Nino events.

In a near-annual fish like delta smelt, a strong relationship would be expected between number of spawners present in one year and number of recruits to the population the following year. Instead, the stock-recruit relationship for delta smelt is weak, accounting for about a quarter of the variability in recruitment (Sweetnam and Stevens 1993). This relationship does indicate, however, that factors affecting numbers of spawning adults (e.g., entrainment, toxics, and predation) can have an effect on delta smelt numbers the following year.

Delta smelt feed primarily on (1) planktonic copepods (small crustaceans used by fish for food), (2) cladocerans (small crustaceans used by fish for food), (3) amphipods (small crustaceans used by fish for food) and, to a lesser extent, (4) on insect larvae. Larger fish may also feed on the opossum shrimp (*Neomysis mercedis*). The most important food organism for all sizes seems to be the euryhaline copepod (*Eurytemora affinis*) although in recent years the exotic species, *Pseudodiaptomus forbesi*, has become a major part of the diet (Moyle et al. 1992).

Delta smelt are a minor prey item of juvenile and subadult striped bass (*Morone saxatilis*), in the Sacramento-San Joaquin Delta (Stevens 1966). They also have been reported from the stomach contents of white catfish (*Ameiurus catus*) (Turner 1966 in Turner and Kelley (eds) 1966) and black crappie (*Pomoxis nigromaculatus*) (Turner 1966 in Turner and Kelley 1966) in the Delta.

Delta smelt were once one of the most common pelagic (living in open water away from the bottom) fish in the upper Sacramento-San Joaquin estuary, as indicated by its abundance in California Department of Fish and Game trawl catches (Erkkila et al. 1950; Radtke 1966; Stevens and Miller 1983). Since the 1850s, however, the amount and extent of suitable habitat for the delta smelt has declined dramatically due in large part to hydraulic mining, agricultural development in the Delta, agricultural practices, water diversion, and recreation.

In addition to the degradation and loss of estuarine habitat, delta smelt have been increasingly subject to entrainment, upstream or reverse flows of waters in the Delta and San Joaquin River, and constriction of low salinity habitat to deep-water river channels of the interior Delta (Moyle et al. 1992). These adverse conditions are primarily a result of the steadily increasing proportion of river flow being diverted from the Delta and occasional droughts (Monroe and Kelly 1992).

Reduced water quality from agricultural runoff, effluent discharge and boat effluent has the potential to harm the pelagic larvae and reduce the availability of the planktonic food source. When the mixing zone is located in Suisun Bay where there is extensive shallow water habitat within the euphotic zone (depths less than four meters), high densities of phytoplankton and zooplankton may accumulate (Arthur and Ball 1978, 1979, 1980). The introduction of the Asian clam (*Potamocorbula amurensis*), a highly efficient filter feeder, presently reduces the concentration of phytoplankton in this area.

Delta smelt abundance from year to year has fluctuated greatly in the past, but between 1982 and 1992 their population was consistently low. The decline became precipitous in 1982 and 1983 due to extremely high outflows and continued through the drought years 1987-1992 (Moyle et al. 1992). In 1993, numbers increased considerably, apparently in response to a wet winter and spring. During the period 1982-1992, most of the population was confined to the Sacramento River channel between Collinsville and Rio Vista (D. Sweetnam, CDFG unpublished data). This was still an area of high abundance in 1993, but delta smelt were also abundant in Suisun Bay. The abundance indices have shown a consistently low population for the last 10 years and a precipitous decline in the past few years (Stevens et al. 1990, Souza and Bryant 2002, CDFG 2001). The actual size of the delta smelt population is not known. However, the pelagic life

style of delta smelt, short life span, spawning habits, and relatively low fecundity indicate that a fairly substantial population probably is necessary to keep the species from becoming extinct. The health of the Delta and the declining delta smelt population has become a critical issue with wide ranging implications that have included proposals to up-list the species to endangered status.

Environmental Baseline

As a result of long-term monitoring in the Antioch area, delta smelt have been recorded in the San Joaquin River in close proximity to the action area as well as up and downstream of the action area. Therefore, the Service believes that the delta smelt is reasonably certain to occur within the action area given the biology and ecology of the animal, the presence of suitable habitat in and adjacent to the action area, as well as the recent records of this listed fish.

The Antioch Bridge crosses what is considered in the delta smelt programmatic as the "central delta smelt zone" (Service 2004). Adult delta smelt spawn in central Delta sloughs from February through August in shallow water areas having submersed aquatic plants and other suitable substrates and refugia. These shallow water areas have been identified in the Delta Native Fishes Recovery Plan (Service 1996) as essential to the long-term survival and recovery of delta smelt and other resident fish. A no net loss strategy of delta smelt population and habitat was proposed in this recovery plan.

More comprehensive information regarding the biology of the delta smelt and its current status (including abundance monitoring) are included in the species' five year review and in the biological opinion for the Operations Criteria and Plan (OCAP) for the continued operation of the Federal Central Valley Project (CVP) and State Water Project (SWP) on the Service's delta smelt recovery webpage (http://www.fws.gov/sacramento/es/delta_smelt.htm).

Delta Smelt Critical Habitat

In determining which areas to designate as critical habitat, the Service considers those physical and biological features that are essential to a species' conservation and that may require special management considerations or protection (50 CFR 424.12(b).

The Service is required to list the known primary constituent elements together with the critical habitat description. Such physical and biological features include, but are not limited to, the following:

1. Space for individual and population growth, and for normal behavior;

2. Food, water, air, light, minerals, or other nutritional or physiological requirements;

3. Cover or shelter;

4. Sites for breeding, reproduction, rearing of offspring, germination, or seed dispersal; and

5. Generally, habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species.

In designating critical habitat for the delta smelt, the Service identified the following primary constituent elements essential to the conservation of the species: physical habitat, water, river flow, and salinity concentrations required to maintain delta smelt habitat for spawning, larval and juvenile transport, rearing, and adult migration. These elements are organized by habitat conditions required for each life stage of the delta smelt and are further described as follows.

The spawning habitat element are described as shallow, fresh or slightly brackish backwater sloughs and edgewaters with suitable water quality and substrates for egg attachment to ensure egg hatching and larval viability. Specific areas that have been identified as important delta smelt spawning habitat include Barker, Lindsey, Cache, Prospect, Georgiana, Beaver, Hog, and Sycamore sloughs and the Sacramento River in the Delta, and tributaries of northern Suisun Bay.

The larval and juvenile transport element includes the ability to transport larvae from where they were hatched to shallow, productive rearing or nursery habitat. Adequate river flow is necessary to transport larvae from upstream spawning areas to rearing habitat in Suisun Bay and to ensure that rearing habitat is maintained in Suisun Bay. To ensure this, X2 (the 2 ppt isohaline mixing zone) must be located westward of the confluence of the Sacramento-San Joaquin Rivers, located near Collinsville (Confluence), during the period when larvae or juveniles are being transported, according to historical salinity conditions. X2 is important because the "entrapment zone" or zone where particles, nutrients, and plankton are "trapped," leading to an area of high productivity, is associated with its location. Habitat conditions suitable for transport of larvae and juveniles may be needed by the species as early as February 1 and as late as August 31, because the spawning season varies from year to year and may start as early as December and extend until July.

The rearing habitat element includes areas that support a food-rich environment that allow larval and juvenile delta smelt to mature into adulthood. An area extending eastward from Carquinez Strait, including Suisun, Grizzly, and Honker bays, Montezuma Slough and its tributary sloughs, up the Sacramento River to its confluence with Three Mile Slough, and south along the San Joaquin River including Big Break, defines the specific geographic area critical to the maintenance of suitable rearing habitat. Three Mile Slough represents the approximate location of the most upstream extent of historical tidal incursion. Rearing habitat is vulnerable to impacts of export pumping and salinity intrusion from the beginning of February to the end of August.

The adult migration element reflects the importance of providing unrestricted access to suitable spawning habitat. Adequate flow and suitable water quality is needed to attract migrating adults in the Sacramento and San Joaquin river channels and their associated tributaries, including Cache and Montezuma sloughs and their tributaries. These areas are vulnerable to physical disturbance and flow disruption during migratory periods.

The geographical boundaries of the designated critical habitat for the delta smelt includes all water and submerged lands below ordinary high water and the entire water column bounded by and contained in Suisun Bay (including Grizzly and Honker Bays); the length of Goodyear, Suisun, Cutoff, First Mallard (Spring Branch), and Montezuma sloughs; and the existing contiguous waters contained within the Delta.

Refer to the federal register announcement for additional information regarding these primary constituent elements and a map of the critical habitat (http://ecos.fws.gov/docs/federal_register/fr2751.pdf).

Delta smelt critical habitat has been affected by activities that destroy spawning and refugial areas and change hydrology patterns in Delta waterways. Critical habitat also has been affected by diversions that have shifted the position of X2 upstream of the confluence of the Sacramento and San Joaquin rivers. This shift has caused a decreased abundance of smelt. Existing baseline conditions and implementation of the Service's 1994 and 1995 biological opinions concerning the operation of the CVP and the SWP, provide a substantial part of the necessary positive riverine flows and estuarine outflows to transport smelt larvae downstream to suitable rearing habitat in Suisun Bay outside the influence of marinas, agricultural diversions, and Federal and State pumping plants.

The demands on surface water resources in the Central Valley have increased and there are several proposed diversion projects that would likely result in lower delta outflows and increased entrainment.

Environmental Baseline

The proposed Antioch Bridge Seismic Retrofit Project is within the designated critical habitat for the delta smelt. The action area spans the San Joaquin River from bank to bank and therefore has the potential to interrupt adult migration to suitable upstream spawning and larval/juvenile transport to rearing habitat in Suisun Bay.

Giant Garter Snake

The Service published a proposal to list the giant garter snake as an endangered species on December 27, 1991 (56 FR 67046). The Service reevaluated the status of the snake before adopting the final rule. The snake was listed as a threatened species on October 20, 1993 (58 FR 54053).

The giant garter snake is one of the largest garter snakes species reaching a total length of approximately 64 inches. Females tend to be slightly longer and proportionately heavier than males. The weight of adult female snakes is typically 1.1-1.5 pounds. Dorsal background coloration varies from brown to olive with a cream, yellow, or orange dorsal stripe and two light colored lateral stripes. Some individuals have a checkered pattern of black spots between the dorsal and lateral stripes. Background coloration and prominence of the checkered pattern and three yellow stripes are geographically and individually variable; individuals in the northern Sacramento Valley tend to be darker with more pronounced mid-dorsal and lateral stripes (Hansen 1980; Rossman et al. 1996). Ventral coloration is variable from cream to orange to olive-brown to pale blue with or without ventral markings (Hansen 1980).

Giant garter snakes formerly occurred throughout the wetlands that were extensive and widely distributed in the Sacramento and San Joaquin Valley floors of California (Fitch 1940; Hansen and Brode 1980; Rossman and Stewart 1987). The historical range of the snake is thought to have extended from the vicinity of Chico, Butte County, southward to Buena Vista Lake, near Bakersfield, in Kern County (Fitch 1940; Fox 1948; Hansen and Brode 1980; Rossman and Stewart 1987). Early collecting localities of the giant garter snake coincide with the distribution of large flood basins, particularly riparian marsh or slough habitats and associated tributary streams (Hansen and Brode 1980).

Loss of habitat due to agricultural activities and flood control have extirpated the listed snake from the southern one third of its range in former wetlands associated with the historic Buena Vista, Tulare, and Kern lake beds (Hansen 1980; Hansen and Brode 1980). By 1971, so much wetland habitat had been reclaimed, that the California Department of Fish and Game classified the giant garter snake as a rare animal and conducted a series of field surveys. The results of these surveys indicated that snake populations were distributed in marsh wetlands, tributary streams, and portions of the rice productions zones of the Sacramento Valley in Butte, Glenn, Colusa, Sutter, Yolo and Sacramento Counties, in the Delta region along the eastern fringes of the Sacramento-San Joaquin River Delta in Solano, Contra Costa, Sacramento, and San Joaquin Counties, and in the San Joaquin Valley in San Joaquin, Stanislaus, Merced, Mendota, and Fresno Counties (Hansen 1988; Hansen and Brode 1980).

Upon federal listing in 1993, the Service identified 13 separate populations of giant garter snakes, with each population representing a cluster of discrete locality records (Service 1993b). The 13 populations largely coincide with historical flood basins and tributary streams throughout the Central Valley: (1) Butte Basin, (2) Colusa Basin, (3) Sutter Basin, (4) American Basin, (5) Yolo Basin/Willow Slough, (6) Yolo Basin/Liberty Farms, (7) Sacramento Basin, (8) Badger Creek/Willow Creek, (9) Caldoni Marsh/White Slough, (10) East Stockton--Diverting Canal & Duck Creek, (11) North and South Grasslands, (12) Mendota, and (13) Burrel/Lanare.

A population is a group of organisms that interbreed and share a gene pool. The boundaries of a population, both in space and time, are generally not discrete and, in practice, as usually defined by the researcher (Krebbs 1994). The gene pool and breeding patterns of the 13 giant garter

snake populations identified in the final rule remain unstudied and unknown. What was described as "13 populations" should therefore be described more accurately as sub-populations and occurrences that note observations of individuals about which much remains unknown (Service 1999).

Surveys over the last 25 years suggest that sub-populations of giant garter snake in the northern parts of its range (i.e., Butte, Colusa, and Sutter Counties) are relatively large and stable (Wylie et al. 1997; Wylie et al. 2003a, 2004a). Habitat corridors connecting sub-populations, however, are either not present or not protected, and urban encroachment increases as a serious threat (Service 2003). Sub-populations in Yolo, Sacramento, Solano, and San Joaquin Counties areas are small, fragmented, and threatened by urbanization (Hansen 2004; Service 1999). Those sub-populations in the San Joaquin Valley, however, are most vulnerable having suffered near-devastating declines and possible extirpations over the last two decades (including populations in Stanislaus, Merced, Madera and Fresno Counties) (Dickert 2002, 2003; Hansen 1988; Williams and Wunderlich 2003). The southern sub-populations are extremely small, distributed discontinuously in isolated patches, and therefore are highly vulnerable to extinction by random environmental, demographic, and genetic processes (Goodman 1987).

Endemic to wetlands in the Sacramento and San Joaquin valleys, the giant garter snake inhabits 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 (Service 1999). Essential habitat components consist of: (1) wetlands with adequate water during the snake's active season (early-spring through mid-fall) to provide food and cover; (2) emergent, herbaceous wetland vegetation, such as cattails and bulrushes, for escape cover and foraging habitat during the active season; (3) upland habitat with grassy banks and openings in waterside vegetation for basking; and (4) higher elevation uplands for over-wintering habitat with escape cover (vegetation, burrows) and underground refugia (crevices and small mammal burrows) (Hansen 1988). Snakes are typically absent from larger rivers and other bodies of water that support introduced populations of large, predatory fish, and from wetlands with sand, gravel, or rock substrates (Hansen 1988; Hansen and Brode 1980; Rossman and Stewart 1987). Riparian woodlands do not provide suitable habitat because of excessive shade, lack of basking sites, and absence of prey populations (Hansen 1988).

Giant garter snakes are the most aquatic garter snake species and are active foragers, feeding primarily on aquatic prey such as fish and amphibians (Fitch 1941). Historically, giant garter snake prey likely consisted of Sacramento blackfish (*Orthodon microlepidots*), thick-tailed chub (*Gila crassicauda*), and red-legged frog (*Rana aurora*) (Rossman et al. 1996; Service 1999). Because these prey species are no longer available (chub extinct, red-legged frog extirpated from the Central Valley, blackfish declining), other than Sierran treefrogs (*Pseudacris sierra*), the predominant food items are now introduced species such as carp (*Cyprinus carpio*), mosquito-fish (*Gambusia affinis*), and larval and sub-adult bullfrogs (*Rana catesbiana*) (Fitch 1941; Hansen and Brode 1993; Rossman et al. 1996).

The giant garter snake breeding season extends through March and April, and females give birth to live young from late July through early September (Hansen and Hansen 1990). Brood size is variable, ranging from 10 to 46 individual young, with a mean of 23 individuals (Hansen and Hansen 1990). At birth, young average about 8.1 inches snout-to-vent length and 0.10 to 0.18 ounces. Although growth rates are variable, young typically more than double in size by one year of age, and sexual maturity averages three years in males and five years for females (Service 1993b).

The giant garter snake is highly aquatic but also occupies a terrestrial niche (Service 1999; Wylie et al. 2004a). Aquatic habitat includes remnant native marshes and sloughs, restored wetlands, low gradient streams, and agricultural wetlands including rice fields and irrigation and drainage canals. Terrestrial habitat includes adjacent uplands which provide areas for basking, retreats, and over-wintering. Basking takes place in tules, cattails, saltbush, and shrubs over-hanging the water, patches of floating vegetation including waterweed, on rice checks, and on grassy banks (Service 1999). The snake typically inhabits small mammal burrows and other soil and/or rock crevices during the colder months of winter (i.e., October to April) (Hansen and Brode 1993; Wylie et al. 1996; Wylie et al. 2003a). It also uses burrows as refuge from extreme heat during its active period (Wylie et al. 1997; Wylie et al. 2004a). While individuals usually remain in close proximity to wetland habitats, the Biological Resource Division of the U.S. Geological Survey (BRD) has documented snakes using burrows as much as 165 feet away from the marsh edge to escape extreme heat and as far as 820 feet from the edge of marsh habitat for over-wintering habitat (Wylie et al. 1997). Snakes typically select burrows with sunny exposures along south and west facing slopes (Service 1993b).

In studies of marked snakes in the Natomas Basin, snakes moved about 0.25 to 0.5 miles per day (Hansen and Brode 1993). Home range (area of daily activity) averages about 0.1 mile^2 (25 hectares) in both the Natomas Basin and the Colusa National Wildlife Refuge (NWR) (Wylie 1998a; Wylie et al. 2002). Total activity, however, varies widely between individuals; individual snakes have been documented to move up to 5 miles over a few days in response to dewatering of habitat (Wylie et al. 1997) and to use up to more than 8 miles of linear aquatic habitat over the course of a few months, and to have a home range as large as 14.5 miles (Wylie and Martin 2004).

In agricultural areas, snakes were documented using rice fields in 19-20 percent of the observations, marsh habitat in 20-23 percent of observations, and canal and agricultural waterway habitats in 50-56 percent of the observations (Wylie 1998b). In the Natomas Basin, habitat used consisted almost entirely of irrigation ditches and established rice fields (Wylie 1998a; Wylie et al. 2004b). In the Colusa NWR, snakes were regularly found on or near edges of wetlands and ditches with vegetative cover (Wylie et al. 2003a). Telemetry studies also indicate that active snakes use uplands extensively; more than 31 percent of observations were in uplands (Wylie 1998b). Snakes observed in uplands during the active season were consistently near vegetative cover, particularly where cover exceeded 50 percent in the area within 1.6 feet of the snake (Wylie 1998b).

Giant garter snakes have been documented moving into restored habitat after two years. At the Colusa NWR, after two years, restoration area population estimates increased from 30 snakes per kilometer to 59-95 snakes per kilometer (Wylie et al. 2004a). At the Colusa Basin Drainage Canal, of the three available upland restoration treatments, 1) soil planted with native grasses over rock riprap, 2) soil planted with native grasses without rock, and 3) rock riprap only; giant garter snakes were most commonly found at the soil over rock riprap treatment (Wylie and Martin 2004).

Giant garter snakes are eaten by a variety of predators, including raccoons (*Procyon lotor*), striped skunks (*Mephitis mephitis*), opossums (*Didelphis virginiansa*), bull frogs, hawks (*Buteo* sp.), egrets (*Casmerodius albus*, *Egretta thula*), and great blue herons (*Ardea herodias*) (Dickert 2003; Service 1999; Wylie et al. 2003c). Many areas supporting snakes have been documented to have abundant predators; however, predation does not seem to be a limiting factor in areas that provide abundant cover, high concentrations of prey items, and connectivity to a permanent water source (Hansen and Brode 1993; Wylie et al. 1996).

The current distribution and abundance of the giant garter snake is much reduced from former times (Service 1999). Less than 10 percent, or approximately 319,000 acres, of the historic 4.5 million acres of Central Valley wetlands remain (U.S. Department of Interior 1994), of which very little provides habitat suitable for the giant garter snake. Loss of habitat due to agricultural activities and flood control have extirpated the snake from the southern one-third of its range in former wetlands associated with the historic Buena Vista, Tulare, and Kern lakebeds (Hansen 1980; Hansen and Brode 1980). These lakebeds once supported vast expanses of ideal snake habitat, consisting of cattail and bulrush dominated marshes (Service 1999). Cattail and bulrush floodplain habitat also historically typified much of the Sacramento Valley (Hinds 1952). Prior to reclamation activities beginning in the mid- to late-1800s, about 60 percent of the Sacramento Valley was subject to seasonal overflow flooding providing expansive areas of snake habitat (Hinds 1952). Valley flood wetlands are now subject to cumulative effects of upstream watershed modifications, water storage and diversion projects, as well as urban and agricultural development.

The CVP is the largest water management system in California and the historic water development activities that preceded it have not only resulted in the loss of all but approximately 10 percent of wetlands, they have created an ecosystem altered to such an extent that remaining wetlands, like agriculture, depend on managed water (U.S. Department of Interior 1994). The historic disturbance events associated with seasonal inundation that occur naturally in dynamic riverine, riparian, and wetland ecosystems have been largely eliminated. In addition to the highly managed water regimes, implementation of CVP has resulted in conversion of native habitats to agriculture, and has facilitated urban development through the Central Valley (Service, unpublished). In 1992, Congress enacted the Central Valley Project Improvement Act (CVPIA), the concerns of which include pricing and management of Central Valley water and attempting to mitigate for project impacts on fish, wildlife, and associated habitat. CVPIA, however, has been largely ineffective thus far, addressing primarily only the water needs of publicly-owned

wetlands, which account for less than one-fourth of the wetlands in the Central Valley (Service, unpublished).

Residential and commercial growth within the Central Valley is consuming an estimated 15,000 acres of Central Valley farmland each year (American Farmland Trust 1999). In the future, this transformation is expected to accelerate. Rice fields have become important habitat for giant garter snakes, particularly associated canals and their banks for both spring and summer active behavior and winter hibernation (Hansen 2004). While within the rice fields, snakes forage in the shallow water for prey, utilizing rice plants and vegetated berms dividing rice checks for shelter and basking sites (Hansen and Brode 1993). The loss of rice land resulting from residential and commercial growth compounds the adverse effect of direct habitat loss resulting from development itself.

Ongoing maintenance of aquatic habitats for flood control and agricultural purposes eliminates or prevents the establishment of habitat characteristics required by the giant garter snake (Hansen 1988). Such practices can fragment and isolate available habitat, prevent dispersal of snakes among habitat units, and adversely affect the availability of the snake's food items (Hansen 1988; Brode and Hansen 1992). For example, tilling, grading, harvesting and mowing may kill or injure giant garter snakes (Service 1999; Wylie et al. 1997). Biocides applied to control aquatic vegetation reduce cover for the snake and may harm prey species (Wylie et al. 1996). Rodent control threatens the snake's upland estivation habitat (Wylie et al. 1996; Wylie et al. 2004a). Restriction of suitable habitat to water canals bordered by roadways and levee tops renders snakes vulnerable to vehicular mortality (Wylie et al. 1997). Materials used in construction projects (e.g., erosion control netting) can entangle and kill snakes (Stuart et al. 2001; Barton and Kinkead 2005). Livestock grazing along the edges of water sources degrades water quality and can contribute to the elimination and reduction of available quality snake habitat (Hansen 1988). Fluctuation in rice and agricultural production affects stability and availability of habitat (Wylie and Casazza 2001; Wylie et al. 2003b, 2004b).

Other land use practices also currently threaten the survival of the giant garter snake. Nonnative predators, including introduced predatory game fish, bullfrogs, and domestic cats, can threaten snake populations (Dickert 2003; Wylie et al. 1996; Wylie et al. 2003c). Nonnative competitors, such as the introduced water snake (*Nerodia fasciata*) in the American River and associated tributaries near Folsom, may also threaten the giant garter snake (Stitt et al. 2005). Recreational activities, such as fishing, may disturb snakes and disrupt basking and foraging activities. While large areas of seemingly suitable snake habitat exist in the form of duck clubs and waterfowl management areas, water management of these areas typically does not provide the summer water needed by the species. Degraded water quality continues to be a threat to the species both on and off refuges.

The disappearance of giant garter snakes from much of the west side of the San Joaquin Valley was approximately contemporaneous with the expansion of subsurface drainage systems in this area, providing circumstantial evidence that the resulting contamination of ditches and sloughs

with drainwater constituents (principally selenium) may have contributed to the demise of giant garter snake populations. Dietary uptake is the principle route of toxic exposure to selenium in wildlife, including giant garter snakes (Beckon et al. 2003). Many open ditches in the northern San Joaquin Valley carry subsurface drainwater with elevated concentrations of selenium. Green sunfish (*Lepomis cyanellus*) in this drainwater have been found to have concentrations of selenium ranging from 12 to 23 µp/g (Saiki 1998), within the range of concentrations associated with adverse affects on predator aquatic reptiles (Hopkins et al. 2002). Since 1996, subsurface drainwater has been discharged, via the Grassland Bypass Project into Mud Slough North, where selenium concentrations in small fish, including mosquito fish, frequently reach 10-15 µp/g (Beckon et al. 2003).

The Central Valley and Delta region contains a number of endangered ecosystems due to its fertile soils, amiable climates, easy terrains, and other factors that historically have encouraged human settlement and exploitation. Environmental impacts associated with urbanization include loss of biodiversity and habitat, alternation of natural fire regimes, fragmentation of habitat from road construction, and degradation due to pollutants (Service 1999).

Environmental Baseline

The action area is located near the western extent of this species' recognized distribution in the Delta region and is included in the Mid Valley Recovery Unit identified in the 1999 draft recovery plan for the giant garter snake (Service 1999). Little is known about the listed snake's distribution in the Antioch area but a giant garter snake has been documented in the action area (Hansen 1987) and the Service identified the levee banks of Mayberry Slough and the interconnecting drainage ditches in the and around the action area as suitable giant garter snake habitat during a July 16, 2008, field visit. The action area contains habitat components that can be used by the snake for feeding, resting, mating, and other essential behaviors, as well as for a movement corridor. Proposed access roads cross aquatic habitat for the snake. The proposed access roads, laydown, and work areas are also located in areas that provide likely upland basking and winter refugia habitat within 200 feet of aquatic habitat. The surrounding uplands are utilized for grazing and therefore are not subject to regular disking or other intense agricultural maintenance that are more detrimental to the listed snake. Snakes have been documented to move up to 5 miles over a few days in response to dewatering of habitat (Wylie et al. 1997) and to use up to more than 8 miles of linear aquatic habitat over the course of a few months, and to have a home range as large as 14.5 miles (Wylie and Martin 2004). Therefore, there is a potential to encounter dispersing giant garter snakes throughout Sherman Island. Because of the biology and ecology of the snake, the presence of suitable habitat within the proposed project, and observations of the species, the Service has determined that the snake is reasonably certain to occur within the Sherman Island portion of the action area.

Effects of the Proposed Action

Delta Smelt

Installation of trestles on the south shoreline of the San Joaquin River could detrimentally affect delta smelt by increasing turbidity, pile driving, increasing noise, reducing water quality, creating predator habitat, restricting channels, and changing water velocities. Re-suspended sediments may contain toxic substances which may interfere with the development of young delta smelt. The vegetation upon which delta smelt may depend for egg attachment and refugia may become silted over or removed by the proposed actions.

Caltrans has estimated that the action area includes approximately 342.645 acres of surface water within the San Joaquin River. The Service considers the top 10 feet of the water column throughout the action area within the San Joaquin River to be SWH for the delta smelt. The action area is wider on the south shore due to the area needed to install the approximately 910-foot long, 0.952-acre temporary marine trestle. The action area includes work space for barge activities in deeper water (>10 feet) along with adequate space near the south shore for the trestle and the additional work space needed to construct the trestle. The completed trestle structure will result in direct effects to approximately 0.522 acres of SWH due to shading and 0.002 acres of substrate within the SWH due to pile driving and installation of temporary piers. This shading could decrease productivity in SWH and enhance habitat for predators of the delta smelt. The Service did not include the trestle shading that extends around the existing Antioch Bridge piers because this area is already significantly shaded by the overhead bridge. Activities within the remaining action area within the San Joaquin River will be limited to boat/barge use and is unlikely to have a measureable effect on the delta smelt.

As SWH is removed and turbidity increased, the delta smelt's feeding, breeding, and sheltering would likely be reduced as food sources associated with the aquatic plants and found in the water column is destroyed, and habitat used for spawning substrate and refugia is eliminated. Habitat for predatory fish will also be enhanced by the shaded water area. The trestle will eventually be removed after approximately 2.5 years. Removal of the trestle will result in additional disturbance to the substrate that could affect the delta smelt.

The above effects are greatly reduced by the restriction of in-water work to time periods when delta smelt eggs, larvae, and juveniles are not present and delta smelt adults are rarely present or present in low numbers. The potential adverse effects associated with pile driving will likely be reduced by the use of a vibratory hammer along with the implementation of one or more of Caltran's proposed hydroacoustic attenuation methods. Adverse effects associated with increased turbidity will likely be limited due to the proposed methodology along with monitoring and compliance with the conditions of the RWQCB. The trestle structure will be installed under the existing Antioch Bridge structure and will therefore be a limited addition (to be removed after approximately 2.5 years) to an existing situation. In addition, the above shading effects to 0.522

acres of delta smelt habitat are minimized by the preservation, creation, or restoration of shallow water habitat at 3:1.

Critical Habitat for the Delta Smelt

The proposed project includes 342.645 acres of critical habitat for the delta smelt, which includes all water and all submerged lands below ordinary high water within the action area.

The proposed project would affect feeding, breeding, and sheltering for the delta smelt within critical habitat. Direct effects to critical habitat PCEs would likely be limited to the 0.522 acres of habitat associated with the trestle installation and shading on the south shore of the San Joaquin River. Although it is unclear what long-term effects the installation of the trestle will have on the PCEs, the trestle structure will be completely removed within approximately 2.5 years of its installation.

The above effects to the PCEs are likely reduced based on the location relative to the existing Antioch Bridge, the eventual removal of the trestle, and the commitment for the preservation, creation, or restoration of shallow water habitat lost or shaded at 3:1. Therefore proposed project is not expected to diminish the long-term value of the critical habitat for the delta smelt, or prevent critical habitat from sustaining its role in the conservation and recovery of the species.

Giant Garter Snake

The direct effects of the project to the giant garter snake are likely limited to activities on the north side of the San Joaquin River on Sherman Island where the proposed project would result in adverse effects to approximately 2.44 acres of giant garter snake upland habitat within 200 feet of giant garter snake aquatic habitat. These effects include approximately 1.10 acres of upland habitat due to temporary access roads, approximately 0.22 acres of upland habitat due to permanent access road widening, and approximately 1.12 acres of upland habitat due to equipment staging. According to Caltrans, no aquatic habitat for the giant garter snake would be directly affected. Therefore, snakes in the action area are most likely to be encountered basking or foraging. Snakes in underground refugia may be unearthed, crushed, or buried, decreasing the chances for detection. Other than the 0.22 acres of permanent road widening the use of the other access roads and staging areas will be limited to the approximately 2.5-year duration of the project. Caltrans plans to restore these areas to their former function following use and they will continue to be managed by DWR and will not be incorporated into the Caltrans right-of-way. These effects will likely be further offset by compensation that is consistent with the 1997 programmatic biological opinion. Access to the Sherman Island work area is limited by a locked gate and is not open to the public. The project, including the permanent road widening, is not expected to result in increased use or disturbance to the area following completion of the Antioch Bridge Seismic Retrofit Project.

Construction activities associated with the project occurring in snake upland habitat may harm, harass, injure, or kill giant garter snakes. The proposed project has been designed to avoid initial ground-disturbing activities associated with the establishment of the staging areas and the improvement of access roads within the active period for the snake (May 1 – October 1), resulting in a decreased risk of direct mortality. The Service believes that after October 1, snakes are more likely to be dispersing into the uplands in search of overwintering hibernacula and prey, and could be subject to mortality from the ground disturbing activities. Snakes have been observed traveling greater than 200 feet from aquatic habitat into the uplands; therefore ground disturbing activity throughout the approximately 33.5-acre action area on Sherman Island could result in direct effects to this species. The construction would remove vegetation cover and basking sites, fill or crush burrows or crevices, obstruct snake movement, and result in the death/removal of potential non-aquatic the prey, and may result in the direct disturbance, displacement, injury, and/or mortality of snakes. Snakes may disperse across or may bask on existing roads, and thus may be killed or injured by construction equipment or other vehicles accessing the project site. As evidenced by the CNDDB record, this species has been claimed as roadkill in the action area before (CNDDB 2009). Silting, fill, or spill of oil or other chemicals could cause loss of prey items in Mayberry Slough and the surrounding interconnecting drainage ditches.

