UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
650 Capitol Mall, Suite 5-100
Sacramento, California 95814-4700

**Refer to NMFS No: [WCR-2017-7288]**

December 1, 2017

Julia Green
Branch Chief
California Department of Transportation
District 3 Environmental Management
703 B Street
Marysville, California 95901

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Bridge Scour Mitigation Project in Sacramento County, Project Number 03-3F540

Dear Mr Green:

Thank you for your letter of April 7, 2017, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for Bridge Scour Mitigation Project in Sacramento County, Project Number 03-3F540.

NMFS recognizes that Caltrans has assumed the Federal Highway Administration's (FHWA) responsibilities under Federal environmental laws for this project as allowed by a Memorandum of Understanding with the FHWA effective December 23, 2016.

Thank you, also, for your request for consultation pursuant to the essential fish habitat (EFH) provisions in Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA)(16 U.S.C. 1855(b)) for this action.

The enclosed biological opinion, based on the provided biological assessment and best available scientific and commercial information, concludes that the proposed action is not likely to jeopardize the continued existence of the Central Valley spring-run Chinook salmon (*Oncorhynchus tshawytscha*) evolutionary significant unit; California Central Valley (CCV) steelhead (*O. mykiss*) distinct population segment; or southern distinct population segment of North American green sturgeon (*Acipenser medirostris*), and is not likely to destroy or adversely modify their designated critical habitats. NMFS has also included an incidental take statement with reasonable and prudent measures and non-discretionary terms and conditions that are necessary and appropriate to avoid, minimize, or monitor incidental take of listed species associated with the project.

NMFS also reviewed possible project effects to the Sacramento River winter-run Chinook salmon evolutionary significant unit (*O. tshawytscha*), and concluded that the action is not likely to adversely affect this evolutionary significant unit or its designated critical habitat.

NMFS' review concludes that the project will adversely affect the EFH of Pacific Coast Salmon in the action area and has included conservation recommendations, including adoption of the ESA reasonable and prudent measures and associated terms and conditions from the biological opinion.

Caltrans has a statutory requirement under section 305(b)(4)(B) of the MSA to submit a detailed written response to NMFS within 30 days of receipt of these conservation recommendations.

Please contact Katie Schmidt at (916) 930-3685, or via email at katherine.schmidt@noaa.gov, if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

for Barry A. Thom
Regional Administrator

Enclosure

cc: To the file: 1251422-WCR2017-SA00346

UNITED STATES DEPARTMENT OF COMMERCE
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# Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response

Bridge Scour Mitigation Project in Sacramento County
Project Number 03-3F540

National Marine Fisheries Service Consultation Number: WCR-2017-7288

**Action Agency:** California Department of Transportation

**Affected Species and NMFS' Determinations:**

| ESA-Listed Species | Status | Is Action Likely to Adversely Affect Species?* | Is Action Likely to Affect Critical Habitat? | Is Action Likely To Jeopardize the Species? | Is Action Likely To Destroy or Adversely Modify Critical Habitat? |
|---|---|---|---|---|---|
| Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*) evolutionarily significant unit (ESU) | Endangered | No | NA | NA | NA |
| Central Valley spring-run Chinook salmon (*Oncorhynchus tshawytscha*) ESU | Threatened | Yes | Yes | No | No |
| California Central Valley steelhead (*Oncorhynchus mykiss*) distinct population segment (DPS) | Threatened | Yes | Yes | No | No |
| Southern DPS of North American green sturgeon (*Acipenser medirostris*) | Threatened | Yes | Yes | No | No |

*Please refer to section 2.12 for the analysis of species or critical habitat that are not likely to be adversely affected.

| Fishery Management Plan That Describes EFH in the Project Area | Does Action Have an Adverse Effect on EFH? | Are EFH Conservation Recommendations Provided? |
|---|---|---|
| Pacific Coast Salmon | Yes | Yes |

**Consultation Conducted By:** National Marine Fisheries Service, West Coast Region

**Issued By**: Maria Rea
for Barry A. Thom
Regional Administrator

**Date**: 12-1-2017

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## List of Acronyms and Abbreviations

ACID – Anderson-Cottonwood Irrigation Dam
BA – biological assessment
BMP – best management practice
BO – biological opinion
Caltrans – California Department of Transportation
CCV – California Central Valley
CCVO – California Central Valley Office
CDFW – California Department of Fish and Wildlife
CFR – Code of Federal Regulations
CV – Central Valley
CVRWQCB – Central Valley Regional Water Quality Control Board
Delta – Sacramento-San Joaquin River Delta
DO – dissolved oxygen
DPS – distinct population segment
DQA – Data Quality Act
EBMUD - East Bay Municipal Utility District
EFH – essential fish habitat
ESA – Endangered Species Act
ESL – Environmental Study Limit
ESU – evolutionarily significant unit

FHWG – Fisheries Hydroacoustic Working Group
FMP – Fisheries Management Plan
FR – Federal Register
GCID – Glenn-Colusa Irrigation District
HAPCs – habitat areas of particular concern
LWM/LWD – large woody material/large woody debris
MSA – Magnuson-Stevens Fishery Conservation and Management Act
NMFS – National Marine Fisheries Service
NTU – nephelometric turbidity unit
OHWM – ordinary high water mark
PAHs – polycyclic aromatic hydrocarbons
PBF – physical or biological feature
PCE – primary constituent element
PCTS – Public Consultation Tracking System
PM– post mile
ppt – parts per thousand
PVA – population viability analysis
RM – river mile
RMS – root mean square
RSP – rock slope protection
SB - southbound
sDPS – southern distinct population segment
SEL – sound exposure level
SPCCP – Spill Prevention Control and Countermeasures Plan
SR – state route
SWE – snow water equivalent
SWPPP – Stormwater Pollution Prevention Plan
USC – United States Code
USFWS – U.S. Fish and Wildlife Service
USGS – United States Geological Survey
VSP – viable salmonid population
WCR – West Coast Region
WPCP – Water Pollution Control Program

# 1. INTRODUCTION

This introduction section provides information relevant to the other sections of this document and is incorporated by reference into sections 2 and 3 below.

## 1.1 Background

The National Marine Fisheries Service (NMFS) prepared the biological opinion (BO) and incidental take statement portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 USC 1531 et seq.), and implementing regulations at 50 CFR 402.

We also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 USC 1801 et seq.) and implementing regulations at 50 CFR 600.

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available through NMFS' Public Consultation Tracking System (PCTS): https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts. A complete record of this consultation is on file at the NMFS California Central Valley Office (CCVO).

## 1.2 Consultation History

- On January 31, 2017, the California Department of Transportation (Caltrans) created a species list using the NMFS species list tool.
- On April 7, 2017, NMFS West Coast Region (WCR) – CCVO received a consultation initiation request and Biological Assessment (BA) from Caltrans for the Bridge Scour Mitigation Project 03-3F540 in Sacramento County, dated March 2017. Caltrans determined the following listed species and their critical habitats may be affected by the proposed project: Central Valley (CV) spring-run Chinook salmon ESU; California Central Valley (CCV) steelhead distinct population segment DPS; and southern DPS (sDPS) of North American green sturgeon. Essential fish habitat for Pacific Coast Salmon was also identified.
- On May 1, 2017, NMFS received a Memorandum of Understanding notification from the U.S. Army Corps of Engineers designating the Federal Highway Administration, and thereby Caltrans, as the lead federal agency for this project, with all responsibilities included under the National Environmental Policy Act.
- On May 11, 2017, NMFS received additional project details from Caltrans indicating that several major project components had changed and some clarifications were due, namely:
    - (1) At the Lagoon Creek Environmental Study Limit (ESL), only "Option 3" was considered in the effects analysis of the submitted BA and recalculation of the required number of piles and impacts strikes to install them were provided (see Proposed Action for update- pg. 57 (Caltrans 2017a)).

    - (2) Recalculations of the permanent fill of the square piles to be placed in Lagoon Creek indicate a net gain of aquatic habitat by 9028 $ft^2$ compared to status quo (pg. 63 (Caltrans 2017a)).
    - (3) The Lagoon Creek ESL aquatic habitat will be de-watered and allowed to dry for at least 15 days (within the May 1 – October 1 work window) prior to the start of other construction activities in the aquatic habitat (pg. 74 (Caltrans 2017a)).
    - (4) At the American River ESL, Caltrans is dropping geotechnical investigation from the scope of the proposed action at that site (description of action on pg. 9 of NMFS BA, impact analysis of geotechnical investigation at the American River ESL on pgs. 32-34 (Caltrans 2017a)). All other proposed activities at this location remain the same.
- On July 7, 2017, following a telephone conversation with the Caltrans lead project biologist Chris Collison, NMFS initiated formal consultation (PCTS#: WCR-2017-7288/ARN: 151422-WCR2017-SA00346) for the Bridge Scour Mitigation Project in Sacramento County Project Number 03-3F540.
- Between July 17, 2017 and September 18, 2017, email exchanges between Caltrans and NMFS occurred, clarifying aspects of the project.
- On September 18, 2017, there was an email exchange between Katie Schmidt, Chris Collison, Jason Meigs, and other Caltrans staff which resulted in the following conservation measure being added to the project description: "In-stream construction at the American River location will be limited to the hours between two hours after sunrise until two hours before sunset."
- On November 7, 2017, NMFS requested via email that Caltrans consider the inclusion of the Sacramento River winter-run Chinook salmon ESU in this opinion, since juvenile winter-run use the American River for rearing and "may be affected" by the proposed action. After review, NMFS concluded that the project was not likely to adversely affect Sacramento River winter-run Chinook salmon due to Caltrans' seasonal work window. Caltrans reviewed these concerns and concurred with the determination.

### 1.3 Proposed Action

Under the ESA "Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies (50 CFR 402.02). Under the MSA, federal action means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a federal agency (50 CFR 600.910).

"Interrelated actions" are those that are part of a larger action and depend on the larger action for their justification. "Interdependent actions" are those that have no independent utility apart from the action under consideration (50 CFR 402.02). There are no interrelated or interdependent actions associated with the Project.

Caltrans proposes to mitigate scour damage on bridges at two separate sites to preserve the integrity and stability of bridge facilities. The bridges are the American River Bridge (Bridge No. 24-0001L) located on southbound (SB) state route (SR) 160 post mile (PM) 44.47 in the City of Sacramento (38.596356, -121.476341 WGS 84) and the Lagoon Creek Bridges (North Span Bridge No. 24-0027L, Center Span Bridge No. 24-0045L, and South Span Bridge No. 24-0028L)

located on SB SR-99 (38.311048, -121.321229 WGS 84). Both are located in Sacramento County, California.

### 1.3.1 American River Bridge Project Description

The SR 160 American River Bridge SB span is a closed-spandrel concrete arch bridge, originally built in 1928. It was widened to a three-lane bridge to support additional lanes of automotive traffic in 1934, and in 1987, a single light rail track was introduced to provide passenger service in both directions. The existing structure is now approximately 55 feet wide and 620 feet long.

The foundation of each arch of the American River Bridge consists of four pile footings and a spread-footing pile cap (reinforced concrete slabs constructed on top of a group of foundation piles). Incrementally, significant river flows have resulted in scour that has removed the rock slope protection (RSP) placed around the spread footings and necessitates replacement of the RSP frequently to maintain structural integrity and stability.

In 2010, a peer review team determined that the American River Bridge was "scour critical" and recommended installing sheet-piles around Piers 2 through 5 as the most practical solution. The proposed project is to implement these recommendations. The sheet piles to be installed are heavy duty "z-section (PZ-27)" steel sheet piles that will joined edge to edge to completely encase the spread footings of Piers 2, 3, 4, and 5. The continuous sheet pile wall will be set 2 feet away from the existing pile cap foundations and installed to a depth that should eliminate scour issues. Because sheet piles can only be installed after all obstructions are removed, any RSP and any existing riprap remaining at the bridge pier footings will be removed to prior to sheet pile installation. Removal will be accomplished by use of an excavator. Because the objective is an encasing wall, 360-degree access will be required to set all piles around the piers, the heavy equipment and personnel may be staged from a temporary trestle and a floating barge.

If barge-mounted construction access is necessary and feasible, a barge loaded with construction equipment will be towed to the American River action area by a 16-foot steel-hulled Boston Whaler with a 90-horsepower four-cycle outboard motor, or similar vessel, launched from the contractor's equipment staging and storage facilities downstream of the site. This vessel will stay on site during construction and will be used to maneuver the barge into place as needed to maneuver and reposition the barge. The barge will be tied against the existing piers and also anchored to the river bottom by four vertical anchors to keep it stationary during construction activities. The four vertical anchors (one at each corner) will be hammered 5 to 10 feet into the substrate and will allow the barge to float and accommodate changes in water height. Because barges require water depths of at least six feet, summer water depths of the American River may not be sufficient to support barge operations, and therefore a temporary work trestle may be used in addition to, or instead, of a floating barge to stage construction equipment and personnel.

A temporary trestle may also be constructed from the north side of the American River levee for construction access to bridge piers. It would be accessed from the bottom of an existing ramp leading down to the American River from a mobile home park and extend from the north bank to the south side of Pier 2, the southernmost pier. The south levee of the American River will not be used for construction access, nor will the trestle extend to the south levee. Instead, "fingers" will

extend laterally off of the main trestle along each side of the American River Bridge piers in order to provide construction access under the bridge. After the first few piles are installed, the piles will be capped to form a bent, girders will be placed on top of the bents, and timber decking will be placed to create the temporary trestle. As the trestle is built, it will then become the platform for the remainder of the construction of the trestle as it progresses towards Pier 2. Construction of the fingers will be similar to that of the main trestle, and both the main deck and the fingers will be 26 feet wide. To set the 18-inch or 20-inch diameter steel pipe piles of the temporary trestle, an impact hammer will be used to install the piles that will be capped or braced by steel beams. These temporary piles will be driven to a depth of approximately 30 feet. Each bent will consist of five piles and each bent will be spaced 30 to 35 feet apart. A portion of the trestle and the wooden decking will be movable in order to allow passage of river traffic through the construction site.

After support platforms are in place and the existing RSP excavated out, the permanent sheet piles will be driven into place. The steel piles will be driven in with an impact pile driver, but also may be initially set or "stabbed" with a vibratory hammer (though for the environmental analyses, an impact hammer is assumed to be used in underwater pressure levels calculations). Once the sheet pile walls are in place, the annular space between the permanent sheet piles and the existing bridge piers will be dewatered and filled with granular structure backfill material, from the channel bottom to nearly the top of the sheet piles.

When the construction for the American River Bridge retrofit is complete and all the sheet piles have been installed around the existing piers and backfilled, the temporary trestle will be completely removed. The 18 inch to 20 inch steel piles will likely be removed by a vibratory extractor. The trestle will likely be progressively disassembled as portions of the trestle are no longer required for construction access. Removal of the temporary support trestle will take approximately three weeks.

Preliminary timeline estimates indicate that the project will require approximately 200 total working days to complete in a barge-mounted scenario, including project mobilization, pile driving and other associated construction activities. Installation of the temporary trestle will take approximately six weeks, including 20 to 25 working days to drive the 306 temporary steel piles and the permanent installation of 568 sheet piles will take approximately 21 to 29 working days of pile driving (with access from the temporary trestle). However, since the construction activities associated with the American River portion of the proposed action may take more than one construction season, the temporary trestle may need to be completely removed between seasonal work windows and reconstructed in the follow construction season, or the trestle bents may be left in place while the topside wooden decking that form the platform will be removed while leaving the trestle bents in place for the winter season. Then, in the subsequent work season, the topside wooden decking would be replaced and construction on the main project would resume. Caltrans estimates a total of 200 work day will be required to complete scour mitigation for the American River Bridge and two construction season will be necessary.