Indirect effects of the proposed project on the giant garter snake include temporary displacement and reduction of prey (both aquatic and terrestrial); and increased sedimentation, oils, and other hazardous materials from access roads and staging areas which could wash into drainages. Roads and parking/staging areas may affect chemical signals, which serve as sensory mechanisms of intraspecific communication and prey detection. The ability to detect odors and phermones plays a role in the detection of cues to locate mates (Le Master et al. 2001), prey items (Chiszar et al. 1990), and ambush sites (Clark 2004) in reptiles. Phermone scent trailing, observed in a variety of reptilian species, could be altered by contaminants running off of roads (Klauber 1931) or road substrate type (Shine et al. 2004). Giant garter snakes may be adversely affected by all of these factors.

Disturbance during construction activities may also cause giant garter snakes to move into or across areas of unsuitable habitat where they may be prone to higher rates of mortality from vehicles and predation. The proposed project may also result in increased disturbances to snakes due to traffic, predation, and increases in pollution (i.e. stormwater runoff into the receiving ditches) once the proposed staging areas are established.

Giant garter snakes may be attracted to gravel surfaces of the staging areas and widened access roads as basking habitat, and may be injured or killed by vehicles driving and parking in the proposed staging area. Research has found that some snake species may be attracted to road surfaces to thermoregulate (Klauber 1939; Sullivan 1981; Ashley and Robinson 1996). Depending on air and surface temperatures, snakes may not be able to move quickly enough to avoid being injured or killed by vehicles or equipment in these staging areas.

Cumulative Effects

Cumulative effects include the effects of future State, Tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Delta Smelt and its Critical Habitat

Cumulative effects on the delta smelt and its designated critical habitat include the adverse effects associated with point and non-point source chemical contaminant discharges. These contaminants include selenium and numerous pesticides and herbicides associated with discharges related to agricultural and urban activities. Implicated as potential sources of mortality for delta smelt, these contaminants may adversely affect delta smelt reproductive success and survival rates. Spawning habitat may also be affected if submersed aquatic plants used as substrates for adhesive egg attachment are lost due to toxic substances.

Additional cumulative effects may result from any continuing or future non-Federal diversions of water that may entrain adult or larval fish or that may decrease outflows incrementally, thus shifting the position of the delta smelt's preferred habitat upstream. Water diversions through intakes serving numerous small, private agricultural lands and duck clubs in the Delta, upstream of the Delta, and in Suisun Bay contribute to these cumulative effects. These diversions also include municipal and industrial uses, as well as providing water for power plants. State or local levee maintenance may also destroy or adversely modify critical habitat by disturbing spawning or rearing habitat and release contaminants into the water.

The introduction of exotic species may occur when levees are breached or when separate creeks or river systems are reconnected during various projects. Several exotic species may adversely affect the smelt, including the Asian clam and three non-native species of euryhaline copepods. The Asian clam could play an important role in affecting the phytoplankton dynamics. The exotic copepods may displace native species and at least one species of copepods (*Sinocalanus doerri*) is difficult for larval fishes to catch because of its fast swimming and effective escape response. Reduced feeding efficiency and ingestion rates weaken and slow the growth of young and make them more vulnerable to starvation and predation.

Giant Garter Snake

The overall status of the giant garter snake has not improved since its listing. Based on scarcity of suitable habitat and limited population size, at listing, threats to the Delta Basin population were considered imminent (Service 1993b). The status of the Delta Basin sub-population has been, and continues to be, adversely affected by past and present Federal, state, private, and other human activities.

The Federal Highway Administration/Caltrans and/or the Corps have consulted with the Service on the issuance of wetland fill permits for several transportation-related projects within the Delta Basin that affected snake habitat. The direct effect of these projects is often small and localized, but the effects of transportation projects, which improve access and therefore indirectly affect snakes by facilitating further development of habitat in the area and by increasing snake mortality via vehicles, are not quantifiable.

The global average temperature has risen by approximately 0.6 degrees centigrade during the 20th Century (International Panel on Climate Change 2001, 2007; Adger et al 2007). There is an international scientific consensus that most of the warming observed has been caused by human activities (International Panel on Climate Change 2001, 2007; Adger et al. 2007), and that it is "very likely" that it is largely due to increasing concentrations of greenhouse gases (carbon dioxide, methane, nitrous oxide, and others) in the global atmosphere from burning fossil fuels and other human activities (Cayan et al. 2005, EPA Global Warming webpage http://yosemite.epa.gov; Adger et al. 2007). Eleven of the twelve years between 1995 and 2006 rank among the twelve warmest years since global temperatures began in 1850 (Adger et al. 2007). The warming trend over the last fifty years is nearly twice that for the last 100 years (Adger et al. 2007). Looking forward, under a high emissions scenario, the International Panel on Climate Change estimates that global temperatures will rise another four degrees centigrade by the end of this Century; even under a low emissions growth scenario, the International Panel on Climate Change estimates that the global temperature will go up another 1.8 degrees centigrade (International Panel on Climate Change 2001).

The increase in global average temperatures affects certain areas more than others. The western United States, in general, is experiencing more warming than the rest of the Nation, with the 11 western states averaging 1.7 degrees Fahrenheit warmer temperatures than this region's average over the 20th Century (Saunders et al. 2008). California, in particular, will suffer significant consequences as a result of global warming (California Climate Action Team 2006). In California, reduced snowpack will cause more winter flooding and summer drought, as well as higher temperatures in lakes and coastal areas. The incidence of wildfires in the Golden State also will increase and the amount of increase is highly dependent upon the extent of global warming. No less certain than the fact of global warming itself is the fact that global warming, unchecked, will harm biodiversity generally and cause the extinction of large numbers of species. If the global mean temperatures exceed a warming of two to three degrees centigrade above pre-industrial levels, twenty to thirty percent of plant and animal species will face an increasingly high risk of extinction (International Panel on Climate Change 2001, 2007).

The mechanisms by which global warming may push already imperiled species closer or over the edge of extinction are multiple. Global warming increases the frequency of extreme weather events, such as heat waves, droughts, and storms (International Panel on Climate Change 2001, 2007; California Climate Action Team 2006; Lenihan et al. 2003). Extreme events, in turn may cause mass mortality of individuals and significantly contribute to determining which species will remain or occur in natural habitats. As the global climate warms, terrestrial habitats are

moving northward and upward, but in the future, range contractions are more likely than simple northward or upslope shifts. Ongoing global climate change (Anonymous 2007; Inkley et al. 2004; Adger et al. 2007; Kanter 2007) likely imperils the giant garter snake and the resources necessary for its survival. Since climate change threatens to disrupt annual weather patterns, it may result in a loss of their habitats and/or prey, and/or increased numbers of their predators, parasites, and diseases. Where populations are isolated, a changing climate may result in local extinction, with range shifts precluded by lack of habitat.

Conclusion

After reviewing the current status of the delta smelt and its critical habitat, the environmental baseline, the effects of the project, and the cumulative effects, it is the Service's biological opinion that the proposed Antioch Bridge Seismic Retrofit Project is not likely to jeopardize the continued existence of the delta smelt, or result in the destruction or adverse modification of its critical habitat. We base this determination on the nature of the effects; the restriction of in-water work to times when delta smelt are less likely to be present; implementation of required noise attenuation during pile driving, and the preservation of shallow water habitat lost or shaded at 3:1.

It is also the Service's biological opinion that the project, as proposed, is not likely to jeopardize the continued existence of the giant garter snake. This determination is based on the nature of the effects; the restriction of upland ground disturbance on Sherman Island to when giant garter snakes are less likely to be in underground winter refugia; proposed restoration of areas of temporal effects, and Caltrans' commitment to compensate for the effects to this listed snake as outlined in the Service's 1997 programmatic biological opinion.

INCIDENTAL TAKE STATEMENT

Section 9(a)(1) of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened fish and wildlife species without special exemption. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to a listed species by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. Harm is defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by impairing behavioral patterns including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with this Incidental Take Statement.

The measures described below are non-discretionary, and must be implemented by Caltrans so that they become binding conditions of any grant or permit issued to Caltrans as appropriate, in order for the exemption in section 7(o)(2) to apply. Caltrans has a continuing duty to regulate the activity covered by this Incidental Take Statement. If Caltrans (1) fails to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

Amount or Extent of Take

The Service anticipates that incidental take of delta smelt will occur. However, the Service anticipates that any take of delta smelt will be difficult to detect and quantify because they have a relatively small body size; they are relatively secretive; their presence in the Delta and associated areas coincides with relatively turbid conditions, which makes their detection difficult; and their presence in aquatic vegetation makes them difficult to detect. Therefore, it is not possible to provide precise numbers of delta smelt that could be injured, harassed, harmed, or killed due to the proposed action. Accordingly, the Service anticipates that all delta smelt within the approximately 0.522 acres of delta smelt habitat that will be affected by the project due to shading. Low mortality is anticipated because of the work restriction windows and implementation of required noise attenuation during pile driving. Because the species is wide-ranging and its distribution varies from one year to the next, take may vary from year to year. Additionally, losses of the species may be masked by seasonal fluctuations in numbers. Upon implementation of the following reasonable and prudent measures, incidental take associated with the Antioch Bridge Seismic Retrofit Project in the form of harm, harassment, injury, or mortality to delta smelt will become exempt from the prohibitions described under section 9 of the Act.

The Service anticipates that incidental take of the giant garter snake will be difficult to detect or quantify because giant garter snakes are cryptically colored, secretive, and known to be sensitive to human activities. Snakes may avoid detection by retreating to burrows, soil crevices, vegetation, and other cover. Individual snakes are difficult to detect unless they are observed, undisturbed, at a distance. Most close-range observations represent chance encounters that are difficult to predict. It is not possible to make an accurate estimate of the number of snakes that would be harassed or harmed during construction activities, including use of staging areas and access roads. In instances when take is difficult to detect, the Service may estimate take in numbers of individuals per acre of habitat lost or degraded as a result of the action. The Service anticipates that all giant garter snakes within the approximately 2.44 acres of upland habitat within 200 feet of giant garter snake aquatic habitat on Sherman Island may be subject to harassment and harm as a result of habitat modification and degradation due to the proposed project. Snakes in this area are likely to encountered basking or foraging above ground or unearthed from or crushed in underground refugia. The Service is also issuing incidental take for giant garter snakes within the remaining 31.06 acres of upland habitat within the action area on Sherman Island. The snakes within this area are likely to be encountered during dispersal and

may be subject to harassment and harm due to staging and mobilization and use of the access roads.

Upon implementation of the following reasonable and prudent measures incidental take associated with the proposed action described above for the delta smelt and giant garter snake will become exempt from the prohibitions described under section 9 of the Act.

Effect of the Take

The Service has determined that this level of anticipated take is not likely to result in jeopardy to the delta smelt or adverse modification or destruction of its critical habitat. The Service has also determined that the level of anticipated take for is not likely to jeopardize the continued existence of the giant garter snake.

Reasonable and Prudent Measures

The following reasonable and prudent measures are necessary and appropriate to minimize the effect of the proposed action on the delta smelt and its critical habitat and the giant garter snake. Caltrans will be responsible for implementation of and compliance with these measures:

1. Caltrans shall implement the conservation measures in the project description as described in the January 2009, Biological Assessment and this biological opinion.

2. Caltrans shall minimize adverse effects to the delta smelt and giant garter snake. Take in the form of harassment, harm, or mortality of delta smelt and harassment and/or harm of the giant garter snake during construction activities and associated with implementing the project shall be minimized.

3. Caltrans shall ensure their compliance with this biological opinion.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, Caltrans shall ensure compliance with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are nondiscretionary.

1. The following Terms and Conditions implement Reasonable and Prudent Measure one (1):

    a. Caltrans shall minimize the potential for harm, harassment, or killing of federally listed fish and wildlife species resulting from project related activities by implementation of the conservation measures as described in the January 2009,

Biological Assessment and appearing in the *Project Description* of this biological opinion.

b. Caltrans shall include Special Provisions that include the Conservation Measures and the Terms and Conditions of this biological opinion in the solicitation for bid information. In addition, Caltrans shall educate and inform contractors involved in the project as to the requirements of the biological opinion.

2. The following Terms and Conditions implement Reasonable and Prudent Measure two (2):

a. Prior to ground-breaking (including site preparation or grading) on any component of the proposed project, Caltrans shall provide the Service with written documentation that they have satisfied their proposed compensation for the delta smelt and the giant garter snake. If the banks identified for credit purchase have not been approved to sell credits prior to ground-breaking, Caltrans will provide evidence that the necessary funds have been set aside in a secure account. If the approval to sell credits for the species has been denied by the Service, then Caltrans shall reinitiate consultation with the Service.

b. The applicants shall include a copy of this biological opinion within its solicitations for design and construction of the proposed project making the primary contractor responsible for implementing all requirements and obligations included within the biological opinion, and to educate and inform all other contractors involved in the project as to the requirements of the biological opinion. A copy of the solicitations containing the biological opinion also will be provided to Coast-Bay Branch Chief at the Sacramento Fish and Wildlife Office.

c. A Worker Environmental Awareness Training Program for all construction personnel prior to their involvement in work activities. The program shall include discussion of the delta smelt and the giant garter snake including an overview of their life history and take prohibitions outlined in the biological opinion. The program shall focus on the conservation measures that are relevant to employee's personal responsibility. Distributed materials should include wallet-sized cards with a distinctive photograph of the giant garter snake, compliance reminders, and relevant contact information. Documentation of the training, including individual signed affidavits, shall be submitted to the Service with the annual compliance report described in the *Reporting Requirements* beginning on page 41 of this biological opinion. An outline of the program shall be submitted to Chris Nagano, Division Chief, Endangered Species Program within twenty (20) working days prior to the initial onset of construction activities. As needed, training shall be conducted in Spanish for Spanish language speakers. Documentation of the training, including individual signed affidavits, shall be kept on file and available on request.

d. Project employees shall be provided with written guidance governing vehicle use, speed limits on unpaved roads, fire prevention, and other hazards.

e. Only Service-approved biological monitors shall implement the monitoring duties outlined in this biological opinion including delivery of the Worker Environmental Awareness Training Program.

f. At least 30 calendar days prior to initiating construction activities, the project proponents shall submit the names and qualifications of the biological monitor(s) for the proposed project for Service approval.

g. The Resident Engineer or their designee shall be responsible for implementing the conservation measures and Terms and Conditions of this biological opinion and shall be the point of contact for the project. The Resident Engineer or their designee shall maintain a copy of this biological opinion onsite whenever construction is taking place. Their name and telephone number shall be provided to the Service at least thirty (30) calendar days prior to groundbreaking at the project. Prior to ground breaking, the Resident Engineer must submit a letter to the Service verifying that they posses a copy of this biological opinion and have read the Terms and Conditions.

h. A Service-approved biologist(s) shall be onsite during any ground disturbing activities on Sherman Island. Prior to approval, the biologist(s) must submit a letter to the Service verifying that they possess a copy of this biological opinion and understand its Terms and Conditions. The biologist(s) will keep a copy of this biological opinion in their possession when onsite. The biologist(s) shall have the authority to stop any work, through communication with the Resident Engineer or their designee that may result in the take of a listed species. If the biologist(s) exercises this authority, the Service and the California Department of Fish and Game shall be notified by telephone and email within one (1) working day. The Service contact is Chris Nagano, Division Chief, Endangered Species Program at the Sacramento Fish and Wildlife Office at telephone (916) 414-6600 or by an email message at Chris_Nagano@fws.gov.

i. A Service-approved biological monitor(s) shall be onsite to monitor the initial ground disturbance activities on Sherman Island. The biological monitor shall perform a clearance survey immediately prior to the initial ground disturbance. The biological monitor shall also investigate areas of disturbed soil for signs of listed species within 30 minutes following the initial disturbance of that given area.

j. The biological monitor shall be required to report any take to the Service immediately by telephone at (916) 414-6600 and by email or written letter addressed to Chris Nagano, Division Chief, Endangered Species Program, within one (1) working day of the incident.

k. The Service considers all of the 33.5-acre action area on Sherman Island to be giant garter snake habitat. All ground-disturbing activities (including grubbing, clearing, and site compaction) occurring on Sherman Island shall be conducted between May 1 and October 1. If it appears that ground disturbing activity on Sherman Island may go beyond October 1, the project proponents shall contact the Service as soon as possible, but not later than September 15 of the year in question, to determine if additional measures are necessary to minimize take.

l. Giant garter snakes encountered in active construction areas shall be allowed to leave on their own volition. Caltrans shall contact the Service and the California Department of Fish and Game for direction if a giant garter snake does not leave on its own within one working day.

m. Runoff from dust control and oil and other chemicals used in other construction activities shall be retained in the construction site and prevented from flowing into areas containing giant garter snake habitat. The runoff shall be retained in the construction areas by creating small earthen berms, installing silt fences or hay-bale dikes, or implementing other measures on the construction site to prevent runoff from entering the habitat of the snake.

n. Any dewatered habitat shall remain dry for at least 15 consecutive days after April 15 and prior to excavating or filling of the dewatered habitat.

o. Erosion control structures will be installed concurrently with road construction. Erosion control structures will be constructed so runoff will be directed away from sensitive habitats. Tightly woven fiber netting (mesh size less than 0.25 inches) or similar material shall be used for erosion control or other purposes at the project site to minimize the potential for giant garter snakes from being trapped by the erosion control material. Coconut coir matting is an acceptable erosion control material. No plastic mono-filament matting shall be used for erosion control. The edge of the material shall be buried in the ground to prevent giant garter snakes from crawling underneath the material. Erosion control measures shall direct water flow into existing drainages or disperse water across vegetated areas in order to avoid concentrating water.

p. To the extent feasible, the project proponents shall confine clearing of vegetation and scraping, or digging, of soil to the minimal area necessary to facilitate construction activities.

q. To the maximum extent possible, night-time construction should be minimized.

3. The following Terms and Conditions implement Reasonable and Prudent Measure three (3):

   a. The following shall be implemented for staging, storage sites, vehicle parking areas, and access associated with the project:

      1. Contractors may independently seek off-site staging locations. Offsite staging locations will be subject to the requirements of resource agencies and permits will be the responsibility of the contractor.

      2. Caltrans will require as part of the construction contract that all contractors comply with the Act in the performance of the work as described in the project description of this biological opinion and conducted within the action area.

      3. If a staging, storage, access, or vehicle parking area that is in compliance with the Act is not available, the agency with jurisdiction and the contractor would be responsible for compliance with the Act.

   b. If requested, before, during, or upon completion of ground breaking and construction activities, Caltrans shall allow access by Service and/or California Department of Fish and Game personnel to the project site to inspect project effects to the delta smelt and giant garter snake, and their habitats.

Reporting Requirements

Observations of delta smelt, giant garter snakes, or of any listed or sensitive animal species shall be reported to the California Natural Diversity Data Base (CNDDB).

Any salvaged delta smelt specimens taken shall be properly preserved in accordance with the Natural History Museum of Los Angeles County's policy of accessioning (10% formalin in a quart jar or freezing). Information concerning how the specimen was taken, length of the interval between death and preservation, the environmental conditions, the incidental take permit number (81420-2008-F-1537), and any other relevant information shall be written on 100% rag content paper, with indelible ink, and included in the container with the specimen. Preserved specimens shall be delivered to the Service's Division of Law Enforcement at 2800 Cottage Way, Room W-2928, Sacramento, California 95825, (916) 414-6660.

Injured giant garter snakes shall be cared for by a licensed veterinarian or other qualified person such as the on-site biologist; dead individuals must be placed in a sealed plastic bag with the date, time, location of discovery, and the name of the person who found the animal; the carcass should be kept in a freezer; and held in a secure location. The Service and the California Department of Fish and Game will be notified within one (1) working day of the discovery of death or injury to a giant garter snake that occurs due to project related activities or is observed at

the project site. Notification will include the date, time, and location of the incident or of the finding of a dead or injured animal clearly indicated on a USGS 7.5 minute quadrangle and other maps at a finer scale, as requested by the Service, and any other pertinent information. The Service contacts are Chris Nagano, Division Chief, Endangered Species Program at the Sacramento Fish and Wildlife Office (916) 414-6600, and Dan Crum, Resident Agent-in-Charge of the Service's Law Enforcement Division at (916) 414-6660. The California Department of Fish and Game contact is Mr. Scott Wilson at telephone (707) 944-5563. Sightings of any listed or sensitive animal species should be reported to the California Natural Diversity Database of the California Department of Fish and Game

Caltrans shall submit a post-construction compliance report prepared by the on-site biologist to the Sacramento Fish and Wildlife Office within 60 calendar days following each year of construction or within 60 calendar days of any break in construction activity lasting more than 60 calendar days. This report shall detail (i) dates that construction occurred; (ii) pertinent information concerning the success of the project in meeting compensation and other conservation measures; (iii) an explanation of failure to meet such measures, if any; (iv) known project effects on the delta smelt and giant garter snake, if any; (v) occurrences of incidental take of either of these species; (vi) documentation of employee environmental education; and (vii) other pertinent information. The reports shall be addressed to the Coast-Bay Branch Chief of the Endangered Species Program, Sacramento Fish and Wildlife Office.

Caltrans shall report to the Service any information about take or suspected take of listed wildlife species not authorized by this biological opinion. Caltrans must notify the Service via email and telephone within 24 hours of receiving such information. Notification must include the date, time, location of the incident or of the finding of a dead or injured animal, and photographs of the specific animal. The individual animal shall be preserved, as appropriate, and held in a secure location until instructions are received from the Service regarding the disposition of the specimen or the Service takes custody of the specimen. The Service contacts are Chris Nagano, Division Chief, Endangered Species Program, Sacramento Fish and Wildlife Office at (916) 414-6600, and Resident Agent-in-Charge Dan Crum of the Service's Law Enforcement Division at (916) 414-6660.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities that can be implemented to further the purposes of the Act, such as preservation of endangered species habitat, implementation of recovery actions, or development of information and data bases. We propose the following conservation recommendations:

1. Caltrans should assist the Service in implementing recovery actions identified in the recovery plan for the Sacramento-San Joaquin Delta native fishes.

2. Caltrans should consider participating in the planning for a regional habitat conservation plan for the delta smelt, giant garter snake, other listed species, and sensitive species.

3. Caltrans should consider establishing functioning preservation and creation conservation banking systems to further the conservation of the delta smelt, giant garter snake, and other listed species. It is possible that such banking systems could be utilized for other required mitigation (i.e., seasonal wetlands, riparian habitats, etc.) where appropriate. Efforts should be made to preserve habitat along roadways in association with wildlife crossings.

4. Roadways can constitute a major barrier to critical wildlife movement. Therefore, Caltans, should incorporate culverts, tunnels, or bridges on highways and other roadways that allow safe passage by giant garter snakes and other listed animals. Photographs, plans, and other information should be included in biological assessments if "wildlife friendly" crossings are incorporated into projects. Efforts should be made to establish upland culverts designed specifically for wildlife movement rather than accommodations for hydrology. Transportation agencies should also acknowledge the value of enhancing human safety by providing safe passage for wildlife in their early project design.

5. Caltrans should continue to pursue multifaceted compensation packages such as the one developed for the proposed U.S. Interstate 580/Isabel Avenue Interchange Construction Project (Service File # 1-1-07-F-0280) on future formal consultations with the Service.

6. Caltrans should continue to develop and implement their Early Statewide Biological Mitigation Planning Project that has been developed by the University of California at Davis, Road Ecology Center through Caltrans funding.

7. Caltrans should examine the use of natural fiber check dams enhanced with polyacrylamide as a BMP to control sediment discharge.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed and/or proposed species or their habitats, the Service requests notification of the implementation of these recommendations.

REINITIATION--CLOSING STATEMENT

This concludes formal consultation on the proposed Antioch Bridge Seismic Retrofit Project, Contra Costa and Sacramento Counties, California. As provided in 50 CFR §402.16 and in the terms and conditions of this biological opinion, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) the final project design exceeds the described action area in the January 2009, Biological Assessment; (2) the amount or extent of incidental take is exceeded; (3) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (4) the agency action is

subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; or (5) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

If you have questions concerning this opinion on the proposed Antioch Bridge Seismic Retrofit Project, Contra Costa and Sacramento Counties, California, please contact John Cleckler or Ryan Olah at the letterhead address or at (916) 414-6600.

Sincerely,

for Susan K. Moore
Field Supervisor

cc:
Christopher States, Stuart Kirkham, California Department of Transportation, Oakland, CA
Scott Wilson, Melissa Escaron, California Department of Fish and Game, Yountville, CA
Carl. T. Hausner, David. H. Sulouff, Eleventh Coast Guard District, Alameda, CA
Dannas Berchtold, Greg Vaughn, Central Valley Regional Water Quality Control Board, Rancho Cordova, CA
Douglas Hampton, Monica Gutierrez, National Marine Fisheries Service, Sacramento, CA
Erin Foresman, Carolyn Mulvihill, U.S. Environmental Protection Agency, San Francisco, CA
Paul M. Maniccia, U.S. Army Corps of Engineers, Sacramento, CA

Appendix G - NOAA's National Marine Fisheries Services Biological Opinion and Consultation Letter

DEPARTMENT OF TRANSPORTATION
OFFICE OF THE DIRECTOR
111 GRAND AVENUE
P.O. BOX 23660
OAKLAND, CA 94623-0660
PHONE (510) 286-5900
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Flex your power!
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January 22, 2009

Mr. Howard Brown
Branch Chief, Sacramento River Basin Branch
National Marine Fisheries
Sacramento Area Office
650 Capitol Mall, Suite 8-300
Sacramento, CA 95814-4706
ATTN: Monica Gutierrez

04-CC-160-KP 1.3/2.1 (PM 0.8/1.3)
03-SAC-160-KP 0/2.1 (PM 0/1.3)
EA 1A5210

Subject: Antioch Bridge Seismic Retrofit Project, Contra Costa and Sacramento Counties, California

Dear Mr. Brown:

Caltrans is initiating formal consultation for Central Valley steelhead (*Oncorhynchus mykiss irideus*) and requests concurrence for Sacramento River winter run and Central Valley spring run Chinook salmon (*Oncorhynchus tschawytscha*) and green sturgeon (*Acipenser medirostris*) for the Antioch Bridge Seismic Retrofit Project. Caltrans is acting as the NEPA lead agency under the provisions of the *Memorandum of Understanding* (MOU) *between the Federal Highway Administration and the California Department of Transportation Concerning the State of California's Participation in the Surface Transportation Project Pilot Delivery Program*, which became effective July 1, 2007. The MOU was signed pursuant to Section 6005 of the 2005 Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) which allows the Secretary of Transportation to assign, and the State of California to assume, responsibility for FHWA's responsibilities under NEPA as well as consultation and coordination responsibilities under other Federal environmental laws. As this project is covered by the Pilot Program MOU, FHWA has assigned and Caltrans has assumed FHWA responsibility for environmental review, consultation and coordination on this project. Please direct all future correspondence on this project to Caltrans.

We have enclosed an electronic copy of the BA for this project. A hard copy was delivered to Monica Gutierrez (NOAA) during an interagency meeting for the project held in Sacramento on January 14, 2009. If you or your staff have any questions or would like to discuss this matter further, feel free to phone me at (510) 622-8729 or Chris States (510) 286-7185.

Sincerely,

JEFFERY G. JENSEN
Office Chief
SIGNED FOR
Office of Biological Sciences and Permits

cc: Mo Pazooki, Project Management
Christopher States, Office of Biological Sciences and Permits
Howell Chan, Environmental Analysis
Jim Richards, Deputy District Director, Environmental Planning and Engineering

JGJ/wsk

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

JUN 2 3 2009

In Response Refer To:
2009/00173

Jeffery G. Jensen
Office Chief, Office of Biological Sciences and Permits
Department of Transportation
~~111 Grand Avenue~~
P.O. Box 23660
Oakland, California 94623-0660

Dear Mr. Jensen:

Enclosed is NOAA's National Marine Fisheries Service's (NMFS) biological and conference opinion (Enclosure 1) for the proposed Antioch Bridge Seismic Retrofit project (Project) located in Contra Costa and Sacramento Counties, California, and its effects on Sacramento River Winter-run Chinook salmon (*Oncorhynchus tshawytscha*), Central Valley (CV) Spring-run Chinook salmon (*O. tshawytscha*), CV steelhead (*O. mykiss*), and Southern Distinct Population Segment (DPS) of North American green sturgeon (*Acipenser medirostris*) in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*). Your initial request for formal section 7 consultation and conferencing on this project was received on January 26, 2009. On February 6, 2009, formal consultation and conferencing was initiated by NMFS' Sacramento Area Office.

This biological and conference opinion is based primarily on the biological assessment (BA) provided on January 14, 2009. The BA incorporated recommendations and addressed NMFS comments as discussed in meetings, correspondence, and emails.

Based on the best available scientific and commercial information, the biological and conference opinion concludes that the Project, as presented by the California Department of Transportation, is not likely to jeopardize the continued existence of the listed species or destroy or adversely modify designated or proposed critical habitat. NMFS anticipates that the proposed project will result in the incidental take of CV steelhead and North American green sturgeon. An incidental take statement that includes reasonable and prudent measures and non-discretionary terms and conditions that are intended to minimize the impact of the anticipated incidental take of CV steelhead and North American green sturgeon is included with the opinion. The section 9 prohibitions against taking of listed species and the terms and conditions in the incidental take statement of this conference and biological opinion will not apply to the Southern DPS of North American green sturgeon until a final section 4(d) ruling under the ESA has been published in the Federal Register. Additionally, the analysis of project effects on proposed critical habitat for the Southern DPS of North American green sturgeon is considered a conference opinion for those effects. This conference opinion does not take the place of a biological opinion under

section 7(a)2 of the ESA. The conference opinion may be adopted as a biological opinion when the proposed critical habitat designation for the Southern DPS of North American green sturgeon becomes final if no significant new information is developed, and no significant changes to the project are made that would alter the contents, analyses or conclusions of this opinion.

Also enclosed are NMFS' Essential Fish Habitat (EFH) conservation recommendations for Pacific salmon (O. tshawytscha) as required by the Magnuson-Stevens Fishery Conservation and Management Act as amended (16 U.S.C. 1801 *et seq.*; Enclosure 2). The document concludes that the Project will adversely affect the EFH of Pacific salmon in the action area and adopts certain terms and conditions of the incidental take statement and the ESA conservation recommendations of the biological opinion as the EFH conservation recommendations.

Please contact Monica Gutierrez at our Sacramento Area Office at (916) 930-3657, or via e-mail at Monica.Gutierrez@noaa.gov, if you have any questions regarding this response or require additional information.

Sincerely,

Rodney R. McInnis
Regional Administrator

Enclosures (2)

cc: Copy to file – ARN# 151422SWR2009SA00060
NMFS-PRD, Long Beach, CA
Bryan Chesney, Long Beach, CA

Enclosure 1

BIOLOGICAL and CONFERENCE OPINION

ACTION AGENCY: California Department of Transportation

ACTION: Antioch Bridge Seismic Retrofit Project

CONSULTATION
CONDUCTED BY: Southwest Region, National Marine Fisheries Service – MG 2009/00173

FILE NUMBER: 151422SWR2009SA00060

DATE ISSUED: June 23, 2009

I. CONSULTATION HISTORY

The California Department of Transportation (Caltrans) proposes to retrofit the Antioch Bridge on State Route (SR) 160 in Contra Costa and Sacramento Counties, California. The seismic retrofit of Antioch Bridge is a necessary action for the bridge to meet current design standards. The original construction of Antioch Bridge was completed in 1978. The seismic design of the bridge was based on the criteria developed after the San Francisco Earthquake of 1971. The Loma Prieta Earthquake of 1989 prompted Caltrans to implement the Seismic Retrofit Program (Program). After the Northridge Earthquake of 1994, Caltrans implemented Phase two of the Program, which required seven state-owned toll bridges, including the Antioch Bridge, to be retrofitted.

On April 21, 2008, the first of several pre-consultation meetings was held at the Caltrans District 4 office in Oakland, California. Technical assistance was provided to Stuart Kirkham (Caltrans District 4) relating to Incidental Harassment Authorization under the Marine Mammals Protection Act and other pre-consultation discussions.

On September 10, 2008, a meeting was held at the Caltrans headquarters in Sacramento, California, to discuss design changes to the project description. In addition, John Clecker (U.S. Fish and Wildlife [USFW] Biologist) specified an in-water work window (August 1-November 30) for delta smelt (*Hypomesus transpacificus*) for the project region. Doug Hampton (National Marine Fisheries Service [NMFS] Biologist) concurred, stating that a work window of August 1-October 31 would cover both delta smelt and Chinook salmon, but that he would allow up to November 30 as a work window, provided that the project proponent incorporated appropriate minimization measures in constructing the temporary marine trestle (*e.g.* limiting pile size to no

greater than 24-inch diameter, vibrating piles). Melissa Escaron (California Department of Fish and Game [CDFG] Biologist) concurred with the work window.

On November 5, 2008, the second interagency meeting for the Antioch Bridge Seismic Retrofit Project was held at Caltrans Headquarters in Sacramento, California. At this meeting, John Clecker, suggested sending copies of the biological assessment (BA) to every party that would need the biological and conference opinion (BO). He also agreed with NMFS on the methodology Caltrans was pursing in the hydro-acoustic analysis.