1.3.2 Lagoon Creek Bridges Project Description

The existing bridges at SR 99 SB over Lagoon Creek are a series of three reinforced concrete girder bridges. Originally built in 1928, all three bridges were reconstructed and expanded to their current lengths in 1958. The existing Lagoon Creek Bridge "North Span" (24-0027L, PM 5.05) consists of two bents each of five 4-foot square concrete columns on 5-feet by 5-feet by 2-feet concrete spread footings. The North Span is a two-lane bridge with a length of 89 feet and an overall total width of approximately 38 feet. The existing Lagoon Creek Bridge "Center Span" (24-0045L, PM 4.98) is supported by five bents, each comprised of four 4-foot square concrete columns on 5-feet by 5-feet by 2-feet concrete spread footings. The Center Span is also a two-lane bridge, with a length of 180 feet and an overall total width of 37 feet 8 inches. The existing Lagoon Creek Bridge "South Span" (24-0028L, PM 4.90) consists of two bents each comprised of five 4-foot square concrete columns on 5-feet by 5-feet by 2-feet concrete spread footings. The South Span is a two-lane bridge with a length of 89 feet and an overall total width of approximately 38 feet.

The scour issues at the Lagoon Creek Bridges are such that bridge replacement is considered the most cost effective and long-term solution. The proposed project is to implement these recommendations. To replace the Center Span of the SB side of the Lagoon Creek Bridges, the vertical height would need to be raised to match the height of the SR 99 northbound bridges and must provide sufficient freeboard to accommodate high-water events. The North and South spans of the SR 99 SB Lagoon Creek Bridges share a profile with the Center Span, and therefore the profile grades of all of the SR 99 SB spans will need to be raised to match the adjusted height of the new Center Span.

Although there were three construction options under consideration to accomplish bridge replacement at Lagoon Creek, Caltrans identified Option 3 as the most likely construction scenario, and therefore analyzed this option in their effects analysis of the submitted BA (Caltrans 2017a). Therefore, this BO will also only consider Option 3 in its analyses of the proposed project.

In Option 3 (the proposed project), the superstructure and substructure of all three bridges will be removed and replaced in kind, but with widened left (outside) shoulders. The inside widening would close the exiting gap between the SB and northbound structures in the new design. The existing bridges superstructure will be removed by saw cut and jackhammer, and the substructure concrete columns will be removed using the same methods, but also sawing, cutting, or breaking the existing columns off at approximately 2 feet below the existing ground level. The girders will be replaced with reinforced concrete slab bridges on new bents supported by twelve 24-inch diameter cast in steel shell (CISS) piles. CISS piles are open-ended cylindrical concrete piers fabricated within a steel shell installed by pile driving. The inside space is dewatered, the soil is drilled out, and then filled with concrete and steel. Piles may be initially set with a vibratory hammer, but will be finished with an impact hammer. The North Span and the South Span Bridges will each be supported by one bent of 12 piles each and the Center Span Bridge will be supported by two bents of twelve piles each, therefore, in total, 48 CISS piles will be required for the replacement of all three bridges in the new design. Temporary bridges would not be required for allowing automotive traffic during construction.

Geotechnical investigation will help determine the depth the CISS piles will need to be set at, as well as inform the final replacement bridge design. The geotechnical investigation borings will be drilled on the shoulder of SR 99 or in the SB lanes, not in aquatic habitat. Removal of woody riparian vegetation is not planned during the geotechnical investigation. Caltrans proposed to initiate drilling of two borings at each bridge site, for a total of six boring. After standard penetration test sampling is complete, the boreholes will be backfilled and sealed according to the Caltrans Geotechnical Manual (Caltrans 2017*b*). The geotechnical investigation is estimated to take approximately 30 working days (5 days for each boring) at the Lagoon Creek Bridges site, including backfilling and sealing of bore holes.

Temporary cofferdams are expected to be used during the construction of the Lagoon Creek bridges. Because Lagoon Creek flows perennially, 'clear water diversion' in the form of a temporary cofferdams will be constructed using sandbags, aqua dams, or similar exclusionary materials. The intent is to hold out water and unstable soils from the construction area and allow in-the-dry construction below the water line at the bridge foundations. As standing water is expected to occur within the depressions at this location, these portions of Lagoon Creek may be dewatered by pumping or flows upstream of the cofferdam may be diverted around the construction area. Sheet piles are not expected to be used at the Lagoon Creek portion of the action area.

In addition to the removal of the existing structures, the foundation areas may need to be filled, temporary falsework may be need to be erected, and/or retaining walls may need to be placed before pile driving begins. Construction access will be from the south end of the project site at the end of an existing paved cul-de-sac on the west side of SR 99. This farm road and paved area will be used to move construction material and equipment to and from the site, and also be used as a staging area. Caltrans estimates construction at Lagoon Creek will require the equivalent of 200 working days and is projected to be completed in a single work season.

To fully compensate for impacts to CCV at the Lagoon Creek site resulting from the proposed scour mitigation, off-site mitigation credits that will benefit the CCV steelhead ESU through creating and maintaining shaded riparian or floodplain riparian will be purchased from a NMFS-approved conservation bank. The credit purchase will be at a 1:1 ratio for impacts above the OHWM and 3.3:1 for impacts to habitat below the OHWM, according to US Army Corps of Engineers guidelines (Caltrans 2017). NMFS-approved mitigation banks with service areas that include the proposed action area include the Cosumnes Floodplain Mitigation Bank and the Bullock Bend Mitigation Bank. Caltrans may choose to buy credits from either of these banks, otherwise Caltrans instead may choose to participate in the in-lieu fee program to fulfil their obligations.

## 2. ENDANGERED SPECIES ACT: BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitats upon which they depend. As required by section 7(a)(2) of the ESA, each federal agency must ensure that its actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, federal action agencies consult with NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provides an opinion stating how the agency's actions would affect listed species and their critical habitats. If incidental take is reasonably certain to occur, section 7(b)(4) requires NMFS to provide an incidental take statement (ITS) that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

The Caltrans has determined the proposed action is not likely to adversely affect Sacramento River winter-run Chinook salmon. Our concurrence is documented in the "Not Likely to Adversely Affect" Determinations section (2.12).

### 2.1 Analytical Approach

This BO includes both a jeopardy analysis and an adverse modification analysis.
The jeopardy analysis relies upon the regulatory definition of "to jeopardize the continued existence of a listed species," which is "to engage in an action that would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

This BO relies on the definition of "destruction or adverse modification," which "means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features" (81 FR 7214).

The designations of critical habitat for CV spring-run Chinook salmon, CCV steelhead, and the sDPS of North American green sturgeon use the term primary constituent elements (PCE) or essential features. The new critical habitat regulations (81 FR 7414) replace this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a ''destruction or adverse modification'' analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this BO, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

We use the following approach to determine whether a proposed action is likely to jeopardize listed species, or destroy or adversely modify critical habitat:

- Identify the rangewide status of the species and critical habitat expected to be adversely affected by the proposed action.
- Describe the environmental baseline in the action area.
- Analyze the effects of the proposed action on both species and their habitat using an "exposure-response-risk" approach.
- Describe any cumulative effects in the action area.
- Integrate and synthesize the above factors by: (1) Reviewing the status of the species and critical habitat; and (2) adding the effects of the action, the environmental baseline, and cumulative effects to assess the risk that the proposed action poses to species and critical habitat.
- Reach a conclusion about whether species are jeopardized or critical habitat is adversely modified.
- If necessary, suggest a reasonable and prudent alternative (RPA) to the proposed action.

### 2.1.1 Use of Analytical Surrogates

It is impossible to precisely quantify and track the amount or number of individuals that are expected to be incidentally taken (injure, harm, kill, etc.) per species as a result of the proposed action due to the variability and uncertainty associated with the response of listed species to the effects of the proposed action, the varying population size of each species, annual variations in the timing of spawning and migration, individual habitat use within the action area, and difficulty in observing injured or dead fish. However, it is possible to estimate the extent of incidental take by designating as ecological surrogates, those elements of the project that are expected to result in incidental take, that are more predictable and/or measurable, with the ability to monitor those surrogates to determine the extent of take that is occurring.

The most appropriate threshold for take for this project, is an ecological surrogate of habitat disturbance. Descriptions of the habitat disturbance anticipated during the scour mitigation, including the loss of shaded riverine aquatic (SRA) cover and floodplain rearing habitat, were provided in the biological assessment.

### 2.1.2 Conservation Banking in the Context of the ESA Environmental Baseline

Conservation (or mitigation) banks present a unique situation in terms of how they are used in the context of the *Effects Analysis* and the *Environmental Baseline* in ESA section 7 consultations.

When NMFS is consulting on a proposed action that includes conservation bank credit purchases, it is likely that physical restoration work at the bank site has already occurred and/or that a section 7 consultation occurred at the time of bank establishment. A traditional interpretation might suggest that the overall ecological benefits of the conservation bank actions belong in the *Environmental Baseline*. Under this interpretation, where proposed actions include credit purchases, it would not be possible to attribute their benefits to the proposed action, without double-counting. Such an interpretation does not reflect the unique circumstances that

conservation banks serve. Specifically, conservation banks are established based on the expectation of future credit purchases. Conservation banks would not be created and their beneficial effects would not occur in the absence of this expectation.

For these reasons, it is appropriate to treat the beneficial effects of the bank as accruing in connection with and at the time of specific credit purchases, not at the time of bank establishment or at the time of bank restoration work. This means that, in formal consultations on projects within the service area of a conservation bank, the beneficial effects of a conservation bank should be accounted for in the *Environmental Baseline* after a credit transaction has occurred. More specifically, the *Environmental Baseline* section should mention the bank establishment (and any consultation thereon) but, in terms of describing beneficial effects, it should discuss only the benefits attributable to credits already sold. In addition, in consultations that include credit purchases as part of the proposed action, the proportional benefits attributable to those credit purchases should be treated as effects of the action. Conversely, where a proposed action does not include credit purchases, it will not receive any direct offset associated with the bank. This approach preserves the value of the bank for its intended purposes, both for the value of the credits to the bank proponent and the conservation value of the bank to listed species and their critical habitat.

This BO will analyze the beneficial effects of the credit transaction associated with the proposed action. The beneficial effects associated with the remainder of the credits at the bank that have not been subject to a transaction (and their associated ecological benefits) will not be considered in the *Environmental Baseline* nor in the effects of the action.

## 2.2 Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each species that may be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR 402.02. The opinion also examines the condition of critical habitat throughout the designated area, evaluates the value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the current function of the essential PBFs that help to form that value for the conservation of the species.

The descriptions of the status of species and conditions of the designated critical habitats in this BO are a synopsis of the detailed information available on NMFS' West Coast Regional website. The following federally listed species ESUs or DPSs and designated critical habitat occur in the action area and may be affected by the proposed action:

**Table 1. Affected species and habitats.**

| Species | Scientific Name | Original Listing Status | Current Listing Status | Critical Habitat Designated |
|---|---|---|---|---|
| Central Valley spring-run Chinook salmon ESU | *Oncorhynchus tshawytscha* | 9/16/1999<br>64 FR 50394<br>Threatened | 6/28/2005<br>70 FR 37160<br>Threatened | 9/2/2005<br>70 FR 52488 |
| California Central Valley steelhead DPS | *Oncorhynchus mykiss* | 3/19/1998<br>63 FR 13347<br>Threatened | 1/5/2006<br>71 FR 834<br>Threatened | 9/2/2005<br>70 FR 52488 |
| North American green sturgeon, Southern DPS | *Acipenser medirostris* | 4/7/2006<br>71 FR 17757<br>Threatened | 4/7/2006<br>71 FR 17757<br>Threatened | 10/9/2009<br>74 FR 52300 |

2.2.1 CV Spring-run Chinook salmon

Since the independent populations in Butte, Deer and Mill creeks are the best trend indicators for ESU viability, NMFS can evaluate risk of extinction based on VSP parameters in these watersheds. Steven T. Lindley et al. (2007) indicated that the spring-run Chinook salmon populations in the CV had a low risk of extinction in Butte and Deer creeks, according to their population viability analysis (PVA) model and other population viability criteria (*i.e.*, population size, population decline, catastrophic events, and hatchery influence, which correlate with VSP parameters abundance, productivity, spatial structure, and diversity). The Mill Creek population of spring-run Chinook salmon was at moderate extinction risk according to the PVA model, but appeared to satisfy the other viability criteria for low-risk status. However, the CV spring-run Chinook salmon ESU failed to meet the "representation and redundancy rule" for the spatial structure parameter since they are the only demonstrably viable populations from one diversity group (northern Sierra Nevada) out of the three diversity groups that historically supported the ESU, or out of the four diversity groups as described in the NMFS CV Salmon and Steelhead Recovery Plan (NMFS 2014), which stated a recovery criteria of nine viable populations. Over the long term, these three remaining 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 Chinook salmon populations in these three watersheds due to their close proximity to each other. One large event could eliminate all three populations.

In the latest status review (NMFS 2016a), the authors found, with a few exceptions, CV spring-run Chinook salmon populations had increased through 2014 since the previous status review (2010/2011). The Mill and Deer creek populations shifted from the high extinction risk category to the moderate risk of extinction category, and Butte Creek remained in the low risk of extinction category. Additionally, the Battle Creek and Clear Creek populations showed stable or increasing numbers from 2010 through 2014 instead large fluctuations in their overall abundances. The SWFSC concluded in their viability report (T. H. Williams et al., 2016) that the status of CV spring-run Chinook salmon (through 2014) has probably improved since the 2010/2011 status review and that the ESU's extinction risk may have decreased, however in

2015 and 2016 sharp declines were observed in the populations originating from natal streams (CDFW 2017). Therefore, this ESU is still facing a significant extinction risk, and that risk is likely to increase over at least the next few years as the full effects of the recent California drought are realized (NMFS 2016a).

### 2.2.2 California CV steelhead

All indications are that natural CCV steelhead have continued to decrease in abundance and in the proportion of naturally spawned fish to hatchery produced fish over the past 25 years (NMFS 2016b); the long-term abundance trend remains negative. Hatchery production and returns are dominant over natural fish, and one of the four hatcheries is dominated by Eel/Mad River origin steelhead stock. Continued decline in the ratio between naturally produced juvenile steelhead to hatchery juvenile steelhead in fish monitoring efforts indicates that the wild population abundance is declining. Hatchery releases (100 percent adipose fin-clipped fish since 1998) have remained relatively constant over the past decade, yet the proportion of adipose fin-clipped hatchery smolts to unclipped naturally produced smolts captured in monitoring studies has steadily increased over the past several years.

Although there have been recent restoration efforts in the San Joaquin River tributaries, CCV steelhead populations in the San Joaquin Basin continue to show an overall very low abundance, and fluctuating return rates. Steven T. Lindley et al. (2007) developed viability criteria for CV salmonids. Using data through 2005, Steven T. Lindley et al. (2007) found that data were insufficient to determine the status of any of the naturally-spawning populations of CCV steelhead, except for those spawning in rivers adjacent to hatcheries, which were likely to be at high risk of extinction due to extensive spawning of hatchery-origin fish in natural areas.

The widespread distribution of wild CCV steelhead in the CV provides the spatial structure necessary for the DPS to survive and avoid localized catastrophes. However, most wild CCV steelhead populations are very small, are not monitored, and may lack the resiliency to persist for protracted periods if subjected to additional stressors, particularly widespread stressors such as climate change (NMFS 2016b). The genetic diversity of CCV steelhead has likely been impacted by low population sizes and high numbers of hatchery fish relative to wild fish. The life-history diversity of the DPS is mostly unknown, as very few studies have been published on traits such as age structure, size at age, or growth rates in CCV steelhead.

The 2016 status review concluded that overall, the status of CCV steelhead appears to have changed little since the 2011 status review when the Technical Recovery Team concluded that the DPS was in danger of extinction (NMFS 2016b). Further, there is still a general lack of data on the status of wild populations. There are some encouraging signs, as several hatcheries in the CV have experienced increased returns of steelhead over the last few years. There has also been a slight increase in the percentage of wild steelhead in salvage at the south Sacramento-San Joaquin River Delta (Delta) fish facilities, and the percentage of wild fish in those data remains much higher than at Chipps Island. The new video counts at Ward Dam show that Mill Creek likely supports one of the best wild steelhead populations in the CV, though at much reduced levels from the 1950's and 60's. Restoration and dam removal efforts in Clear Creek continue to benefit CCV steelhead. However, the catch of unmarked (wild) steelhead at Chipps Island is still

less than five percent of the total smolt catch, which indicates that natural production of steelhead throughout the CV remains at very low levels. Despite the positive trend on Clear Creek and encouraging signs from Mill Creek, all other concerns raised in the previous status review remain.

### 2.2.3 Southern DPS of North American green sturgeon

The viability of sDPS green sturgeon is constrained by factors such as a small population size, lack of multiple populations, and concentration of spawning sites into just a few locations. The risk of extinction is believed to be moderate because, although threats due to habitat alteration are thought to be high and indirect evidence suggests a decline in abundance, there is much uncertainty regarding the scope of threats and the viability of population abundance indices (NMFS 2015). Viability is defined as an independent population having a negligible risk of extinction due to threats from demographic variation, local environmental variation, and genetic diversity changes over a 100-year timeframe (McElhany, Ruckelshaus, Ford, Wainwright, & Bjorkstedt, 2000). The best available scientific information does not indicate that the extinction risk facing sDPS green sturgeon is negligible over a long-term (~100 year) time horizon; therefore the sDPS is not believed to be viable. To support this statement, the PVA that was done for sDPS green sturgeon in relation to stranding events (Thomas et al., 2013) may provide some insight. While this PVA model made many assumptions that need to be verified as new information becomes available, it was alarming to note that over a 50-year time period the DPS declined under all scenarios where stranding events were recurrent over the lifespan of a green sturgeon. There is a strong need for additional information about sDPS green sturgeon, especially with regard to a robust abundance estimate, a greater understanding of their biology, and further information about their habitat needs.

Although the population structure of sDPS green sturgeon is still being refined, only one spawning population of sDPS green sturgeon exists in the Sacramento River Basin (NMFS 2015). Steven T. Lindley et al. (2007), in discussing winter-run Chinook salmon, states that an ESU represented by a single population at moderate risk of extinction is at high risk of extinction over the long run. This concern applies to any DPS or ESU represented by a single population, and if this were to be applied to sDPS green sturgeon directly, it could be said that sDPS green sturgeon face a high extinction risk. However, the position of NMFS, upon weighing all available information (and lack of information) has stated the extinction risk to be moderate (NMFS 2015).

### 2.2.4 Critical Habitat: Physical and Biological Features

*CV Spring-run Chinook salmon & CCV steelhead*

Critical habitat includes the stream channels in the designated stream reaches and the lateral extent as defined by the ordinary high water mark (OHWM). Critical habitat is defined as specific areas that contain the PBFs and physical habitat elements essential to the conservation of the listed species. Critical habitat for CV spring-run Chinook salmon includes stream reaches of the Feather, Yuba and American rivers, Big Chico, Butte, Deer, Mill, Battle, Antelope, and Clear creeks, the Sacramento River, as well as portions of the northern Delta (70 FR 52488). Critical habitat for CCV steelhead includes stream reaches such as those of the Sacramento, Feather, and

Yuba rivers, and Deer, Mill, Battle, and Antelope creeks in the Sacramento River basin; the San Joaquin River, including its tributaries, and the waterways of the Delta (70 FR 52488).

The following are the freshwater inland habitat types used as PBFs by CV spring-run Chinook salmon and CCV steelhead that may be affected by the proposed project:

1. Freshwater Rearing Habitat: Freshwater rearing sites are those with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and survival; water quality and forage supporting juvenile salmonid development; and natural cover such as shade, submerged and overhanging large woody material (LWM), log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks. Both spawning areas and migratory corridors comprise rearing habitat for juveniles, which feed and grow before and during their outmigration. Non-natal, intermittent tributaries also may be used for juvenile rearing. Rearing habitat condition is strongly affected by habitat complexity, food supply, and the presence of predators of juvenile salmonids. In contrast, the channelized, leveed, and riprapped river reaches and sloughs that are common in the Sacramento-San Joaquin system typically have low habitat complexity, low abundance of food organisms, and offer little protection from piscivorous fish and birds. However, since juvenile life stages of salmonids are dependent on the function of this habitat for successful survival and recruitment, freshwater rearing habitat therefore has a high intrinsic conservation value even if the current conditions are significantly degraded from their natural state.

2. Freshwater Migration Corridors: Ideal freshwater migration corridors are free of migratory obstructions, with water quantity and quality conditions that enhance migratory movements. They contain natural cover such as riparian canopy structure, submerged and overhanging large woody objects, aquatic vegetation, large rocks and boulders, side channels, and undercut banks which augment juvenile and adult mobility, survival, and food supply. Migratory corridors are downstream of the spawning areas and include the lower mainstems of the Sacramento and San Joaquin rivers and the Delta. These corridors allow the upstream passage of adults and the downstream emigration of juveniles. Migratory habitat condition is strongly affected by the presence of barriers, which can include dams (*i.e.*, hydropower, flood control, and irrigation flashboard dams), unscreened or poorly screened diversions, degraded water quality, or behavioral impediments to migration. For successful survival and recruitment of salmonids, freshwater migration corridors must function sufficiently to provide adequate passage. For adults, upstream passage through the Delta and much of the Sacramento River is not a problem, yet a number of challenges exist on many tributary streams. For juveniles, unscreened or inadequately screened water diversions throughout their migration corridors and a scarcity of complex in-river cover have degraded this PBF. However, since the primary migration corridors are used by numerous populations and are essential for connecting early rearing habitat with the ocean, even the degraded reaches are considered to have a high intrinsic conservation value to the species. For successful survival and recruitment of salmonids, freshwater migration corridors must function sufficiently to provide adequate passage. For this reason, freshwater migration corridors are considered to have a high conservation value even if the migration corridors are significantly degraded compared to their natural state.

*sDPS North American Green Sturgeon*
Designated freshwater critical habitat for sDPS green sturgeon includes the main stem Sacramento River upstream from the I Street Bridge to Keswick Dam, the American River downstream of the American River Bridge, the Feather River upstream to the fish barrier dam adjacent to the Feather River Fish Hatchery, the Yuba River upstream to Daguerre Dam, and also includes the stream channels and waterways in the Delta (74 FR 52300). A full and exact description of all sDPS green sturgeon critical habitat, including excluded areas, can be found at 50 CFR 226.219. Critical habitat for sDPS green sturgeon includes PBFs within the defined area that are essential to the conservation of the species and have been designated for freshwater riverine systems, estuarine habitats, and nearshore coastal areas.

The following are the freshwater inland habitat parameters required as PBFs by sDPS green sturgeon that may be affected by the proposed project:

1. Food Resources: Abundant food items for larval, juvenile, subadult, and adult life stages for sDPS green sturgeon should be present in sufficient amounts to sustain growth, development, and support basic metabolism. Although specific information on food resources for green sturgeon within freshwater riverine systems is lacking, they are presumed to be generalists and opportunists that feed on similar prey as other sturgeons (Israel & Klimley, 2008). The food resources have been highly degraded, in part due to the high amount of invasive species that have been introduced to CV rivers and the Bay-Delta.

2. Adequate flow regime: A flow regime (*i.e.*, the magnitude, frequency, duration, seasonality, and rate-of-change of fresh water discharge over time) necessary for normal behavior, growth, and survival of all life stages. Due to current surface water storage and management practices, many rivers historically used by green sturgeon do not have sufficient flows to consistently support their movement, feeding, or spawning requirements.

3. Water Quality: Adequate water quality, including temperature, salinity, oxygen content, and other chemical characteristics are necessary for normal behavior, growth, and viability of all life stages. Suitable water temperatures would include: stable water temperatures within spawning reaches; temperatures within 11°C - 17°C (optimal range is 14°C - 16°C) in spawning reaches for egg incubation (March-August) (Van Eenennaam, Linares-Casenave, Deng, & Doroshov, 2005); temperatures below 20°C for larval development (Werner, Linares-Casenave, Van Eenennaam, & Doroshov, 2007); and temperatures below 24°C for juveniles (Allen, Hodge, Werner, & Cech, 2006; Mayfield & Cech, 2004). Suitable salinity levels range from fresh water (< 3 parts per thousand (ppt)) for larvae and early juveniles to brackish water (10 ppt) for juveniles prior to their transition to salt water. Adequate levels of dissolved oxygen (DO) are needed to support oxygen consumption by early life stages, ranging from 61.78 to 76.06 mg $O_2$ $hr^{-1}$ $kg^{-1}$ for juveniles (Allen & Cech, 2007). Suitable water quality would also include water with acceptably low levels of contaminants (*i.e.*, pesticides, organochlorines, selenium, elevated levels of heavy metals, *etc*.) that may disrupt normal

development of embryonic, larval, and juvenile stages of green sturgeon. Poor water quality can have adverse effects on growth, reproductive development, and reproductive success. Studies on the effects of water contaminants upon green sturgeon are needed; studies performed upon white sturgeon have clearly demonstrated the negative impacts contaminants can have upon white sturgeon biology (Fairey et al., 1997; Feist et al., 2005; Foster, Fitzpatrick, Feist, Schreck, & Yates, 2001; Foster, Fitzpatrick, Feist, Schreck, Yates, et al., 2001; Kruse & Scarnecchia, 2002). Legacy contaminants such as mercury still persist in the watershed and pulses of pesticides have been identified in winter storm discharges throughout the Sacramento River basin, the CV, and the Delta.

4. Adequate water depth: Deep (≥5 m) holding pools for both upstream and downstream holding of adult or subadult fish, with adequate water quality and flow to maintain the physiological needs of the holding adult or subadult fish. The alteration and channelization of most natural waterways in the CV, in conjunction with tight control manipulation of otherwise natural flows, has left many rivers significantly shallower and in some cases, completely disconnected as water released from dams completely infiltrates or is utilized. Adult green sturgeon require relatively deep channels due to their natural body size to navigate through all stretches up to their breeding grounds for the sDPS to survive.

5. Sediment Quality: Sediment should be of the appropriate quality and characteristics necessary for normal behavior, growth, and viability of all life stages. This includes sediments free of contaminants [*e.g.*, elevated levels of heavy metals such as mercury, copper, zinc, cadmium, and chromium, polycyclic aromatic hydrocarbons (PAHs), and organochlorine pesticides] that can result in negative effects on any life stage of green sturgeon or their prey. The Sacramento River and its tributaries have a long history of contaminant exposure from abandoned mines, separation of gold ore from mine tailings using mercury, and agricultural practices with pesticides and fertilizers which result in deposition of these materials in the sediment horizons in the river channel. Disturbance of these sediment horizons by natural or anthropogenic actions can liberate sequestered contaminants into the river.

### 2.2.5 Climate Change

One major factor affecting the rangewide status of the threatened and endangered anadromous fish in the CV and their aquatic habitat at large is climate change.

Warmer temperatures associated with climate change reduce snowpack and alter the seasonality and volume of seasonal hydrograph patterns (Cohen, Miller, Hamlet, & Avis, 2000). Central California has shown trends toward warmer winters since the 1940s (M. D. Dettinger & Cayan, 1995). An altered seasonality results in runoff events occurring earlier in the year due to a shift in precipitation falling as rain rather than snow (M. D. Dettinger, Daniel R. Cayan, Mary K. Meyer, Anne E. Jeton, 2004; M. Roos, 1991). Specifically, the Sacramento River basin annual runoff amount for April-July has been decreasing since about 1950 (Maurice  Roos, 1987; M. Roos, 1991). Increased temperatures influence the timing and magnitude patterns of the hydrograph.

The magnitude of snowpack reductions is subject to annual variability in precipitation and air temperature. The large spring snow water equivalent (SWE) percentage changes, late in the snow season, are due to a variety of factors including reduction in winter precipitation and temperature increases that rapidly melt spring snowpack (VanRheenen, 2004). Factors modeled by VanRheenen (2004) show that the melt season shifts to earlier in the year, leading to a large percent reduction of spring SWE (up to 100% in shallow snowpack areas). Additionally, an air temperature increase of 2.1°C (3.8°F) is expected to result in a loss of about half of the average April snowpack storage (VanRheenen, 2004). The decrease in spring SWE (as a percentage) would be greatest in the region of the Sacramento River watershed, at the north end of the CV, where snowpack is shallower than in the San Joaquin River watersheds to the south.

Projected warming is expected to affect all runs of CV Chinook salmon. Because the runs are restricted to low elevations as a result of impassable rim dams, if climate warms by 5°C (9°F), it is questionable whether any CV Chinook salmon populations can persist (J. G. Williams, 2006). Based on an analysis of an ensemble of climate models and emission scenarios and a reference temperature from 1951- 1980, the most plausible projection for warming over Northern California is 2.5°C (4.5°F) by 2050 and 5°C by 2100, with a modest decrease in precipitation (M.D. Dettinger, 2005). Chinook salmon in the CV are at the southern limit of their range, and warming will shorten the period in which the low elevation habitats used by naturally-producing fall-run Chinook salmon are thermally acceptable. This would particularly affect fish that emigrate as fingerlings, mainly in May and June, and especially those in the San Joaquin River and its tributaries.

Spring-run Chinook salmon adults are vulnerable to climate change because they over-summer in freshwater streams before spawning in autumn (Thompson et al., 2011). Spring-run Chinook salmon spawn primarily in the tributaries to the Sacramento River, and those tributaries without cold water refugia (usually input from springs) will be more susceptible to impacts of climate change. Even in tributaries with cool water springs, in years of extended drought and warming water temperatures, unsuitable conditions may occur. Additionally, juveniles often rear in the natal stream for one to two summers prior to emigrating, and would be susceptible to warming water temperatures. In Butte Creek, fish are limited to low elevation habitat that is currently thermally marginal, as demonstrated by high summer mortality of adults in 2002 and 2003, and will become intolerable within decades if the climate warms as expected. Ceasing water diversion for power production from the summer holding reach in Butte Creek resulted in cooler water temperatures, more adults surviving to spawn, and extended population survival time (Mosser, Thompson, & Strange, 2013).

Although steelhead will experience similar effects of climate change to Chinook salmon, as they are also blocked from the vast majority of their historic spawning and rearing habitat, the effects may be even greater in some cases, as juvenile steelhead need to rear in the stream for one to two summers prior to emigrating as smolts. In the CV, summer and fall temperatures below the dams in many streams already exceed the recommended temperatures for optimal growth of juvenile steelhead, which range from 14°C to 19°C (57°F to 66°F). Several studies have found that steelhead require colder water temperatures for spawning and embryo incubation than salmon (McCullough, Spalding, Sturdevant, & Hicks, 2001). In fact, McCullough et al. (2001) recommended an optimal incubation temperature at or below 11°C to 13°C (52°F to 55°F).

Successful smoltification in steelhead may be impaired by temperatures above 12°C (54°F), as reported in Richter and Kolmes (2005). As stream temperatures warm due to climate change, the growth rates of juvenile steelhead could increase in some systems that are currently relatively cold, but potentially at the expense of decreased survival due to higher metabolic demands and greater presence and activity of predators. Stream temperatures that are currently marginal for spawning and rearing may become too warm to support wild steelhead populations.

Southern DPS green sturgeon spawn primarily in the Sacramento River in the spring and summer. The Anderson-Cottonwood Irrigation Dam (ACID) is considered the upriver extent of green sturgeon passage in the Sacramento River. The upriver extent of green sturgeon spawning, however, is approximately 30 kilometers downriver of ACID where water temperature is higher than ACID during late spring and summer. Thus, if water temperatures increase with climate change, temperatures adjacent to ACID may remain within tolerable levels for the embryonic and larval life stages of green sturgeon, but temperatures at spawning locations lower in the river may be more affected. It is uncertain, however, if green sturgeon spawning habitat exists closer to ACID, which could allow spawning to shift upstream in response to climate change effects. Successful spawning of green sturgeon in other accessible habitats in the CV (*i.e.,* the Feather River) is limited, in part, by late spring and summer water temperatures. Similar to salmonids in the CV, green sturgeon spawning in the major lower river tributaries to the Sacramento River are likely to be further limited if water temperatures increase and suitable spawning habitat remains inaccessible.