On December 3, 2008, a teleconference was held between NMFS and Caltrans to confirm the in-water work windows and avoidance and minimization measures. NMFS indicated that the August 1- November 30 work window would be likely to avoid impacts to all the NMFS species for the project, except for CV steelhead. Avoidance and minimization measures for Green sturgeon were not discussed.

On January 6, 2009, another teleconference was held between NMFS, Stuart Kirkham (Caltrans District 4), and Melissa Escaron, to discuss project effects to CV steelhead and proposed mitigation. NMFS concurred with Caltrans' estimates of take for CV steelhead, and the proposed compensatory mitigation, pending review of Caltrans' analysis report on the estimates of CV steelhead.

On January 14, 2009, a meeting was held at the Caltrans Headquarters in Sacramento to discuss summary of findings, conclusions, and determinations of the draft BA.

On January 26, 2009, NMFS received a letter from Caltrans (District 4) requesting initiation of formal section 7 consultation under ESA.

II. DESCRIPTION OF THE PROPOSED ACTION

A. Construction Activities

Caltrans proposes to retrofit the Antioch Bridge to meet current seismic standards due to current insufficient bridge performance during a maximum credible earthquake. Caltrans plans to install steel cross bracing between columns to stiffen the superstructure cross frames (pier 12 to pier 31) and will install bracing to the existing cross frames at the bent caps (pier 2 to pier 40). The existing elastometric bearings will be replaced with isolation bearings (abutment 1 to pier 41). Existing curtain walls will be removed and all columns within the slab span structure (bent 42 to abutment 71) will be retrofitted. A temporary marine trestle, with an approximate length of 910 feet and a width of 25 feet, will be constructed from the south bank of the San Joaquin River to pier 11 to allow construction access to the piers in the shallow water area. The trestle platform is expected to be approximately 5 feet above the Mean Higher-High Water (MHHW). The trestle will be constructed using approximately 160, 24-inch diameter hollow steel shell piles. The piles will be installed with a vibratory hammer, which should take approximately 10 minutes per pile to install. An impact hammer will be used on every other pile to ensure that the piles meet load

bearing specifications. This will result in a maximum of 60 strikes per day. Pile installation will be limited to the in-water work window of August 1-November 30. A temporary access road on the south shore will be constructed to allow access to the temporary marine trestle. At the completion of the project, the trestle along with the piles will be removed by the same vibratory hammer used to install the piles. The duration of the vibration for removing the piles will be no longer than 30 sec/pile. Barges will be used to retrofit piers 12 to 21 and no aquatic impacts are anticipated beyond the potential installation of mooring lines.

Another temporary access road will be constructed from the southernmost bridge support on Sherman Island (pier 22) to the last bridge support of Mayberry Slough (pier 38) to provide construction access for retrofit work. There will be construction of another temporary access road that parallels the slab span structure on both sides, north of Mayberry Slough, to facilitate removal of the curtain walls from the slab structure and reinforce existing columns and abutments and to allow work for the permanent widening of an existing access road along Mayberry Slough to access piers north of Mayberry Slough. There is no anticipated aquatic disturbance during the construction of the temporary access roads. The proposed project is scheduled to begin mid-2010 and end in late 2012.

B. Action Area

Action area is defined as areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). For purposes of this consultation, the action area consists of two components. The terrestrial component of the action area is defined by: 1) the project footprint, including all cleared areas, and staging areas; and 2) construction noise levels in excess of ambient conditions. The aquatic component of the action area is defined by: 1) the segment of the Feather River upstream and downstream of bridge construction sites where pile driving sound noise levels are expected to exceed ambient conditions; 2) construction-related water quality impacts in excess of ambient conditions; and 3) operational stormwater quality impacts in excess of ambient conditions. A plan view map of the project vicinity showing the action area boundary is presented in Figure 1.

The proposed Antioch Bridge Seismic Retrofit project is located along a two mile (mi) stretch of SR 160, from the southern limit of the project at Post Mile (PM) 0.8 in Contra Costa County to PM 1.3 at the Contra Costa/Sacramento County line, and from PM 0 to PM 1.3 in Sacramento County, on Sherman Island (Figure 1). The bridge currently supports SR 160 and connects the City of Antioch on the south bank of the San Joaquin River to Sherman Island on the north. It spans the 3,600-foot (ft) width of the river and over 4,000 feet of Sherman Island, before touching down just north of Mayberry Slough. The San Joaquin River is relatively shallow on the south side, with depths of less than 10 ft out to pier 11. The main channel extends between piers 12 and 20 with deep water passage between piers 19 and 20 near the northern shore. On the north side of the river, Sherman Island supports irrigated pasture and irrigated crops as well as ruderal vegetation in fallow fields. Mayberry Slough and an irrigation canal cross the project action area in the vicinity of piers 32, 39, and 40, respectively.

The project limits, which include Caltrans right-of-way (ROW) and temporary construction easements, cover approximately 62 acres (ac), including 7.5 ac on the south shore of the San Joaquin River in Contra Costa County, 21 ac of the San Joaquin River, and 33.5 ac on Sherman Island in Sacramento County. The action area consists of the project's footprint including areas for access and staging. No areas of indirect effects are anticipated. The action area also includes the project limit, plus an additional 8577 m zone around the temporary trestle which represents the extent of elevated underwater sound pressure levels that may result in adverse behavioral responses to listed species.

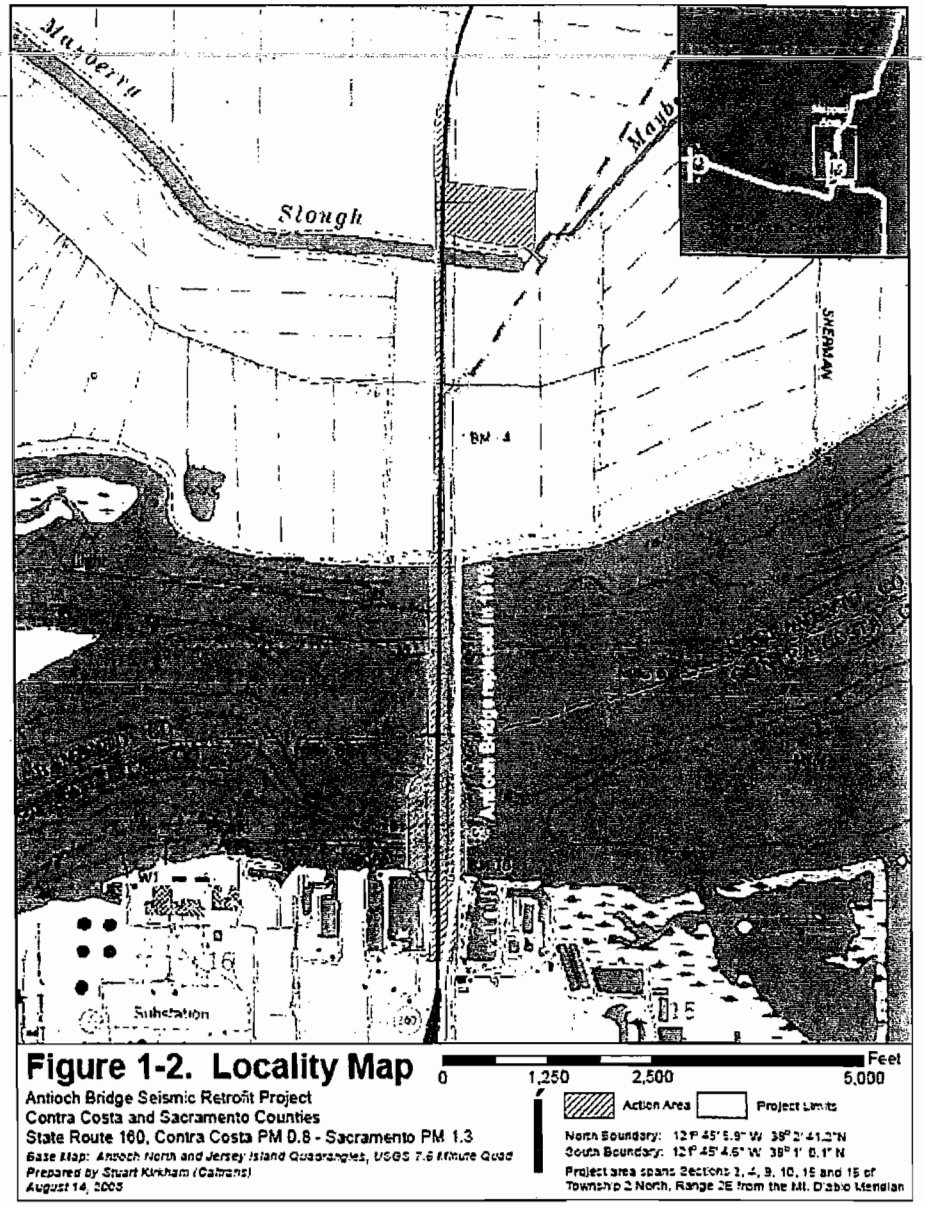

Figure 1. Antioch Bridge Seismic Retrofit project area map (Kirkham 2008)

C. Proposed Conservation Measures

The following conservation measures have been incorporated into the project design to avoid and/or minimize potential adverse effects of the proposed project on special status fish species and their designated and/or proposed critical habitats.

1. The Project Delivery Team (PDT) altered the design strategy such that deep water permanent pile driving to reinforce the foundations of the bridge columns will be unnecessary, a change which will greatly reduce the potential for effects to the listed ESA fish species in the San Joaquin River. Additionally, coordination efforts concerning the temporary marine trestle have refined the design parameters of the temporary structure to use a vibratory hammer for pile driving and to limit the pile size to a maximum diameter of 24 in, which will minimize the hydro-acoustic signature and effects on earlier life stages and smaller individuals of listed anadromous fish. Caltrans will proof one pile per day for every 4 to 6 piles. In other words, one pile per day (thus, either 1 of 4 or 1 of 6) will be tested with an impact hammer to see if the pile will withstand the load that the trestle will have to bear.

2. An in-water work window will be established from August 1 to November 30. This will help avoid any direct impacts to most ESA-listed species covered under this consultation. However, adult and juvenile CV steelhead and green sturgeon may be present in the action area during the proposed in-water construction period.

3. Barges will be used to retrofit piers 12 to 21, and no aquatic impacts are anticipated from this activity.

4. Bridge cross bracings that will be installed between bridge columns will be anchored to the columns using a drill and bond method. This method will reduce the amount of concrete debris that could potentially fall into the San Joaquin River.

5. This project will not require on-site borrow or disposal of excavated material. Gravel and rock will be imported for construction of the temporary access road and road widening. These materials will be removed upon completion of the project, and removal and disposal of this material will be implemented through contractors and subcontractors as part of the Caltrans standard Best Management Practices (BMPs) and Stormwater Pollution Prevention Plan (SWPPP). BMPs and SWPPP measures are a standard part of the plans and specifications for this project and are included in the California Central Valley Regional Water Quality Control Board (CVRWQCB) Section 401 Water Quality Certification.

III. STATUS OF THE SPECIES AND CRITICAL HABITAT

The following Federally listed species evolutionary significant units (ESU) or distinct population segments (DPS) and designated or proposed critical habitat occur in the action area and may be affected by the proposed project:

Sacramento River winter-run Chinook salmon ESU (*Oncorhynchus tshawytscha*)
endangered (June 28, 2005, 70 FR 37160)
Sacramento River winter-run Chinook salmon designated critical habitat
(June 16, 1993, 58 FR 33212)
Central Valley spring-run Chinook salmon ESU (*Oncorhynchus tshawytscha*)
threatened (June 28, 2005, 70 FR 37160)
Central Valley spring-run Chinook salmon designated critical habitat
(September 2, 2005, 70 FR 52488)
Central Valley steelhead DPS (*Oncorhynchus mykiss*)
threatened (January 5, 2006, 71 FR 834)
Central Valley steelhead designated critical habitat
(September 2, 2005, 70 FR 52488)
Southern DPS of North American green sturgeon (*Acipenser medirostris*)
threatened (April 7, 2006, 70 FR 17757)
Southern DPS of North American green sturgeon proposed critical habitat (September 8, 2008, 73 FR 52084)

A. Species and Critical Habitat Listing Status

In 2005, NMFS completed an updated status review of 16 salmon ESUs, including Sacramento River winter-run Chinook salmon and Central Valley (CV) spring-run Chinook salmon, and concluded that the species' status should remain as previously listed (June 28, 2005, 70 FR 37160). On January 5, 2006, NMFS published a final listing determination for 10 steelhead DPSs, including CV steelhead. The new listing concludes that CV steelhead will remain listed as threatened (71 FR 834).

1. Sacramento River Winter-run Chinook salmon

Sacramento River winter-run Chinook salmon were originally listed as threatened in August 1989, under emergency provisions of the ESA, and formally listed as threatened in November 1990 (55 FR 46515). The ESU consists of only one population that is confined to the upper Sacramento River in California's Central Valley. The Livingston Stone National Fish Hatchery population has been included in the listed Sacramento River winter-run Chinook salmon population as of June 28, 2005 (70 FR 37160). NMFS designated critical habitat for winter-run Chinook salmon on June 16, 1993 (58 FR 33212). The ESU was reclassified as endangered on January 4, 1994 (59 FR 440), due to increased variability of run sizes, expected weak returns as a result of two small year classes in 1991 and 1993, and a 99 percent decline between 1966 and 1991. NMFS reaffirmed the listing of Sacramento River winter-run Chinook salmon as

endangered on June 28, 2005 (70 FR 37160). The critical habitat designation includes the Sacramento River from Keswick Dam, Shasta County (River Mile 302) to Chipps Island (River Mile 0) at the westward margin of the Sacramento-San Joaquin Delta; all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait; all waters of the 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 (58 FR 33212). Designated critical habitat for Sacramento River winter-run Chinook salmon does not occur within the proposed project's action area.

2. CV spring-run Chinook salmon

NMFS listed the CV spring-run Chinook salmon ESU as threatened on September 16, 1999 (64 FR 50394). In June 2004, NMFS proposed that CV spring-run Chinook salmon remain listed as threatened (69 FR 33102). This proposal was based on the recognition that although CV spring-run Chinook salmon productivity trends are positive, the ESU continues to face risks from having a limited number of remaining populations (*i.e.*, 3 existing independent populations from an estimated 17 historical populations), a limited geographic distribution, and potential hybridization with Feather River Hatchery (FRH) spring-run Chinook salmon, which until recently were not included in the ESU and are genetically divergent from other populations in Mill, Deer, and Butte creeks. On June 28, 2005, after reviewing the best available scientific and commercial information, NMFS issued its final decision to retain the status of CV spring-run Chinook salmon as threatened (70 FR 37160). This decision also included the FRH spring-run Chinook salmon population as part of the CV spring-run Chinook salmon ESU. Critical habitat was designated for CV spring-run Chinook salmon on September 2, 2005 (70 FR 52488). Designated critical habitat includes approximately 8,935 net miles (mi) of riverine habitat and 470 mi^2 of estuarine habitat (primarily in San Francisco-San Pablo-Suisun Bays) in California (70 FR 52488). Designated critical habitat for CV spring-run Chinook salmon does not occur within the proposed project's action area.

3. CV steelhead

CV steelhead were originally listed as threatened on March 19, 1998 (63 FR 13347). This DPS consists of steelhead populations in the Sacramento and San Joaquin river basins in California's Central Valley. In June 2004, after a complete status review of the 26 west coast salmon DPSs, NMFS proposed that CV spring-run Chinook salmon remain listed as threatened (69 FR 33102), while the other Chinook salmon and steelhead were further reviewed. On June 28, 2005, after reviewing the best available scientific and commercial information, NMFS issued its final decision to retain the status of CV steelhead as threatened (70 FR 37160). This decision also included the Coleman National Fish Hatchery and FRH steelhead populations. These populations were previously included in the DPS but were not deemed essential for conservation and thus not part of the listed steelhead population. Critical habitat was designated for CV steelhead on September 2, 2005 (70 FR 52488). Critical habitat includes the stream channels to the ordinary high water line within designated stream reaches such as those of the American, Feather, and Yuba Rivers, and Deer, Mill, Battle, Antelope, and Clear Creeks in the Sacramento

River basin; the Calaveras, Mokelumne, Stanislaus, and Tuolumne Rivers in the San Joaquin River basin; and, the Sacramento and San Joaquin Rivers and Delta. Designated critical habitat for CV steelhead does occur within the proposed project's action area.

4. Southern DPS of North American Green Sturgeon

The Southern DPS of North American green sturgeon was listed as threatened on April 7, 2006, (70 FR 17386). The Southern DPS presently contains only a single spawning population in the Sacramento River, and adults and juveniles may occur within the action area. NMFS issued proposed critical habitat for the Southern DPS of North American green sturgeon on September 8, 2008 (73 FR 52084). The areas proposed as critical habitat include: coastal U.S. marine waters within 110 meters (m) depth from Monterey Bay, California (including Monterey Bay), north to Cape Flattery, Washington, including the Strait of Juan de Fuca, Washington, to its United States boundary; the Sacramento River, lower Feather River, and lower Yuba River in California; the Sacramento-San Joaquin Delta and Suisun, San Pablo, and San Francisco bays in California; the lower Columbia River estuary; and certain coastal bays and estuaries in California (Humboldt Bay), Oregon (Coos Bay, Winchester Bay, and Yaquina Bay), and Washington (Willapa Bay and Grays Harbor). Proposed critical habitat for Southern DPS of North American green sturgeon does occur within the proposed project's action area.

B. Species Life History, Population Dynamics, and Likelihood of Survival and Recovery

1. Chinook Salmon

a. General Life History

Chinook salmon exhibit two generalized freshwater life history types (Healey 1991). "Stream-type" Chinook salmon, enter freshwater months before spawning and reside in freshwater for a year or more following emergence, whereas "ocean-type" Chinook salmon spawn soon after entering freshwater and migrate to the ocean as fry or parr within their first year. Spring-run Chinook salmon exhibit a stream-type life history. Adults enter freshwater in the spring, hold over summer, spawn in fall, and the juveniles typically spend a year or more in freshwater before emigrating. Winter-run Chinook salmon are somewhat anomalous in that they have characteristics of both stream- and ocean-type races (Healey 1991). Adults enter freshwater in winter or early spring, and delay spawning until spring or early summer (stream-type). However, juvenile winter-run Chinook salmon migrate to sea after only 4 to 7 months of river life (ocean-type). Adequate instream flows and cool water temperatures are more critical for the survival of Chinook salmon exhibiting a stream-type life history due to over summering by adults and/or juveniles.

Chinook salmon typically mature between 2 and 6 years of age (Myers *et al.* 1998). Freshwater entry and spawning timing generally are thought to be related to local water temperature and flow regimes. Runs are designated on the basis of adult migration timing; however, distinct runs also differ in the degree of maturation at the time of river entry, thermal regime and flow

characteristics of their spawning site, and the actual time of spawning (Myers *et al.* 1998). Both spring-run and winter-run Chinook salmon tend to enter freshwater as immature fish, migrate far upriver, and delay spawning for weeks or months. For comparison, fall-run Chinook salmon enter freshwater at an advanced stage of maturity, move rapidly to their spawning areas on the mainstem or lower tributaries of the rivers, and spawn within a few days or weeks of freshwater entry (Healey 1991).

During their upstream migration, adult Chinook salmon require stream flows sufficient to provide olfactory and other orientation cues used to locate their natal streams. Adequate stream flows are necessary to allow adult passage to upstream holding habitat. The preferred temperature range for upstream migration is 38 °F to 56 °F (Bell 1991; CDFG 1998). Boles (1988) recommends water temperatures below 65 °F for adult Chinook salmon migration, and Lindley *et al.* (2004) report that adult migration is blocked when temperatures reach 70 °F, and that fish can become stressed as temperatures approach 70 °F. Reclamation reports that spring-run Chinook salmon holding in upper watershed locations prefer water temperatures below 60 °F; although salmon can tolerate temperatures up to 65 °F before they experience an increased susceptibility to disease.

Information on the migration rates of adult Chinook salmon in freshwater is scant and primarily comes from the Columbia River basin where information regarding migration behavior is needed to assess the effects of dams on travel times and passage (Matter *et al.* 2003). Keefer *et al.* (2004) found migration rates of Chinook salmon ranging from approximately 10 kilometers (km) per day to greater than 35 km per day and to be primarily correlated with date, and secondarily with discharge, year, and reach, in the Columbia River basin. Matter *et al.* (2003) documented migration rates of adult Chinook salmon ranging from 29 to 32 km per day in the Snake River. Adult Chinook salmon inserted with sonic tags and tracked throughout the Delta and lower Sacramento and San Joaquin rivers were observed exhibiting substantial upstream and downstream movement in a random fashion while on their upstream migration (California Bay-Delta Authority (CALFED) 2001). Adult salmonids migrating upstream are assumed to make greater use of pool and mid-channel habitat than channel margins (Stillwater Sciences 2004), particularly larger salmon such as Chinook salmon, as described by Hughes (2004). Adults are thought to exhibit crepuscular behavior during their upstream migrations; meaning that they primarily are active during twilight hours. Recent hydroacoustic monitoring showed peak upstream movement of adult CV spring-run Chinook salmon in lower Mill Creek, a tributary to the Sacramento River, occurring in the 4-hour period before sunrise and again after sunset.

Spawning Chinook salmon require clean, loose gravel in swift, relatively shallow riffles or along the margins of deeper runs, and suitable water temperatures, depths, and velocities for redd construction and adequate oxygenation of incubating eggs. Chinook salmon spawning typically occurs in gravel beds that are located at the tails of holding pools (USFWS 1995a). The range of water depths and velocities in spawning beds that Chinook salmon find acceptable is very broad. The upper preferred water temperature for spawning Chinook salmon is 55 °F to 57 °F (Chambers 1956; Smith 1973; Bjornn and Reiser 1991; Snider 2001).

During the 4 to 6 week period when alevins remain in the gravel, they utilize their yolk-sac to nourish their bodies. As their yolk-sac is depleted, fry begin to emerge from the gravel to begin exogenous feeding in their natal stream. The post-emergent fry disperse to the margins of their natal stream, seeking out shallow waters with slower currents, finer sediments, and bank cover such as overhanging and submerged vegetation, root wads, and fallen woody debris, and begin feeding on zooplankton, small insects, and other micro-crustaceans. As they switch from endogenous nourishment to exogenous feeding, the fry's yolk-sac is reabsorbed, and the belly suture closes over the former location of the yolk-sac (button-up fry). Fry typically range from 25 mm to 40 mm during this stage. Some fry may take up residence in their natal stream for several weeks to a year or more, while others actively migrate, or are displaced downstream by the stream's current. Once started downstream, fry may continue downstream to the estuary and rear, or may take up residence in river reaches along the way for a period of time ranging from weeks to a year (Healey 1991).

Rearing fry seek nearshore habitats containing beneficial aspects such as riparian vegetation and associated substrates important for providing aquatic and terrestrial invertebrates, predator avoidance, and slower velocities for resting (NMFS 1996a). The benefits of shallow water habitats for salmonid rearing also have recently been realized as shallow water habitat has been found to be more productive than the main river channels, supporting higher growth rates, partially due to higher prey consumption rates, as well as favorable environmental temperatures (Sommer *et al.* 2001).

When juvenile Chinook salmon reach a length of 50 to 57 mm, they move into deeper water with higher current velocities, but still seek shelter and velocity refugia to minimize energy expenditures. In the mainstems of larger rivers, juveniles tend to migrate along the margins and avoid the elevated water velocities found in the thalweg of the channel. When the channel of the river is greater than 9 to 10 feet in depth, juvenile salmon tend to inhabit the surface waters (Healey 1982). Migrational cues, such as increasing turbidity from runoff, increased flows, changes in day length, or intraspecific competition from other fish in their natal streams may spur outmigration of juveniles when they have reached the appropriate stage of maturation (Kjelson *et al.* 1982; Brandes and McLain 2001).

Similar to adult movement, juvenile salmonid downstream movement is primarily crepuscular. Martin *et al.* (2001) found that the daily migration of juveniles passing Red Bluff Diversion Dam (RBDD) is highest in the four hour period prior to sunrise. Juvenile Chinook salmon migration rates vary considerably presumably depending on the physiological stage of the juvenile and hydrologic conditions. Kjelson *et al.* (1982) found fry Chinook salmon to travel as fast as 30 km per day in the Sacramento River and Sommer *et al.* (2001) found rates ranging from approximately 0.5 miles up to more than 6 miles per day in the Yolo Bypass. As Chinook salmon begin the smoltification stage, they prefer to rear further downstream where ambient salinity is up to 1.5 to 2.5 parts per thousand (Healey 1980; Levy and Northcote 1981).

Fry and parr may rear within riverine or estuarine habitats of the Sacramento River, the Delta, and their tributaries. In addition, CV Chinook salmon juveniles have been observed rearing in

the lower reaches of non-natal tributaries and intermittent streams in the Sacramento Valley during the winter months (Maslin *et al.* 1997; Snider 2001). Within the Delta, juvenile Chinook salmon forage in shallow areas with protective cover, such as intertidal and subtidal mudflats, marshes, channels, and sloughs (McDonald 1960; Dunford 1975). Cladocerans, copepods, amphipods, and larvae of diptera, as well as small arachnids and ants are common prey items (Kjelson *et al.* 1982; Sommer *et al.* 2001; MacFarlane and Norton 2002). Shallow water habitats are more productive than the main river channels, supporting higher growth rates, partially due to higher prey consumption rates, as well as favorable environmental temperatures (Sommer *et al.* 2001). Optimal water temperatures for the growth of juvenile Chinook salmon in the Delta are between 54 to 57 °F (Brett 1952). In Suisun and San Pablo Bays water temperatures reach 54 °F by February in a typical year. Other portions of the Delta (*i.e.*, South Delta and Central Delta) can reach 70 °F by February in a dry year. However, cooler temperatures are usually the norm until after the spring runoff has ended.

Within the estuarine habitat, juvenile Chinook salmon movements are dictated by the tidal cycles, following the rising tide into shallow water habitats from the deeper main channels, and returning to the main channels when the tide recedes (Levings 1982; Levy and Northcote 1982; Levings *et al.* 1986; Healey 1991). As juvenile Chinook salmon increase in length, they tend to school in the surface waters of the main and secondary channels and sloughs, following the tides into shallow water habitats to feed (Allen and Hassler 1986). In Suisun Marsh, Moyle *et al.* (1989) reported that Chinook salmon fry tend to remain close to the banks and vegetation, near protective cover, and in dead-end tidal channels. Kjelson *et al.* (1982) reported that juvenile Chinook salmon demonstrated a diel migration pattern, orienting themselves to nearshore cover and structure during the day, but moving into more open, offshore waters at night. The fish also distributed themselves vertically in relation to ambient light. During the night, juveniles were distributed randomly in the water column, but would school up during the day into the upper 3 meters of the water column. Available data indicate that juvenile Chinook salmon use Suisun Marsh extensively both as a migratory pathway and rearing area as they move downstream to the Pacific Ocean. Juvenile Chinook salmon were found to spend about 40 days migrating through the Delta to the mouth of San Francisco Bay and grew little in length or weight until they reached the Gulf of the Farallons (MacFarlane and Norton 2002). Based on the mainly ocean-type life history observed (*i.e.*, fall-run Chinook salmon) MacFarlane and Norton (2002) concluded that unlike other salmonid populations in the Pacific Northwest, CV Chinook salmon show little estuarine dependence and may benefit from expedited ocean entry.

b. *Sacramento River Winter-Run Chinook Salmon*

Sacramento River winter-run Chinook salmon adults enter the San Francisco Bay between November and June, with a peak occurring in March (Yoshiyama *et al.* 1998; Moyle 2002). Spawning occurs primarily from mid April to mid August, with the peak activity occurring in May and June in the Sacramento River reach between Keswick dam and Red Bluff Diversion Dam (RBDD) (Vogel and Marine 1991). The majority of Sacramento River winter-run Chinook salmon spawners are 3 years old.

Sacramento River winter-run Chinook salmon fry begin to emerge from the gravel in late June to early July and continue through October (Fisher 1994), with emergence generally occurring at night. Post-emergent fry disperse to the margins of the river, seeking out shallow waters with slower currents, finer sediments, and bank cover such as overhanging and submerged vegetation, root wads, and fallen woody debris, and begin feeding on small insects and crustaceans.

Emigration of juvenile winter-run past RBDD may begin as early as mid July, typically peaks in September, and can continue through March in dry years (Vogel and Marine 1991; NMFS 1997). From 1995 to 1999, all Sacramento River winter-run Chinook outmigrating as fry passed RBDD by October, and all outmigrating pre-smolts and smolts passed RBDD by March (Table 1; Martin *et al.* 2001).

Juvenile Sacramento River winter-run Chinook salmon occur in the Delta primarily from November through early May based on data collected from trawls in the Sacramento River at West Sacramento (RM 57) (USFWS 2001). The timing of migration may vary somewhat due to changes in river flows, dam operations, and water year type. Winter-run Chinook salmon juveniles remain in the Delta until they reach a fork length of approximately 118 millimeters (mm) and are from 5 to 10 months of age, and then begin emigrating to the ocean as early as November, continuing through May (Fisher 1994; Myers *et al.* 1998).

(1) Population Dynamics. Historical Sacramento River winter-run Chinook salmon population estimates were as high as 100,000 fish in the 1960s; however, populations declined below 200 fish in the 1990s (Good *et al.* 2005). Population estimates in 2003 (8,218), 2004 (7,869), 2005 (15,875), and 2006 (17,304) show a recent increase in the population size (CDFG 2009) and a 4-year average of 12,317 (2003 through 2006). The 2006 run was the highest since the listing. However, the population estimate for winter-run Chinook salmon in 2007 was only 2,542 and 2,850 for 2008 (CDFG 2009). The saltwater life history traits and food requirements of winter-run Chinook salmon and fall-run Chinook salmon are similar. Therefore, the unusual and poor ocean conditions that caused the drastic decline in returning fall run Chinook salmon populations coast wide in 2007 and 2008 (Lindley *et al.* 2009) are suspected to have also caused the observed decrease in the winter-run Chinook salmon spawning population during this period (Oppenheim 2008). Two current methods are utilized to estimate the juvenile production of Sacramento River winter-run Chinook salmon: the Juvenile Production Estimate (JPE) method, and the Juvenile Production Index (JPI) method (Gaines and Poytress 2004). Gaines and Poytress (2004) estimated the juvenile population of Sacramento River winter-run Chinook salmon exiting the upper Sacramento River at RBDD to be 3,707,916 juveniles per year using the JPI method between the years 1995 and 2003 (excluding 2000 and 2001). Using the JPE method, they estimated an average of 3,857,036 juveniles exiting the upper Sacramento River at RBDD between the years of 1996 and 2003 (Gaines and Poytress 2004). Averaging these 2 estimates yields an estimated juvenile population size at RBDD of 3,782,476.

Based on the RBDD counts, the population showed steady growth from the 1990s through 2006 with positive short-term trends. However, an age-structured density-independent model of spawning escapement by Botsford and Brittnacker in 1998 (as referenced in Good *et al.* 2005)

assessing the viability of Sacramento River winter-run Chinook salmon found the species was certain to fall below the quasi-extinction threshold of 3 consecutive spawning runs with fewer than 50 females (Good *et al.* 2005). Lindley *et al.* (2003) assessed the viability of the population using a Bayesian model based on spawning escapement that allowed for density dependence and a change in population growth rate in response to conservation measures and found a biologically significant expected quasi-extinction probability of 28 percent. Although the status of the Sacramento River winter-run Chinook salmon population has improved over the last two decades since its listing, the recent severe declines illustrate the volatility of this small, single population ESU. Because there is only one population, and it depends on cold-water releases from Shasta Dam to provide suitable spawning habitat, the ESU is highly vulnerable to a prolonged drought resulting in depletion of the cold-water pool in Shasta Lake (Good *et al.* 2005).

Although NMFS proposed that this ESU be upgraded from endangered to threatened status in 2005, the Final Listing Determination (June 28, 2005, 70 FR 37160) maintained the status of the Sacramento River winter-run Chinook salmon ESU as endangered. This population remains below the draft recovery goals established for the run (NMFS 1997, 1998) and the naturally spawned component of the ESU is dependent on one extant population in the Sacramento River. In general, the draft recovery criteria for Sacramento River winter-run Chinook salmon include a mean annual spawning abundance over any 13 consecutive years of at least 10,000 females with a concurrent geometric mean of the cohort replacement rate greater than 1.0. Recent trends in Sacramento River winter-run Chinook salmon abundance and cohort replacement remain positive, indicating some recovery since the listing. However, the population remains well below the recovery goals of the draft recovery plan, and is particularly susceptible to extinction because of the reduction of the genetic pool to one population.

Hydropower, flood control, and water supply dams of the CVP, SWP, and other municipal and private entities have permanently blocked or hindered salmonid access to historical spawning and rearing grounds. Clark (1929) estimated that originally there were 6,000 linear miles of salmon habitat in the Central Valley system and that 80 percent of this habitat had been lost by 1928. Yoshiyama *et al.* (1996) calculated that roughly 2,000 linear miles of salmon habitat was actually available before dam construction and mining, and concluded that 82 percent is not accessible today. The percentage of habitat loss for steelhead is presumably greater, because steelhead were more extensively distributed upstream than Chinook salmon.