In summary, observed and predicted climate change effects are generally detrimental to the species (M. McClure, 2011; Wade et al., 2013), so unless offset by improvements in other factors, the status of the species and critical habitat is likely to decline over time. The climate change projections referenced above cover the time period between the present and approximately 2100. While there is uncertainty associated with projections, which increases over time, the direction of change is relatively certain (M. M. McClure et al., 2013) and is expected to exacerbate the extinction risk of the ESUs and DPSs covered here.

## 2.3 Action Area

"Action area" means all 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). The action area includes two disjointed areas, including on approximately 88.29 acres in the American River construction area and on 50.94 acres in the Lagoon Creek construction area.

### 2.3.1 American River Bridge Action Area

The American River action area is around the SR 160 American River Bridge at RM 2.0 in Sacramento County, California. The American River Bridge is within the Sacramento East 7.5-minute United States Geological Survey (USGS) Quadrangle and is centered at 38.59641° N, -121.47652° W. The construction area for this portion of the project extends 1,000 meters in either direction of the bridges, and a barge will likely be hauled to the bridge location from downstream. The action area includes the portion of the river expected to be exposed to adverse effects resulting from the proposed project including mobilized sedimentation, increased turbidity, and hydroacoustic impacts (in magenta, Figure 1). Underwater sound analysis was

conducted to determine the extent of area that will experience increased underwater noise and delimit the true extent of the action area.

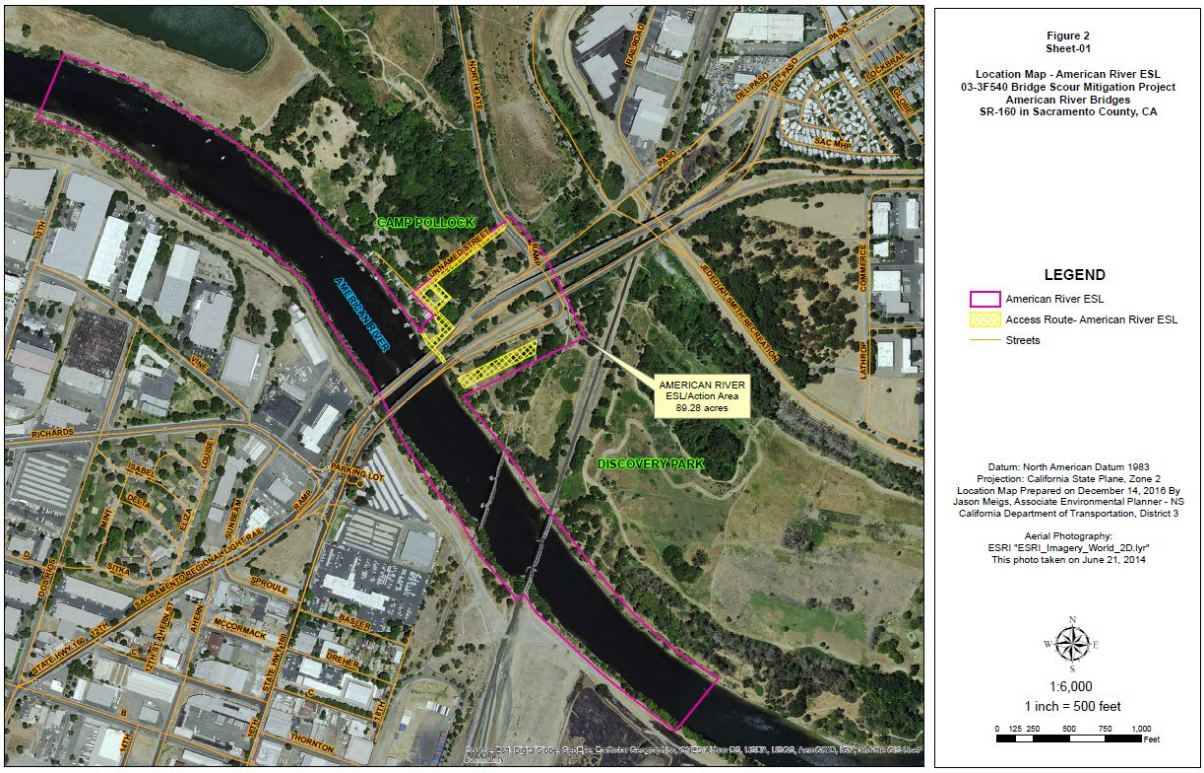


Figure 1. American River Bridge action area (Caltrans 2017*a*).

2.3.2 Lagoon Creek Bridges Action Area

The Lagoon Creek action area is situated around a series of three spans on State Highway 99 over Lagoon Creek in Sacramento County, California. The surface waters of Lagoon Creek, also known as Skunk Creek (USGS 2015), are tributary to the Lower Cosumnes and Lower Mokelumne Rivers. The Lagoon Creek Bridges are within the Galt 7.5-minute USGS Quadrangle and the center of the Lagoon Creek Center Span is located at 38.31113° N, -121.32156° W. The construction area for this project extends 1,000 meters in either direction of the bridges. The action area includes the portion of the river expected to be exposed to adverse effects resulting from the project including mobilized sedimentation, increased turbidity, and hydroacoustic impacts (in red, Figure 2). Underwater sound analysis was conducted to determine the extent of area that will experience increased underwater noise and delimit the true extent of the action area.

Figure 2. Lagoon Creek Bridges action area (Caltrans 2017).

Caltrans plans to purchase mitigation credits from a conservation bank or the in-lieu fee program. The action area also includes the two mitigation banks that have service areas within the project area. These include the Cosumnes Floodplain Mitigation Bank, which is a 472-acre floodplain site at the confluence of the Cosumnes River and Mokelumne River (Mokelumne River Mile 22) and Bullock Bend Mitigation Bank, a 119.65-acre floodplain site along the Sacramento River at the confluence of the Feather River (Sacramento River Mile 80).

## 2.4 Environmental 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).

### 2.4.1 American River

The American River is a 120 mile long perennial tributary to the Sacramento River (USGS 2015) and is considered as a "Navigable Water and a "Reasonably Permanent Water". It is fed by the melting snowpack of the Sierra Nevada and many headwaters and tributaries. It generally retains a high level of water quality and is a source of drinking water for the City of Sacramento (Wikipedia 2017b). The current Folsom Dam was finished in 1955, and is used for water storage

and flood control (Wikipedia 2017a). Below Folsom Dam, the American River passes through an urbanized area but is buffered by a riparian park "The American River Parkway" before it joins with the Sacramento River mainstem. The American River has above average water quality and provides increased flow of superior water quality to the Sacramento River (EPA 2012), though it is still considered an impaired river due to detections of mercury, polychlorinated biphenyls, and unknown toxicity.

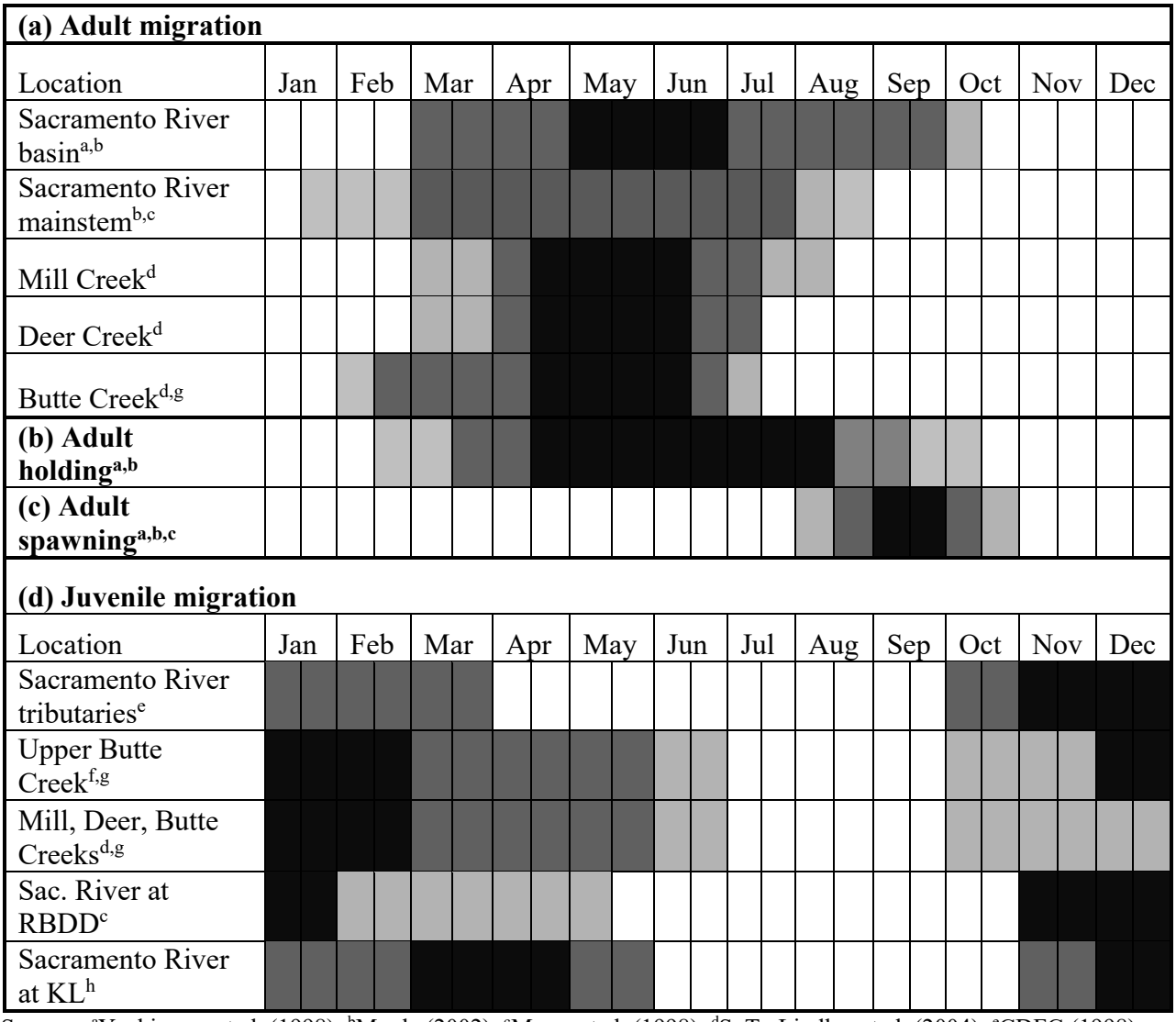
The proposed project action area at the American River extends approximately 2,117 linear meters or 1.32 river miles (RM). The portion of the American River accessible to anadromous fishes for freshwater rearing and migration purposes (and in some cases, spawning), totals 75 RM from Folsom Dam to the Delta (USGS 2015). The project action area therefore affects approximately 1.76% of the total length of riverine habitat currently available in this watershed.

2.4.1.1 Occurrence of Listed Species and Critical Habitat

The American River Bridge action area functions primarily as freshwater rearing habitat and as a freshwater migration corridor for CV spring-run Chinook, CCV steelhead, and sDPS green sturgeon. Various life stages of these species may be found within the action area throughout the year.

*CV spring-run Chinook salmon ESU*
The American River is noted as historically supporting a CV spring-run Chinook salmon population; however large dams have greatly reduced the river's ability to support a viable population. The NMFS salmonid recovery plan describes a recovery action of reintroduction into the river reaches above Folsom Dam. No recovery actions in areas below the Nimbus Fish Hatchery were identified in the latest recovery plan (NMFS 2014). If a fish passage plan was successfully implemented over or around the Folsom Dam in the American River, the parameters of spatial structure and diversity would be improved towards recovery of the spring-run Chinook salmon ESU, however it is noted that passage discussions are in their infancy and would not realistically co-occur with current project timing (SARSAS 2009, Auburn Journal 2015).

Since there is not an established population of spawning spring-run in the American River (CDFW 2017), only straying or disoriented adults would be found in the action area, at the latest until the end of August (Figure 3). The number of fish that may stray into the lower American River is unknown, but expected to be a low overall number of adult fish.




Sources: [a]Yoshiyama et al. (1998); [b]Moyle (2002); [c]Myers et al. (1998); [d]S. T. Lindley et al. (2004); [e]CDFG (1998); [f]McReynolds, Garman, Ward, and Plemons (2007); [g]P. D. Ward, McReynolds, and Garman (2003); [h]Snider and Titus (2000)

Note: Yearling spring-run Chinook salmon rear in their natal streams through the first summer following their birth. Downstream emigration generally occurs the following fall and winter. Most young-of-the-year spring-run Chinook salmon emigrate during the first spring after they hatch.

Relative Abundance: = High = Medium = Low

Figure 3. The temporal occurrence of adult (a) and juvenile (b) CV spring-run Chinook salmon in the Sacramento River. Darker shades indicate months of greater relative abundance.

The Knights Landing dataset is the most indicative of juvenile emigration timing and juvenile presence at the American River Bridge action area since it is the closet sampling location and indicate juvenile spring-run Chinook should be in the area until the end of May (Figure 3). Spring-run Chinook salmon juveniles were also captured in rotary screw traps in 2015 on the

lower American River during winter/spring months in 2015 (Figure 4), and so the lower American River likely supports a small amount of rearing CV spring-run Chinook juveniles.

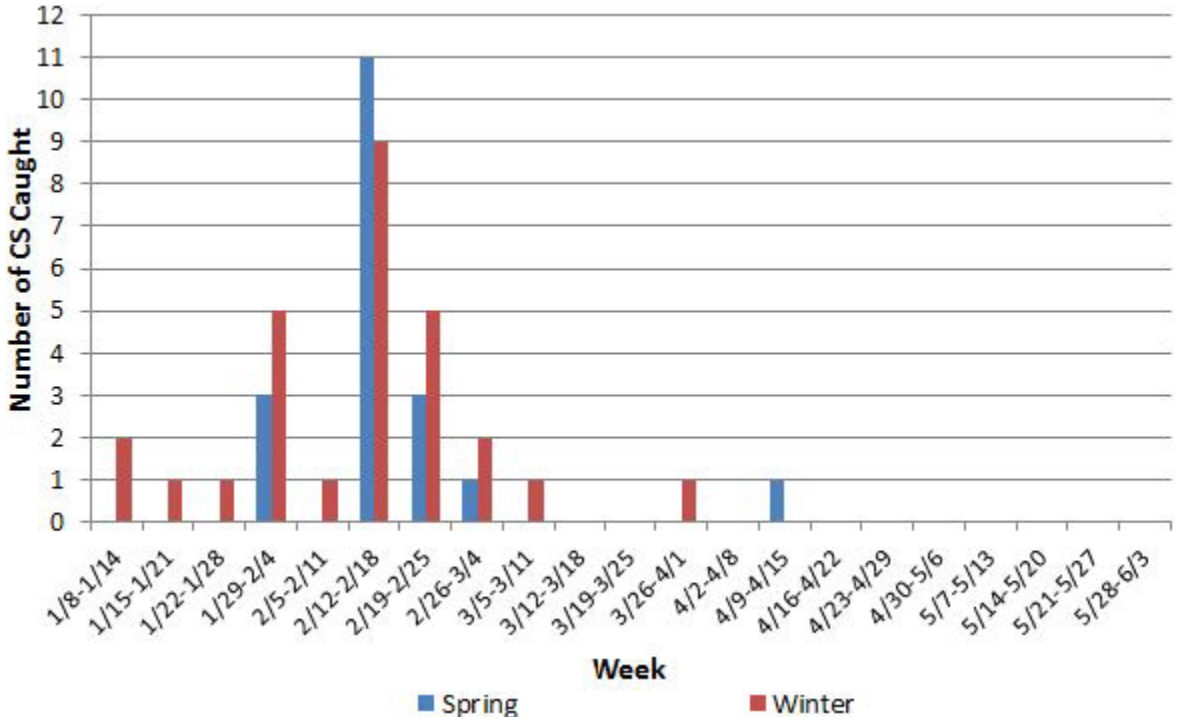


Figure 4. Weekly catch totals of juvenile spring- and winter-run Chinook salmon during the 2015 survey season, sampled from rotary screw traps set on the lower American River (CDFW 2017).

*CV spring-run Chinook salmon critical habitat*

The PBFs for CV spring-run Chinook salmon critical habitat within the American River action area include (1) freshwater rearing and (2) a freshwater migration corridor. These PBFs have been degraded from their historical condition due to human activity on and near the mainstem Sacramento River and American River. The American River is no longer able to support CV spring-run spawning as the Folsom Dam and Reservoir has blocked access to higher-elevation, cold-water holding pools necessary to support the spring-run Chinook salmon life history pattern. As adults cannot over-summer and ripen, current habitat conditions do not support spawning.

Naturally occurring floodplain habitat has been largely removed near the action area due to bank revetment and other levee repair actions, limiting the value for juvenile rearing in respects to its historical state while in turn increasing the value compared to the current state of the system as a whole as all other areas have seen decreases in suitable, accessible rearing habitat. Similarly, habitat complexity has been reduced due to revetment activities, removal of overhanging vegetation, and the damming of the American River, reducing macroinvertebrate production, shelter from predators, and thermal refugia, and blocking volitional passage to high elevation holding pools. But the lower American River in the action area remains largely free of migration impediments and retains a relatively high level of water quality with limited agricultural or nutrient load inputs.

*California CV steelhead DPS*

The American River contains rearing habitat and a migration corridor for juvenile CCV steelhead within the project action area, and below Nimbus Fish Hatchery is considered a Core 2 watershed for the DPS (NMFS 2014). Core 2 watersheds have "populations [that] meet, or have the potential to meet, the biological recovery standard for moderate risk of extinction" (NMFS 2014), and therefore are important to maintain to support geographic variability within the DPS. Within the action area portion of the American River, the rearing habitat and ability to be a migration corridor is classified as consistent and fair. The CCV steelhead spawning habitat upstream, at the base of Folsom Dam, is also qualified as fair and consistent. Dry Creek, which enters the American River approximately a mile and a half upstream of the action area, is classified as a Core 3 watershed for CCV steelhead (NMFS 2014), likely because it does not offer spawning habitat, only periodic passage to higher quality spawning grounds far upstream of the confluence with the American River. Although it is a small proportion of the total habitat available in the American River (1.76%), the rearing habitat in the action area is important because it provides rearing opportunities for juveniles out-migrating from this short system. Therefore, this system may contribute more to the DPS's overall reproductive success than its relatively short system length would otherwise indicate.

The American River portion of the action area serves as migration access to the spawning areas on Dry Creek and the reaches of the American River that support spawning below the Folsom Dam, above the action area. Otherwise, steelhead are well-distributed throughout the CV below the major rim dams (Good *et al.* 2005, NMFS 2011a). The mainstem of the Sacramento River serves as a primary migratory corridor for both upstream and downstream migration, connecting spawning habitat within the Sacramento River basin to the San Francisco Bay estuary and the Pacific Ocean.

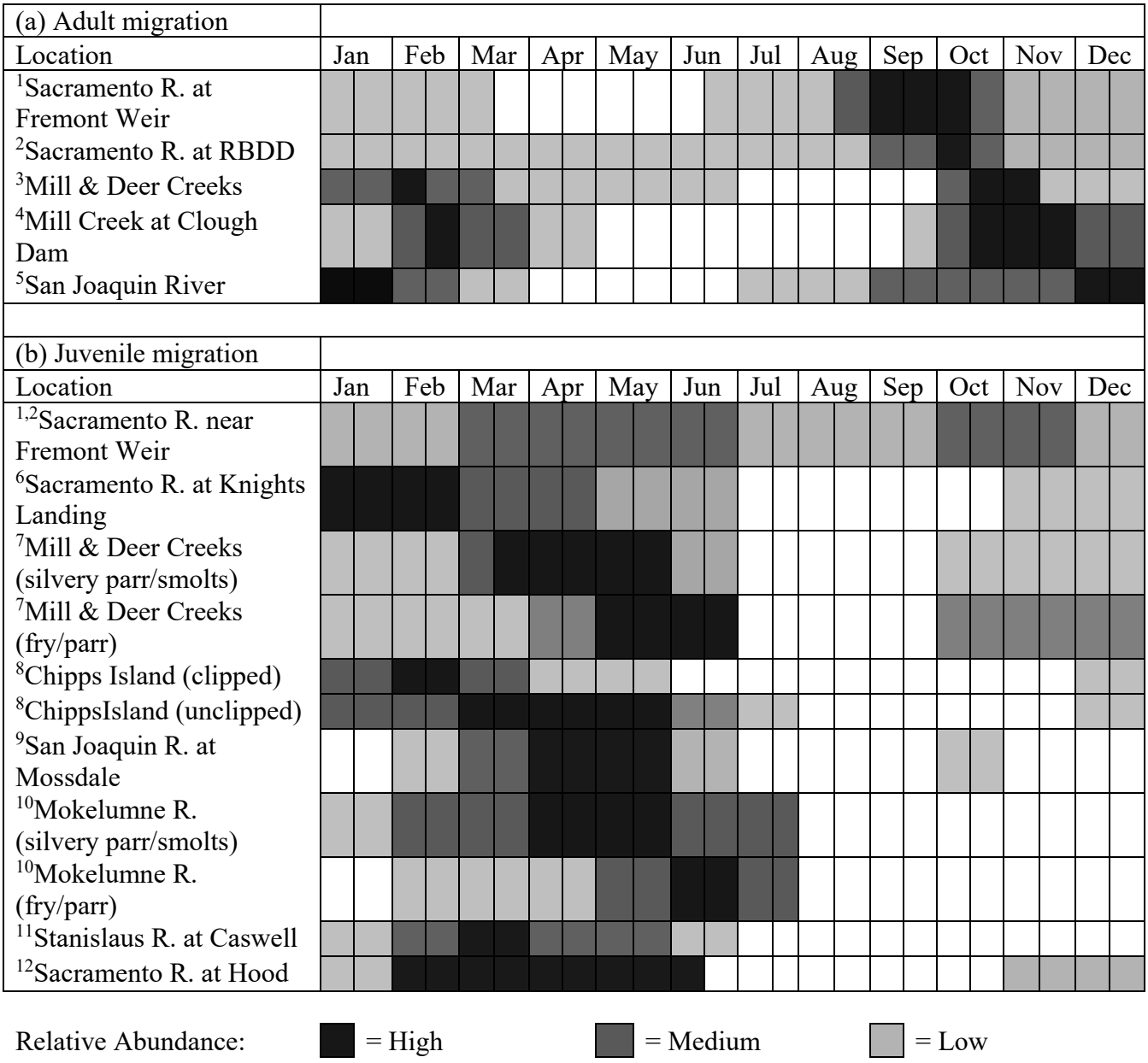
Adults can be found in the mainstem Sacramento River at Fremont Weir (the closest location to the confluence with the American River) from mid-June through mid-March, with migration activity peaking mid-August through October (Figure **5.** The temporal occurrence of (a) adult and (b) juvenile CCV steelhead at locations in the CV. Darker shades indicate months of greatest relative abundance.Figure 5). Therefore, adults may be present in the action area during the seasonal construction window, July through October in increasing abundance as they migrate up to spawning habitat in upper reaches of the American River or its tributaries (Hallock, Fry Jr., & LaFaunce, 1957).

Juvenile rearing tends to occur in areas with cool, clear fast-moving water where riffle habitat is predominant over pool habitat (Moyle, 2002). Due to the hydrology of the American River in the action area, long wide stretches of relatively slow-moving water briefly interrupted by the American River Bridge piers, juveniles are more likely to be migrating through than rearing. Again, the Knights Landing location is most indicative of juvenile presence and timing in the action area and shows that juvenile steelhead emigration should be complete by June (Figure 5).

*California CV steelhead critical habitat*

The American River action area contains designated critical habitat for CCV steelhead, which extends from the American River's confluence with the Sacramento River, up to the base of the

Folsom Dam. Dry Creek converges with the American River upstream of the action area and is also designated CCV steelhead critical habitat. PBFs within the action area include freshwater rearing sites and freshwater migration corridors. These PBFs have been degraded from their historical condition due to human activity on and near the American River and Dry Creek. Since Folsom Dam blocks access spawning grounds above its placement, all CCV steelhead spawning in the American River is limited to suitable gravel areas below the dam, though it is likely in much more limited quantities and much lower in overall quality than higher elevation sites. Naturally occurring floodplain habitat has been largely removed near the action area due to bank revetment and other levee repair actions, limiting habitat value for juvenile rearing, and the placement of Folsom Dam. The hydrology of the American River has been altered from its natural state and the area is less valuable to steelhead rearing in the mainstem or floodplain. Similarly, habitat complexity has been reduced due to revetment activities and removal of vegetation, reducing macroinvertebrate production, shelter from predators, and thermal refugia.




Sources: [1]Hallock et al. (1957); [2]McEwan (2001); [3]Harvey (1995); [4]CDFW unpublished data; [5]CDFG Steelhead Report Card Data 2007; [6]NMFS analysis of 1998-2011 CDFW data; [7]M. R. Johnson and Merrick (2012); [8]NMFS analysis of 1998-2011 USFWS data; [9]NMFS analysis of 2003-2011 USFWS data; [10]unpublished EBMUD RST data for 2008-2013; [11]Oakdale RST data (collected by FishBio) summarized by John Hannon (Reclamation) ; [12]Schaffter (1980).

Figure 5. The temporal occurrence of (a) adult and (b) juvenile CCV steelhead at locations in the CV. Darker shades indicate months of greatest relative abundance.

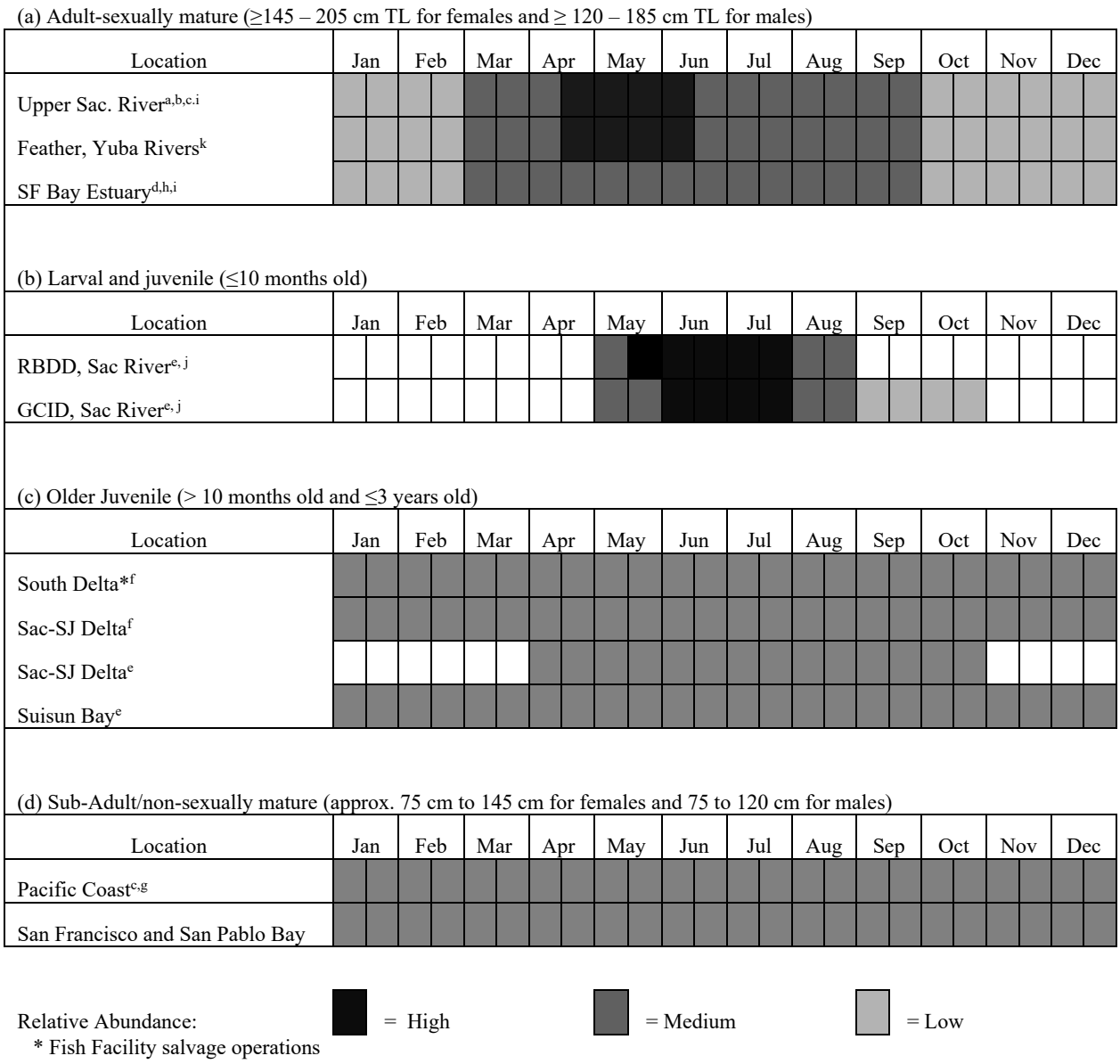
*Southern DPS North American green sturgeon*
The upper mainstem Sacramento River is the only area where consistent annual spawning of sDPS green sturgeon has been confirmed via observations of eggs and larvae (Poytress, Gruber, Van Eenennaam, & Gard, 2015). Adult green sturgeon are believed to spawn April through early July, however there is evidence timing is mediated by flow and therefore spawning could occur also occur late summer or early fall as well (Figure 6). After spawning, some adults vacate freshwater immediately while others may hold in the Sacramento River or other freshwater areas for several months (Thomas & Klimley 2015). Since the American River confluence with the Sacramento River is approximately 2 miles away from the action area, it is possible for adult green sturgeon may stray into the American River action area while finding their way up to the spawning areas or while adults are holding in freshwater after spawning. The overall abundance of adult green sturgeon that use the American River is unknown, but is likely to be low, since the portion of the American River crossed by the SR 160 bridge is relatively shallow and does not offer suitable holding habitat.

The American River currently is not currently considered to host green sturgeon spawning, and its historical value to the DPS is unknown. It may still provide rearing habitat to the DPS as suitable conditions are available, which is a short stretch of the American River was included in their critical habitat designation (including about half of the project's action area). Currently, green sturgeon recovery actions are still to be determined and will depend on the outcomes of upcoming habitat assessments. In addition, recovery actions identified in the recovery plan target high risk threats to the DPS. Threats that occur in the American River and this project are medium and low ranking threats, such as in-water construction, shoreline development, anthropogenic underwater sound, point-source sediment, and in-water structures. Therefore, at this time, restoration and reintroduction is not under consideration for the American River for sDPS North American green sturgeon (NMFS 2017), and this action area is not of particular value to this DPS.

Green sturgeon larvae disperse 18 days after hatching, but may stay in freshwater rearing for up to three years before entering the Pacific Ocean. There is currently insufficient information available to determine how long juvenile sturgeon may rear in the mainstem Sacramento River or its tributaries specifically. It is possible, that some juveniles rearing in the Sacramento River will stray into the American River at some point prior to their entry into the Delta/Pacific Ocean and should be expected to be present in low numbers in the American River action area year-round (Figure 6).

*North American green sturgeon critical habitat*
Critical habitat for sDPS green sturgeon occurs in the action area, to from the American River confluence with the Sacramento River, to just upstream of the easternmost American River Bridge/northbound SR 160 lane. The mainstem Sacramento River serves primarily as a migration corridor and the major spawning river for green sturgeon, but despite being suitable to support juvenile to adult life stages, there is little data regarding the frequency use of the American River by green sturgeon. It is possible they may have historically used the American River for spawning, or more extensively for freshwater rearing, before the placement of Folsom Dam. The PBFs of sDPS green sturgeon critical habitat included within the action area include (1) food resources, (2) adequate flow regime for all life stages, (3) water quality, (4) adequate

water depth for all life stages, and (5) sediment quality. Where the river is of sufficient depth, the American River portion of critical habitat is likely of moderate value to the sDPS due to the limitations and extent of degradation prevalent throughout the Sacramento River basin.