As a result of migrational barriers, winter-run populations have been confined to lower elevation mainstems that historically only were used for migration and rearing. Population abundances have declined in these streams due to decreased quantity and quality of spawning and rearing habitat. Higher temperatures at these lower elevations during late-summer and fall are also a major stressor to adult and juvenile salmonids. According to Lindley *et al.* (2004), of the four independent populations of winter-run that occurred historically, only one mixed stock of winter-run remains below Keswick Dam. Similarly, of the 19 independent populations of spring-run that occurred historically, only three independent populations remain in Deer, Mill, and Butte Creeks (Lindley *et al.* 2007). Dependent populations of spring-run continue to occur in Big Chico, Antelope, Clear, Thomes, and Beegum Creeks and the Yuba River, but rely on the extant

independent populations for their continued survival. CV steelhead historically had at least 81 independent populations based on Lindley *et al.*'s (2006) analysis of potential habitat in the Central Valley. However, due to dam construction, access to 38 percent of all spawning habitat has been lost, as well as access to 80 percent of the historically available habitat.

Lindley *et al.* (2007) state that the winter-run Chinook salmon population fails the "representation and redundancy rule" because it has only one population and that population spawn outside of the eco-region in which it evolved. In order to satisfy the "representation and redundancy rule," at least two populations of winter-run Chinook salmon would have to be re-established in the basalt- and porous-lava region of its origin. An ESU represented by only one spawning population at moderate risk of extinction is at a high risk of extinction over an extended period of time (Lindley *et al.* 2007).

(2) Viable Salmonid Population Summary for Sacramento River Winter-Run Chinook Salmon. McElhany *et al.* (2000) define a viable salmonid population (VSP) as an independent population that has a negligible probability of extinction over a 100-year time frame. The VSP concept provides specific guidance for estimating the viability of populations and larger-scale groupings of Pacific salmonids such as ESU or DPS. Four VSP parameters form the key to evaluating population and ESU/DPS viability: (1) abundance; (2) productivity (*i.e.*, population growth rate); (3) population spatial structure; and (4) diversity (McElhany *et al.* 2000).

Abundance. Redd and carcass surveys, and fish counts, suggest that the abundance of winter-run Chinook salmon has been increasing. The depressed 2007 and 2008 abundance estimates are significant exceptions to this trend and may represent a new cycle of poor ocean productivity. Population growth is estimated to be positive in the short-term trend at 0.26; however, the long-term trend is negative, averaging -0.14. Recent winter-run Chinook salmon abundance represents only 3 percent of the maximum post-1967, 5-year geometric mean, and is not yet well established (Good *et al.* 2005).

Productivity. Prior to the recent declines, ESU productivity had been positive over the short term, and adult escapement and juvenile production were been increasing annually (Good *et al.* 2005). The long-term trend for the ESU remains negative however, as the cohort replacement rate (CRR) estimate suggests a reduction in productivity for the 1998-2001 cohorts.

Spatial Structure. The greatest risk factor for winter-run Chinook salmon lies with their spatial structure (Good *et al.* 2005). The remnant population cannot access historical winter-run habitat and must be artificially maintained in the Sacramento River by a regulated, finite cold water pool from Shasta Dam. Winter-run Chinook salmon require cold water temperatures in summer that simulate their upper basin habitat, and they are more likely to be exposed to the impacts of drought in a lower basin environment. Battle Creek remains the most feasible opportunity for the ESU to expand its spatial structure, which currently is limited to the upper 25-mile reach of the mainstem Sacramento River below Keswick Dam.

Diversity. The second highest risk factor for the Sacramento River winter-run Chinook salmon

ESU has been the detrimental effects on its diversity. The genetics of the present winter-run population has resulted from the introgression of several stocks that occurred when Shasta Dam blocked access to the upper watershed. A second genetic bottleneck occurred with the construction of Keswick Dam; there may have been several others within the recent past (Good *et al.* 2005). Concerns of genetic introgression with hatchery populations are also increasing. Although Livingston Stone National Fish Hatchery (LSNFH) is characterized as one of the best examples of a conservation hatchery operated to maximize genetic diversity and minimize domestication of the offspring produced in the hatchery, it still faces some of the same diversity issues as other hatcheries in reducing the diversity of the naturally-spawning population. Therefore, Lindley *et al.* (2007) characterizes hatchery influence as a looming concern with regard to diversity. Even with a small contribution of hatchery fish to the natural spawning population, hatchery contributions could compromise the long term viability and extinction risk of winter-run.

NMFS concludes that the current diversity in this ESU is much reduced compared to historic levels, and that winter-run are at a high risk of extinction based on the spatial structure and diversity VSP parameters.

c. *CV Spring-Run Chinook Salmon*

Historically the spring-run Chinook salmon were the second most abundant salmon run in the Central Valley (CDFG 1998). These fish occupied the upper and middle reaches (1,000 to 6,000 foot elevations) of the San Joaquin, American, Yuba, Feather, Sacramento, McCloud and Pit Rivers, with smaller populations in most tributaries with sufficient habitat for over-summering adults (Stone 1874; Rutter 1904; Clark 1929). The Central Valley drainage as a whole is estimated to have supported spring-run Chinook salmon runs as large as 600,000 fish between the late 1880s and 1940s (CDFG 1998). Before the construction of Friant Dam, nearly 50,000 adults were counted in the San Joaquin River alone (Fry 1961). Construction of other low elevation dams in the foothills of the Sierras on the American, Mokelumne, Stanislaus, Tuolumne, and Merced Rivers extirpated CV spring-run Chinook salmon from these watersheds. Naturally-spawning populations of CV spring-run Chinook salmon currently are restricted to accessible reaches of the upper Sacramento River, Antelope Creek, Battle Creek, Beegum Creek, Big Chico Creek, Butte Creek, Clear Creek, Deer Creek, Feather River, Mill Creek, and Yuba River (CDFG 1998).

Adult CV spring-run Chinook salmon leave the ocean to begin their upstream migration in late January and early February (CDFG 1998a) and enter the Sacramento River between March and September, primarily in May and June (Table 2; Yoshiyama *et al.* 1998; Moyle 2002). Lindley *et al.* (2006a) indicate adult CV spring-run Chinook salmon enter native tributaries from the Sacramento River primarily between mid April and mid June. Typically, spring-run Chinook salmon utilize mid- to high-elevation streams that provide appropriate temperatures and sufficient flow, cover, and pool depth to allow over-summering while conserving energy and allowing their gonadal tissue to mature (Yoshiyama *et al.* 1998). Spring-run Chinook salmon spawning occurs between September and October depending on water temperatures. Between 56

and 87 percent of adult spring-run Chinook salmon that enter the Sacramento River basin to spawn are 3 years old (Calkins *et al.* 1940; Fisher 1994).

Table 1. The temporal occurrence of adult and juvenile Sacramento River winter-run Chinook salmon in the Sacramento River.

Adult Location	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Sacramento River basin[1]												
Sacramento River[2]												
Juvenile Location	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Sacramento River at Red Bluff[3]												
Sacramento River at Red Bluff[2]												
Sacramento River at Knights Landing[4]												
Lower Sacramento River (seine)[5]												
West Sacramento River (trawl)[5]												

Relative Abundance: =High =Medium =Low

Sources: [1] Yoshiyama *et al.* (1998); Moyle (2002); [2] Meyers *et al.* (1998); [3] Martin *et al.* (2001); [4] Snider and Titus (2000); [5] USFWS (2001)

Table 2. The temporal occurrence of adult and juvenile Central Valley spring-run Chinook salmon in the Sacramento River.

Adult Location	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Sacramento River basin[1, 2]												
Sacramento River[3]												
Mill Creek[4]												
Deer Creek[4]												
Butte Creek[4]												
Juvenile Location	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Sacramento River Tributaries												
Upper Butte Creek												
Mill, Deer, Butte Creeks												
Sacramento River @ RBDD												
Sacramento River @ Knights Landing												

Relative Abundance: =High =Medium =Low

Sources: [1] Yoshiyama *et al.* (1998); [2] Moyle (2002); [3] Meyers *et al.* (1998); [4] Lindley *et al.* (2007); [5] CDFG (1998); [6] McReynolds *et al.* (2005); Ward *et al.* (2002, 2003); [7] Snider and Titus (2000)

Spring-run Chinook salmon fry emerge from the gravel from November to March (Moyle 2002) and emigration timing is highly variable, as they may migrate downstream as young-of-the-year

(YOY) or as juveniles or yearlings. The modal size of fry migrants at approximately 40 mm between December and April in Mill, Butte, and Deer creeks reflects a prolonged emergence of fry from the gravel (Lindley *et al.* 2006a). Studies in Butte Creek (Ward *et al.* 2002, 2003; McReynolds *et al.* 2005) found the majority of CV spring-run Chinook salmon migrants to be fry occurring primarily during December, January, and February, and that these movements appeared to be influenced by flow. Small numbers of CV spring-run Chinook salmon remained in Butte Creek to rear and migrate as yearlings later in the spring. Juvenile emigration patterns in Mill and Deer creeks are very similar to patterns observed in Butte Creek, with the exception that Mill and Deer creeks juveniles typically exhibit a later YOY migration and an earlier yearling migration (Lindley *et al.* 2006a).

Once juveniles emerge from the gravel they initially seek areas of shallow water and low velocities while they finish absorbing their yolk sac (Moyle 2002). Many will also disperse downstream during high-flow events. As is the case in other salmonids, there is a shift in microhabitat use by juveniles to deeper, faster water as they grow. Microhabitat use can be influenced by the presence of predators which can force fish to select areas of heavy cover and suppress foraging in open areas (Moyle 2002). Peak movement of juvenile CV spring-run Chinook salmon in the Sacramento River at Knights Landing occurs in December, and again in March and April. However, juveniles are also observed between November and the end of May (Snider and Titus 2000). Based on the available information, the emigration timing of CV spring-run Chinook salmon appears highly variable (CDFG 1998). Some fish may begin emigrating soon after emergence from the gravel, whereas others over summer and emigrate as yearlings with the onset of intense fall storms (CDFG 1998).

(1) Population Dynamics. The CV spring-run Chinook salmon ESU has displayed broad fluctuations in adult abundance, ranging from 1,403 in 1993 to 25,890 in 1982. The average abundance for the ESU was 12,590 for the period of 1969 to 1979, 13,334 for the period of 1980 to 1990, 6,554 from 1991 to 2001, and 16,349 between 2002 and 2005. For the period of 2006 to 2008 the average abundance for the ESU fell to a low of 854 (CDFG 2009). Sacramento River tributary populations in Mill, Deer, and Butte creeks are probably the best trend indicators for the CV spring-run Chinook ESU as a whole because these streams contain the primary independent populations within the ESU. Generally, these streams have shown a positive escapement trend since 1991. Escapement numbers are dominated by Butte Creek returns, which have averaged over 7,000 fish since 1995 (until 2005). During this same period, adult returns on Mill Creek have averaged 778 fish, and 1,463 fish on Deer Creek. Although recent trends are positive, annual abundance estimates display a high level of fluctuation, and the overall number of CV spring-run Chinook salmon remains well below estimates of historic abundance. Additionally, in 2003 high water temperatures, high fish densities, and an outbreak of Columnaris Disease (*Flexibacter Columnaris*) and Ichthyophthiriasis (*Ichthyophthirius multifiis*) contributed to the pre-spawning mortality of an estimated 11,231 adult spring-run Chinook salmon in Butte Creek. Most recently, returns on Butte, Mill, and Deer creeks have been the lowest since prior to 2000, with the 2008 estimate on Butte Creek at 3,935, 362 on Mill Creek and 140 on Deer Creek.

(2) Viable Salmonid Population Summary for Central Valley Spring-Run Chinook

Salmon. The following provides the evaluation of the likelihood of viability for the threatened spring-run ESU based on the VSP parameters of abundance, productivity, spatial structure, and diversity.

Abundance. The CV spring-run Chinook salmon ESU has experienced a trend of increasing abundance in some natural populations, most dramatically in the Butte Creek population (Good *et al.* 2005). There has been more opportunistic utilization of migration-dependent streams overall. The Feather River Hatchery (FRH) spring-run stock has been included in the ESU based on its genetic linkage to the natural population and the potential development of a conservation strategy for the hatchery program.

Productivity. The 5-year geometric mean for the extant Butte, Deer, and Mill Creek spring-run populations ranges from 491 to 4,513 fish (Good *et al.* 2005), indicating increasing productivity over the short-term and projected as likely to continue (Good *et al.* 2005). The productivity of the Feather River and Yuba River populations and contribution to the CV spring-run ESU currently is unknown.

Spatial Structure. Spring-run Chinook salmon presence has been reported more frequently in several upper Central Valley creeks, but the sustainability of these runs is unknown. Butte Creek spring-run cohorts have recently utilized all available habitat in the creek; the population cannot expand further and it is unknown if individuals have opportunistically migrated to other systems. The spatial structure of the spring-run ESU has been seriously compromised by the extirpation of all San Joaquin River basin spring-run populations.

Diversity. The CV spring-run ESU fails to meet the "representation and redundancy rule," since the Northern Sierra Nevada is the only diversity group in the spring-run ESU that contains demonstrably viable populations out of at least 3 diversity groups that historically contained them. Independent populations of spring-run only occur within the Northern Sierra Nevada diversity group. The Northwestern California diversity group contains a few ephemeral populations of spring-run that are likely dependent on the Northern Sierra Nevada populations for their continued existence. The spring-run populations that historically occurred in the Basalt and Porous Lava, and Southern Sierra Nevada, diversity groups have been extirpated. Over the long term, the three remaining independent populations are considered to be vulnerable to catastrophic events, such as volcanic eruptions from Mount Lassen or large forest fires due to the close proximity of their headwaters to each other. Drought is also considered to pose a significant threat to the viability of the spring-run populations in the Deer, Mill and Butte Creek watersheds due to their close proximity to each other. Feather River spring-run have introgressed with the fall-run, and it appears that the Yuba River population may have been impacted by FRH fish straying into the Yuba River. Additionally, the diversity of the spring-run ESU has been

further reduced with the loss of the San Joaquin River basin spring-run populations.

Butte Creek and Deer Creek spring-run are at low risk of extinction, satisfying both population viability analysis and other viability criteria. Mill Creek is at moderate extinction risk according to the PVA, but appear to satisfy the other viability criteria for low risk status (Lindley *et al.* 2007). Spring-run fail the representation and redundancy rule for ESU viability, as their current distribution has been severely constricted. Therefore, spring-run are at moderate risk of extinction over an extended period of time.

2. CV steelhead

a. General Life History

Steelhead can be divided into two life history types, summer-run steelhead and winter-run steelhead, based on their state of sexual maturity at the time of river entry and the duration of their spawning migration, stream-maturing and ocean-maturing. Only winter steelhead currently are found in California Central Valley rivers and streams (McEwan and Jackson 1996), although there are indications that summer steelhead were present in the Sacramento River system prior to the commencement of large-scale dam construction in the 1940s (Interagency Ecological Program (IEP) Steelhead Project Work Team 1999). At present, summer steelhead are found only in North Coast drainages, mostly in tributaries of the Eel, Klamath, and Trinity river systems (McEwan and Jackson 1996).

CV steelhead generally leave the ocean from August through April (Busby *et al.* 1996) and enter freshwater from August to November and spawn from December to April in small streams and tributaries where cool, well oxygenated water is available year-round (Table 3; Williams 2006; Hallock *et al.* 1961; McEwan and Jackson 1996). Timing of upstream migration is correlated with higher flow events, such as freshets or sand bar breaches, and associated lower water temperatures. Unlike Pacific salmon, steelhead are iteroparous, or capable of spawning more than once before death (Busby *et al.* 1996). However, it is rare for steelhead to spawn more than twice before dying; most that do so are females (Busby *et al.* 1996). Iteroparity is more common among southern steelhead populations than northern populations (Busby *et al.* 1996). Although one-time spawners are the great majority, Shapolov and Taft (1954) reported that repeat spawners are relatively numerous (17.2 percent) in California streams.

Spawning occurs during winter and spring months. The length of time it takes for eggs to hatch depends mostly on water temperature. Hatching of steelhead eggs in hatcheries takes about 30 days at 51 degrees Fahrenheit (F). Fry emerge from the gravel usually about four to six weeks after hatching, but factors such as redd depth, gravel size, siltation, and temperature can speed or retard this time (Shapovalov and Taft 1954). Newly emerged fry move to the shallow, protected areas associated with the stream margin (McEwan and Jackson 1996) and they soon move to other areas of the stream and establish feeding locations, which they defend (Shapovalov and Taft 1954).

Table 3. The temporal occurrence of adult and juvenile Central Valley steelhead in the Central Valley.

Adult Location	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Sacramento River basin[1, 2]												
Sacramento River at Red Bluff[2, 3]												
Mill, Deer Creeks[4]												
Sacramento River at Fremont Weir[6]												
San Joaquin River[7]												
Juvenile Location	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Sacramento River[1, 2]												
Sacramento River at Knights Landing[2, 8]												
Sacramento River at Knights Landing[9]												
Chipps Island (wild)[10]												
Mossdale[8]												
Woodbridge Dam[11]												
Stanislaus River at Caswell[12]												
Sacramento River at Hood[13]												

Relative Abundance: =High =Medium =Low

Sources: [1] Hallock (1961); [2] McEwan (2001); [3] USFWS unpublished data; [4] CDFG (1995); [5] Hallock *et al.* (1957); [6] Bailey (1954); [7] CDFG Steelhead Report Card Data; [8] CDFG unpublished data; [9] Snider and Titus (2000); [10] Nobriga and Cadrett (2003); [11] Jones & Stokes Associates, Inc. (2002); [12] S.P. Cramer and Associates, Inc. (2000); [13] Schaffter (1980)

Steelhead rearing during the summer takes place primarily in higher velocity areas in pools, although young-of-the-year also are abundant in glides and riffles. Productive steelhead habitat is characterized by complexity, primarily in the form of large and small woody debris. Cover is an important habitat component for juvenile steelhead both as velocity refugia and as a means of avoiding predation (Meehan and Bjornn 1991).

Juvenile steelhead emigrate episodically from natal streams during fall, winter, and spring high flows. Emigrating CV steelhead use the lower reaches of the Sacramento River and the Delta for rearing and as a migration corridor to the ocean. Juvenile CV steelhead feed mostly on drifting aquatic organisms and terrestrial insects and will also take active bottom invertebrates (Moyle 2002). Some may utilize tidal marsh areas, non-tidal freshwater marshes, and other shallow water areas in the Delta as rearing areas for short periods prior to their final emigration to the sea. Hallock *et al.* (1961) found that juvenile steelhead in the Sacramento River basin migrate downstream during most months of the year, but the peak period of emigration occurred in the spring with a much smaller peak in the fall. Nobriga and Cadrett (2003) also have verified these temporal findings based on analysis of captures at Chipps Island.

(1) Population Dynamics. Historic CV steelhead run sizes are difficult to estimate given the paucity of data, but may have approached one to two million adults annually (McEwan 2001). By the early 1960s the steelhead run size had declined to about 40,000 adults (McEwan 2001). Over the past 30 years, the naturally-spawned steelhead populations in the upper Sacramento River have declined substantially. Hallock *et al.* (1961) estimated an average of 20,540 adult steelhead through the 1960s in the Sacramento River, upstream of the Feather River. Steelhead counts at the RBDD declined from an average of 11,187 for the period of 1967 to 1977, to an average of approximately 2,000 through the early 1990s, with an estimated total annual run size for the entire Sacramento-San Joaquin system, based on RBDD counts, to be no more than 10,000 adults (McEwan and Jackson 1996, McEwan 2001). Steelhead escapement surveys at RBDD ended in 1993 due to changes in dam operations.

Recent estimates from trawling data in the Delta indicate that approximately 100,000 to 300,000 (mean 200,000) smolts emigrate to the ocean per year, representing approximately 3,600 female steelhead spawners in the Central Valley basin (Good *et al.* 2005). This can be compared with McEwan's (2001) estimate of one million to two million spawners before 1850, and 40,000 spawners in the 1960s.

Existing wild steelhead stocks in the Central Valley are mostly confined to the upper Sacramento River and its tributaries, including Antelope, Deer, and Mill creeks and the Yuba River. Populations may exist in Big Chico and Butte creeks and a few wild steelhead are produced in the American and Feather rivers (McEwan and Jackson 1996). Recent snorkel surveys (1999 to 2002) indicate that steelhead are present in Clear Creek (J. Newton, USFWS, pers. comm. 2002, as reported in Good *et al.* 2005). Because of the large resident *O. mykiss* population in Clear Creek, steelhead spawner abundance has not been estimated.

Until recently, CV steelhead were thought to be extirpated from the San Joaquin River system. Recent monitoring has detected small self-sustaining populations of steelhead in the Stanislaus, Mokelumne, and Calaveras rivers, and other streams previously thought to be devoid of steelhead (McEwan 2001). On the Stanislaus River, steelhead smolts have been captured in rotary screw traps at Caswell State Park and Oakdale each year since 1995 (S.P. Cramer and Associates Inc. 2000, 2001).

It is possible that naturally-spawning populations exist in many other streams but are undetected due to lack of monitoring programs (JEP Steelhead Project Work Team 1999). Incidental catches and observations of steelhead juveniles also have occurred on the Tuolumne and Merced rivers during fall-run Chinook salmon monitoring activities, indicating that steelhead are widespread throughout accessible streams and rivers in the Central Valley (Good *et al.* 2005). CDFG staff has prepared juvenile migrant CV steelhead catch summaries on the San Joaquin River near Mossdale representing migrants from the Stanislaus, Tuolumne, and Merced rivers. Based on trawl recoveries at Mossdale between 1988 and 2002, as well as rotary screw trap efforts in all three tributaries, CDFG staff stated that it is "clear from this data that rainbow trout do occur in all the tributaries as migrants and that the vast majority of them occur on the Stanislaus River" (Letter from Dean Marston, CDFG, to Madelyn Martinez, NMFS, January 9, 2003b). The documented returns on the order of single fish in these tributaries suggest that existing populations of CV steelhead on the Tuolumne, Merced, and lower San Joaquin rivers are severely depressed.

Lindley *et al.* (2006b) indicated that prior population census estimates completed in the 1990s found the CV steelhead spawning population above RBDD had a fairly strong negative population growth rate and small population size. Good *et al.* (2005) indicated the decline was continuing as evidenced by new information (Chipps Island trawl data). CV steelhead populations generally show a continuing decline, an overall low abundance, and fluctuating return rates.

(2) Viable Salmonid Population Summary for Central Valley Steelhead. In order to determine the current likelihood of viability of the CV steelhead DPS, we used the historical population structure of CV steelhead presented in Lindley *et al.* (2006) and the concept of VSP for evaluating populations described by McElhany *et al.* (2000). While McElhany *et al.* (2000) introduced and described the concept of VSP, Lindley *et al.* (2007) applied the concept to the CV steelhead DPS. The following provides the evaluation of the likelihood of viability for the threatened CV steelhead DPS based on the VSP parameters of abundance, productivity, spatial structure, and diversity.

Abundance. All indications are that natural CV steelhead have continued to decrease in abundance and in the proportion of natural fish over the past 25 years (Good *et al.* 2005); the long-term trend remains negative. There has been little steelhead population monitoring despite 100 percent marking of hatchery steelhead since 1998. Hatchery production and returns are far greater than those of natural fish and include significant numbers of non-DPS-origin Eel River steelhead stock.

Productivity. An estimated 100,000 to 300,000 natural juvenile steelhead are estimated to leave the Central Valley annually, based on rough calculations from sporadic catches in trawl gear (Good *et al.* 2005). Concurrently, one million in-DPS hatchery steelhead smolts and another half million out-of-DPS hatchery steelhead smolts are released annually in the Central Valley. The estimated ratio of non-clipped to clipped steelhead has decreased from 0.3 percent to less than 0.1 percent, with a net decrease to one-third of wild female spawners from 1998 to 2000 (Good *et al.* 2005).

Spatial Structure. Steelhead appear to be well-distributed where found throughout the Central Valley (Good *et al.* 2005). Until recently, there was very little documented evidence of steelhead due to the lack of monitoring efforts. Since 2000, steelhead have been confirmed in the Stanislaus and Calaveras rivers.

Diversity. Analysis of natural and hatchery steelhead stocks in the Central Valley reveal genetic structure remaining in the DPS (Nielsen *et al.* 2003). There appears to be a great amount of gene flow among upper Sacramento River basin stocks, due to the post-dam, lower basin distribution of steelhead and management of stocks. Recent reductions in natural population sizes have created genetic bottlenecks in several CV steelhead stocks (Good *et al.* 2005; Nielsen *et al.* 2003). The out-of-basin steelhead stocks of the Nimbus and Mokelumne River hatcheries are not included in the CV steelhead DPS.

Lindley *et al.* (2007) indicated that prior population census estimates completed in the 1990s found the CV steelhead spawning population above RBDD had a fairly strong negative population growth rate and small population size. Good *et al.* (2005) indicated the decline was continuing as evidenced by new information (Chipps Island trawl data). CV steelhead populations generally show a continuing decline, an overall low abundance, and fluctuating return rates. The future of CV steelhead is uncertain due to limited data concerning their status. However, Lindley *et al.* (2007) concluded that there is sufficient evidence to suggest that the DPS is at moderate to high risk of extinction.

3. Southern DPS of North American Green Sturgeon

a. General Life History

North American green sturgeon are widely distributed along the Pacific Coast and have been documented offshore from Ensenada Mexico to the Bering Sea and found in rivers from British Columbia to the Sacramento River (Moyle 2002). As is the case for most sturgeon, North American green sturgeon are anadromous; however, they are the most marine-oriented of the sturgeon species (Moyle 2002). In North America, spawning populations of the anadromous green sturgeon currently are found in only three river systems, the Sacramento and Klamath rivers in California and the Rogue River in southern Oregon.

Two green sturgeon DPSs were identified based on evidence of spawning site fidelity (indicating multiple DPS tendencies), and on the preliminary genetic evidence that indicate differences at

least between the Klamath River and San Pablo Bay samples (Adams *et al.* 2002). The Northern DPS includes all green sturgeon populations starting with the Eel River and extending northward. The southern DPS would include all green sturgeon populations south of the Eel River with the only known spawning population being in the Sacramento River.

The southern DPS of North American green sturgeon life cycle can be broken into three distinct phases based on developmental stage and habitat use: (1) year-round juveniles, (2) pre-and post-spawning adults, and (3) adult and sub-adult summer residents.

Southern DPS green sturgeon adults begin their upstream spawning migrations into the San Francisco Bay in March, reach Knights Landing during April, and spawn between March and July (Heublein *et al.* 2006). Peak spawning is believed to occur between April and June and thought to occur in deep turbulent pools (Adams *et al.* 2002). Substrate is likely large cobble but can range from clean sand to bedrock (USFWS 2002). Newly hatched green sturgeon are approximately 12.5 to 14.5 mm in length. According to Heublein (2006), all adults leave the Sacramento River prior to September 1.

Adult green sturgeon in the San Francisco Estuary make significant long-distance movements with distinct directionality and are not related to salinity, current, or temperature, but resource availability (Kelley *et al.* 2007). The majority of green sturgeon in the Rogue River emigrated from freshwater habitat in December after water temperatures dropped (Erickson *et al.* 2002). Green sturgeon were most often found at depths greater than 5 meters with low or no current during summer and autumn months (Erickson *et al.* 2002). Holding in deep pools is a way to conserve energy and utilize abundant food resources. Based on captures of adult green sturgeon in holding pools on the Sacramento River above the Glenn-Colusa Irrigation District (GCID) diversion (RM 205), the documented presence of adults in the Sacramento River during the spring and summer months, and the presence of larval green sturgeon in late summer in the lower Sacramento River indicating spawning ocurrence, it appears adult green sturgeon could possibly utilize a variety of freshwater and brackish habitats for up to nine months of the year (Beamesderfer *et al.* 2004; S.P. Cramer & Associates, Inc., pers. comm. 2006).

Based on the distribution of sturgeon eggs, larva, and juveniles in the Sacramento River, CDFG (2002) indicated that southern DPS of green sturgeon spawn in late spring and early summer above Hamilton City possibly to Keswick Dam. Adult green sturgeon are believed to spawn every 3 to 5 years and reach sexual maturity only after several years of growth (Table 4; CDFG 2002). Adult female green sturgeon produce between 60,000 and 140,000 eggs each reproductive cycle, depending on body size, with a mean egg diameter of 4.3 mm (Moyle *et al.* 1992; Van Eenennaam *et al.* 2001).

After approximately 10 days larvae begin feeding, growing rapidly, and young green sturgeon appear to rear for the first 1 to 2 months in the Sacramento River between Keswick Dam and Hamilton City (CDFG 2002). Juvenile green sturgeon first appear in USFWS sampling efforts at RBDD in June and July at lengths ranging from 24 to 31 mm fork length (CDFG 2002; USFWS 2002). The mean yearly total length of post-larval green sturgeon captured in rotary screw traps

Table 4. The temporal occurrence of adult, larval and post-larval, juvenile, and coastal migrant Southern DPS of North American green sturgeon.

Adult Location (≥13 yrs for females, ≥9 yrs for males)	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Upper Sac River[1, 2, 3]												
SF Bay Estuary[4, 8]												
Larval / Post-Larval Location (≤10 mos)	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
RBDD, Sac River[5]												
GCID, Sac River[5]												
Juvenile Location (>10 mos and ≤3 yrs)												
South Delta*[6]												
Sac-SJ Delta[6]												
Sac-SJ Delta[5]												
Suisun Bay[5]												
Coastal Migrant Location (3-13 yrs for females, 3-9 yrs for males)												
Pacific Coast[3, 7]												

Relative Abundance: =High =Medium =Low

Sources: [1] USFWS (2002); [2] Moyle *et al.* (1992); [3] Adams *et al.* (2002) and NMFS (NMFS 2005a); [4] Kelley *et al.* (2006); [5] CDFG (2002); [6] IEP Relational Database, fall midwater trawl green sturgeon captures from 1969 to 2003; [7] Nakamoto *et al.* (1995); [8] Heublein (2006) *Fish Facility salvage operations

at the RBDD ranged from 26 mm to 34 mm between 1995 and 2000 indicating they are approximately 2 weeks old. The mean yearly total length of post-larval green sturgeon captured in the GCID rotary screw trap, approximatley 30 miles downstream of RBDD, ranged from 33 mm to 44 mm between 1997 and 2005 (CDFG, unpublished data) indicating they are approximately 3 weeks old (Van Eenennaam *et al.* 2001).

Green sturgeon larvae do not exhibit the initial pelagic swim-up behavior characteristic of other *Acipenseridae*. They are strongly oriented to the bottom and exhibit nocturnal activity patterns. Under laboratory conditions green sturgeon larvae cling to the bottom during the day and move into the water column at night (Van Eenennaam *et al.* 2001). After six days, the larvae exhibit nocturnal swim-up activity (Deng *et al.* 2002) and nocturnal downstream migrational movements (Kynard *et al.* 2005). Juvenile green sturgeon continue to exhibit nocturnal behavior beyond the metamorphosis from larvae to juvenile stages. Kynard *et al.*'s (2005) laboratory studies indicated that juvenile fish continued to migrate downstream at night for the first six months of life. When ambient water temperatures reached 46 degrees F, downstream migrational behavior diminished and holding behavior increased. These data suggests that 9-to 10-month-old fish would hold over in their natal rivers during the ensuing winter following hatching, but at a location downstream of their spawning grounds. Juvenile green sturgeon have been salvaged at the Harvey O. Banks Pumping Plant and the John E. Skinner Fish Facility (Fish Facilities) in the South Delta, and captured in trawling studies by the CDFG during all months of the year (CDFG 2002). The majority of these fish were between 200 and 500 mm indicating they were from 2 to 3 years of age based on Klamath River age distribution work by Nakamoto *et al.* (1995). The lack of a significant proportion of juveniles smaller than approximately 200 mm in Delta captures indicate juvenile Southern DPS North American green sturgeon likely hold in the mainstem Sacramento River as suggested by Kyndard *et al.* (2005).