Sources: [a]USFWS (2002); [b]Moyle *et al*. (1992); [c]Adams *et al*. (2002) and NMFS (2005); [d]Kelly *et al*. (2007); [e]CDFG (2002); [f]IEP Relational Database, fall midwater trawl green sturgeon captures from 1969 to 2003; [g]Nakamoto *et al*. (1995); [h]Heublein (2006); [i]CDFG Draft Sturgeon Report Card (2007), [j]Poytress *et al* (2011, 2012), [k]Alicia Seesholtz, DWR, personal communication

Figure 6. The temporal occurrence of (a) adult, (b) larval (c) juvenile and (d) subadult coastal migrant sDPS of green sturgeon. Locations emphasize the CV of California. Darker shades indicate months of greatest relative abundance.

2.4.1.2 Factors Affecting Listed Species and Critical Habitat in the American River

Many anthropomorphic and naturally occurring factors have led to the decline of anadromous fish in the native lotic ecosystems. The American River, like most watersheds in the California CV, has been substantially degraded from its natural condition. Due to the construction of Folsom Dam, flows and temperatures through the action area have been altered from their natural regimes. Altered flow regimes can influence migratory cues, water quality (including contaminants, DO, and nutrients for primary productivity), and temperature.

Dams also block passage to spawning areas that are of greater intrinsic value, so all populations natal to the American River are currently forced to complete any natural spawning at a lower elevation than they otherwise would have, below Folsom Dam. Currently, CCV steelhead are the only listed anadromous species known to still spawn in the American River. Spawning in sub-par areas can lead to lower hatching success, in part due to redd or nest superimposition (when the spawning bed spatial extent is limited and redds overlap one another), higher than optimal water temperatures, degraded water quality due to anthropogenic pollution, and decreased water flow and velocity needs to oxygenate the developing eggs. Dams also retain the sediments that would normally re-supply spawning beds with appropriately sized gravel, but current spawning beds are losing suitable gravel due to the natural erosion and riverine transport while not being replenished, therefore diminishing in total area over time.

Over the past six years, drought conditions exacerbated by climate change have played a significant role in adversely affecting listed anadromous fishes and their critical habitats by limiting the available surface water supplies, and by causing air and water temperatures to increase. Considering direct effects, critical and lethal water temperatures were frequently reached and sustained through a majority of spring and summer seasons for consecutive years, for multiple life stages in many water ways designated as critical habitat. Air temperatures, especially nighttime air temperatures, were unseasonably warm, and precipitation and snowpack levels were insufficient to mitigate daytime heating with cold water that would have normally been input throughout the summer. Harmful water temperatures also continued into the fall season throughout the drought years, again as unseasonably high air temperatures persisted and precipitation levels were less than what would normally be expected. Increased temperatures also have the potential to disrupt aquatic macroinvertebrate production, leading to declines in food availability in the action area (J. V. Ward & Stanford, 1982). Therefore, CV spring-run Chinook and CCV steelhead, rearing and migration corridor PBFs have been partially degraded as a result of flow and temperature alteration in the American River. Green sturgeon PBFs are also affected by drought: adequate flow regime for all life stages, water quality, and migratory corridors.

Artificially-created levees have been constructed along the banks of the American River have substantially reducing the density and diversity of riparian vegetation within the action area despite the implementation of the American River Parkway (Wikipedia 2017b), and areas behind the levees have been urbanized. Riparian vegetation provides a host of ecosystem services and its removal has diminished habitat value within the action area. Riparian vegetation plays a key role in the conservation value of rearing habitat for all salmonid life stages. It provides shading to lower stream temperatures; increases the recruitment of large woody material into the river, increasing habitat complexity; provides shelter from predators; and enhances the productivity of

aquatic macroinvertebrates (Anderson & Sedell, 1979; Pusey & Arthington, 2003). It has also been shown to directly influence channel morphology and may be directly correlated with improved water quality in aquatic systems (Dosskey et al., 2010; Schlosser & Karr, 1981).

Another continuing issue in the urbanized American River system, especially within the Sacramento city limits, is extensive homeless camps that persist along the banks and levees of this system. These camps are continuing sources of trash, untreated human and animal effluent, and various other hazardous contaminants (CBS13 2017, Sacramento Bee 2017a, 2017b). All of these types of contaminants are discharged into the river consistently, or all at once during flood flows, and may be causing localized nutrient and pollutant loading which may be reducing water quality and causing a cascade of issues (similar to agricultural inputs (Paerl, Hall, & Calandrino, 2011)). Inhabitants of these camp also removal or alter the riverside vegetation in the immediate vicinity to make shelter or to fuel campfires. The ecological impacts of extensive homeless encampments is not well studied and seems to be an issue that will be persistent throughout the foreseeable future.

The American River also hosts water sports and recreation, such as swimming and boating (Wikipedia 2017b). Such activities, while largely harmless to listed fish in individual occurrences, cumulatively can approach worrisome levels during hot days and on weekends when many members of the public seek relief from high daytime temperatures. Fishes may avoid areas that experience high watersport use due to underwater noise created by boat motors, music, and splashing. These activities can also create temporary sediment plumes in high traffic wading and swimming areas, which may deter fish or affect them at sub-lethal physiological levels. Human use of rivers typically leads to introduced materials like forgotten refuse, and petroleum products may enter the river through engine oil or fuel leaks.

As air temperatures increase in the CV due to climate change, water temperatures in the American River are likely to increase as well. Though Folsom Dam receives snowmelt and deep-sourced spring water, it is not deep enough to create and maintain a cold-water pool that could be used to offset otherwise critical or lethal water temperatures in the summer and fall water, as the water/temperature management schedule in place for Shasta Dam ameliorates potential high water temperature scenarios in the Sacramento River. The amount of snowmelt available is also predicted to decrease as climate change progresses. The population and urbanization of the Sacramento Basin is expected to continue to increase in the foreseeable future (SACOG 2016). With expected increases urbanization and stormwater constituent loads but decreases in available freshwater sufficiently clean freshwater to dilute, it is likely that the future flows and water quality of the American River will decrease.

### 2.4.2 Lagoon Creek

At the location of the project, Lagoon Creek is approximately 31 miles from entry with the Delta/Pacific Ocean. Lagoon Creek is considered a “Reasonably Permanent Water” and drains rugged and rural portions of the California CV and the foothills of the Sierra Nevada approximately 40 miles south of Sacramento, California. As a tributary of the Lower Mokelumne River in area of high agricultural activity, flows are used heavily for irrigation (Wikipedia 2017c).

In addition, the Lagoon Creek Bridges action area is upstream of the Cosumnes Floodplain Mitigation Bank, which sits at the confluence of the Cosumnes and Mokelumne rivers. The bank offers floodplain mosaic wetlands, floodplain riparian habitat, and shaded riverine aquatic habitat credits. These types of credits and habitats support CCV steelhead rearing habitat and will be maintained in perpetuity within bank boundaries.

2.4.2.1 Occurrence of Listed Species and Critical Habitat

Lagoon Creek/Skunk Creek may provide rearing and migratory corridors for salmonid juveniles when the water year provides sufficient flow in the area to facilitate access to the action area.

*CV spring-run Chinook salmon*
In the Mokelumne River, Chinook salmon have been observed passing the Woodbridge Irrigation District Dam, an area significantly upstream of the confluence leading to Lagoon Creek, from March through July in small numbers (Workman, 2003). This seasonal migration timing is normally attributed to a spring-run life history pattern, however CV spring-run Chinook ESU genetics have not been confirmed as currently occurring in this area. Due to multiple barriers and the lack of evidence that adult or juvenile spring-run Chinook utilize the Mokelumne River, the Cosumnes River, or Lagoon Creek, this ESU is not expected to occur at the Lagoon Creek action area.

*California CV steelhead*
Steelhead are well-distributed throughout the CV below the major rim dams (Good *et al.* 2005, NMFS 2011a). The Mokelumne River serves as a primary migratory corridor for both upstream and downstream migration, connecting spawning habitat within the San Joaquin River basin to the San Francisco Bay estuary and the Pacific Ocean. Adults can be found in the Mokelumne River and lower Cosumnes River primarily during the fall and winter seasons and may spawn November through January. Due to the characteristic flows, passage impediments, and the limited riparian habitat available in Lagoon Creek, adult CCV steelhead are not expected to utilize the area.

Rearing juveniles tend to occur in areas with cool, clear fast-moving water where riffle habitat is predominant over pool habitat (Moyle, 2002). Their preferences may not be met by the physical conditions available at Lagoon Creek, but juvenile CCV steelhead do occupy the Mokelumne River during the first half of the year as parr or smolts through July (Figure 5). If flows were sufficient to connect floodplain habitat of Cosumnes or Mokelumne rivers to Lagoon Creek and water temperatures were sufficiently cool, it is conceivable that juvenile CCV steelhead may utilize the Lagoon Creek action area for auxiliary rearing purposes. Because of adjacent habitat in the larger watersheds, numbers of juvenile CCV steelhead in the Lagoon Creek action area are expected to be low.

*Southern DPS North American green sturgeon*
The Cosumnes and Mokelumne Rivers and the northern Delta may at times contain sDPS green sturgeon. However, sampling by East Bay Municipal Utility District (EBMUD) in the Mokelumne River has never encountered green sturgeon in their sampling (M. Workman, *pers.*

*comm.*). Since the Lagoon Creek action area is but a shallow tributary that has not shown evidence of green sturgeon use, sDPS green sturgeon are not expected to occur in the action area of Lagoon Creek.

The Lagoon Creek portion of the action area does not contain any critical habitat designated for anadromous fishes under NMFS jurisdiction.

2.4.2.2 Factors Affecting Listed Species and Critical Habitat in Lagoon Creek

Not much information is available about Lagoon Creek/Skunk Creek specifically, since it is an intermittent tributary of the Lower Mokelumne River (USGS 2015). Since it occurs in an area of high agricultural activity (Wikipedia 2017c), flows are likely used for irrigation, either by directly pumping or impounding water or indirectly by the water table being drawn down by groundwater pumping. In addition, Lagoon Creek likely experiences increased turbidity, nutrient loading, and agricultural-related pollutants like pesticides associated with such activities. Within the action area, traffic noise from the highway bridges above are now part of the normal noise environment, though the effects of the traffic noise on the habitat value have not been assessed. California CV steelhead juveniles may occur in the Lagoon Creek action area when flows are sufficient to keep waters at or below sub-lethal temperatures while ensuring access back to the Cosumnes and Mokelumne Rivers.

Climate change predictions indicates that a drier climate will likely extended and increase the severity of droughts for the California CV, and the precipitation that California does receive is predicted to be increasingly extreme events such as atmospheric river deluges. In which cases, small intermittent streams like Lagoon Creek may become more typified by having very low flows or be dry for long periods and, therefore become inaccessible to CCV steelhead.

As stated previously, the Lagoon Creek action area does not contain any designated critical habitat for anadromous species under NMFS's jurisdiction, though effects from the proposed actions within the construction area here may have indirect effects to designated critical habitat downstream.

2.4.3 Mitigation Banks

There are two conservation or mitigation banks approved by NMFS with service areas that include the action area considered in this BO. Both these banks occur within critical habitat for CCV steelhead. These include:

***Cosumnes Floodplain Mitigation Bank:*** Established in 2008, the Cosumnes Floodplain Mitigation Bank is 472-acre floodplain site at the confluence of the Cosumnes and Mokelumne Rivers (Mokelumne River Mile 22) and is approved by NMFS to provide habitat credits to mitigation for project impacts to CCV steelhead rearing habitat. There are shaded riverine aquatic, floodplain riparian, and floodplain mosaic wetlands credits available. To date, there have been 22.39 of 38.13 credits sold and the ecological value (increased rearing habitat for juvenile salmonids) of the sold credits are part of the environmental baseline. All features of this bank are designated critical habitat for the species analyzed in this BO.

***Bullock Bend Mitigation Bank:*** Established in 2016, the Bullock Bend Mitigation Bank is a 119.65-acre floodplain site along the Sacramento River at the confluence of the Feather River (Sacramento River Mile 80) and is approved by NMFS to provide habitat credits for impacts to Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon and CCV steelhead. There are salmonid floodplain restoration, salmonid floodplain enhancement and salmonid riparian forest credits available. To date, there have been 12.5 of 119.65 credits sold and the ecological value (increased rearing habitat for juvenile salmonids) of the sold credits are part of the environmental baseline. All features of this bank are designated critical habitat for the species analyzed in this BO.

## 2.5 Effects of the Action

Under the ESA, "effects of the action" means the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action later in time, but still are reasonably certain to occur.

### 2.5.1 Effects of the Proposed Action to Listed Fish Species

The following is an analysis of the potential direct and indirect effects to listed fish species that may occur as a result of implementing the proposed scour mitigation actions at the American River Bridge and the Lagoon Creek Bridge. For our analysis on the effects of the proposed action to listed species, we have used the presence of species in the action area to determine the risk each the species and life stage may face if exposed to project impacts. The effects of the proposed action components that were analyzed include: (1) pre-construction geotechnical investigation, (2) riparian vegetation removal, (3) pile driving and associated underwater acoustic exposure, (4) construction-related dewatering, (5) sediment mobilized by construction, (6) release or spill of contaminants and pollution, and (7) general construction direct injury and disturbance.

At the American River action area, the proposed action includes several components that may directly, or indirectly, affect CV spring-run Chinook salmon, CCV steelhead, and sDPS green sturgeon. However, these species will not be impacted by pre-construction geotechnical investigation or vegetation removal at this location since these activities are not proposed for this site.

Due to these species' ranges, habitat preferences, and biological limitations, at the Lagoon Creek action area only juvenile CCV steelhead are considered likely to be directly, or indirectly, affected by the scour mitigation action. Therefore, potential impacts to green sturgeon, spring-run Chinook salmon, and adult CCV steelhead are not expected and will not be discussed further.

**1) Pre-Construction Geotechnical Investigation**

The pre-construction geotechnical investigation borings will produce noise and vibration. Caltrans's Drilling Services has performed a noise study for the sound levels typically produced by standard penetration test boring and hammers at various distances from the drill rig and operations (Table 2).

Table 2. Noise generated by standard penetration test boring activities measured at various distances from drill rig.

| Distance from rig (feet) | Produced by drilling (dB) | Produced by hammering (dB) |
|---|---|---|
| 5 | 92.1 | 93.4 |
| 25 | 73.3 | 79.9 |
| 50 | 69.0 | 72.8 |
| 75 | 65.5 | 69.3 |
| 100 | 64.2 | NA |

There is potential for the drilling fluids or core materials to inadvertently contaminate and impair water quality in adjacent wetlands as an indirect result. If contamination were to occur, listed fishes could be exposed to hazardous chemicals and detrimentally impaired, depending on the type of chemical released and its concentration In addition, geotechnical investigations have the potential to mobilize sediment if sediments or erosion are allowed to discharge into waterways, increasing in-river sediment plumes and turbidity, which can lead to impaired gill respiration, decreasing overall fitness if the entire waterbody is affected, or causing fish to avoid the turbid area.

*Lagoon Creek*
Six borings will be drilled on the shoulder of SR 99 (primary location) or in the SB lanes of SR 99 (alternate location), neither of which are in aquatic habitat. Since the boring locations will not be placed within aquatic habitats, dewatering will not be required to conduct the geotechnical investigations at the Lagoon Creek location. Caltrans plans to implement best management practices (BMPs) around and beneath all drilling equipment, and will have a Spill Prevention Control and Countermeasures Plan (SPCCP) on hand to prevent both sediment and chemical spills from entering the river during geotechnical investigations, preventing direct and indirect adverse effects to listed species that may be present in Lagoon Creek. Because of the location of the borings outside of aquatic habitat, there is no risk of direct injury from this activity.

According to Table 2 above, sound exposure levels (SEL) produced by geotechnical drilling and hammering are not expected to reach or exceed threshold SELs that are known to injure or kill fishes greater than 2 grams, 187 decibels (dB) of cumulative SEL and 206 dB peak SEL (Caltrans 2016). At most, noise levels produced are expected reach a maximum of 94 dB or less at 5 feet from the drilling rig. Since noise generated by geotechnical borings are below injurious threshold criteria even at their maximum, acoustic effects are only expected to cause harassment to fishes and may elicit startle responses or cause fishes to avoid the area.

The proposed seasonal in-water work window has been set from June 15th to October 15th. The geotechnical investigation should be concluded in less than 12 days, since only two borings are

required. Assuming the geotechnical investigation will be performed before channel construction begins, it may overlap with CCV steelhead juvenile presence. According to available data, juvenile steelhead are present in the Mokelumne River until the end of July (Figure 5). Behavioral changes such as escape responses or sheltering/hiding may be elicited at the noise levels produced while the geotechnical investigation is underway. Since the noise produced by the drilling will be limited in duration, any the changes in fish behavior that do occur are unlikely to adversely affect juvenile growth and survival in a measurable way. Therefore, the geotechnical investigations may affect, but are not expected to adversely affect, juvenile CCV steelhead.

**2) Riparian Vegetation Removal**

Decreases in riparian vegetation create physical changes in the environment which cumulatively decrease the survivorship of juvenile salmonids (Bjornn & Reiser 1991). When overhanging and streamside vegetation is removed, summer water temperatures typically increase proportionally with the increase of sunlight exposure reaching the water surface. Exposed water surfaces have the potential to quickly exceed the sub-lethal and lethal water temperature ranges for salmonids. Increases in water temperature can also influence the fish species composition to reflect that of a warm water community in the system (Marchetti & Moyle 2001), increasing the number of juveniles predators, and changes in cover influences the macroinvertebrate prey assemblage (Meehan 1991) to one less supportive of juveniles salmonid growth. Increased water temperatures coupled with insufficient flows typically favor aquatic pathogen proliferation while simultaneously decreasing fish autoimmune response through stress and lead to mass salmonid deaths (USFWS 2003).

*Lagoon Creek*
Mature woody riparian vegetation is rooted below the OHWM in the construction and planned structure footprint. Streamside vegetation cover will be reduced to provide construction equipment access to enable the removal and replacement of the bridge spans by trimming the plants down to their roots when necessary. Vegetation removal may also be required to place the temporary cofferdam. For the purposes of this analysis, we assume as the worst-case scenario, that all riparian canopy cover would be trimmed to ground level. Tree inventory has not been performed at this site so exact removal/trimming estimates are unknown, but the mature woody riparian species expected to be removed or trimmed include narrow-leaf willows, pacific willows, and bulrush.

Temporary impacts associated with the action are estimated to result in 1.96 acres of vegetation disturbance. Caltrans proposes to partially offset riparian vegetation disturbance and removal by replanting the area after construction is complete to the extent feasible. The canopy is projected to be replaced in five to ten years after replanting. The new bridge supports will require permanent fill, and because the two existing bridges will be widened to the median, any riparian vegetation existing in the median may require permanent removal as well. Total permanent impacts to riparian vegetation for all spans and project completion is estimated to be 0.003 acres.

In order to offset permanent impacts in areas where revegetation is not possible, Caltrans proposes to purchase mitigation credits from a NMFS approved conservation bank or in-lieu fee

program. The purchase of mitigation credit from a NMFS approved bank creates beneficial effects that will restore and protect floodplain and riparian habitat and improve juvenile rearing habitat as analyzed in this BO. Although the banks that cover this area technically do not include CCV steelhead credits, we expect that the CCV steelhead ESU will benefit from the purchase of these credits since individual juveniles should be able to access the floodplain areas created and maintained by the banks/programs to fulfill the purchase of such credits.

Negative alterations to any available rearing habitat, could hinder the recovery of CCV steelhead ESU, depending on the extent and severity, and how sparse other rearing areas are locally. At most, all woody riparian vegetation may be trimmed to the ground, removing all overhanging shade, and the area may not be fully restored for up to ten years. Adequate water temperatures are especially critical during the early summer months when ambient air temperatures being to increase. Steelhead may still be in valley floor ecosystems during summer months. Removal of vegetation at Lagoon Creek is expected to increase temperatures, which is expected to result in adverse effects to rearing CCV steelhead. However, because of the low number of juveniles expected to use Lagoon Creek the impact of these actions are also expected to be low. Additionally, flows in Lagoon Creek are usually low during the construction window and may not support CCV steelhead juvenile movement to the action area. The Cosumnes Mitigation Bank downstream offers preferable rearing habitat to that offered by Lagoon Creek, and should be encountered first by juveniles straying up the system while rearing. The long-term adverse effects are expected to be limited to a small number of individual CCV steelhead juveniles that might move into the area because rearing will improve gradually over a time span of ten years while the replanted vegetation establishes. Purchase of mitigation bank credits is expected to offset the permanent riparian impacts.

**3) <u>Construction-related Dewatering</u>**

Dewatering activities can potentially affect fishes through two avenues: 1) directly, as fish may become entrapped in the enclosed space, may be impinged on the water pump intake resulting in injury or death, remain hidden during dewatering and become stranded, resulting in injury or death, and/or require handling for relocation, which may result in injury or death; or 2) indirectly, as dewatering may introduce contaminated or turbid water into areas with fish and degrading the water quality, which may result in sub-lethal effects. To avoid degrading the water quality, Caltrans intends to filter and/or treat the dewatered water in a way that ensures that it will meet water quality requirements of their waste water discharge permit or water quality certification issued by the CV Regional Water Quality Control Board (CVRWQCB) prior to its discharge.

*American River*
During the installation of the temporary work trestle, hollow steel piles will be driven into the riverbed to provide support for the structure. The annuli of the hollow temporary piles are not expected to be dewatered but, the underwater sound attenuation system may employ a dewatered casing system and require dewatering to function effectively. Also, subsequent to the sealing of the sheet pile wall, the space between the sheet pile wall and the existing cap foundation will be de-watered and filled with granular structure backfill, from the channel bottom to near the top of

the sheet pile wall. Fish capture/relocation before the de-watering and backfilling of this space is not feasible and is not expected to occur.

Considering that the likelihood of juvenile salmonid and green sturgeon entrapment before dewatering is minimal at the American River during the work window (Figure 3 and Figure 5), adverse effects to juveniles due to dewatering are not expected. Adult salmonids and green sturgeon are expected to be able to navigate past or avoid the immediate dewatering area, so the probability of an adult fish becoming entrapped in these small spaces and injured or killed during dewatering is also low. Therefore, adverse effects due to dewatering at the American River are not expected to occur.

*Lagoon Creek*
Because Lagoon Creek flows perennially, temporary cofferdams will be used to perform "clear water diversions" to dewater the construction area. The cofferdams will be constructed using sandbags, aqua-dams, or similar materials, but sheet piling is not expected to be used, and is therefore not analyzed as part of the proposed project. Some of the depressed areas immediately in the vicinity under the span will be de-watered by pumping, and flow from upstream of the cofferdam will be diverted around the construction area via conduit. If standing water is present in depressions under the bridges, these areas will require dewatering via pumping to allow in-the-dry construction below the water line. The cofferdam will require continuous pumping to maintain dry conditions within the dewatered area. The cofferdam will only remain in place during the construction window, and will be completely removed between construction seasons if more than one is required to complete the project.

California CV steelhead juveniles may possibly occur in the depressions under the Center Span in Lagoon Creek proper during the work window, although it is expected they will be in low densities. These fish may be stranded in the depressions due to falling water levels that are likely to occur throughout the work window. Therefore, fish capture and relocation will be necessary during dewatering activities. Qualified biologists will conduct sweeps through the area to be dewatered, using electroshock gear and seine nets or dip nets to capture fishes. Captured fish will be relocated to suitable habitats downstream of the active construction area (those areas outside of injurious pile driving pressures areas, or at least 158 meters away). Relocation efforts will continue until all observed fish have been removed from the dewatered reach. In addition, the dewatering will be performed by screened intakes so elusive fish will not be sucked into the pump.

Despite best efforts, fish mortality during capture and relocation efforts occurs often. Each step of the process -electroshock, net capture, and handling- induces physiological stress even when skilled fish biologists perform the relocation. In addition, any fish that are able to elude capture may be impinged onto the intake screen of the pump and injured, or remain stranded after dewatering. The overall mortality number associated with dewatering is expected to be less than three percent of fish captured and relocated. Also, during active construction, some use of aquatic and wetland habitats will be temporarily blocked while the dewatered areas are maintained via cofferdams and continuous pumping, which will limit fish use of the area.

The capture and relocation of juvenile salmonids associated with the temporary dewatering of the cofferdams and depressed areas at Lagoon Creek is expected to adversely affect a small number of CCV steelhead juveniles rearing in the area.

**4) Pile Driving and Underwater Sound Exposure**

Piles that are driven into river bed substrate propagate sound waves through the water which can damage a fish's swim bladder and other internal organs by causing sudden rapid oscillations in water pressure, which translates to rupturing or hemorrhaging tissue in the bladder when the air in swim bladders expand and contract in response to the pressure oscillations (Gisiner, 1998; Popper, Carlson, Hawkins, Southall, & Gentry, 2006). A perforated or hemorrhaged swim bladder has the potential to compromise the ability of a fish to orient itself both horizontally and vertically in the water column. This can result in the diminished ability to maintain position in the water column and affects the efficiency of feeding, migration, and avoidance of predators, can reduce general fitness, and even result in death. Sensory cells and other internal organ tissue may also be damaged by noise generated during pile driving activities as sound reverberates through a fish's viscera (Gaspin, 1975). In addition, morphological changes to the form and structure of auditory organs (saccular and lagenar maculae) have been observed after intense noise exposure (Hastings, 1995). Smaller fish with lower mass are more susceptible to the impacts of elevated sound fields than larger fish, and acute injury resulting from acoustic impacts should be scaled based on the mass of a given fish. Juveniles and fry have less inertial resistance to a passing sound wave and are therefore more at risk for non-auditory tissue damage (Popper & Hastings, 2009) than larger fish of the same species.

Fish can also be injured or killed when exposed to lower sound pressure levels for longer periods. Hastings (1995) found death rates of 50 percent and 56 percent for gouramis (*Trichogaster sp*.) when exposed to continuous sounds at 192 dB at 400 Hz and 198 dB at 150 Hz, respectively, and 25 percent for goldfish (*Carassius auratus*) when exposed to sounds of 204 dB at 250 Hz for two hours or less. Hastings (1995) also reported that acoustic "stunning," a potentially lethal effect resulting in a physiological shutdown of body functions, immobilized gourami within eight to thirty minutes of exposure to the aforementioned sounds.

Multiple studies have shown responses in the form of behavioral changes in fish due to human-produced noise (Popper & Hastings, 2009; Slotte, Hansen, Dalen, & Ona, 2004; Wardle et al., 2001). Instantaneous behavioral responses may range from mild awareness to a startle response. Fish may also exhibit movements that displace them from a position normally occupied in their habitat for short or long durations. Depending on the innate behavior that is being disrupted, the direct and indirect adverse effects could be varied. This is of particular concern for juvenile fish as there are innate behaviors that are essential to their maturation and survival such as feeding, sheltering, and migratory patterns. An example of a significant, direct adverse effect would be cessation or alteration of migratory behavior. In the context of the proposed action area, the migratory behavior of juvenile salmonids and green sturgeon may be affected by various pile driving and acoustic impacts. Though pile driving may affect migratory behavior, it is not expected to completely prevent salmonids and sturgeon from passing upstream or downstream because pile driving will not be continuous through the day, and will not occur at night, when the majority of fish migrate.

Based on recommendations from the Fisheries Hydroacoustic Working Group (FHWG), NMFS uses a dual metric criteria to assess onset of injury for fish exposed to pile driving sounds (Caltrans 2016, 2017b). For a single strike, the peak exposure level (peak) above which injury is expected to occur is 206 dB (reference to 1 micro-pascal [1µpa] squared per second). However, cumulative acoustic effects are expected for any situation in which multiple strikes are being made to an object with a single strike peak dB level above the effective quiet threshold of 150 dB. Therefore, the accumulated sound exposure level (SEL) level above which injury of fish is expected to occur is 187 dB for listed fish greater than 2 grams in weight, and 183 dB for fish less than 2 grams. If either the peak SEL or the accumulated SEL threshold is exceeded, then physical injury is expected to occur. Behavioral effects may still occur below these thresholds for injury. NMFS uses a 150 dB root mean square (RMS) threshold for behavioral responses in salmonids and green sturgeon. Though the dB value is the same, the 150 dB RMS threshold for behavioral effects is unrelated to the 150 dB effective quiet threshold.

*American River Bridge*

Temporary steel piles and permanent sheet piles will be installed in the American River, below the OHWM. Underwater sound levels generated by pile driving are expected be above the interim thresholds of fish injury as calculated by the NMFS underwater sound calculator (reference, (Table 3), therefore sound attenuation devices are proposed to be employed to help control the upper limits of the SEL peak, RMS, and SEL cumulative listed fishes may experience.

Table 3. Hydroacoustic effects expected at the American River Bridge (NMFS Pile Driving Calculations Microsoft Excel worksheet (Caltrans 2016), Caltrans 2015).

| | | | | | | | | Distance (m) to Threshold | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Onset of Physical Injury | | | Behavior |
| | | | | | | | | Peak dB | Cumulative SEL dB | | |
| Pile Type | Driver Type | Strikes Per Day | Reference Distance (m) | Attenuation (dB) | Peak (dB) | SEL (dB) | RMS (dB) | 206 dB | Fish >2 g 187 dB | Fish < 2 g 183 dB | RMS dB 150 dB |
| PZ-27 sheet pile | Impact | 21,600 | 10 | 0 | 211 | 179 | 192 | 22 | 858 | 858 | 6310 |
| 20-in steel pile | Impact | 17,280 | 10 | 0 | 208 | 176 | 187 | 14 | 541 | 541 | 2929 |
| PZ-27 sheet pile | Impact | 21,600 | 10 | 5* | 206 | 174 | 187 | 10 | 398 | 398 | 2929 |
| 20-in steel pile | Impact | 17,280 | 10 | 5* | 203 | 171 | 182 | 6 | 251 | 251 | 1359 |

*Assume a 5 dB reduction in sound magnitude when sound attenuation devices are employed, as proposed as part of the action.

*Temporary Work Trestle*- Unmitigated installation of 20-inch steel piles is expected to result in un-attenuated single strike sound levels of 208 dB peak at 10 meters from the pile, with an

estimated SEL of 176 dB. In this scenario, the peak sound level would be above the interim threshold set by the FHWG for fish injury for peak pressure (Caltrans 2016, 2017b) up to 14 meters from the driven pile and out to 541 meters for cumulative SEL. If a NMFS-approved bubble curtain, or some other sound attenuation device, a minimum reduction of at least 5 dB is anticipated. In a scenario where attenuation methods were used, the maximum expected single strike sound levels would be 206 dB peak expected within 6 meters from the pile, and injurious cumulative SEL exposure within 251 meters from the pile (Table 3). Behavioral responses/alterations would be expected out to 1,359 meters of pile driving.

In order to appropriately estimate the number of impact strikes needed to complete the temporary trestle, Caltrans performed a preliminary drivability analysis to determine the pile load bearing capacities. This preliminary analysis incorporated the soil profile of the construction site, predicted blow counts expected for pile driving (blows per minute), and the current pile design and other information available in the Pile Driving Compendium (Caltrans 2017b). According to information available by their manufacturer, the selected diesel impact hammer, a Delmag D36-32, is capable of delivering 17,280 to 25,440 blows in an eight-hour workday when continuously operated. Using the lower estimate to be a conservative over-estimate of a workday, as continuous operations are highly unlikely in this construction scenario, 17,280 blows per day would result in an SEL cumulative experience of 218 dB at 10 meters from the driven pile, if attenuation measures are not taken. Assuming that a measure such as a bubble curtain will provide 5 dB of noise reduction, the attenuated SEL cumulative is still high due to the large number of blows per day, at 213 dB cumulative SEL at 10 meters, above the interim threshold for fish injury.