(1) Population Dynamics. Limited population abundance information comes from incidental captures of North American green sturgeon from the white sturgeon monitoring program by the CDFG sturgeon tagging program (CDFG 2002). By comparing ratios of white sturgeon to green sturgeon captures CDFG provides estimates of adult and sub-adult North American green sturgeon abundance. Estimated abundance between 1954 and 2001 ranged from 175 fish to more than 8,000 per year and averaged 1,509 fish per year. Unfortunately there are many biases and errors associated with these data and CDFG does not consider these estimates reliable. Fish monitoring efforts at RBDD and GCID on the upper Sacramento River have captured between 0 and 2,068 juvenile North American green sturgeon per year (Adams *et al.* 2002). The only existing information regarding changes in the abundance of the Southern DPS of green sturgeon includes changes in abundance at the John E. Skinner Fish Facility between 1968 and 2001. The average number of North American green sturgeon taken per year at the State Facility prior to 1986 was 732; from 1986 on, the average per year was 47 (70 FR 17386). For the Harvey O. Banks Pumping Plant, the average number prior to 1986 was 889; from 1986 to 2001 the average was 32 (70 FR 17386). In light of the increased exports, particularly during the previous 10 years, it is clear that the abundance of the Southern DPS of North American green sturgeon is dropping. Additional analysis of North American green and white sturgeon taken at the Fish Facilities indicate that take of both North American green and white sturgeon per acre-foot of

water exported has decreased substantially since the 1960s (70 FR 17386). Catches of sub-adult and adult North American green sturgeon by the IEP between 1996 and 2004 ranged from 1 to 212 green sturgeon per year (212 occurred in 2001); however, the portion of the Southern DPS of North American green sturgeon is unknown as these captures were primarily located in San Pablo Bay. Recent spawning population estimates using sibling based genetics by Israel (2006) indicate a maximum spawning population of 32 spawners in 2002, 64 in 2003, 44 in 2004, 92 in 2005, and 124 in 2006 above RBDD (with an average of 71). Based on the length and estimated age of post-larvae captured at RBDD (approximately two weeks of age) and GCID (downstream, approximately three weeks of age), it appears some of Southern DPS North American green sturgeon are spawning above RBDD. Note, there are many assumptions with this interpretation (*i.e.*, equal sampling efficiency and distribution of post-larvae across channels), and this information should be considered cautiously.

There are at least two records of confirmed adult sturgeon observation in the Feather River (Beamesderfer *et al.* 2004), however, there are no observations of juvenile or larval sturgeon even prior to the 1960s when Oroville Dam was built (NMFS 2005a). There are also unconfirmed reports that green sturgeon may spawn in the Feather River during high flow years (CDFG 2002).

Spawning in the San Joaquin River system has not been recorded, but alterations of the San Joaquin River tributaries (Stanislaus, Tuolumne, and Merced rivers) and its mainstem occurred early in the European settlement of the region. During the later half of the 1800s impassable barriers were built on these tributaries where the water courses left the foothills and entered the valley floor. Therefore, these low elevation dams have blocked potentially suitable spawning habitats located further upstream for over a century. Additional destruction of riparian and stream channel habitat by industrialized gold dredging further disturbed any valley floor habitat that was still available for sturgeon spawning. It is likely that both white and green sturgeon utilized the San Joaquin River basin for spawning prior to the onset of European influence, based on past use of the region by populations of CV spring-run Chinook salmon and CV steelhead. These two populations of salmonids have either been extirpated or greatly diminished in their use of the San Joaquin River basin over the past two centuries (Adams *et al.* 2002; Moyle 2002; Lindley *et al.* 2004).

(2) Population Viability Summary for the Southern DPS of North American Green Sturgeon. The Southern DPS of North American green sturgeon was not included or analyzed in recent efforts to characterize the status and viability of Central Valley salmonid populations (Lindley *et al.* 2006; Good *et al.* 2005). However, the following summaries have been compiled from the best available data and information on North American green sturgeon to provide a general synopsis of the viability parameters for this DPS.

Abundance. Currently, there are no reliable data on population sizes, and data on population trends are also lacking. Fishery data collected at Federal and State pumping facilities in the Delta indicate a decreasing trend in abundance between 1968 and 2006 (70 FR 17386).

Productivity. There is insufficient information to evaluate the productivity of green sturgeon. However, as indicated above, there appears to be a declining trend in abundance, which indicates low to negative productivity.

Spatial Structure. Current data indicate that the Southern DPS of North American Green Sturgeon is comprised of a single population that spawns in the Sacramento River above and below RBDD. Although some individuals have been observed in the Feather and Yuba rivers, it is not yet known if these fish represent separate spawning populations. Therefore, the apparent presence of a single reproducing population puts the DPS at risk, due to extremely limited spatial structure.

Diversity. Green sturgeon genetic analyses shows strong differentiation between northern and southern populations, and therefore, the species was divided into Northern and Southern DPS's. However, the genetic diversity of the Southern DPS is not well understood.

The majority of the NMFS Biological Review Team (BRT) (NMFS 2005) felt that the blockage of green sturgeon spawning from what were certainly their historic spawning areas above Shasta Dam and the accompanying decrease in spawning habitat in the Feather River with the construction of Oroville Dam made the Southern green sturgeon DPS likely to become endangered in the foreseeable future throughout all of its range. Due to substantial habitat loss, and the decline in abundance observed at water pumping facilities, and the occurrence of only one breeding populations, the Southern DPS of North American green sturgeon remains at a moderate to high risk of extinction.

C. Factors Affecting the Species and Critical Habitat

Water development, water quality, over-harvesting, and disease and predation are some of the many issues affecting the decline of listed anadromous fish species in California. Hydropower, flood control, and water supply dams of the Federal Central Valley Project (CVP), State Water Project (SWP), and other municipal and private entities have permanently blocked or hindered salmonid and green sturgeon access to historical spawning and rearing grounds. Clark (1929) estimated that originally there were 6,000 linear miles of salmon habitat in the Central Valley system and that 80 percent of this habitat had been lost by 1928. Yoshiyama *et al.* (1996) calculated that roughly 2,000 linear miles of salmon habitat was actually available before dam construction and mining, and concluded that 82 percent is not accessible today.

As a result of migrational barriers, spring-run Chinook salmon, and steelhead populations have been confined to lower elevation mainstems that historically only were used for migration. Higher temperatures at these lower elevations during late-summer and fall are a major stressor to adult and juvenile salmonids. Thus, population abundances have declined in these streams due to decreased quantity and quality of spawning and rearing habitat. Green sturgeon populations were likely also affected by barriers and alterations to the natural hydrology. In particular, the RBDD blocked all access to the primary spawning habitat in the Sacramento River for many years under the old operational procedures, and continues to block a significant portion of the

adult spawning run under current operationl procedures.

Water diversions for irrigated agriculture, municipal and industrial use, and managed wetlands are found throughout the Central Valley. Thousands of small and medium-size water diversions exist along the Sacramento and San Joaquin Rivers, and their tributaries. Although efforts have been made in recent years to screen some of these diversions, many remain unscreened. Depending on the size, location, and season of operation, these unscreened diversions entrain and kill many life stages of aquatic species, including juvenile salmonids and green sturgeon. For example, as of 1997, 98.5 percent of the 3,356 diversions included in a Central Valley database were either unscreened or screened insufficiently to prevent fish entrainment (Herren and Kawasaki 2001).

Levee development in the Central Valley affects spawning habitat, freshwater rearing habitat, freshwater migration corridors, and estuarine habitat PCEs. The construction of levees disrupts the natural processes of the river, resulting in a multitude of habitat-related effects. Many of these levees use angular rock (riprap) to armor the bank from erosion. The effects of channelization, and riprapping, include the alteration of river hydraulics and cover along the bank as a result of changes in bank configuration and structural features (Stillwater Sciences 2006). These changes affect the quantity and quality of nearshore habitat for juvenile salmonids and have been thoroughly studied (USFWS 2000; Schmetterling *et al.* 2001; Garland *et al.* 2002). Simple slopes protected with rock revetment generally create nearshore hydraulic conditions characterized by greater depths and faster, more homogeneous water velocities than occur along natural banks. Higher water velocities typically inhibit deposition and retention of sediment and woody debris. These changes generally reduce the range of habitat conditions typically found along natural shorelines, especially by eliminating the shallow, slow-velocity river margins used by juvenile fish as refuge and escape from fast currents, deep water, and predators (Stillwater Sciences 2006).

Increased sedimentation resulting from agricultural and urban practices within the Central Valley is one of the primary causes of salmonid habitat degradation (NMFS 1996a). Sedimentation can adversely affect salmonids during all freshwater life stages by: clogging or abrading gill surfaces, adhering to eggs, hampering fry emergence (Phillips and Campbell 1961), burying eggs or alevins, scouring and filling in pools and riffles, reducing primary productivity and photosynthesis activity (Cordone and Kelley 1961), and affecting intergravel permeability and dissolved oxygen (DO) levels. Excessive sedimentation over time can cause substrates to become embedded, which reduces successful salmonid spawning and egg and fry survival (Waters 1995). In addition, urban storm water and agricultural runoff may be contaminated with pesticides, oil, grease, heavy metals, polycyclic aromatic hydrocarbons (PAHs), and other organics and nutrients (Regional Board 1998) that can potentially destroy aquatic life necessary for salmonid and green sturgeon survival (NMFS 1996a, b). Point source (PS) and non-point source (NPS) pollution occurs in almost every area where urbanization activity influences the watershed. Impervious surfaces (*i.e.*, concrete, asphalt, and buildings) reduce water infiltration and increase runoff, thus creating greater flood hazard (NMFS 1996a, b). Flood control and land drainage schemes may increase the flood risk downstream by concentrating runoff. A flashy

discharge pattern results in increased bank erosion with subsequent loss of riparian vegetation, undercut banks and stream channel widening. In addition to the PS and NPS inputs from urban runoff, juvenile salmonids and green sturgeon are exposed to increased water temperatures as a result of thermal inputs from municipal, industrial, and agricultural discharges.

These human activities have led to increased water temperatures, decreased DO levels, and increased turbidity and contaminant loads have degraded the quality of the aquatic habitat for the rearing and migration of salmonids and green sturgeon. Most anthropogenic chemicals and waste materials including toxic organic and inorganic chemicals eventually accumulate in the sediment (Ingersoll 1995). Direct exposure to contaminated sediments may cause deleterious effects to listed salmonids and green sturgeon. This may occur if a fish swims through a plume of the resuspended sediments or rests on contaminated substrate and absorbs the toxic compounds through one of several routes: dermal contact, ingestion, or uptake across the gills. Elevated contaminant levels may be found in localized "hot spots" where discharge occurs or where river currents deposit sediment loads. Sediment contaminant levels can thus be significantly higher than the overlying water column concentrations (Environmental Protection Agency [EPA] 1994). However, the more likely route of exposure to salmonids and sturgeon is through the food chain, when fish feed on organisms that are contaminated with toxic compounds. Prey species become contaminated either by feeding on the detritus associated with the sediments or dwelling in the sediment itself. Therefore, the degree of exposure to the forage base they consume. Response of salmonids and green sturgeon to contaminated sediments is similar to water borne exposures.

Extensive ocean recreational and commercial troll fisheries for Chinook salmon exist along the Northern and Central California coast, and an inland recreational fishery exists in the Central Valley for Chinook salmon and steelhead. Ocean harvest of Central Valley Chinook salmon is estimated using an abundance index, called the Central Valley Index (CVI). The CVI is the ratio of Chinook salmon harvested south of Point Arena (where 85 percent of Central Valley Chinook salmon are caught) to escapement (adult spawner populations that have "escaped" the ocean fisheries and made it into the rivers to spawn). CWT returns indicate that Sacramento River salmon congregate off the California coast between Point Arena and Morro Bay.

Since 1970, the CVI for Sacramento River winter-run Chinook salmon generally has ranged between 0.50 and 0.80. In 1990, when ocean harvest of winter-run Chinook salmon was first evaluated by NMFS and the Pacific Fisheries Management Council (PFMC), the CVI harvest rate was near the highest recorded level at 0.79. NMFS determined in a 1991 biological opinion that continuance of the 1990 ocean harvest rate would not prevent the recovery of Sacramento River winter-run Chinook salmon. Through the early 1990s, the ocean harvest index was below the 1990 level (*i.e.*, 0.71 in 1991 and 1992, 0.72 in 1993, 0.74 in 1994, 0.78 in 1995, and 0.64 in 1996). In 1996 and 1997, NMFS issued a biological opinion which concluded that incidental ocean harvest of winter-run represented a significant source of mortality to the endangered population, even though ocean harvest was not a key factor leading to the decline of the population. As a result of these biological opinions, measures were developed and implemented by the PFMC, NMFS, and CDFG to reduce ocean harvest by approximately 50 percent. In 2001,

the CVI dropped to 0.27, most likely due to the reduction in harvest and the higher abundance of other salmonids originating from the Central Valley (Good *et al.* 2005).

In-river recreational fisheries historically have taken CV spring-run Chinook salmon throughout the species' range. During the summer, holding adult CV spring-run Chinook salmon are easily targeted by anglers when they congregate in large pools. Poaching also occurs at fish ladders, and other areas where adults congregate; however, the significance of poaching on the adult population is unknown. Specific regulations for the protection of CV spring-run Chinook salmon in Mill, Deer, Butte, and Big Chico Creeks and the Yuba River have been added to the existing CDFG regulations. The current regulations, including those developed for Sacramento River winter-run Chinook salmon provide some level of protection for spring-run fish (CDFG 1998).

There is little information on steelhead harvest rates in California. Hallock *et al.* (1961) estimated that harvest rates for Sacramento River steelhead from the 1953-1954 through 1958-1959 seasons ranged from 25.1 percent to 45.6 percent assuming a 20 percent non-return rate of tags. The average annual harvest rate of adult steelhead above RBDD for the 3-year period from 1991-1992 through 1993-1994 was 16 percent (McEwan and Jackson 1996). Since 1998, all hatchery steelhead have been marked with an adipose fin clip allowing anglers to distinguish hatchery and wild steelhead. Current regulations restrict anglers from keeping unmarked steelhead in Central Valley streams. Overall, this regulation has greatly increased protection of naturally produced adult steelhead; however, the total number of CV steelhead contacted might be a significant fraction of basin-wide escapement, and even low catch-and-release mortality may pose a problem for wild populations (Good *et al.* 2005).

Commercial harvest of white sturgeon results in the incidental bycatch of green sturgeon primarily along the Oregon and Washington coasts and within their coastal estuaries. Oregon, Washington and California have recently prohibited the retention of green sturgeon in their waters for commercial and recreational fisheries. Adams *et al.* (2002, 2007) reported harvest of green sturgeon from California, Oregon, and Washington between 1985 and 2001. Total captures of green sturgeon in the Columbia River Estuary by commercial means ranged from 240 fish per year to 6,000. Catches in Willapa Bay and Grays Harbor by commercial means combined ranged from 9 fish to 2,494 fish per year. Emmett *et al.* (1991) indicated that averages of 4.7 to 15.9 tons of green sturgeon were landed annually in Grays Harbor and Willapa Bay respectively. Overall, captures appeared to be dropping through the years; however, this could be related to changing fishing regulations. Adams *et al.* (2002, 2007) also reported sport fishing captures in California, Oregon, and Washington. Within the San Francisco Estuary, green sturgeon are captured by sport fisherman targeting white sturgeon, particularly in San Pablo and Suisun bays (Emmett *et al.* 1991). However, recent changes to fishing regulations have made it illegal keep green sturgeon for harvest. Based on new research by Israel (2006 and past tagged fish returns reported by CDFG (2002)), a high proportion of green sturgeon present in the Columbia River, Willapa Bay, and Grays Harbor (as much as 80 percent in the Columbia River) may be Southern DPS North American green sturgeon. This indicates a potential threat to the Southern DPS North American green sturgeon population.

Infectious disease is one of many factors that influence adult and juvenile salmonid survival. Salmonids are exposed to numerous bacterial, protozoan, viral, and parasitic organisms in spawning and rearing areas, hatcheries, migratory routes, and the marine environment (NMFS 1996a, 1996b, 1998). Specific diseases such as bacterial kidney disease, *Ceratomyxosis shasta* (C-shasta), columnaris, furunculosis, infectious hematopoietic necrosis, redmouth and black spot disease, whirling disease, and erythrocytic inclusion body syndrome are known, among others, to affect steelhead and Chinook salmon (NMFS 1996a, 1996b, 1998). Very little current or historical information exists to quantify changes in infection levels and mortality rates attributable to these diseases; however, studies have shown that wild fish tend to be less susceptible to pathogens than are hatchery-reared fish. Nevertheless, wild salmonids may contract diseases that are spread through the water column (*i.e.*, waterborne pathogens) as well as through interbreeding with infected hatchery fish. The stress of being released into the wild from a controlled hatchery environment frequently causes latent infections to convert into a more pathological state, and increases the potential of transmission from hatchery reared fish to wild stocks within the same waters.

Accelerated predation also may be a factor in the decline of listed salmonids and green sturgeon. Human-induced habitat changes such as alteration of natural flow regimes and installation of bank revetment and structures such as dams, bridges, water diversions, piers, and wharves often provide conditions that both disorient juvenile fish and attract predators (Stevens 1961; Decato 1978; Vogel *et al.* 1988; Garcia 1989). On the mainstem Sacramento River, high rates of predation are known to occur at the RBDD, Anderson-Cottonwood Irrigation District's (ACID) diversion dam, GCID's diversion facility, areas where rock revetment has replaced natural river bank vegetation, and at South Delta water diversion structures (*e.g.*, Clifton Court Forebay; CDFG 1998). In passing the dam, juveniles are subject to conditions which greatly disorient them, making them highly susceptible to predation by fish or birds. Sacramento pikeminnow (*Ptychocheilus grandis*) and striped bass congregate below the dam and prey on juvenile salmon in the tail waters. The Sacramento pikeminnow is a species native to the Sacramento River basin and has co-evolved with the anadromous salmonids in this system. However, rearing conditions in the Sacramento River today (*e.g.* warm water, low-irregular flow, standing water, and water diversions) compared to its natural state and function decades ago in the pre-dam era, are more conducive to warm water species such as Sacramento pikeminnow and striped bass than to native salmonids.

For listed salmonids and green sturgeon, the construction of high dams for hydropower, flood control, and water supply resulted in the loss of vast amounts of upstream habitat (*i.e.*, approximately 80 percent, or a minimum linear estimate of over 1,000 stream miles), and often resulted in precipitous declines in affected populations. For example, the completion of Friant Dam in 1947 has been linked with the extirpation of spring-run Chinook salmon in the San Joaquin River upstream of the Merced River within just a few years. The reduced populations that remain below Central Valley dams are forced to spawn in lower elevation tailwater habitats of the mainstem rivers and tributaries that were previously not used for this purpose. This habitat is entirely dependent on managing reservoir releases to maintain cool water temperatures suitable

for spawning, and/or rearing. This requirement has been difficult to achieve in all water year types and for all life stages of affected species. CV steelhead, in particular, seem to require the qualities of small tributary habitat similar to what they historically used for spawning; habitat that is largely unavailable to them under the current water management scenario. All salmonid species considered in this consultation have been adversely affected by the production of hatchery fish associated with the mitigation for the habitat lost to dam construction (*e.g.*, from genetic impacts, increased competition, exposure to novel diseases, *etc.*).

Similar to the listed salmonids, the Southern DPS of North American green sturgeon have been negatively impacted by hydroelectric and water storage operations in the Central Valley which ultimately affect the hydrology and accesibility of Central Valley rivers and streams to anadromous fish. Anthropogenic manipulations of the aquatic habitat, such as dredging, bank stabilization, and waste water discharges have also degraded the quality of the Central Valley's waterways for green sturgeon.

IV. ENVIRONEMENTAL BASELINE

The environmental baseline "includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process" (50 CFR §402.02).

A. Status of the Species and Critical Habitat within the Action Area

1. Status of the Species within the Action Area

The action area functions primarily as a migratory corridor for adult and juvenile CV steelhead. All adult CV steelhead originating in the San Joaquin River watershed will have to migrate through the action area in order to reach their spawning grounds and to return to the ocean following spawning. Likewise, all CV steelhead smolts originating in the San Joaquin River watershed will also have to pass through the action area during their emigration to the ocean. The waterways in the action area also are expected to provide some rearing benefit to emigrating steelhead smolts as they move through the action area.

The action area also functions as migratory, holding and rearing habitat for adult and juvenile Southern DPS of North American green sturgeon. Green sturgeon presence in the action area could occur in any month as juveniles, and may reside in freshwater habitats throughout their first few years of growth. Adults are likely to be present in the winter and early spring (outside of in-water work window) as they move through the Delta towards their spawning grounds in the upper Sacramento River watershed.

The following are status summaries of these species and their habitat within the San Joaquin River and action area.

a. Sacramento River Winter-Run Chinook Salmon

The temporal occurrence of Sacramento River winter-run Chinook salmon smolts and juveniles in the action area are best described by the salvage records of the CVP and SWP fish handling facilities. Based on salvage records covering the last 8 years at the CVP and SWP, Sacramento River winter-run Chinook salmon are typically present in the Western and Central Delta action area starting in December. Their presence peaks in March and then rapidly declines from April through June. Nearly 50 percent of the average annual salvage of Sacramento River winter-run Chinook salmon juveniles occurs in March (48.8 percent). Salvage in April accounts for only 2.8 percent of the average annual salvage and falls to less than 1 percent for May and June combined. The presence of juvenile Sacramento River winter-run Chinook salmon in the Western and Central Delta is a function of river flows on the Sacramento River, where the fish are spawned, and the demands for water diverted by the SWP and CVP facilities. When conditions on the Sacramento River are conducive to stimulating outmigrations of juvenile Sacramento River winter-run Chinook salmon, the draw of the CVP and SWP pumping facilities pulls a portion of these emigrating fish through one of the four access points on the Sacramento River (Georgiana Slough, the Delta Cross Channel, Three Mile Slough, and the San Joaquin River via Broad Slough) into the channels of the Western and Central Delta, including the lower sections of the San Joaquin River. The combination of pumping rates and tidal flows moves these fish into the western delta portion of the action area. When the combination of pumping rates and fish movements are high, significant numbers of juvenile Sacramento River winter-run Chinook salmon are drawn into the action area.

b. *CV spring-Run Chinook salmon*

Like the Sacramento River winter-run Chinook salmon, the presence of juvenile CV spring-run Chinook salmon in the action area is under the influence of the CVP and SWP water diversions and the flows on the Sacramento River and its tributary watersheds. Currently, all known populations of CV spring-run Chinook salmon inhabit the Sacramento River watershed. The San Joaquin River watershed populations have been extirpated, with the last known runs on the San Joaquin River being extirpated in the late 1940s and early 1950s by the construction of Friant Dam and the opening of the Kern-Friant irrigation canal.

Juvenile CV spring-run Chinook salmon first begin to appear in the San Joaquin River basin in January. A significant presence of fish does not occur until March (20.1 percent of average annual salvage) and peaks in April (66.8 percent of average annual salvage). By May, the salvage of CV spring-run Chinook salmon juveniles declines sharply (11.5 percent of average annual salvage) and essentially ends by the end of June (1.3 percent of average annual salvage).

c. *CV steelhead*

The CV steelhead DPS occurs in both the Sacramento River and the San Joaquin River watersheds. However the spawning population of fish is much greater in the Sacramento River

watershed and accounts for nearly all of the DPS' population. Like Sacramento River Chinook salmon, Sacramento River steelhead can be drawn into the Central and Western Delta by the actions of the CVP and SWP water diversion facilities. Small, remnant populations of CV steelhead are known to occur on the Stanislaus River and the Tuolumne River and their presence is assumed on the Merced River due to proximity, similar habitats, historical presence, and recent otolith chemistry studies verifying at least one steelhead in the limited samples collected from the river. CV steelhead smolts first start to appear in the action area in November based on the records from the CVP and SWP fish salvage facilities. Their presence increases through December and January (22.5 percent of average annual salvage) and peaks in February (34.6 percent) and March (31.6 percent) before rapidly declining in April (7.8 percent). By June, the emigration has essentially ended, with only a small number of fish being salvaged through the summer at the CVP and SWP.

Steelhead smolt production originating in the San Joaquin River basin (all natural) are monitored by Kodiak trawls conducted by the USFWS and CDFG on the mainstem of the San Joaquin River just above the Head of Old River Barrier during the Vernalis Adaptive Management Program (VAMP) experimental period. These efforts routinely catch low numbers of outmigrating steelhead smolts from the San Joaquin Basin. Monitoring is less frequent prior to the VAMP, therefore emigrating steelhead smolts have a lower probability of being detected. Rotary screw trap (RST) monitoring on the Stanislaus River at Caswell State Park and further upriver near the City of Oakdale indicate that smolt sized fish start emigrating downriver in January and can continue through late May. Fry sized fish (30 to 50 mm) are captured at the Oakdale RST starting as early as April and continuing through June. Adult escapement numbers have been monitored for the past several years with the installation of an Alaskan style weir on the lower Stanislaus River near Riverbank. Typically, very few adult steelhead have been observed moving upstream past the weir. However, in 2006 to 2007, the weir was left in through the winter and spring and seven adult steelhead were counted moving upstream. Natural steelhead production also occurs on the Calaveras River, which empties into the San Joaquin River. Monitoring is conducted by RSTs in the upper reaches of the river below New Hogan Dam. Emigration of smolts from this watershed is highly correlated with stream flow conditions, and passage of smolts through the valley floor section of the watercourse is predicated on the river maintaining connectivity with the Delta. Steelhead smolt migrations are likewise monitored at several sites on the Sacramento River by the USFWS and CDFG. An important monitoring station for tracking smolt numbers is the Chipps Island station in the western Delta. This monitoring site collects steelhead smolts produced within the entire Central Valley basin.

d. *Southern DPS of North American Green Sturgeon*

Juvenile green sturgeon from the Southern DPS are routinely collected at the SWP and CVP salvage facilities throughout the year. However, numbers are considerably lower than for other species of fish monitored at the facilities. Based on the salvage records from 1981 through 2007, green sturgeon may be present during any month of the year, and have been particularly prevalent during July and August. The sizes of these fish are less than 1 meter and average 330 mm with a range of 136 mm to 774 mm. The size range indicates that these are sub-adult fish rather than

adult or larval/juvenile fish. It is believed that these sub-adult fish utilize the Delta for rearing for up to a period of approximately 3 years. The proximity of the CVP and SWP facilities to the action area would indicate that sub-adult green sturgeons have a strong potential to be present within the action area during the installation of the piles in the San Joaquin River. Juvenile green sturgeon have also previously been captured at Santa Clara Shoals during fish monitoring studies (Radtke 1966).

2. Status of Critical Habitat Within the Action Area

The action area is predominately within the San Joaquin Delta sub-basin (Hydrologic Unit [HU] # 18040003) and is included in the critical habitat designated for CV steelhead and proposed critical habitat for North American green sturgeon. A small portion of the western Delta around the confluence of the Sacramento and San Joaquin Rivers and waters westwards towards Chipps Island as well as the mainstem Sacramento River are also designated critical habitat for winter-run and spring-run Chinook salmon. This opinion will focus on the mainstem San Joaquin River at Sherman Island, outside of the designated critical habitat for winter-run and spring-run Chinook salmon.

The San Joaquin Delta HU is in the southwestern portion of the CV steelhead DPS range and includes portions of the south, central and western Delta channel complex. The San Joaquin Delta HU encompasses approximately 628 square miles, with 455 miles of stream channels (at 1:100,000 hydrography). The critical habitat analytical review team (CHART) identified approximately 276 miles of occupied riverine/estuarine habitat in this hydrologic subunit area (HSA) that contained one or more PCEs for the CV steelhead DPS (NMFS 2005). The PCEs of steelhead habitat within the action area also apply to green sturgeon, and include freshwater rearing habitat, freshwater migration corridors, and estuarine areas. The essential features of these PCEs included the following: sufficient water quantity and floodplain connectivity to form and maintain physical habitat conditions necessary for salmonid development and mobility, sufficient water quality, food and nutrients sources, natural cover and shelter, migration routes free from obstructions, natural levels of predation, holding areas for juveniles and adults, and shallow water areas and wetlands. Habitat within the action area is primarily utilized for freshwater rearing and migration by CV steelhead and North American green sturgeon juveniles and smolts and for adult upstream migration. No spawning of CV steelhead and North American green sturgeon occur within the action area.

The general condition and function of freshwater rearing and migration habitats has already been described in the *Status of the Species and Critical Habitat* section of this biological opinion. The substantial degradation over time of several of the essential features of these PCEs has diminished the function and condition of the habitats in the action area. This area currently provides only rudimentary functions compared to its historical status. The natural floodplains have essentially been eliminated, and the once extensive wetlands and riparian zones have been cleared for farming. Little riparian vegetation remains in the Delta, limited mainly to tules growing along the foot of artificial levee banks. Numerous artificial channels also have been created to bring water to irrigated lands that historically did not have access to the river channels

(*i.e.*, Victoria Canal, Grant Line Canal, Fabian and Bell Canal, Woodward Cut, *etc.*). These artificial channels have disturbed the natural flow of water through the Delta. As a byproduct of this intensive engineering of the Delta's hydrology, numerous irrigation diversions have been placed along the banks of the flood control levees to divert water from the area's waterways to the agricultural lands of the Delta's numerous "reclaimed" islands. Most of these diversions are not screened adequately to protect migrating fish from entrainment. Sections of the Delta have been routinely dredged by DWR to provide adequate intake depth for these agricultural water diversions, particularly in the South Delta. Likewise, the main channels of the San Joaquin River and the Sacramento River have been routinely dredged by the Corps to create an artificially deep channel to provide passage for ocean going commercial shipping to the Port of Stockton and the Port of Sacramento.

Water flow through the Delta is highly manipulated to serve human purposes. Rainfall and snowmelt is captured by reservoirs in the upper watersheds, from which its release is dictated primarily by downstream human needs. The SWP and CVP pumps draw water towards the southwest corner of the Delta which creates a net upstream flow of water towards their intake points. Fish, and the forage base they depend upon for food, are drawn along with the current towards these diversion points. In addition to the altered flow patterns in the Delta, numerous discharges of treated wastewater from sanitation wastewater treatment plants (*e.g.*, Cities of Pittsburg and Antioch) and the untreated discharge of numerous agricultural waste ways are emptied into the waters of the San Joaquin River and the channels of the Delta. This leads to cumulative additions to the system of thermal effluent loads as well as cumulative loads of potential contaminants (*i.e.*, selenium, boron, endocrine disruptors, pesticides, biostimulatory compounds, *etc.*).

Those members of the CV steelhead DPS that spawn in the San Joaquin system must pass through the San Joaquin Delta HSA to reach their upstream spawning and freshwater rearing areas on the tributary watersheds, in addition, also providing rearing and migratory habitat for North American green sturgeon. Therefore, it is of critical importance to the long-term viability of the San Joaquin River basin portion of the CV steelhead DPS and North American green sturgeon to maintain a functional migratory corridor and freshwater rearing habitat through the action area and the San Joaquin Delta HSA.

B. Factors Affecting the Species and Habitat in the Action Area

The Project study area is located in the Sacramento-San Joaquin Delta subsection of the Great Valley ecological sub-region (Miles and Goudey 1997). This region is characterized by a low, level plain at the confluence of the Sacramento and San Joaquin Rivers. Numerous artificial levees have been constructed throughout the region to reclaim lands for agricultural production.

Historically, the interplay between deposited sediments, plant growth, daily tidal flooding, and seasonal flooding resulted in a complex distribution of elevated waterways, vegetated islands, and nearshore tidal and subtidal habitats. This interplay continues today, but has been dramatically altered by human activities over the last two centuries.

Early Delta modifications were designed to enable navigation, control flooding of settled areas, and allow farming on the rich islands laced throughout the tidal Delta. Later, freshwater from the tidal Delta was exported to other communities and agricultural lands throughout the Central Valley and beyond to southern California. Water conveyance structures such as canals, cross channels, and interties significantly altered natural features. The pumping facilities at the Federal CVP, beginning in 1940, and the SWP, beginning in 1960, substantially decreased the outflow of fresh water from the Delta. Water movement patterns have been altered at both local and broad scales (The Bay Institute 1998). The balance between natural sedimentation rates and varying sea levels was altered by sediment deposition associated with placer mining in the Central Valley watershed along much of the western slopes of the Sierra Mountains from the 1860s to the 1880s, and by the direct filling of portions of the San Francisco Bay and estuary to accommodate shoreline development. The combination of these activities significantly reduced the aerial extent of freshwater marshes, once a dominant feature in the Delta habitat mosaic.

The flow of freshwater into the estuary has been greatly reduced by water diversions largely to support irrigated agriculture (Nichols 2007). Many stressors, such as chemical pollution, dissolved oxygen, water temperature, reversed flows, etc., in the Delta have resulted in the detriment of salmonids and sturgeon. Water diversions and water exports are a big part of the modified Delta and are a significant cause of the loss and decline of many resident and migratory fish species. As of April 1997, 3,356 diversions have been located and mapped using GPS in the Central Valley (Herren and Kawasaki 2001). Of these, 298 diversions were found within the San Joaquin River Basin. The Federal and State pumping plants draw off much of the inflowing freshwater of the San Joaquin River (Herbold and Moyle 1989). Spring- and fall-runs of salmon formerly existed in the major San Joaquin River tributaries and in the upper San Joaquin River, and there also may have been a late-fall-run present in the mainstem (Yoshiyama *et al.* 2001). However, all salmon runs in the San Joaquin River above the confluence of the Merced River were extirpated by the late-1940s (Yoshiyama *et al.* 2001).

Sources of selenium input to the Delta include: oil refinery effluents from five refineries in the Delta; agricultural drainage discharged through the San Joaquin River; direct discharge of agricultural drainage through a proposed extension of the San Luis Drain; and effluents from municipal wastewater treatment plants (Presser *et al.* 2008). The greatest increase in selenium uptake seems to occur along the pathway from water to algae and zooplankton where selenium is bioaccumulated several hundredfold. Fish consume organisms at lower trophic levels and, in general, seem to accumulate selenium to whole-body concentrations found in their food. Low waterborne concentrations of selenium that are readily bioaccumulated in plankton and detrital food pathways are, therefore, a threat to organisms, such as fish at the top of the trophic structure (Hamilton *et al.* 1990). For example, the introduction of the overbite clam (*Corbula amurensis*) has caused harm to green and white sturgeon. Overbite clams accumulate high levels of selenium and other toxic material and pass it on to sturgeon that consume overbite clams (Moyle 2002). Reproductive failure in fish exposed to elevated concentrations of selenium in the environment is probably due to bioaccumulation in the ovaries and their progeny, which causes lethal edema in larvae (Hamilton *et al.* 1990). Early life stages of salmonids and sturgeon are

generally more sensitive to toxicant stresses because of the lack or underdevelopment of metabolic mechanisms essential for handling toxicant stresses, or interference with metabolic processes that are vital to developing organisms (Hamilton *et al.* 1990) (green sturgeon are four times more sensitive than white sturgeon(Woodbury 2009)). Juvenile chinook salmon are exposed to selenium while they undergo parr-smolt transformations in the Sacramento-San Joaquin Delta. According to a study done by Hamilton *et al.* (1990), selenium reduced survival and growth in salmonids in freshwater and only reduced growth in fish that were in brackish water.

Invasive organisms, from plants to fish, are prevalent in the Delta. Introduced exotic species continue to change the area's biota by altering its food webs (Nichols 2007). California has the highest number of fish introductions of any state in the United States. Species invasion is a complex process with multiple steps: transport, release, establishment, spread, and integration. The movements of invaders between watersheds in California are primarily related to water transfers (*i.e.*, aqueducts, canals, and diversions) and salinity gradient in the Delta. Invasive and/or exotic species that become widely established are typically spread by humans (as opposed to natural dispersal from a center of origin). On a watershed basis, there have been relatively few extinctions of native fishes in California, although declining abundances of many native species suggests that the full impact of alien fishes has not yet occurred (Marchetti *et al.* 2004). Invasive species that affect ecosystem processes may indirectly impact populations of native species (see Figure 2). Invasive species can replace native species in their trophic level and can alter properties of an ecosystem.

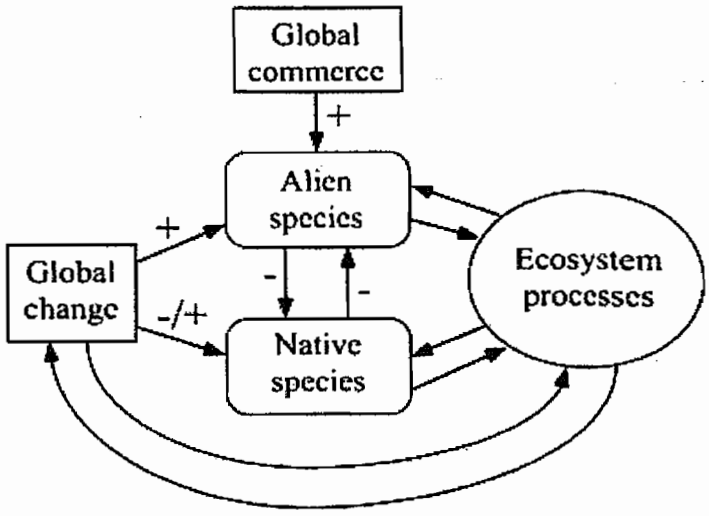

Figure 2 shows how alien species can indirectly and directly impact native species (Dukes and Mooney 2004)

In an uninvaded ecosystem, the value of the ecosystem function may vary over time due to shifts

in species dominance. As an invasion progresses, the invader makes up an increasing proportion of biomass at its trophic level. Thus, the decline of listed anadromous fish can be directly attributed to competition with or predation by fish species that were introduced for sport fishing (Dukes and Mooney 2004). Introduced fish and invertebrates change the availability of food and cover, which results in the detriment of listed juvenile salmonids and sturgeon. Introduced fish species (*e.g.* striped bass) tend to be more abundant and thus can out-compete native salmon, sturgeon, and steelhead by limiting their benthic food source (Moyle 2002).

V. EFFECTS OF THE ACTION

Pursuant to Section 7(a)(2) of the ESA (16 U.S.C. §1536), Federal agencies are directed to ensure that their activities are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. This biological opinion assesses the effects of Antioch Bridge Seismic Retrofit project on CV steelhead, their designated critical habitat, the Southern DPS of North America green sturgeon, and their proposed critical habitat. The proposed Project is likely to adversely affect listed species and critical habitat through vibration of the piles for the temporary marine trestle. In the *Description of the Proposed Action* section of this Opinion, NMFS provided an overview of the action. In the *Status of the Species* and *Environmental Baseline* sections of this Opinion, NMFS provided an overview of the threatened and endangered species and critical habitat that are likely to be adversely affected by the activity under consultation.

Regulations that implement section 7(b)(2) of the ESA require NMFS to evaluate the direct and indirect effects of Federal actions and actions that are interrelated with or interdependent to the Federal action to determine if it would be reasonable to expect them to appreciably reduce listed species' likelihood of both surviving and recovering in the wild by reducing their reproduction, numbers, or distribution (16 U.S.C. §1536; 50 CFR 402.02). Section 7 of the ESA also requires NMFS to determine if Federal actions would appreciably diminish the value of critical habitat for the conservation of listed species (16 U.S.C. §1536). This biological opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat.

A. Approach to the Assessment

NMFS generally approaches "jeopardy" analyses in a series of steps. First, NMFS evaluates the available evidence to identify direct and indirect physical, chemical, and biotic effects of the proposed actions (these effects include direct impacts to a species habitat; modifications to something in the species' environment - such as reducing a species' prey base, enhancing populations of predators, altering its spawning substrate, altering its ambient temperature regimes; or adding something novel to a species' environment - such as introducing exotic competitors or disruptive noises). Once NMFS has identified the effects of the action, the available evidence is evaluated to identify a species' likelihood and extent of exposure to any adverse effects caused by the action (*i.e.* the extent of spatial and temporal overlap between the

species and the effects of the action). Once NMFS has identified the level of exposure that a species will have to the effects of the action, the available evidence is evaluated to identify the species' probable response, including physical and behavioral reactions, to these effects. These responses then will be assessed to determine if they can reasonably be expected to reduce a species' reproduction, numbers, or distribution (for example, by changing birth, death, immigration, or emigration rates; increasing the age at which individuals reach sexual maturity; decreasing the age at which individuals stop reproducing; among others). The available evidence is then used to determine if these reductions, if there are any, could reasonably be expected to appreciably reduce a species' likelihood of surviving and recovering in the wild.

1. Information Available for the Assessment

To conduct the assessment, NMFS examined an extensive amount of evidence from a variety of sources. Detailed background information on the status of these species and critical habitat has been published in a number of documents including peer reviewed scientific journals, primary reference materials, governmental and non-governmental reports, the biological assessment for this project, and project meeting notes. Additional information investigating the effects of the project's actions on the listed species in question, their anticipated response to these actions, and the environmental consequences of the actions as a whole was obtained from the aforementioned resources. For information that has been taken directly from published, citable documents, those citations have been referenced in the text and listed at the end of this document.

2. Assumptions Underlying This Assessment

In the absence of definitive data or conclusive evidence, NMFS must make a logical series of assumptions to overcome the limits of the available information. These assumptions will be made using sound, scientific reasoning that can be logically derived from the available information. The progression of the reasoning will be stated for each assumption, and supporting evidence cited.

The potential adverse effects to listed species resulting from the proposed construction of the Antioch Bridge and the implementation of the minimization measures are primarily associated with elevated underwater sound pressure levels generated during pile driving. However, other potential impacts to listed salmonids and green sturgeon and designated critical habitat include turbidity resulting from ground disturbance for areas associated with bridge construction and mitigation.

The information used in this assessment includes *Status of the Species* and *Environmental Baseline* sections of this biological opinion, studies and accounts of the impacts of construction and pile driving activities on anadromous fish.

B. Assessment

The proposed project includes actions that may adversely affect several life stages of listed fish

species. Adverse effects to these species and their habitat may result from changes in water quality from construction activities, loss of riparian vegetation from construction activities, and physical injury and harassment of juveniles and adults from exposure to elevated levels of underwater sound produced during pile driving. The project includes integrated design features to avoid and minimize many of these potential impacts.

There will not be any long term changes to the footprint of the bridge or other habitat features within the action area, thus, there will only be short term exposure to construction related impacts to listed fish. During the period of August-October, adult CV steelhead enter freshwater to spawn, with a peak migration period of September-October (Moyle 2002). The steelhead migration period overlaps the pile driving in-water work window (August-November), and thus some of the adult fish moving into the San Joaquin watershed are likely to be exposed to the effects of the in-water work activities. Adult green sturgeon upstream migration occurs from March through July (Moyle *et al.* 1995). Although some of these fish migrate through the action area, they will likely not be present when in-water construction activities are proposed to occur. However, there is a possibility that some of these fish may occur within the action area and be exposed to the effects of the in-water work activities as they migrate back downstream in the fall months following spawning. There is also the potential for juveniles to be rearing and feeding in the Delta and around the action area year round, so a small proportion of the juvenile population may be exposed to the effects of the in-water work activities.

The action area also functions as a migratory corridor and rearing habitat for juvenile Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon ESUs, green sturgeon, and CV steelhead from the Sacramento River watershed that are drawn into the Central and South Delta by the actions of the CVP and SWP water diversion facilities and must therefore emigrate towards the ocean through the lower San Joaquin River system. Winter- and spring-run Chinook salmon, like green sturgeon, only spawn in the upper Sacramento River watershed. Construction of low elevation dams in the foothills of the Sierras on the American, Mokelumne, Stanislaus, Tuolumne, and Merced Rivers extirpated CV spring-run Chinook salmon from these watersheds. Naturally-spawning populations of CV spring-run Chinook salmon currently are restricted to accessible reaches of the upper Sacramento River. Therefore, adult Chinook salmon are unlikely to migrate through the action area or be exposed to the effects of the in-water work activities. Their designated critical habitat does not extend east of Suisun Bay (towards San Joaquin River). In addition, their migration timing (January through April for winter-run and March through May for spring-run) do not coincide with the proposed in-water work window.

The temporal occurrence of Sacramento River winter-run Chinook salmon smolts and juveniles in the action area are best described by the salvage records of the CVP and SWP fish handling facilities. Based on salvage records covering the last 8 years at the CVP and SWP, Sacramento River winter-run Chinook salmon are typically present in the Western and Central Delta action area starting in December. Their presence peaks in March and then rapidly declines from April through June. Nearly 50 percent of the average annual salvage of Sacramento River winter-run Chinook salmon juveniles occurs in March (48.8 percent). Salvage in April accounts for only 2.8 percent of the average annual salvage and falls to less than 1 percent for May and June combined.

The presence of juvenile Sacramento River winter-run Chinook salmon in the Western and Central Delta is a function of river flows on the Sacramento River, where the fish are spawned, and the demands for water diverted by the SWP and CVP facilities. When conditions on the Sacramento River are conducive to stimulating outmigrations of juvenile Sacramento River winter-run Chinook salmon, the draw of the CVP and SWP pumping facilities pulls a portion of these emigrating fish through one of the four access points on the Sacramento River (Georgiana Slough, the Delta Cross Channel, Three Mile Slough, and the San Joaquin River via Broad Slough) into the channels of the Western and Central Delta, including the lower sections of the San Joaquin River. The combination of pumping rates and tidal flows moves these fish into the western delta portion of the action area. When the combination of pumping rates and fish movements are high, significant numbers of juvenile Sacramento River winter-run Chinook salmon are drawn into the action area. Like the Sacramento River winter-run Chinook salmon, the presence of juvenile CV spring-run Chinook salmon in the action area are under the influence of the CVP and SWP water diversions and the flows on the Sacramento River and its tributary watersheds. Currently, all known populations of CV spring-run Chinook salmon inhabit the Sacramento River watershed. The San Joaquin River watershed populations have been extirpated, with the last known runs on the San Joaquin River being extirpated in the late 1940s and early 1950s by the construction of Friant Dam and the opening of the Kern-Friant irrigation canal.

Juvenile CV spring-run Chinook salmon would first begin to appear in the action area in January. A significant presence of fish do not occur until March (20.1 percent of average annual salvage) and peak in April (66.8 percent of average annual salvage). By May, the salvage of CV spring-run Chinook salmon juveniles decline sharply (11.5 percent of average annual salvage) and essentially end by the end of June (1.3 percent of average annual salvage).

1. Pile Driving and Bridge Construction

The proposed project includes installation of a temporary trestle (approximately 910 ft long) that will be constructed from the south end of the bridge. The proposed project will require two 24-inch diameter steel shell piles for every 25 feet of trestle and around the piers. The driving of steel piles for the temporary trestle will occur in water less than 10 feet in depth. There will be approximately 160 piles driven to a depth of 50 feet to support the temporary trestle. Four to six piles supporting between two to three sections of the trestle will be installed per day. Water depths would range from the shore or mud during lower tides to about 10 feet (3 meters). These piles would be vibrated in for approximately ten minutes per pile and one pile per each section (approximately 36 sections in total) will be driven with an impact hammer for approximately 20 blows per pile to verify the bearing capacity of the pile. This would equate to a maximum of 3,600 seconds of vibratory pile installation and 60 hammer strikes per day. The impact radius for 4 piles/day around a single pile for 187 dB SEL would be at a distance of 190 ft. The impact radius for 6 piles/day around a single pile for 187 dB SEL would be at a distance of 235 ft. The impact radius for a single strike of 206 dB_{peak} would be 45 ft.

NMFS uses a single strike peak sound pressure level (SPL) of 206 dB and an accumulated sound exposure level (SEL) of 187 dB to correlate underwater sound with potential injury to fish. These are the thresholds that indicate the onset of physical injury. The SPL is an expression of the sound pressure using the decibel scale and the standard reference pressures of micro-Pascal (1 μPa) for water and biological tissues. SEL is the exposure of fish to a total amount of energy (*i.e.*, dose) that can be used to determine a physical injury response. In other words, it is the time-integrated, sound-pressure-squared level. Because sound is a form of energy, the damage potential of a given sound environment will depend not only on its level, but also its duration. The root-mean-square (RMS) is 150 dB for a behavioral response in a fish. The level is determined by analyzing the waveform and computing the square root of the average of the squared pressures over the time period that comprises that portion of the waveform containing 90% of the sound (pressure squared) energy (Hastings and Popper 2005). This calculated RMS SPL is described as "RMS (impulse)" and is used to report an overall average SPL for a single pile driving pulse (Hastings and Popper 2005). Because all SEL measurements are normalized to a one second time interval, it may be used to compare the energy content of different exposures to sound. SEL is calculated by summing the cumulative pressure squared ($p2$) over time and is often used as an indication of the energy dose.

The installation of steel piles with a vibratory hammer in the San Joaquin River is expected to result in adverse effects to exposed fish due to high levels of underwater sound that will be produced. Adverse effects can range from physical injury to the exposed fish, sometimes resulting in death, to lesser impacts, such as behavioral modifications or increased susceptibility to predation, which do not necessarily result in death or long term adverse impacts by themselves. The degree to which an individual fish exposed to underwater sound will respond (from a startle response to immediate mortality) is dependent on a number of variables such as the species of fish, size of the fish, presence of a swimbladder, sound pressure intensity and frequency, shape of the sound wave (rise time), depth of the water around the pile and the bottom substrate composition and texture. Injury is expected if either: 1) the peak pressure of any strike exceeds 206 dB (re: 1 μPa); or 2) SEL, accumulated over all pile strikes, exceeds 187 dB (re: 1 μPa_2*sec) for fishes 2 grams or larger and 183 dB (re: 1 μPa_2*sec) for fishes smaller than 2 grams. Because all ESA-listed fish in the action area during pile driving are expected to be larger than 2 grams, the threshold for accumulated SEL used in this analysis is 187 dB.

a. Immediate Mortality of Fish from Pile Driving

The effect of pile driving on free swimming fish depends on the duration, frequency (Hz), and pressure (dB) of the compression wave. Rassmusen (1967) found that the immediate mortality of juvenile fish may occur at sound pressure levels exceeding 206 dB. Due to their size, adult CV steelhead and green sturgeon can tolerate higher pressure levels and immediate mortality rates for adults are expected to be less than those experienced by juveniles. As sound pressure levels are not expected to exceed 187 dB, no immediate mortality of juvenile or adult fish is expected.

b. Injury of Fish from Pile Driving

High levels of underwater acoustic noises have been shown to have adverse impacts upon the auditory sensory organs of fish within close proximity of the noise source. The loss of hearing sensitivity may adversely affect a salmonids' ability to orient itself (*i.e.*, due to vestibular damage), detect predators, locate prey, or sense their acoustic environment. Chronic noise exposure can reduce a fish's ability to detect piscine predators either by reducing the sensitivity of the auditory response or by masking the noise of an approaching predator. Disruption of the exposed fish's ability to maintain position or swim with the school will enhance its potential as a target for predators. Unusual behavior or swimming characteristics single out an individual fish and allow a predator to focus its attack upon that fish more effectively. Swimbladders, which are inflated with gas, can expand rapidly as the pressure waves pass through the fish and can press against, and strain, adjacent organs, such as the liver and kidney (Keevin and Hempen 1997). In addition, this pneumatic compression causes demonstrable injury, in the form of ruptured capillaries, internal bleeding, and maceration of highly vascular organs (Caltrans 2002). Hastings and Popper (2005) also noted that sound waves can cause different types of tissues to vibrate at different frequencies, and that this differential vibration can cause tearing of mesenteries and other sensitive connective tissues. Exposure to high noise levels can also lead to injury through "rectified diffusion," the formation and growth of bubbles in tissues. These bubbles can cause inflammation, cellular damage, and blockage or rupture of capillaries, arteries, and veins (Crum and Mao 1996; Stroetz *et al.* 2001; Vlahakis and Hubmayr 2000). Death from barotrauma and rectified diffusion injuries can be instantaneous, or delayed for minutes, hours or even days after exposure.

c. Behavioral Responses of Fish from Pile Driving

Behavioral responses to high noise levels can be in the form of a startled response, avoidance, agitation, etc. These behavioral responses can also lead to increased susceptibility to predation. In addition, elevated SPLs from impact and vibratory pile driving could conceivably delay the migration of fish and affect their foraging and migratory behavior.

d. Summary of Effects from Pile Driving

The activities related to pile driving are temporary and will only last the duration of the in-water work activities. Sublethal and/or subinjurious effects to juvenile CV steelhead and green sturgeon, including altered behavior, auditory masking, and temporary hearing threshold shifts can affect vulnerability to predation, foraging success, and other factors that influence survival and fitness. Pile driving will take place during each in-water work window during the bridge construction period (*i.e.*, concurrently with pile driving during temporary trestle installation and during removal of the temporary piles as elements of bridge construction are completed). Because daily pile driving activities will be separated by overnight rest periods when migration can proceed uninhibited, upstream and downstream migration of listed fish are not expected to be significantly delayed. The populations of these fish in the San Joaquin River represent a small number of the entire population in the Central Valley, and the action is expected to have little impact upon the entire DPS. There is potential for adult CV steelhead and green sturgeon to be adversely effected from pile driving activities, however, it is expected to be relatively low due to

their larger bodies (above two grams) and pile driving activities occurring only in the daytime which would avoid corpuscular and nocturnal periods when steelhead and sturgeon migratory activity is highest.

3. Water Quality

NMFS anticipates that some local increases in turbidity will result as a consequence of these actions. The increases in local turbidity levels are associated with the re-suspension of bottom sediments during the piling removal and installation phase of the construction process. The proposed in-water construction activities are not expected to lead to significant impacts to water quality in the action area. There are expected to be minor, short term increases in turbidity and sedimentation in localized areas due to the driving and removal of temporary piles. The expected increases in turbidity and suspended sediment may disrupt feeding and migratory behavior of listed fish over a small area for a short period of time. The turbidity associated with installation and removal of piles could result in localized displacement and likely behavioral modifications to individual salmonids and green sturgeon if they do not readily move away from the areas directly affected by the project. Turbidity and sedimentation events are not expected to affect feeding success of green sturgeon as they are not known to rely heavily on visual cues for feeding (Sillman *et al.* 2005). These temporary behavioral changes are not expected to result in injury or death of listed salmonids and green sturgeon. NMFS does not anticipate that turbidity levels associated with the pile driving will increase to deleterious levels. Furthermore, turbidity conditions are expected to return to ambient levels within hours to days of the termination of pile driving actions. Moreover, based on the timing of the pile driving actions, NMFS does not expect listed salmonids to be adversely effected by sedimentation and turbidity in the San Joaquin River. Green sturgeon, which can occupy waters containing variable levels of suspended sediment and thus turbidity, are not expected to be impacted by the slight increase in the turbidity levels anticipated from the pile driving action as explained above.

Unanticipated spills into the San Joaquin River, such as toxic substances used at construction sites (gasoline and lubricants) can lead to adverse effects and mortality in juvenile and adult salmonids and green sturgeon. If these toxins seep into the water, these substances can kill aquatic organisms through exposure to lethal concentrations or exposure to non-lethal levels that cause physiological stress and increased susceptibility to other sources of mortality. However, NMFS expects that Caltrans will adhere to the standard BMP's and SWPPP during construction activities to prevent these kinds of effects on listed salmonids and green sturgeon. Therefore, NMFS does not expect the Project will result in water contamination that will injure or kill listed anadromous fish.

3. Effects on Designated or Proposed Critical Habitat Primary Constituent Elements (PCEs)

The basic premise to the conservation value of an overall critical habitat designation is the sum of the values of the components that comprise the habitat. For example, the conservation value of listed salmonid critical habitat is determined by the conservation value of the watersheds that make up the designated area. In turn, the conservation value of the specific watershed is

comprised of the sum of the value of the PCEs that make up the area. PCEs are specific areas or functions, such as spawning or rearing habitat, that support different life history stages or requirements of the species. The conservation value of the PCE is the sum of the quantity, quality, and availability of the essential features of that PCE. Essential features are the specific processes, variables or elements that comprise a PCE. Thus, an example of a PCE would be spawning habitat and the essential features of that PCE are conditions such as clean spawning gravels, appropriate timing and duration of certain water temperatures, and water quality free of pollutants.

Therefore, reductions in the quantity, quality, or availability of one or more essential feature reduce the value of the PCE, which in turn reduces the function of the sub-area (*e.g.*, watersheds), which in turn reduces the function of the overall designation. In the strictest interpretation, reductions to any one essential feature or PCE would equate to a reduction in the value of the whole. However there are other considerations. We look to various factors to determine if the reduction in the value of an essential feature or PCE would affect higher levels of organization. For example:

- The timing, duration and magnitude of the reduction
- The permanent or temporary nature of the reduction
- Whether the essential feature or PCE is limiting (in the action area or across the designation) to the recovery of the species or supports a critical life stage in the recovery needs of the species (for example, juvenile survival is a limiting factor in recovery of the species and the habitat element supports juvenile survival).

In our assessment, we combine information about the contribution of constituent elements of critical habitat (or of the physical, chemical, or biotic phenomena that give the designated area value for the conservation of listed species) to the conservation value of those areas of critical habitat that occur in the action area, given the physical, chemical, biotic, and ecological processes that produce and maintain those constituent elements in the action area. We use the conservation value of those areas of designated critical habitat that occur in the action area as our point of reference for this comparison. For example, if the critical habitat in the action area has limited current value or potential value for the conservation of listed species, that limited value is our point of reference for our assessment of the consequences of the added effects of the proposed action on that conservation value.

a. Estuarine Migratory Corridors

Ideal estuarine areas are free of migratory obstructions with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh and salt water. Natural cover such as submerged and overhanging large woody material, aquatic vegetation, and side channels, are necessary for juvenile and adult foraging. Current estuarine areas are degraded as a result of human activities such as levee construction, urbanization and water exports.

The trestle for the Antioch Bridge is only temporary and will not obstruct the migratory pathway for exposed fish. Fish that use the action area as a migratory corridor will be able to continue using the channel during and after construction of the Antioch Bridge.

b. Estuarine Feeding and Rearing Habitat

Presence of the temporary piles will effect 0.011 ac (estimated as the cross-sectional area of 160 piles of 24-inch diameter) of foraging habitat. Estuarine rearing habitats support juvenile rearing and feeding, and function as migratory corridors for adult fish. Rearing habitat condition is strongly affected by habitat complexity, food supply, and presence of predators of juvenile salmonids. Salmonids such as CV steelhead rely more heavily on freshwater rearing habitat and green sturgeon rely more on the condition of the benthos which will not be affected. Prey species for juvenile and adult CV steelhead and green sturgeon within bays and estuaries primarily consist of benthic invertebrates and fish, including crangonid shrimp, callianassid shrimp, burrowing thalassinidean shrimp, amphipods, isopods, clams, annelid worms, crabs, sand lances, and anchovies. These prey species are critical for the rearing, foraging, growth, and development of these fish within the bays and estuaries. Currently, the estuary provides these food resources, although annual fluctuations in the population levels of these food resources may diminish the contribution of one group to the diet of green sturgeon relative to another food source. The recent spread of the Asian overbite clam has shifted the diet profile of white sturgeon to this invasive species. The overbite clam now makes up a substantial proportion of the white sturgeon's diet in the estuary. NMFS assumes that green sturgeon have also altered their diet to include this new food source based on its increased prevalence in the benthic invertebrate community.

Impacts to foraging habitat associated with the proposed action are minimal and temporary, and will not appreciably diminish the conservation value of the critical habitat, thus will have little impact to the exposed fish

c. Summary of PCEs in the Action Area

The PCEs of critical habitat that will be adversely affected include estuarine rearing and feeding sites for juveniles and estuarine migration corridors for both juveniles and adults. The temporary trestle piles will be removed upon completion of the proposed action. Therefore, NMFS expects that nearly all of the adverse effects to critical habitat from this project will be minimal and short-term and will not affect future generations of listed fish beyond the construction period of the project.

VI. CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Land surrounding the Caltrans ROW in the action area belongs to the California Department of Water Resources. They lease the land to tenants for grazing cattle. The southern part of this action area is located in the East Bay Regional Park District's Oakley Regional Park and includes a small portion of a developed marina.

Non-Federal actions that may affect the action area include ongoing agricultural activities and increased urbanization. Agricultural practices in and upstream of the San Joaquin River may adversely affect riparian and wetland habitats through upland modifications of the watershed that lead to increased siltation or reductions in water flow in stream channels flowing into the San Joaquin River. Unscreened agricultural diversions throughout the Delta entrain fish including juvenile salmonids and green sturgeon. Grazing activities from dairy and cattle operations can degrade or reduce suitable critical habitat for listed salmonids by increasing erosion and sedimentation as well as introducing nitrogen, ammonia, and other nutrients into the watershed, which then flow into the receiving waters of the San Joaquin River. Stormwater and irrigation discharges related to both agricultural and urban activities contain numerous pesticides and herbicides that may adversely affect salmonid reproductive success and survival rates (Dubrovsky *et al.* 1998, 2000; Daughton 2003).

Global climate change is a broad-scale cumulative effect that is likely to affect the action area. The world is about 1.3 °F warmer today than a century ago and the latest computer models predict that, without drastic cutbacks in emissions of carbon dioxide and other gases released by the burning of fossil fuels, the average global surface temperature may rise by two or more degrees in the 21st century (Intergovernmental Panel on Climate Change (IPCC) 2001). Much of that increase will likely occur in the oceans, and evidence suggests that the most dramatic changes in ocean temperature are now occurring in the Pacific (Noakes 1998). Using objectively analyzed data Huang and Liu (2000) estimated a warming of about 0.9 degrees F per century in the Northern Pacific Ocean.

Sea levels are expected to rise by 0.5 to 1.0 meters (m) in the northeastern Pacific coasts in the next century, mainly due to warmer ocean temperatures, which lead to thermal expansion much the same way that hot air expands. This will cause increased sedimentation, erosion, coastal flooding and permanent inundation of low-lying natural ecosystems within the action area (*i.e.*, salt marsh, riverine, mud flats) affecting critical habitat PCEs. Increased winter precipitation, decreased snow pack, and permafrost degradation could affect the flow and temperature of rivers and streams, with negative impacts on fish populations and the habitat that supports them.

Summer droughts along the South Pacific coast and in the interior of the northwest Pacific coastlines will mean decreased stream flow in those areas, decreasing salmonid survival and reducing water supplies in the dry summer season when irrigation and domestic water use are greatest. Global climate change may also change the chemical composition of the water that fish inhabit: the amount of oxygen in the water may decline, while pollution, acidity, and salinity levels may increase. This will allow for more invasive species to over take native fish species and impact predator-prey relationships (Stachowicz *et al.* 2002; Peterson and Kitchell 2001).

An alarming prediction is that Sierra snow packs are expected to decrease with global warming and that the majority of runoff in California will be from rainfall in the winter rather than from melting snow pack in the mountains (CDWR 2006). This will alter river runoff patterns and transform the tributaries that feed the Central Valley from a spring/summer snowmelt dominated system to a winter rain dominated system. It can be hypothesized that summer temperatures and flow levels will become unsuitable for salmonid survival. The cold snowmelt that furnishes the late spring and early summer runoff will be replaced by warmer precipitation runoff. This should truncate the period of time that suitable cold-water conditions exist below existing reservoirs and dams due to the warmer inflow temperatures to the reservoir from rain runoff. Without the necessary cold-water pool developed from melting snow pack filling reservoirs in the spring and early summer, late summer and fall temperatures below reservoirs, such as Shasta Lake and Lake Oroville, potentially could rise above thermal tolerances for juvenile and adult salmonids (*i.e.* CV steelhead) that must hold below the dam over the summer and fall periods.

Anticipated climate change may affect spatial and temporal precipitation patterns along with the intensity and duration of precipitation within the San Joaquin River watershed. Ambient air temperatures in California are projected to increase several degrees centigrade (°C) by the end of this century. As a result, it is possible that less precipitation will occur as snowfall and more will occur as rain in future years. The effect of climate change is anticipated to be more winter and less spring and summer run-off within the watershed. In addition, expected run-off is anticipated to be warmer, possibly affecting the ability to meet downstream water temperature objectives to protect salmon, steelhead and green sturgeon. A reduction in snowpack combined with increased ambient air temperatures is expected to result in earlier melting of snow and less run-off from the snowpack than that which occurs today. A change in the run-off pattern within the San Joaquin River watershed will likely affect reservoir storage and downstream river flows due to more frequent spillway releases. Currently, summer water temperatures often are close to the upper tolerance limits for salmon and steelhead and any increase in ambient air temperatures as a result of climate change is anticipated to make it more difficult at the very least, if not impossible, to meet established water temperature objectives on the San Joaquin River. Reduced reservoir storage as a result of the anticipated change in run-off pattern may also affect the availability of a cold water supply necessary to maintain river temperatures downstream.

There are no specific plans for development within the action area of the proposed project. Therefore, further cumulative effects beyond those described above are not expected.

VII. INTEGRATION AND SYNTHESIS

This section integrates the current conditions described in the status of the species and the environmental baseline for the action area with the effects of the proposed action and the cumulative effects of future actions. The purpose of this synthesis is to develop an understanding of the likely short-term and long-term responses of listed species and critical habitat to the proposed project.

A. Summary of Status of the Species and Environmental Baseline

The San Joaquin River basin historically contained numerous independent populations of CV steelhead and spring-run Chinook salmon (Lindley *et al.* 2006, 2007). Potentially, the Southern DPS of North American green sturgeon were also present in these watersheds prior to anthropogenic changes. The suitability of these watersheds to support these runs of fish changed with the onset of human activities in the region. Human intervention in the region initially captured mountain runoff in foothill reservoirs which supplied water to farms and urban areas. As demand grew, these reservoirs were enlarged or additional dams were constructed higher in the watershed to capture a larger fraction of the annual runoff. San Joaquin Valley agriculture created ever greater demands on the water captured by these reservoirs, diminishing the flow of water remaining in the region's rivers, and negatively impacting regional populations of anadromous fish. Reclamation actions eliminated vast stretches of riparian habitat and seasonal floodplains from the San Joaquin River watershed and Delta through the construction of levees and the armoring of banks with rock riprap for flood control. Construction of extensive water conveyance systems and water diversions altered the flow characteristics of the Delta region. These anthropogenic actions resulted in substantial degradation of the functional characteristics of the aquatic habitat in the watershed upon which the region's anadromous fish populations depended.

Presently, CV spring-run Chinook salmon have been functionally extirpated from the San Joaquin River basin. Populations of CV steelhead in the San Joaquin River basin have been substantially diminished to only a few remnant populations in the lower reaches of the Stanislaus, Tuolumne, and Merced Rivers below the first foothill dams. The Southern DPS of North American green sturgeon have not been documented spawning in the San Joaquin River, but human alterations, which have been ongoing for over 100 years in the watershed, may have extirpated local populations before accurate records were maintained. Since the viability of small remnant populations of CV steelhead in the San Joaquin River basin is especially tenuous and such populations are susceptible to temporally rapid decreases in abundance and possess a greater risk of extinction relative to larger populations (Pimm *et al.* 1988; Berger 1990; Primack 2004), activities that reduce the quality and quantity of habitats, or that preclude the formation of independent population units (representation and redundancy rule cited by Lindley *et al.* 2007), are expected to drive the species towards extinction as individual populations within the larger DPS become extinct (McElhany *et al.* 2000). Therefore, activities having severe impacts on steelhead populations or destroying designated critical habitat, within these smaller population units have significant implications for the DPS as a whole.

a. CV Steelhead

Estimates of adult escapement of steelhead to these watersheds are typically only a few dozen or so. This is reflected by the low number of smolts captured by monitoring activities throughout the year in different tributaries (*i.e.*, rotary screw traps on the Stanislaus, Tuolumne, Merced, and Calaveras Rivers, and the Mossdale trawls on the San Joaquin River below the confluence of these three east side tributaries) in which only a few dozen smolts to several hundred smolts are

collected each year (Marston 2004; Cramer 2005). These capture numbers have been extrapolated to estimate an annual population of only a few thousand juvenile steelhead smolts basin-wide in the San Joaquin River region. The Stanislaus River weir, which is used to count adult steelhead passing through the counting chamber or dead carcasses floating back onto the weir, has only recorded a few adult fish each year it has been in use. This is indicative of the low escapement numbers for adult steelhead in this watershed (Cramer 2005). The other San Joaquin tributaries are thought to have similar or even lower numbers based on the superiority of the Stanislaus River in terms of habitat and water quality for CV steelhead.

Under these low adult escapement conditions, the loss of one individual female's reproductive capacity through mortality can have a relatively high impact on a given watershed's potential population if the number of adults returning to each stream is low. Loss of one female with an expected egg capacity of 5,000 eggs represents approximately 50 to 100 smolts returning to the ocean (Good *et al.* 2005) a significant proportion of the total production from the San Joaquin basin.

b. Southern DPS of North American Green Sturgeon

Southern DPS green sturgeon were also present in these watersheds prior to anthropogenic changes. The suitability of these watersheds to support these runs of fish changed with the onset of human activities in the region. Southern DPS green sturgeon have not been documented utilizing the San Joaquin River as a spawning river in recorded history but human alterations, which have been ongoing for over 100 years in the watershed, may have extirpated these populations before accurate records were maintained. However, fish survey records indicate that juvenile and sub-adult green sturgeon make use of the lower San Joaquin River for rearing purposes during the first several years of their life.

The basic pattern described for adult green sturgeon migrations into the Delta region from the San Francisco Bay estuary is that adult fish enter the Delta region starting in late winter or early spring and migrate upstream towards the stretch of the Sacramento River between Red Bluff and Keswick Dam. After spawning, adults return downstream and re-enter the Delta in the fall and winter months. Juvenile and larval green sturgeon begin to show up in rotary screw trap catches along the Sacramento River starting in summer (Beamesderfer *et al.* 2004) and could be expected to reach the Delta by fall. The extent and duration of these fish entering and remaining in the San Joaquin River within the action area is unclear, but because of the habitat similarities and lack of barriers between the action area and documented sturgeon habitat in the Delta, NMFS believes that green sturgeon could be found during any month of the year within the action area. Southern DPS green sturgeon have not been documented utilizing the San Joaquin River as a spawning river in recorded history but human alterations, which have been ongoing for over 100 years in the watershed, may have extirpated these populations before accurate records were maintained. However, fish survey records indicate that juvenile and sub-adult green sturgeon make use of the lower San Joaquin River for rearing purposes during the first several years of their life. Juvenile and adult green sturgeon are likely to be present in the Delta during the construction phase of the project, as juveniles and adults utilize the Delta for rearing on a year-round basis prior to

migrating to the ocean.

c. Designated and Proposed Critical Habitat

The evidence presented in the Status of Species and Environmental Baseline sections indicate that past and present activities within the San Joaquin River basin have caused significant habitat loss, degradation and fragmentation. This has significantly reduced the quality and quantity of the remaining freshwater rearing sites and the migratory corridors within the lower valley floor reaches of the San Joaquin River for the CV steelhead population. Alterations in the geometry of the San Joaquin River Basin, removal of riparian vegetation and shallow water habitat, construction of armored levees for flood protection, changes in river flow created by demands of water diverters, and the influx of contaminants from agricultural and urban dischargers have also substantially reduced the functionality of the region's waterways. Additional losses of freshwater spawning sites, rearing sites, and migratory corridors have occurred upstream of the action area in the tributaries of the San Joaquin and Sacramento River basins, further reducing the overall conservation value of the critical habitat designation.

The current condition of proposed critical habitat for the Southern DPS of green sturgeon is degraded over its historical conditions. In particular, passage and water flow PCEs have been impacted by human actions, substantially altering the historical river characteristics in which the Southern DPS of green sturgeon evolved. The conservation value of green sturgeon proposed critical habitat has suffered similar types of degradation as already described for CV steelhead critical habitat. In addition, the alterations to the Sacramento-San Joaquin River Delta, as part of proposed critical habitat, may have a particularly strong impact on the survival and recruitment of juvenile green sturgeon due to their protracted rearing time in the delta and estuary. Loss of individuals during this phase of the life history of green sturgeon represents losses to multiple year classes rearing in the Delta, which can ultimately impact the potential population structure for decades to come.

B. Summary of the Effects of the Proposed Action on Listed Species Likelihood of Survival and Recovery

Under the proposed Antioch Bridge Seismic Retrofit project, adverse impacts to listed species stemming from increased sedimentation and acoustic impacts from pile driving are expected to occur. These impacts may cause physiological stress to the extent that the normal behavior patterns (*e.g.*, feeding, sheltering and migration) of affected individuals may be disrupted. Overall, the changes in turbidity and suspended sediment associated with this project are expected to adversely affect listed species primarily by low-level, short-term alteration of habitat conditions, which may reduce feeding or increase predation rates for juveniles. The potential for the increase in suspended sediment to adversely affect adult green sturgeon is unclear. However, because sturgeon are demersal fish closely associated with the bottom substrate, feed by taste and feel with their barbels, and even shovel up sediment with their snouts when searching for food, it is expected that they would be unaffected by the levels and duration of turbidity expected to be produced by the proposed project. Potential impacts are expected to be minimized by meeting

CVRWQCB water quality objectives, Caltrans water pollution specifications, implementing "best management practices" for erosion control, staging equipment outside of the riparian corridor, limiting the amount of riparian vegetation removal, and restoring disturbed riparian habitat values at the project site.

Pile driving activities are scheduled to occur August 1-November 30. Elevated levels of underwater sound around the pile driving activities may cause mortality, injury, or temporary behavioral changes to exposed fish These impacts will be substantially minimized by the pile driving work window restrictions. Loss of hearing sensitivities in juvenile fish will expose them to higher risks of predation. Fish with impacted hearing capacities will have a lower ability to detect predators and may be unable to maintain position in the water column (due to inner ear equilibrium factors). Underwater noise from pile driving may cause startling and/or avoidance of preferred habitat by fish in the immediate vicinity of the project site. The startling of fish can cause harm by temporarily disrupting normal behaviors that are essential to growth and survival such as feeding, sheltering, and migrating. Disruption of these behaviors would occur for specific periods during daylight operation hours of the pile driving hammer. Construction lapses, including daily breaks and nighttime non-working periods, as well as long periods when no pile driving is scheduled to occur, will allow fish to migrate through the action area and minimize the extent of impacts to populations. NMFS believes that the limited exposure to underwater sound levels associated with the proposed project is unlikely to significantly affect growth or survival of exposed adult and juvenile salmonids and green sturgeon.

a. CV Steelhead

NMFS anticipates that the proposed project will result in the exposure of a small number of adult and juvenile CV steelhead to temporary increased levels of turbidity and suspended sediment, as well as noise from pile driving activities. The exposure to noise in particular is expected to adversely affect a small number of individuals. Noise may delay or impede fish migration causing increased energy expenditure by affected individuals, but as sound pressure levels are not expected to exceed a peak of 206 dB, no direct and/or immediate mortality of juvenile or adult fish is expected. However, fish exposed to an SEL exceeding 187 dB can be physically injured, and potentially lead to indirect mortality.

The elevated stress levels may degrade the fish's health and the reproductive potential of adults, and increase the potential of juveniles to be preyed upon by striped bass or other large predators due to impaired behavioral and physiological responses. Individuals that appear different in their behavior attract predators, and thus experience higher mortality due to predator attacks. Even so, given the low level of exposure expected to result from adherence to the limited seasonal and diurnal in-water work windows, the limited adverse response expected from the few individuals that are exposed to these adverse effects, and the relatively small contribution to juvenile production that the San Joaquin River Basin provides to the overall population numbers for the CV steelhead DPS, it is expected that the effects of the proposed project, when considered in the context of the current baseline and likely future cumulative effects, would not appreciably reduce the likelihood of survival and recovery of the CV steelhead DPS throughout its range.

b. Southern DPS of North American Green Sturgeon

NMFS anticipates that the proposed project will result in the exposure of a small number of adult and juvenile North American green sturgeon to increased levels of turbidity and suspended sediment, as well as noise from pile driving activities. Given the previous analysis showing that green sturgeon are relatively tolerant of turbid/low light environments, the turbidity effects associated with the proposed project are not expected to result in measurable impacts to green sturgeon. The exposure to noise in particular is expected to adversely affect a small number of individuals. Noise may displace or impede fish that are rearing or holding in the action area causing disruptions in feeding and sheltering behavior of individuals. Prolonged exposure to high sound levels may also result in temporary impacts to the hearing ability of exposed fish, but sound pressure levels are not expected to exceed 206 dB, so no direct and/or immediate mortality of juvenile or adult fish is expected. However, fish exposed to an accumulated SEL exceeding 187 dB can be physically injured, and potentially lead to indirect mortality.

The elevated stress levels associated with sound exposure may degrade the fish's health and the reproductive potential of adults, and increase the potential of juveniles to be preyed upon by striped bass or other large predators due to impaired behavioral and physiological responses. Individuals that appear different in their behavior attract predators, and thus experience higher mortality due to predator attacks. Due to the lack of general abundance information regarding the Southern DPS of North American green sturgeon in the San Joaquin River, a variety of estimates must be utilized to determine the range of potential effects resulting from the take of a small number of green sturgeon due to the proposed action. Compared to the estimated population sizes suggested by the CDFG tagging efforts (CDFG 2002b), juvenile and sub-adult captures passing Red Bluff Diversion Dam, and past Interagency Ecological Program (IEP) sampling efforts, the low level of take estimated from the proposed project would impact a very small proportion of the adult and sub-adult North American green sturgeon DPS. Ratios of tagged white to green sturgeon in San Pablo Bay have generated population estimates averaging 12,499 sub-adult and adult green sturgeon. Captures of juvenile green sturgeon passing Red Bluff Diversion Dam have exceeded 2,000 individuals in some years. Utilizing trap efficiency estimates generated for salmonids at this sampling site (Marten *et al.* 2001) the total estimate of juvenile green sturgeon passing RBDD would be in excess of 20,000 fish during that sampling period. Given these juvenile population estimates, the low level of incidental take of North American green sturgeon that is expected to result from the proposed project would represent a very small proportion of the standing population and is not expected to appreciably reduce the likelihood of survival and recovery of the Southern DPS of North American green sturgeon.

C. Summary of Effects of the Proposed Action on Critical Habitat

The effects of the proposed Antioch Bridge Seismic Retrofit project is expected to have minimal adverse effects upon the functionality and conservation value of the freshwater rearing and migratory corridors designated or proposed as critical habitat in the San Joaquin River. Impacts to the designated and proposed critical habitat within the action area that are related to the

construction actions are expected to be temporary, lasting only as long as the pile driving and mooring lines installation/removal activities. The construction actions should never impede or prevent migratory potential in the channel of the San Joaquin River due to numerous factors, including: timing of work, location of the action (large open migratory habitat still accessible to fish), and protective measures implemented to minimize impacts to the river during construction (*i.e.*, BMPs and SWPPP). Temporary loss of foraging habitat is minimal, given the small footprint of the pile driving compared to the available habitat.

NMFS expects that nearly all of the adverse effects to critical habitat from this project will be of a short-term nature and will not affect future generations of listed fish beyond the construction period of the project.

VIII. CONCLUSION

After reviewing the best scientific and commercial data available, including the environmental baseline, the effects of the proposed project, and the cumulative effects, it is NMFS biological opinion that the Antioch Bridge Seismic Retrofit project is not likely to jeopardize the continued existence of endangered Sacramento River Winter-run Chinook salmon, threatened CV Spring-run Chinook salmon, threatened CV steelhead, or threatened Southern DPS of North American green sturgeon, and is not likely to destroy or adversely modify designated or proposed critical habitat for these species.

IX. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by NMFS as an act which kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not the purpose of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The listing of the Southern DPS of North American green sturgeon became effective on July 7, 2006, and some or all of the ESA section 9(a) prohibitions against take will become effective upon the future issuance of protective regulations under section 4(d). Because there are no section 9(a) prohibitions at this time, the incidental take statement, as it pertains to the Southern DPS of North American green sturgeon, does not become effective until the issuance of a final 4(d) regulation, as appropriate.

The measures described below are non-discretionary, and must be undertaken by Caltrans, as appropriate, for the exemption in section 7(o)(2) to apply. Caltrans has a continuing duty to regulate the activity covered by this incidental take statement. If Caltrans (1) fails to assume and implement the terms and conditions or (2) fails to require any contractors to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to any contract, permit or grant documents, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, Caltrans must report the progress of the action and its impact on the species to NMFS as specified in the incidental take statement [50 CFR §402.14(i)(3)].

A. Amount or Extent of Take

NMFS anticipates incidental take of CV steelhead and the Southern DPS of North American green sturgeon from impacts directly related to pile driving activities and impairment of essential behavior patterns as a result of these activities. The incidental take is expected to be in the form of harm, harassment, or mortality of CV steelhead and green sturgeon, resulting from the installation and removal of temporary piles. Incidental take is expected to occur from August 1 through November 30, when CV steelhead and green sturgeon could potentially be in the action area. Moreover, it is not possible to monitor the resulting take given the site conditions present (high natural turbidity), and the likelihood that the full extent of these effects may be delayed for hours or days after initial exposure, perhaps longer. Therefore, NMFS cannot predict what proportion of the migrating fish will be exposed to elevated noise levels and what proportion will move through the action area at night or during other periods when pile driving is not occurring. Therefore, NMFS has designated specific project elements and effects to act as ecological surrogates for the extent of take anticipated to result from the Antioch Bridge Seismic Retrofit project.

1. Ecological Surrogates

The most appropriate ecological surrogates for the extent of take caused by the Project are: the amount, duration and timing of pile driving and pile removal associated with the construction and removal of the temporary trestle, and the amount, duration and timing of increased turbidity caused by these pile driving and removal activities.

- The analysis of the effects of the proposed project anticipates the installation and subsequent removal of up to 160, 24-inch diameter hallow steel shell piles during the in-water work window between August 1 and November 30, during daylight hours, for one season.

  Specifically, the areas in which take is expected to occur from pile driving within the San Joaquin River are:

  a. within 12 meters of the unattenuated impact pile driving necessary to establish the baseline SPLs for the monitoring, assuming that the peak underwater noise levels

experienced by ESA listed fish within this area will exceed the 206 dB_{peak} injury threshold for a single pile strike (equivalent to no more than 207 dB_{peak} measured 10 meters from the pile);

b. within 6,600 feet of vibratory pile driving, where NMFS expects significant behavioral effects on ESA-listed fish due to SPLs in excess of 150 dB_{rms} (equivalent to 191 dB_{peak} measured at 10 meters from each pile).

NMFS expects that noise levels outside of these areas will not exceed the above described thresholds.

- The analysis of the effects of the proposed project anticipates that the turbidity levels produced by installation/removal of piles will not exceed those permitted under the project SWPPP and that if turbidity levels approach or exceed the acceptable criteria established by the Regional Water Quality Control Board (RWQCB), construction activities will be halted until turbidity levels return to within acceptable levels.

If these ecological surrogates are not met and maintained, the proposed Antioch Bridge Seismic Retrofit project will be considered to have exceeded anticipated take levels, triggering the need to reinitiate consultation on the Project.

B. Effect of Take

NMFS has determined that the level of take resulting from the construction of the proposed project is not likely to jeopardize the continued existence of CV steelhead or the Southern DPS of North American green sturgeon, and is not likely to destroy or adversely modify designated critical habitat for CV steelhead or proposed critical habitat for the Southern DPS of North American green sturgeon.

C. Reasonable and Prudent Measures

NMFS has determined that the following reasonable and prudent measures (RPMs) are necessary and appropriate to minimize the incidental take of listed anadromous fish.

1. Real time monitoring shall be conducted to ensure that underwater sound levels analyzed in this biological opinion (150 db RMS, 187 dB accumulated SEL, and 206 peak SPL) are not exceeded.

2. Measures shall be taken to maintain, monitor, and adaptively manage all conservation measures throughout the life of the project to ensure their effectiveness.

D. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, Caltrans must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary:

1. Real time monitoring shall be conducted to ensure that underwater sound levels analyzed in this biological opinion (150 db RMS, 187 dB accumulated SEL, and 206 peak SPL) are not exceeded.

    a. Caltrans shall monitor underwater sound during all impact hammer pile driving activities on land or in water whenever there is a possibility the activity may exceed the 206 dB peak sound level. If underwater sound produced during five or more strikes on a single day exceeds the maximum allowable level of 206 dB_{peak} at 14 meters from the pile being installed, then NMFS must be contacted within 24 hours.

    b. Caltrans shall submit to NMFS daily hydroacoustic monitoring reports (by noon of the day following pile driving) that provide data regarding the actual (or estimated using propagation models) distance to the NMFS thresholds (150 db RMS, 187 dB accumulated SEL, and 206 peak SPL) used in this biological opinion to determine adverse effects to listed species. Specifically, the reports shall:

        - Describe the locations of hydroacoustic monitoring stations that were used to document the extent of the underwater sound footprint during pile-driving activities, including the number, location, distances, and depths of hydrophones and associated monitoring equipment;

        - Include the total number of pile strikes per pile, the interval between strikes, the peak/RMS SPL and SEL per strike, and accumulated SEL per day for each hydroacoustic monitor deployed.

        - Include a monitoring and reporting program that will include provisions to provide daily summaries of the hydroacoustic monitoring results to NMFS, as well as more comprehensive summary reports on a monthly basis during the pile-driving season.

    c. Caltrans shall submit to NMFS a hydroacoustic monitoring summary due 30 days following pile driving that provides a review of the monitoring data and process, as well as any problems that were encountered.

    d. Pile driving shall occur only during daylight hours from one hour after sunrise to one hour before sunset. This is to ensure that pile driving does not occur at dawn or dusk, during peak salmonid migration and feeding times.

2. Measures shall be taken to maintain, monitor, and adaptively manage all conservation measures throughout the life of the project to ensure their effectiveness.

   a. Caltrans shall monitor and maintain all riparian plantings for 5 years, and provide irrigation, fertilization and replacement plantings as necessary to insure full and rapid recovery of disturbed riparian habitat features

   b. If a listed species is observed injured or killed by project activities, Caltrans shall contact NMFS within 48 hours at 650 Capitol Mall, Suite 8-300, Sacramento, CA 95814. Notification shall include species identification, the number of fish, and a description of the action that resulted in take. If possible, dead individuals shall be collected, placed in an airtight bag, and refrigerated with the aforementioned information until further direction is received from NMFS.

Annual updates and reports required by these terms and conditions shall be submitted by December 31 of each year during the construction period to:

Sacramento Area Office
National Marine Fisheries Service
650 Capitol Mall, Suite 8-300
Sacramento CA 95814
FAX: (916) 930-3629
Phone: (916) 930-3600

XI. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. Caltrans should support and promote aquatic and riparian habitat restoration within the Delta region, and implement practices that avoid or minimize negative impacts to salmon, steelhead, and sturgeon on all of their project sites within critical habitat.

2. Caltrans should provide fiscal and staffing support to anadromous salmonid and sturgeon monitoring programs throughout the Sacramento-San Joaquin Delta to improve the understanding of migration and habitat utilization by salmonids and sturgeon in this region.

In order for NOAA Fisheries to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, NOAA Fisheries requests notification of the

implementation of any conservation recommendations.

XII. REINITIATION NOTICE

This concludes formal consultation on the Antioch Bridge Seismic Retrofit project. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, formal consultation shall be reinitiated immediately.

Enclosure 2

Magnuson-Stevens Fishery Conservation and Management Act

ESSENTIAL FISH HABITAT CONSERVATION RECOMMENDATIONS

I. IDENTIFICATION OF ESSENTIAL FISH HABITAT

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended (U.S.C. 180 *et seq.*), requires that Essential Fish Habitat (EFH) be identified and described in Federal fishery management plans (FMPs). Federal action agencies must consult with NOAA's National Marine Fisheries Service (NMFS) on any activity which they fund, permit, or carry out that may adversely affect EFH. NMFS is required to provide EFH conservation and enhancement recommendations to the Federal action agencies.

EFH is defined as those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity. For the purposes of interpreting the definition of EFH, "waters" includes aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means habitat required to support a sustainable fishery and a healthy ecosystem; and,
"spawning, breeding, feeding, or growth to maturity" covers all habitat types used by a species throughout its life cycle. The proposed project site is within the region identified as EFH for Pacific salmon in Amendment 14 of the Pacific Salmon FMP.

The Pacific Fishery Management Council (PFMC) has identified and described EFH, Adverse Impacts and Recommended Conservation Measures for salmon in Amendment 14 to the Pacific Coast Salmon FMP (PFMC 1999). Freshwater EFH for Pacific salmon in the California Central Valley includes waters currently or historically accessible to salmon within the Central Valley ecosystem as described in Myers *et al.* (1998), and includes the San Joaquin Delta (Delta) hydrologic unit (*i.e.*, number 18040003). Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*), Central Valley spring-run Chinook salmon (*O. tshawytscha*), and Central Valley fall-/late fall-run Chinook salmon (*O. tshawytscha*) are species managed under the Salmon Plan that occur in the San Joaquin Delta hydrologic unit. The enclosed biological opinion (Enclosure 1) thoroughly addresses the species of Chinook salmon listed both under the Endangered Species Act (ESA) and the MSA which potentially will be affected by the proposed action. These include Sacramento River winter-run Chinook salmon and Central Valley spring-run Chinook salmon. Therefore, this EFH consultation will concentrate primarily on the Central Valley fall/late fall-run Chinook salmon which is covered under the MSA, although not listed under the ESA.

Factors limiting Chinook salmon populations in the San Joaquin River include periodic reversed flows due to high water exports (drawing juveniles into large diversion pumps), loss of fish into unscreened agricultural diversions, predation by introduced species, and reduction in the quality

and quantity of rearing habitat due to channelization, pollution, rip-rapping, *etc.* (Dettman *et al.* 1987; California Advisory Committee on Salmon and Steelhead Trout 1988, Kondolf *et al.* 1996a, 1996b).

A. Life History and Habitat Requirements

1. Pacific Salmon

General life history information for Central Valley fall-run Chinook salmon is summarized below. Further detailed information on the other Central Valley Chinook salmon Evolutionarily Significant Units (ESUs) are available in the enclosed biological opinion, the NMFS status review of Chinook salmon from Washington, Idaho, Oregon, and California (Myers *et al.* 1998), and the NMFS proposed rule for listing several ESUs of Chinook salmon (63 FR 11482).

Adult Central Valley fall-run Chinook salmon enter the Sacramento and San Joaquin Rivers from July through December and spawn from October through December while adult Central Valley late fall-run Chinook salmon enter the Sacramento and San Joaquin Rivers from October to March and spawn from January to March (U.S. Fish and Wildlife Service [FWS] 1998). Chinook salmon spawning generally occurs in clean loose gravel in swift, relatively shallow riffles or along the edges of fast runs (NMFS 1997).

Egg incubation occurs from October through April (Reynolds *et al.* 1993). Shortly after emergence from their gravel nests, most fry disperse downstream towards the Delta and into the San Francisco Bay and its estuarine waters (Kjelson *et al.* 1982). The remaining fry hide in the gravel or station in calm, shallow waters with bank cover such as tree roots, logs, and submerged or overhead vegetation. These juveniles feed and grow from January through mid-May, and emigrate to the Delta and estuary from mid-March through mid-June (Lister and Genoe 1970). As they grow, the juveniles associate with coarser substrates along the stream margin or farther from shore (Healey 1991). Along the emigration route, submerged and overhead cover in the form of rocks, aquatic and riparian vegetation, logs, and undercut banks provide habitat for food organisms, shade, and protect juveniles and smolts from predation. These smolts generally spend a very short time in the Delta and estuary before entry into the ocean. Whether entering the Delta or estuary as fry or larger juveniles, Central Valley Chinook salmon depend on passage through the Delta for access to the ocean.

II. PROPOSED ACTION

The proposed action is described in detail in section II (*Description of the Proposed Action*) of the enclosed biological opinion (Enclosure 1).

III. EFFECTS OF THE PROPOSED ACTION

The effects of the proposed action on salmonid habitat (*i.e.*, Central Valley steelhead) are described at length in *Effects of the Action* of the preceding biological opinion, and generally are expected to apply to Pacific salmon EFH.

Effects to EFH stemming from construction activities that may contribute sediment and increase turbidity will be avoided or minimized by meeting Regional Water Quality Board objectives, Caltrans water pollution specifications, implementing applicable BMPs, staging equipment outside of the riparian corridor, limiting the amount of riparian vegetation removal, and replacing (if any) lost riparian vegetation at the project site.

EFH will be adversely affected by the disturbance of up to 0.06 acres of riparian vegetation as a result of construction activities as well as the occupation of the riverbed and water column by temporary work trestles and the columns of the new bridge's substructure. The majority of these impacts are expected to be temporary, as all disturbed areas outside the actual footprint of the new bridge would be restored to preconstruction conditions and any areas of disturbed vegetation would be replanted with native riparian vegetation. Additionally, implementation of the proposed project would result in a permanent net increase of riverine habitat since this project would result in fewer piers being located within the channel.

These effects to EFH may result in a temporary redistribution of some individuals, primarily migrating adult and rearing juvenile salmonids, but, due to the temporary nature of these disturbances, the adverse effects that are anticipated to result from the proposed project are not of the type, duration, or magnitude that would be expected to adversely modify EFH to the extent that it could lead to an appreciable reduction in the function and conservation role of the affected habitat. NMFS expects that nearly all of the adverse effects to EFH from this project will be of a short term nature and will not affect future generations of Pacific salmon beyond the construction period of the project.

IV. CONCLUSION

Based on the best available information, and upon review of the effects of the proposed Antioch Bridge Seismic Retrofit project, NMFS believes that the construction and operation of the project features will have temporary adverse effects on EFH of Pacific salmon protected under MSA.

V. EFH CONSERVATION RECOMMENDATIONS

As the habitat requirements of Central Valley fall-run Chinook salmon within the action area are similar to those of the federally listed species addressed in the enclosed biological opinion, NMFS recommends that reasonable and prudent measures numbers 1 and 2 and their respective implementing terms and conditions listed in the incidental take statement prepared for Central Valley steelhead and the Southern DPS of North American green sturgeon in the associated biological opinion, be adopted as EFH conservation recommendations. Those terms and conditions which require the submittal of reports and status updates can be disregarded for the purposes of this EFH consultation as there is no need to duplicate those submittals.

VI. STATUTORY REQUIREMENTS

Section 305 (b) 4(B) of the MSA requires that the Federal lead agency provide NMFS with a detailed written response within 30 days, and 10 days in advance of any action, to the EFH

conservation recommendations, including a description of measures adopted by the lead agency for avoiding, minimizing, or mitigating the impact of the project on EFH (50 CFR '600.920[j]). In the case of a response that is inconsistent with our recommendations, the lead agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreement with NMFS over the anticipated effects of the proposed action and the measures needed to avoid, minimize, or mitigate such effects.

VII. LITERATURE CITED

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

August 5, 2009

In response refer to:
2009/00173

Jeffery G. Jensen
Office Chief, Office of Biological Sciences and Permits
California Department of Transportation
111 Grand Avenue
P.O. Box 23660
Oakland, California 94623-0660

Dear Mr. Jensen:

This letter is regarding NOAA's National Marine Fisheries Service's biological and conference opinion (Opinion) for the proposed Antioch Bridge Seismic Retrofit project, which was issued to your agency on June 23, 2009. Enclosed please find an errata sheet to insert into the issued Opinion. We are issuing this errata sheet due to an administrative error made in processing the final Opinion. The errata sheet includes minor corrections to the text of the Opinion and to the terms and conditions of the Incidental Take Statement. However, these revisions do not change the basic analyses, findings, or the conclusion of the Opinion that the proposed project is not likely to jeopardize the continued existence of the listed species nor destroy or adversely modify designated or proposed critical habitat.

Please contact Monica Gutierrez at our Sacramento Area Office at (916) 930-3657, or via e-mail at Monica.Gutierrez@noaa.gov, if you have any questions regarding this errata sheet, or require additional information.

Sincerely,

for Rodney R. McInnis
Regional Administrator

Enclosures (2)

cc: Copy to file – ARN# 151422SWR2009SA00060
NMFS-PRD, Long Beach, CA

August 5, 2009

Errata Sheet
For

June 23, 2009 Antioch Bridge Seismic Retrofit Project

Pg 44-47. Effects of the Action. Replace section V.B.1., Pile Driving and Bridge Construction, with the following:

1. Pile Driving and Bridge Construction

The installation of steel piles with an impact hammer is expected to result in adverse effects to listed salmonids and green sturgeon due to high levels of underwater sound that will be produced. Although adverse effects to fish from high levels of underwater sound are well documented for explosives (Gaspin 1975; Keevin and Hempen 1997) and air guns (Pearson *et al.* 1992; Engas *et al.* 1996; McCauley *et al.* 2003; Popper *et al.* 2005), there is little information regarding the effects on fish from underwater sound pressure waves generated during the installation of piles (Caltrans 2001; Vagle 2003). Laboratory research on the effects of sound on fish has used a variety of species and sounds (Hastings *et al.* 1996; Popper and Clarke 1976; Scholik and Yan 2002; Turnpenny *et al.* 1994). Experimental data found in the literature concerning the effects of sound on aquatic animals are not reported in a consistent manner, and most of these studies did not examine the type of sound generated by pile driving. Thus, it is difficult to directly apply the results of those studies to pile driving effects on listed salmonids or green sturgeon. However, we do know that exposure of fish to high levels of underwater sound can cause injuries to their swimbladders and internal organs and temporary and permanent hearing damage. The degree to which normal behavior patterns are altered is less understood.

a. *Internal Injuries*

The degree to which an individual fish exposed to underwater sound will be affected (from a startle response to immediate mortality) is dependent on a number of variables such as the species of fish, size of the fish, presence of a swimbladder, sound pressure intensity and frequency, shape of the sound wave (rise time), depth of the water around the pile and the bottom substrate composition and texture. It has long been known that underwater explosives can cause injury and mortality to fish. The Department of the Navy conducted a series of experiments to determine the effects on fish from underwater explosions (Goertner *et al.* 1994; Gaspin 1975) which resulted in significant differences in effects to fish depending on whether or not they had swimbladders. Thus it is the swimbladder, inflated with gas, which expands rapidly as the pressure wave passes through the fish that likely causes the observed injuries to internal organs (Keevin and Hempen 1997). An important characteristic of the underwater sound that causes injury is the frequency. During pile installation, most energy is contained within the frequency range (100-1,000 Hertz) which results in reverberation of the swimbladder. Studies have shown that the most susceptible tissues that are injured during exposure to underwater sound produced from pile driving are the soft-tissue organs surrounding the swimbladder, such as the liver and kidney (Caltrans 2001; Abbott and Bing-Sawyer 2002; Caltrans 2003).

There are two types of swimbladders: physostomous, in which the organ is thin, membranous and connects to the esophagus through a pneumatic duct, and physoclistous, in which the organ is thick-walled and connected to the blood stream (Smith 1982). Salmonids and green sturgeon have physostomous swimbladders (Smith 1982; Lagler *et al.* 1977). As indicated by Keevin and Hempen (1997) fish with physoclistous swimbladders are believed to be most sensitive to blast pressures, however, species with both types of swimbladders are more susceptible to injury than fish with no swimbladders.

Although underwater sound pressure waves generated during pile driving are different in several ways from those generated during explosions, the mechanism of injury (*i.e.*, swimbladder expansion) may be similar. The most important differences between the two are the repetitive nature of pile driving and the overpressure-underpressure oscillations within the pile driving signal. When combined with the multiple strikes to which most fish will be exposed, these repetitive oscillations likely cause the swimbladder to act like a drum, and although any single pulse (depending on its magnitude) may not result in injury to the internal organs, the repetitive nature of the sound produced during pile driving is likely to result in injury.

In 2004, FHWA and Caltrans formed the Fisheries Hydroacoustic Working Group (FHWG) to address the issue of potential impacts to listed species from exposure to underwater sounds produced by pile driving. Caltrans contracted with prominent experts in the field of underwater acoustics to review existing literature on the effects of underwater sound on fish. The result of that effort (Hastings and Popper 2005) indicated that the use of the Sound Exposure Level (SEL) metric, which is expressed as decibels (dB) re one micropascal squared-second[1], would be a better metric to use to correlate physical injury to fish from underwater sound pressure produced during the installation of piles than peak sound pressure level (SPL) that was currently being used. The primary rationale for this new metric was the ability to sum the energy over multiple pulses, which cannot be accomplished with peak pressure. Using SEL, the exposure of fish to a total amount of energy (*i.e.* dose) can be used to determine a physical injury response.

A white paper written for the FHWG by Popper *et al.* (2006) proposed a dual metric approach, incorporating both SEL and peak pressure, in assessing potential physical injuries to fish from exposure to high levels of underwater sound produced during pile driving. The authors proposed interim single strike thresholds of 187 dB_{SEL} and 208 dB_{peak} re one micropascal[2]. In a critique of the white paper, NMFS scientists from the Northwest Fisheries Science Center in Seattle, Washington (Memorandum to Mr. Russ Strach and Mr. Mike Crouse, NMFS from Tracy Collier, NMFS, September 19, 2006) stated that exposure to multiple strikes must be considered in assessing impacts. They further stated that the method described in Hastings and Popper (2005) is appropriate. Specifically, to account for exposure to sound impulses generated by multiple hammer strikes, the single strike SEL at a given distance from the pile is added to 10*log(number of strikes). At a FHWG meeting in Vancouver, Washington in June 2008, an Agreement in Principle between NMFS, Caltrans and others was reached regarding the establishment of interim thresholds to be used to assess physical injury to fish exposed to underwater sound produced during pile driving. Specifically, this included a single strike peak

1 In the remainder of this document, SELs are referenced to one micropascal squared-second.

2 In the remainder of this document, peak SPLs are referenced to one micropascal.

In addition, elevated SPLs from impact and vibratory pile driving could conceivably delay the migration of fish and affect their foraging and migratory behavior.

To determine the level of underwater sound that would elicit a behavioral response, Turnpenny *et al.* (1994) exposed a variety of fish species to varying levels of sound and frequency. No significant avoidance was found for trout at exposure levels (metric not specified) of up to 150 dB, although a reaction threshold of around 170 dB was observed. The authors used pure tone bursts, which cause an effect at a lower sound pressure level due to the higher duty cycle of the signal.

In the early 1990s, pile driving operations in Puget Sound were reported to disrupt juvenile salmon behavior (Feist *et al.* 1992). Though no underwater sound measurements are available from that study, comparisons between juvenile salmon schooling behavior in areas subjected to pile driving/construction and other areas where there was no pile driving/construction indicate that there were fewer schools of fish in the pile-driving areas than in the non-pile driving areas. The results were not conclusive, but suggest that pile-driving operations may result in a disruption in normal migratory behavior.

During the construction of the Benicia-Martinez Bridge Project in April 2002, observations were made during pile driving that suggest small fish subject to the exposure of elevated underwater sound pressure levels can be vulnerable to predation. The stomach of a piscivorous striped bass (*Morone saxatilis*) killed by high underwater sound pressure levels was examined and found to contain several freshly consumed juvenile herring (R. Blizard, Caltrans, personal communication, May 2002). Although necropsies were not performed on the juvenile herring (*Clupea harengus*), the consensus of the biologists present at the site was that the striped bass was feeding heavily on killed, injured, or stunned herring as it also swam too close into the zone of lethal sound pressure levels.

There is uncertainty as to the behavioral response of fish to elevated levels of underwater sound produced when driving piles in or near water. Until new information indicates otherwise, NMFS believes a 150 dB_{rms} threshold for behavioral responses for salmonids is appropriate. Given the typical 15 decibel or so difference between peak SPL and rms, a value of 150 dB_{rms} is approximately equivalent to 165 dB_{peak} SPL.

d. *Pile Driving at the Antioch Bridge Project*

The proposed project includes installation of a temporary trestle (approximately 910 ft long) that will be constructed from the south end of the bridge. The proposed project will require two 24-in diameter steel shell piles for every 25 ft of trestle and around the piers. The driving of steel piles for the temporary trestle will occur in water less than 10 ft in depth. There will be approximately 160 piles driven to a depth of 50 ft to support the temporary trestle. Four to six piles supporting between two to three sections of the trestle will be installed per day. Water depths will range from the shore or mud during lower tides to about 10 ft (3 m). These piles will be vibrated in for approximately ten minutes per pile and one pile per each section (approximately 36 sections in total) will be driven with an impact hammer for approximately 20 strikes per pile to verify the load bearing capacity of the pile. This would equate to a maximum of 3,600 seconds of

vibratory pile installation and 60 hammer strikes per day. On a temporal scale, much more time will be spent using a vibratory hammer to install the piles. However, underwater sound levels generated when using a vibratory hammer (180 dB peak SPL and 166 dB SEL and RMS) are substantially less than when using an impact hammer on a similar size pile. For this project, NMFS estimates that sound levels during the use of a vibratory hammer will be below those considered to physical injure listed salmonids or green sturgeon, although fish within 117 m of the piles may respond behaviorally. Less time will be spent using an impact hammer, but the effect will be greater. Using single strike underwater sound estimates (based on 10 m from the pile) of 208 dB peak SPL, 194 dB rms, and 178 dB SEL, NMFS calculated the distances of 14 m for physical injury due to any single strike or 38 m for physical injury due to cumulative sound exposure, and 8,577 m for adverse behavioral response.

e. *Summary of Effects from Pile Driving*

The activities related to pile driving are temporary and will only last the duration of the in-water work activities. Both injurious and subinjurious effects to juvenile CV steelhead and green sturgeon, including altered behavior, auditory masking, temporary hearing threshold shifts, damage to the fish auditory system and internal organs, are expected and can affect their vulnerability to predation, foraging success, and other factors that influence survival and fitness. Pile driving will take place during each in-water work window during the bridge construction period (*i.e.*, concurrently with pile driving during temporary trestle installation and during removal of the temporary piles as elements of bridge construction are completed). Because daily pile driving activities will be separated by overnight rest periods when migration can proceed uninhibited, upstream and downstream migration of listed fish are not expected to be significantly delayed. The populations of these fish in the San Joaquin River represent a small number of the entire population in the Central Valley, and the action is expected to have little impact upon the entire DPS. There is potential for adult CV steelhead and green sturgeon to be adversely effected from pile driving activities, however, it is expected to be relatively low due to their larger bodies (above two grams) and pile driving activities occurring only in the daytime which would avoid crepuscular and nocturnal periods when steelhead and sturgeon migratory activity is highest.

Pg. 58. Under the first bullet of the Ecological Surrogates, replace letter a. with the following:

a. within 14 meters of the unattenuated impact pile driving necessary to establish the baseline SPLs for the monitoring, assuming that the peak underwater noise levels experienced by ESA listed fish within this area will exceed the 206 dB_{peak} injury threshold for a single pile strike (equivalent to no more than 208 dB_{peak} measured 10 meters from the pile);

Pg. 59. Under the first bullet of the Ecological Surrogates, replace letter b. with the following:

b. within 8,577 m of impact pile driving, where NMFS expects significant behavioral effects on ESA-listed fish due to SPLs in excess of 150 dB_{rms} (equivalent to 194 dB_{rms} measured at 10 meters from each pile).

sound pressure level (SPL) of 206 dB and an accumulated SEL of 187 dB for fish greater than 2 grams or 183 dB for fish less than 2 grams. If either threshold is exceeded, then physical injury is assumed to occur. Because all ESA-listed fish in the action area during pile driving are expected to be larger than 2 grams, the threshold for accumulated SEL used in this analysis is 187 dB.

NMFS must make some assumptions as to the behavior of the fish in order to determine the response (*i.e.*, injury) of the fish. Sonalysts (1997) suggested that although fish (including Atlantic salmon) exhibit a startle response during the first few acoustic exposures, they do not move away from areas of very loud underwater sounds and can be expected to remain in the area unless they are carried away by currents or normal movement patterns. Generally, NMFS will assume that fish will remain in the vicinity of pile driving activities if occupied before pile driving commenced.

NMFS must also make some assumptions as to the recovery of tissue between pile strikes and between multiple piles being driven. It is not known whether there is recovery from any effects of pile driving in the intervals between strikes or, if there is recovery, how long between successive strikes is necessary for this to occur (Popper *et al.* 2006). Although mammalian auditory systems have been show to recover from trauma over periods of time between successive stimuli (Chen *et al.* 1999), if one pile driving strike is quickly followed by another, there is likely a cumulative effect since there may be little tissue recovery following the first strike. As noted in Popper *et al.* (2006) fish tissue is assumed to not recover within intervals on the order of a few seconds between hammer strikes (*e.g.*, they are essentially continuations of the same exposure).

Typically, several piles are installed on any given day, with tens of minutes or hours between the completion of one pile and the initial driving of the next. Recovery of fish tissue likely occurs if pile driving ceases for an extended period of time. At this time, there are no direct empirical data available to determine the conditions required for partial or full recovery of sensory function between exposures. Although there may be some tissue recovery between the completion of one pile and the beginning of pile driving at the next, given the level of uncertainty that exists, NMFS will sum the underwater sound energy produced during the installation of all piles on any given day (assuming pile driving ceases for at least 12 hours during the night) to determine potential physical effects to listed salmonids and green sturgeon (described below).

b. *Hearing Damage*

Sound is a major form of underwater communication for fish, so a functioning auditory system is essential for fish to survive. The structure of the fish inner ear is similar to that of other vertebrates: each ear has three semicircular canals and three otolithic organs, the utricle, saccule, and lagena. The semicircular canals and otolithic chambers are interconnected and filled with endolymphatic fluid. The swimbladder may act somewhat as an eardrum by responding to the sound pressure waves, depending on the species of fish. The motion of the swimbladder radiates a secondary signal to the inner ear. This provides the necessary particle movement for otolithic/auditory nervous stimulation, especially in species having the shortest distance between the swimbladder and the auditory apparatus (pars inferior).

High levels of underwater acoustic noises have been shown to have adverse impacts upon the auditory sensory organs of fish within close proximity of the noise source. The loss of hearing sensitivity may adversely affect a salmonids' ability to orient itself (*i.e.*, due to vestibular damage), detect predators, locate prey, or sense their acoustic environment. Chronic noise exposure can reduce a fish's ability to detect piscine predators either by reducing the sensitivity of the auditory response or by masking the noise of an approaching predator. Disruption of the exposed fish's ability to maintain position or swim with the school will enhance its potential as a target for predators. Unusual behavior or swimming characteristics single out an individual fish and allow a predator to focus its attack upon that fish more effectively.

The literature indicates damage to hearing by intense sound depends on auditory threshold and will vary from species to species (Popper and Fay 1973). Damage to hearing is normally measured in sound pressure levels expressed as root mean squared (RMS) decibels re 1 micropascal[3]. Some fish have hearing thresholds as low as 50 dB_{rms} while others have thresholds as high as 150 dB_{rms}. Enger (1981) exposed 26 cod (*Gadus morhua*) to continuous tones of 180 dB_{rms} at frequencies from 50 to 400 Hertz (Hz) for one to five hours and found destruction of auditory hair cells in the saccule. The cod has a hearing threshold of 75-80 dB_{rms} between 100 and 200 Hz (Chapman and Hawkins 1973), so 180 dB_{rms} is about 100 dB above threshold. For Atlantic salmon (*Salmo salar*), Hawkins and Johnstone (1978) reported a hearing threshold of 95-100 dB_{rms} between 100 and 200 Hz. Since the 100-200 Hz is the bandwidth of best sensitivity for both cod and Atlantic salmon, Hastings (2002) stated she would expect to see damage of auditory hair cells in salmon occurring with exposure to continuous sound at about 200 dB_{rms}. The peak pressure associated with a continuous sound of 200 dB_{rms} is equivalent to 203 dB_{peak}, thus Hastings (2002) concludes permanent hearing damage to the sensory hearing cells of salmonids onsets at a sound level of 203 dB_{peak}. Given the aforementioned discussion, it appears that physical damage to the auditory system of salmonids is likely to occur with continuous sound levels at or above 200 dB_{rms}. However, at this time unclear how auditory tissue cells are affected, either temporarily or permanently, by the repeated bursts of sound wave energy resulting from pile driving, as pure tone continuous sound cannot be correlated with broad frequency multiple impulse sound.

Sonalysts (1997) reported that they performed reaction testing with caged Atlantic salmon at a wide range of sound pressure levels and frequencies. They stated that although some avoidance was noted at certain specific levels and frequencies, no avoidance response was seen when the sound pressure levels (likely RMS) were over 180 dB. The report also included a brief discussion of previously unreported studies that show that beyond a brief startle response associated with the first few acoustic exposures, fish do not move away from areas of very loud noises and are expected to remain in the area unless they are carried away by currents.

c. *Modification to Behavior*

Behavioral responses to high noise levels can be in the form of a startled response, avoidance, agitation, etc. These behavioral responses can also lead to increased susceptibility to predation.

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3 In the remainder of this document, rms pressure levels are referenced to one micropascal.

Pg. 63. Reasonable and Prudent Measures. Replace section IX. C. 1 with the following:

1. Real time monitoring shall be conducted to ensure that underwater sound levels produced during impact pile driving and analyzed in this biological opinion (150 dB RMS at 8,577 m, 187 dB accumulated SEL at 38 m, and 206 dB peak SPL at 14 m from the piles being driven) are not exceeded.

Pg. 60. Terms and Conditions. Replace section IX. D. 1 a. with the following:

1. Real time monitoring shall be conducted to ensure that underwater sound levels produced during impact pile driving and analyzed in this biological opinion (150 dB RMS at 8,577 m, 187 dB accumulated SEL at 38 m, and 206 dB peak SPL at 14 m from the piles being driven) are not exceeded.

    a. Caltrans shall monitor underwater sound during all impact hammer pile driving activities on land or in water. If underwater sound exceeds 150 dB RMS at 8,577 m, 187 dB accumulated SEL at 38 m, and 206 peak SPL at 14 m from the piles being driven, then NMFS must be contacted within 24 hours.

Appendix H - U.S. Army Corps of Engineers – Jurisdictional Determination

DEPARTMENT OF TRANSPORTATION
111 GRAND AVENUE
P. O. BOX 23360
OAKLAND, CA 94612
PHONE (510) 622-8729
FAX (510) 286-5600
TTY (800) 735-2929

Flex your power!
Be energy efficient!

August 18, 2008

Kathleen A. Dadey, PhD.
ATTN: Paul Maniccia
U.S. Army Corps of Engineers
Regulatory Branch
Sacramento District
1325 J Street, Room 1480
Sacramento, CA 95814-2922

04-CC/SAC-160 PM 0.8-1.33/1.3-2.7
EA 1A5210

Dear Dr. Dadey,

Please find enclosed the preliminary Jurisdictional Determination (JD) report *Delineation of Wetlands and Other Waters for the Antioch Bridge Seismic Retrofit Project: Caltrans EA 1A521*. Antioch Bridge spans the San Joaquin River along State Route 160, connecting Contra Costa County east of Antioch with Sacramento County on Sherman Island. The specific location of the bridge runs from Contra Costa Post Mile 0.8 – 1.3 and Sacramento Post Mile 0 – 1.3 along State Route 160.

We are requesting jurisdictional determination on the wetlands and other waters of the United States within the project boundaries as identified within the report. We also would like to request a field visit at the project site with appropriate USACE personnel, at your earliest convenience, as per our discussion during the July 14, 2008 meeting.

We greatly appreciate the time your office is taking to review this project amidst the heavy workload that you are under. We would also appreciate your sending us the USACE file number for this project once it has been assigned. If you have any questions, please do not hesitate to contact Stuart Kirkham (510) 286-5602.

Sincerely,

JEFFREY G. JENSEN
District Office Chief
Office of Biological Science and Permits

bc: Mo Pazooki, Toll Bridge Design
Jeffrey Jensen, Biological Sciences and Permits
Christopher States, Biological Sciences and Permits
Howell Chan, Environmental Analysis

JJ/wsk

Appendix I - Cultural Resources Screening Memo

State of California
DEPARTMENT OF TRANSPORTATION

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: HOWELL CHAN
Environmental Branch Chief
Office of Environmental Analysis

Date: March 3, 2009

File: 04-CC/SAC-160
PM 0.80-1.33/0.00-1.30
EA: 1A5210

From: TODD JAFFKE TJ
Branch Chief, East Counties
Office of Cultural Resource Studies

Subject: Final Cultural Resources compliance for the Proposed Antioch Bridge Retrofit Project in Contra Costa and Sacramento Counties.

This memorandum is to acknowledge that the Office of Cultural Resource Studies has completed the required Historic Property Survey Report (HPSR) and Archaeological Survey Report (ASR) for the Antioch Bridge Retrofit Project.

The Office of Cultural Resource Studies (OCRS) has completed these reports to ensure that the undertaking is carried out in a manner consistent with Caltrans responsibilities under the January 2004 *Programmatic Agreement Among the Federal Highway Administration, the Advisory Council on Historic Preservation, the California State Historic Preservation Officer, and the California Department of Transportation Regarding Compliance with Section 106 of the National Historic Preservation Act, as it Pertains to the Administration of the Federal-Aid Highway Program in California* (PA) for compliance with Section 106 of the National Historic Preservation Act (NHPA).

In accordance with the PA, this HPSR and ASR will not need to be submitted to the Office of Historic Preservation for review as it has a Finding of No Historic Properties Affected. The HPSR and ASR copies will be filed and documented within our office, and a copy will also be sent to Howell Chan for the environmental files. The Section 106 process is now complete for this project. However, if project plans should change, additional studies may be required.

If you need any additional information, please do not hesitate to contact me at (510) 622-8765 or todd_jaffke@dot.ca.gov or Kathryn Rose at (510) 286-5630 or via email at kathryn_rose@dot.ca.gov.

CC: CRS Files, HRC

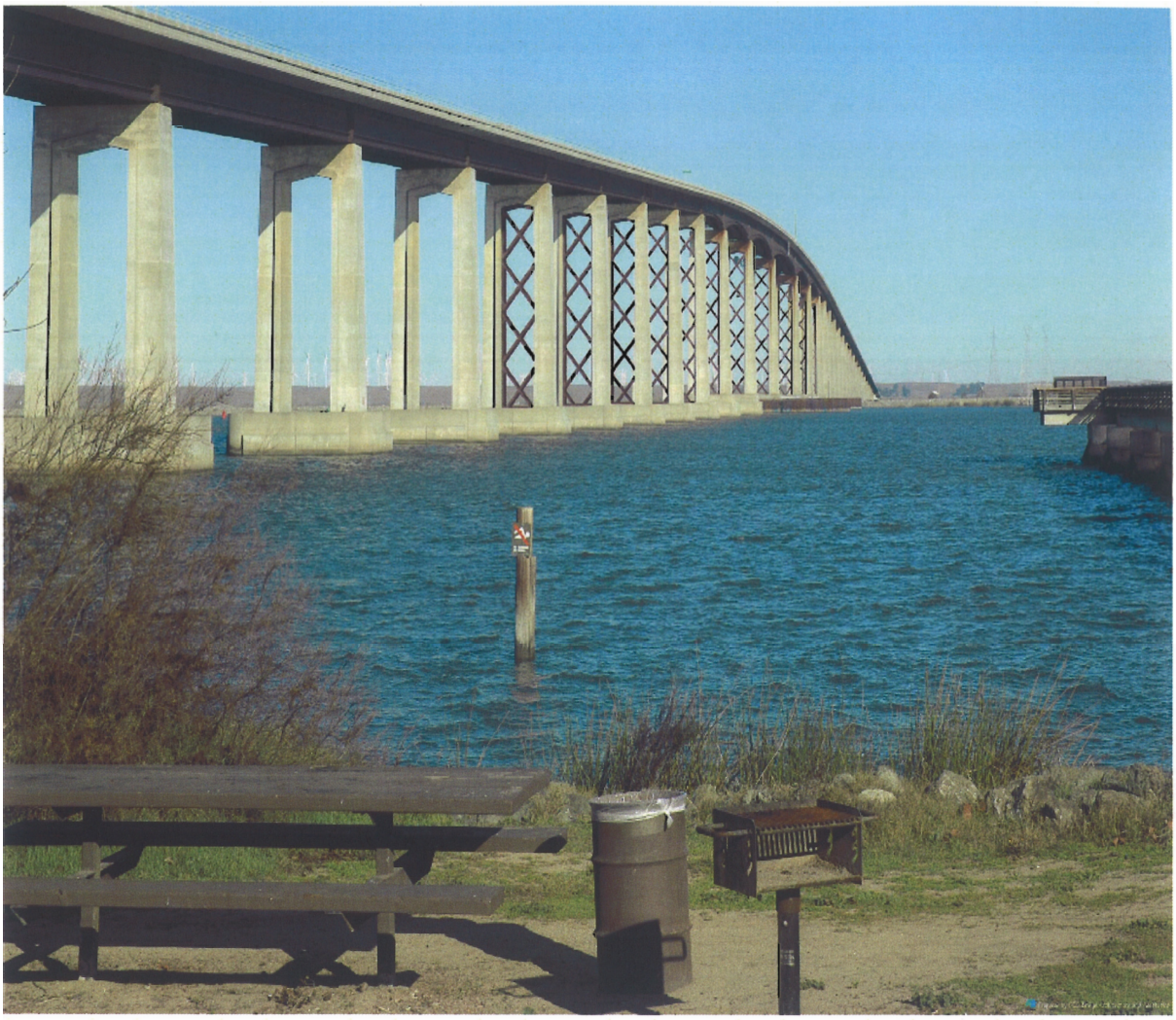
Appendix J - Results of Hydro-acoustic Analysis

Threshold	Marine Mammals (RMS)				Fish		
	Vibratory		Impact				
	A[a]	B[b]	A[a]	B[b]	Peak	Large SEL	Small SEL
dB re:1µPa	**190 dB**	**120 dB**	**190 dB**	**160 dB**	**206 dB**	**187 dB**	**183 dB**
Impact Hammer @ 20 Blows/ day with atenuation	NA	NA	30ft	845ft.	30ft.	30ft.	30ft.
Vibratory Hammer @ 2400 sec/day (4 piles) with no atenuation	75 ft.	10.2 mi	NA	NA	0 ft.	50ft.	75ft.
Vibratory Hammer @ 3600 sec/day (6 piles) with no atenuation	75 ft.	10.2 mi	`NA	NA	0 ft.	50ft.	75ft.

[a] Level A harassment, as defined by the 1994 Marine Mammal Protection Act, has the potential to injure a marine mammal or marine mammal stock in the wild.

[b] Level B harassment, as defined by the 1994 Marine Mammal Protection Act, has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering but which does not have the potential to injure a marine mammal or marine mammal stock in the wild.

Appendix K - Antioch Bridge Visual Simulation



Appendix L - Potential Wetlands and Other Waters in the Study Area

Appendix M. Potential Wetlands and Other Waters in the Study Area (Map 1 of 4)

Antioch Bridge Seismic Retrofit Project

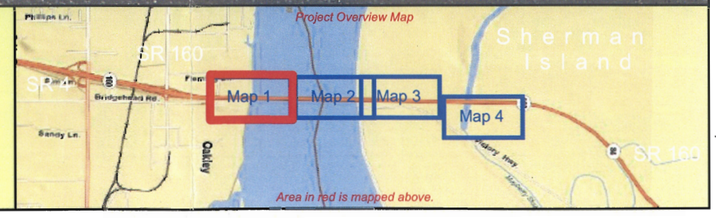
Delineators: Russell Huddleston (CH2M HILL), Stuart Kirkham, Diane Joy Hughey, Kevin Hostert (Caltrans)
Aerial Photo: Caltrans DHIPP Database, June 20, 2002
Map Prepared 8/14/2008: Stuart Kirkham (Caltrans)
Map Revised 10/8/08: Dana Morawitz (CH2M HILL)

N

0 50 100 200 Feet

- Sample Plots (SP)
- USACE Jurisdictional Verification Boundary
- Contour Lines (1 ft interval)
- Emergent Wetland (EW) - 0.282 acres
- Irrigation/Drainage (I/D) - 0.723 acres
- Open Water (OW) - 20.577 acres
- Seasonal Wetland (SW) - 10.298 acres

Note: Acreages in legend refer to total per wetland type. Acreage on maps refers to the acreage of the feature e.g. SW-5 0.012 acres.



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MEAN HIGH WATER (MHW) = 3.84 FT
NAVD 88 VERTICAL DATUM

OW-1
19.952
acres

SP-22
SP-20
SP-21
SW-1
0.025
acres
SW-2
4.893
acres
SP-17
I/D-1
0.017
acres

San Joaquin River

Sherman Island Levee Rd

Appendix M. Potential Wetlands and Other Waters in the Study Area (Map 2 of 4)

Antioch Bridge Seismic Retrofit Project

Delineators: Russell Huddleston (CH2M HILL), Stuart Kirkham, Diane Joy Hughey, Kevin Hostert (Caltrans)
Aerial Photo: Caltrans DHIPP Database, June 20, 2002
Map Prepared 8/14/2008: Stuart Kirkham (Caltrans)
Map Revised 10/8/08: Dana Morawitz (CH2M HILL)

N

0 50 100 200 Feet

Sample Plots (SP)
USACE Jurisdictional Verification Boundary
Contour Lines (1 ft interval)

Emergent Wetland (EW) - 0.282 acres
Irrigation/Drainage (I/D) - 0.723 acres
Open Water (OW) - 20.577 acres
Seasonal Wetland (SW) - 10.298 acres

Note: Acreages in legend refer to total per wetland type. Acreage on maps refers to the acreage of the feature e.g. SW-5 0.012 acres.

Project Overview Map

Map 1 Map 2 Map 3 Map 4

Area in red is mapped above.

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I/D-1
0.017
acres

I/D-2
0.107
acres

SW-1
0.025
acres

SW-2
4.893
acres

SW-3
3.284
acres

OW-2
0.008
acres

OW-3
0.043
acres

I/D-3
0.007
acres

SP-20
SP-22
SP-21
SP-16
SP-17
SP-15
SP-14
SP-13
SP-19
SP-18
SP-12
SP-11

Appendix M. Potential Wetlands and Other Waters in the Study Area (Map 3 of 4)

Antioch Bridge Seismic Retrofit Project

Delineators: Russell Huddleston (CH2M HILL), Stuart Kirkham, Diane Joy Hughey, Kevin Hostert (Caltrans)
Aerial Photo: Caltrans DHIPP Database, June 20, 2002
Map Prepared 8/14/2008: Stuart Kirkham (Caltrans)
Map Revised 10/8/08: Dana Morawitz (CH2M HILL)

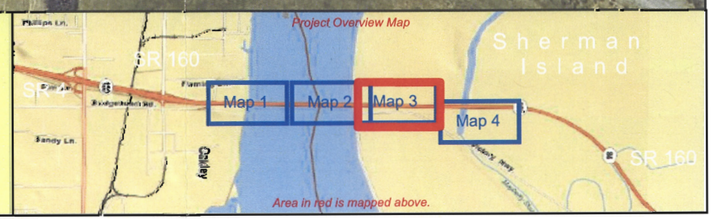
N

0 50 100 200 Feet

Sample Plots (SP)
USACE Jurisdictional Verification Boundary
Contour Lines (1 ft interval)

Emergent Wetland (EW) - 0.282 acres
Irrigation/Drainage (I/D) - 0.723 acres
Open Water (OW) - 20.577 acres
Seasonal Wetland (SW) - 10.298 acres

Note: Acreages in legend refer to total per wetland type. Acreage on maps refers to the acreage of the feature e.g. SW-5 0.012 acres.



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SP-10
SW-3
3.284
acres
I/D-4
0.014
acres
EW-2
0.07
acres
OW-4
0.533
acres
EW-3
0.06
acres
ORDINARY HIGH WATER
(OHW)
Mayberry
Slough
I/D-5
0.116
acres
SP-26
SP-09
SP-29
SP-30
SW-4
0.501 acres
SP-28
SP-27
SP-07
SP-08
SW-5
0.012
acres
I/D-6
0.121
acres
SP-02
SP-01
SP-03
SP-04
SP-05
SP-06
SW-6
1.583
acres
SP-25
I/D-8
0.018
acres
SP-24
SP-23
I/D-7
0.227
acres
OW-5
0.042
acres
I/D-9
0.097
acres

Appendix M. Potential Wetlands and Other Waters in the Study Area (Map 4 of 4)

Antioch Bridge Seismic Retrofit Project

Delineators: Russell Huddleston (CH2M HILL), Stuart Kirkham, Diane Joy Hughey, Kevin Hostert (Caltrans)
Aerial Photo: Caltrans DHIPP Database, June 20, 2002
Map Prepared 8/14/2008: Stuart Kirkham (Caltrans)
Map Revised 10/8/08: Dana Morawitz (CH2M HILL)

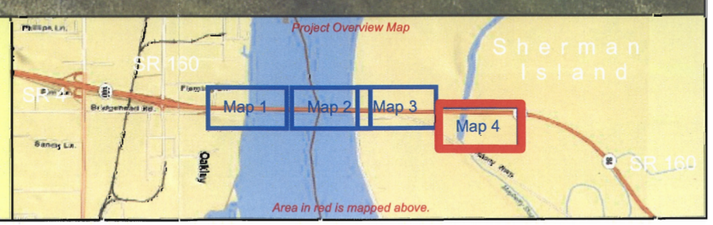
N

0 50 100 200 Feet

- Sample Plots (SP)
- USACE Jurisdictional Verification Boundary
- Contour Lines (1 ft interval)

- Emergent Wetland (EW) - 0.282 acres
- Irrigation/Drainage (I/D) - 0.723 acres
- Open Water (OW) - 20.577 acres
- Seasonal Wetland (SW) - 10.298 acres

Note: Acreages in legend refer to total per wetland type. Acreage on maps refers to the acreage of the feature e.g. SW-5 0.012 acres.



Appendix M - List of Technical Studies

Biological Opinion NOAA's National Marine Fisheries Service, June 23, 2009

Biological Opinion USFWS, August 14,2009

Antioch Bridge Seismic Retrofit Project Burrowing Owl survey July 28, 2009

Request for Incidental Harassment Authorization from NOAA's National Marine Fisheries Service, August 2009

Incidental Take permit application for Giant Garter Snake and Longfin Smelt, June 2009

Section 1602 California Fish and Game Code Lake and Streambed Alteration Agreement Application Package, June 2009

Draft Natural Environment Study, March 2009

Delineation of Wetlands and other Waters of the United States, October 2008

Section 404 Clean Water Act Nationwide Permit Applicatiionand Pre-construction Notification Package, April 2009

Cultural Resources Review of the Antioch Bridge Seismic Retrofit Project, March 03, 2009

Historic Property Survey Report,

Archaeological Survey report, January,2009

Hazardous Materials and Waste Summary

Geotechnical Report

Incidental Harassment Authorization Request, March 2009

Jurisdictional Wetland Delineation Report, November 2008

Project Scope Study Report, 2008

Storm Water Data Report, July,2009

Appendix M - List of Acronyms

APE – Area of Potential Effect

BA – Biological Assessment

BATA – Bay Area Toll Authority

BCDC - Bay Area Conservation and Development Commission

BMPs – Best Management Practices

BO – Biological Opinion

CVS– Central Valley Steelhead

CDFG – California Department of Fish and Game

CEQA – California Environmental Quality Act

CESA – California Endangered Species Act

CNPS – California Native Plant Society

CWA – California Water Act

Department – California Department of Transportation

EFH - Essential Fish Habitat

EPA – Environmental Protection Agency

ESA – Environmental Sensitive Area

FEDA – Federal Endangered Species Act

FHWA – Federal Highway Administration

FMP - Fisheries Management Plan

GHG – Green House Gas

IHA – Incidental Harassment Act

ITA – Incidental Take Permit

IPCC – Intergovernmental Panel on Climate Change

LOA - Letters of Authorization

MBTA – Migratory Bird Treaty Act

MCE – Maximum Credible Earthquake

MEP – Maximum Extent Practicable

MLD - Most Likely Descendent

MMMP - Marine Mammal Monitoring Program

MMPA - Marine Mammal Protection Act

MND – Mitigated Negative Declaration

MSFCMA - Magnuson-Stevens Fisheries Conservation and Management Act

NEPA – National Environmental Policy Act

NES – Natural Environment Study

NHPA – National Historic Preservation Act

NMFS – National Marine Fisheries Service

NOAA – National Oceanic and Atmospheric Administration

NPDES – National Pollution Discharge Elimination System

PA – Section 106 Programmatic Agreement

ROW – Right of Way

RWQCB – Regional Water Quality Control Board

SHPO – State Historic Preservation Officer

SWDR – State Water Department of Resources

SWRCB – State Water Resources Control Board

SWPPP – Storm Water Pollution Prevention Program

SWRCB – State Water Resources Control Board

TMP – Transportation Management Plan

TDC - Target Design Constituents

USACE – United States Army Corps of Engineers

USFWS – United States Fish and Wildlife Service

USGS – United States Geological Society

VIA – Visual Impact Assessment