According to the required depth each pile should be driven to, placement of 20-inch temporary steel piles will require approximately 1,200 blows per pile to ensure the structure can safety bear heavy loads. Therefore, a total of 367,200 total strikes will be required to complete the temporary trestle (306 piles x 1,200 strikes per pile = 367,200 total strikes). To deliver the total number of required strikes using the estimated 17,280 strikes delivered per eight-hour workday, it would take at least 22 working days to complete the temporary trestle. Continuous operations are not expected, therefore for the purposes of this analysis, at least 22 days of cumulative SEL above the interim threshold of fish injury is expected to be experienced by fish in the action area. If strike count per day were less, the per day cumulative SEL would otherwise be less than calculated but the number of days to complete the project would be greater, causing behavioral disruptions for a longer period.

*Permanent Installation of Sheet Piles*- Installation of 568 “PZ-27 Type” steel sheet piles will be accomplished using an impact hammer staged from the temporary work trestle described above and/or onboard a floating barge. Sheet piles may be initially ‘stabbed’ in using vibratory equipment and therefore are expected to produce sound levels that may exceed the RMS behavioral threshold (Pile Driving Compendium, (Caltrans 2017b)) but are not expected to exceed the interim thresholds for fish injury. Therefore, attenuation measures will not be used when ‘stabbing’ the sheet piles into place. When impact hammering is used to finish the permanent sheet pile placement, un-mitigated installation of the “PZ-27 Type” steel sheet piles are expected to result in un-attenuated single strike sound levels of 211 dB peak and 192 DB RMS measured at 10 meters from the driven pile (Table 3), with an estimated SEL of 179 dB.

These calculations translates to peak 206 dB pressures out to 22 meters, cumulative SEL 187 dB out to 858 meters, and RMS 150 dB out to 6310 meters from the driven pile. With the use of an attenuation device and a 5 dB level reduction, distances of injury include up to 10 meters for peak dB and 398 meters for cumulative SEL, and behavioral changes may be seen out to 2,929 meters from the driven pile.

An APE Model 7.5a hydraulic impact hammer was selected for use at this site for driving in the sheet piles. According to its manufacturer, it is capable of delivering 21, 600 to 48,000 blows per eight-hour workday under continuous operations. Using the lower daily estimate (21,600 blows per day), the un-attenuated SEL cumulative is estimated to be 222 dB at 10 meters from the driven sheet pile, above the interim injury threshold. While it is unlikely that the impact hammer would be operated continuously, even with the use of aquatic sound attenuation devices, the attenuated SEL cumulative would still be above the interim injury threshold out to 398 meters from the driven pile.

Preliminary analysis estimates that the 568 steel sheet piles will need to be driven to at least 30 feet of depth and each will require 900 blows to achieve this depth. Therefore, the installation of the permanent steel sheet piles will require 511,200 strikes total (568 sheet piles x 900 strikes each = 511,200 strikes total). Considering the eight-hour workday output estimated for the APE Model 7.5a, at least 24 working days will be needed to complete the installation of the permanent sheet piles. Continuous operation is not expected; therefore, at least additional 24 days of injurious SEL cumulative underwater noise is expected.

To determine the total area affected by underwater sound, Caltrans considered the underwater area where peak pile driving noises are predicted to exceed ambient noise levels, assumed to be 150 dB. This analysis used the activity expected to generate the highest underwater sound pressures, the impact hammer installation of the permanent PZ-27 steel piles. Without the use of attenuation measures, the distance to which the underwater pressures are expected to be above ambient or baseline underwater noise levels is 6,310 meters from the pile driving area (Table 3). With the use of attenuation measures, a 5 dB reduction is expected from the peak maximum, and therefore pile-driving noise should attenuate down to ambient levels in approximately 2,929 meters from the pile driving area up and downstream from the construction site. In this section of the lower American River, there is very little river curving and so the pressure waves are expected to travel in relatively straight lines with few obstructions from the source of propagation. As such, the estimated distances should be fairly close to those affected in the field though a rigorous study of the sound environment and underwater monitoring is not proposed.

*Use of Sound Attenuation Devices* - Caltrans proposes to employ 1) unconfined air-bubble curtains or 2) de-watered attenuation casings or confined air bubble curtains, to control underwater sound. Each of these attenuation devices work to reduce the transmission of sound through the water by interrupting pressure wave propagation through water and are based on the principle that air provides an effective barrier. Any attenuation system selected for each pile driving activity/situation will be in place and operational prior to impact pile driving. If the attenuation system fails, pile driving will stop immediately and will not resume until again operational.

Unconfined air bubble curtains employ a compressor and a perforated hose or pipe system placed around the driven pile, which released large quantities of air bubbles into the water surrounding the driven pile and should inhibit underwater sound propagation. An unconfined air bubble curtain is expected to provide 5 to 30 dB of noise reduction, depending on a variety of situational factors like water velocity. While the most cost-effective attenuation method, unconfined bubbles are subject to horizontal water current movements which may reduce their efficiency.

De-watered attenuation casings consist of hollow steel shells that are large enough to encompass the piles being impacted. These larger diameter steel piles are vibrated into the bottom substrate and then de-watered. The hollow casing must extend a few feet above the water line for effectiveness for the de-watering approach and be free from gaps or holes that would allow water to inundate the air space during pile driving. If the casing is not dewatered, it is equipped with a bubble curtain between the driven pile and the casing, and becomes a confined bubble curtain system. A confined bubble curtain is protected from the influence of water currents and therefore increase the dampening effectiveness of the system. Empirical data suggests confined bubble curtains provide 5 to 30 dB of noise reduction.

*Pile Driving Effect Conclusion*- Even while employing underwater sound attenuation devices during impact pile driving activities as proposed: 1) acute injury from a single strike/peak is expected to occur out to 10 meters, 2) injury due to cumulative exposure/SEL criteria out to 398, and 3) behavioral modifications due to sound pressures out to 2,929 meters from the source of propagation during the sheet pile installation (Table 3). Even when underwater pressures are below the level of physical injury, listed fish species could still be exposed to sound waves far from the immediate construction zone and affect their natural behaviors or elicit a stress response, out to 2,929 meters from the pile driving. According to the total strike calculations, placing both the temporary and permanent structures would require a minimum of 46 8-hour work days over which fish would be affected by impact pile driving.

Caltrans proposes a work window of June 15th to October 15th, and expects the American River Bridge Scour Mitigation to take two in-water work seasons and 200 total working days. The beginning and end periods of Caltrans's proposed work window are outside of NMFS's preferred work window of July 1st to September 30th to avoid most impacts to CV spring-run Chinook, CCV steelhead, and North American green sturgeon (Figure 3, Figure 5, and Figure 6).

Because the CV spring-run Chinook ESU spawns September through October in locations other than the American River, juveniles are unlikely to be emigrating or enter the action area during the work window and therefore are not expected to be exposed to, or affected by, impact pile driving. The in-water work window overlaps with the last half of the peak of the adult CV spring-run Chinook salmon upstream migration (Figure 3). However, the number of adult spring-run Chinook that may stray into the construction area is expected to be low, as currently there is no adequate spawning habitat in the American River. Adults that are present during impact pile driving would be reasonably certain to sustain injurious or at least alter their normal behaviors. In summary, impact pile driving is expected to have an adverse effect on a small number of adult CV spring-run adults.

The proposed June 15th to October 15th in-water work window overlaps completely with adult CCV steelhead upstream migration, including the migration peak from August through October (Figure 5). Depending on the complexity of the waterway, data suggest adult steelhead are more likely to move upstream during the day than at night (Keefer et al. 2012). Specifically, movement peaks were usually much greater and more often observed during the crepuscular portions of the day, but movement during the day was generally more likely than at night. The American River stretch in the action area is not particularly complex (so they may move upstream equally at night and during the day), however since CCV steelhead do spawn in the American River, a significant portion of the adults that use the American River may be harmed or killed and therefore be unable to spawn, or be deterred from moving through the construction area due to impact pile driving and therefore not spawn. Since in-water pile driving may be conducted over two seasons, both direct mortalities or alteration of normal upstream migration behavior of adults could be detrimental to the local Core 2 CCV steelhead population. Maintenance of Core 2 populations are important to retain the stability and spatial heterogeneity of the ESU for increased population viability. To decrease the impacts to adult CCV steelhead, Caltrans proposes to include a daily work hour limit of two hours after sunrise until two hours before sunset to ensure the population may migrate undisturbed during the most important movement periods of each day, however pile driving is still likely to have adverse impacts on adult CCV steelhead. In contrast, potential interactions with juveniles would be mostly avoided by the seasonal work window, only overlapping in their presence in late June. Due to the timing, steelhead juveniles would likely be in low abundance being at the tail end of their outmigration, but mortalities or disturbance may still occur due to pile driving.

Since the migration patterns of green sturgeon are less well known, estimating their exposure and risk is more difficult. The peak in adult green sturgeon upstream migration is believed to be April through June, however timing also seems to be largely driven by flows, and therefore they can be expected until September (Figure 6). Therefore it is possible adult green sturgeon that stray into the American River during the work window will be injured or harassed by impact pile driving hydroacoustic pressures. Total number of adults exposed would likely to be low as they are not know to currently use the American River for spawning. Juveniles may be present any time since they can rear in freshwater for more than three years, and juveniles are more likely to be potentially injured or killed by impact pile driving due to their smaller sizes. There are no robust data for juvenile green sturgeon abundance in the American River, so the number of juveniles that many be impacted and the total impact of this activity on this DPS is highly uncertain but if present, it is reasonably certain they would be adversely affected.

*Lagoon Creek Bridges*

For the new Lagoon Creek Bridges, up to 48 permanent CISS piles will be driven to support the SR 99 SB over three bridge spans below the OHWM or into adjacent wetland areas. If underwater sound is unmitigated, the hydroacoustic levels associated with these activities would be expected to injure or cause behavioral changes in fishes (Table 4). However, Caltrans proposes to dewater the pile driving areas and relocate CCV steelhead prior to beginning pile driving, there will not be juveniles close to the driven piles but they may be present in the aquatic areas upstream and downstream of the diversions. Also since the areas that are receiving piles will be dewatered, sound attenuation will in effect and produce a reduction in produced sound.

Table 4. Hydroacoustic effects expected at the Lagoon Creek Bridges (NMFS Pile Driving Calculations Microsoft Excel worksheet (Caltrans 2016), Caltrans 2015).

| Pile Type | Driver Type | Strikes Per Day | Reference Distance (m) | Attenuation (dB) | Peak (dB) | SEL (dB) | RMS (dB) | Distance (m) to Threshold | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Onset of Physical Injury | | | Behavior |
| | | | | | | | | Peak dB | Cumulative SEL dB | | RMS dB |
| | | | | | | | | | Fish >2 g | Fish < 2 g | |
| | | | | | | | | 206 dB | 187 dB | 183 dB | 150 dB |
| 24-inch CISS | Impact | 17,280 | 10 | 0 | 208 | 173 | 184 | 14 | 341 | 341 | 1848 |
| 24-inch CISS | Impact | 17,280 | 10 | 5* | 203 | 168 | 179 | <10 | 158 | 158 | 858 |

*Assume a 5 dB reduction in sound magnitude when sound attenuation devices are employed, as proposed as part of the action.

*Permanent CISS Piles*- Up to 24 24-inch diameter CISS piles will be driven below the OHWM and up to 24 24-inch diameter CISS piles will also be driven into adjacent and surrounding wetland or riparian habitats to complete this project. Unmitigated installation of 24-inch CISS piles is expected to result in un-attenuated peak single strike sound levels of 208 dB, RMS sound levels of 184 dB, and estimated SELs of 173 dB, and therefore would be above interim thresholds for fish injury. Caltrans is planning on implementing a dewatered cofferdam, which will serve to both dry the construction area and control propagation of impact pressure waves. The system should provide at least 5 dB of noise reduction. Therefore, the maximum expected attenuated single-strike sound levels should be 203 dB peak, 168 dB SEL, and 179 dB RMS as measured at 10 meters from the driven pile. Therefore, acute injury is not expected, injuries from cumulative sound impacts are expected out to 158 meters, and behavioral changes are expected out to 858 meters from the driven pile.

The hammer planned for use at the Lagoon Creek site (Delmag D36-32 diesel impact hammer) is capable of delivering 17,280-25,440 blows per eight-hour working day under continuous operation. Using the lower estimate of 17,280 blows per day, and working behind a dewatered cofferdam functions as a sound attenuation device, the action is expected to produce a cumulative SEL experienced to no more than 210 dB at less than 10 meters from the driven pile. Preliminary Caltrans Structural Engineer analysis estimates that driving 24-inch diameter CISS piles will require 10 to 30 strikes to achieve a foot of depth. With 30 blows per foot assumed, and also assuming the CISS piles will be driven to a tip elevation of 100 feet, each pile will require 3,000 strikes to be set. Considering Lagoon Creek Option 3, 24 24-inch diameter CISS piles will be set below the OHWM for the new bridge's center span, and 24 24-inch diameter CISS piles will be set total for the north and south spans of the new bridge. In total, 144,000 strikes will be required to set all of the piles ((24 piles center span * 3,000 strikes for each = 72,000) + (12 piles north span * 3,000 strikes for each = 36,000) + (12 piles south span * 3,000 strikes for each = 36,000) = 144,000 strikes to set all required piles). If 144,000 strikes will be

required to complete setting permanent piles for the Lagoon Creek project, at least 9 days of injurious SEL cumulative underwater noise is expected (144,000 strikes/17,280 strikes per day = 8.3 days).

To determine the total area affected by that will be affected by underwater sound, Caltrans considered the underwater area where peak pile driving noises are predicted to exceed ambient noise levels, assumed to be 150 dB. This analysis used the activity expected to generate the highest underwater sound pressures, the impact hammer installation of the permanent 24-inch diameter CISS piles. Without the use of attenuation measures, the distance to which the underwater pressures are expected to be above ambient or baseline underwater noise levels is 1,848 meters from the pile driving area. With the use of attenuation measures (dewatered cofferdams), a minimum of 5 dB reduction is expected from the peak maximum, and therefore pile-driving noise should attenuate down to ambient levels in approximately 858 meters from the pile driving area up and downstream from the construction site in a straight-line pressure wave propagation situation. Lagoon Creek is a very shallow waterway with a variable bottom plane and so 858 meters is not expected to be a good estimate of the actual sound travel but a worse-case scenario.

*Use of Sound Attenuation Devices* –All impact pile driving performed in stream channel segments will occur behind a dewatered cofferdam. The dewatering will isolate the piling from the affected waterbody and the air between the vibrating pile and the water in contact with the cofferdam will provide attenuation at least as well as a bubble curtain would, if not better. Because of the uncertainty associated with each construction situation, Caltrans expects at least a 5 dB reduction in underwater pressures due to attenuation, but attenuation could achieve up to a 30 dB reduction. Dewatering will be performed in a 'clear water diversion' before pile driving begins. If the system fails, pile driving will stop immediately and will not resume until again operational.

*Other Measures*- Due to unknowns regarding particular transmission loss through different soil types, Caltrans is assuming that fish responses may range from no response or change in observed behaviors, to stress response or notable changes in observed behaviors. Even when underwater pressures are below the level of physical injury, listed fish species could still be exposed to sound waves that travel far from the immediate construction zone and affect their natural behaviors or elicit a stress response. To reduce the probability of listed fish being affected by active pile driving, the seasonal in-water work window is limited to of June 15th through October 15th.

State Route 99 traffic will still need to use the roads the Lagoon Creek Bridges support. To accommodate the traffic, temporary bridges will be brought in to span gaps and serve transportation traffic during the tear down of the current bridges and completion of the new spans. The temporary bridges will not require supports, therefore will not require additional pile driving and should not have additional adverse effects.

*Pile Driving Effect Summary*- Juvenile CCV steelhead are the only anadromous resource that may reasonably be expected to utilized Lagoon/Skunk Creek. Past data indicate they may be present in the Mokelumne River system February through July, with a peak in emigration

sometime between April through June (Figure 5). Typically, summer water temperatures in shallow streams like Lagoon Creek will exceed lethal temperatures and preclude juvenile presence before the effects of federal actions come into play, but without data specific to this creek, juvenile presence cannot be completely discounted. However, the total number of juveniles to use Lagoon Creek as auxiliary rearing habitat is likely fairly low, since this stretch of this creek is 5 miles from the Cosumnes River and 8 miles from the Mokelumne River (much higher quality rearing habitat), often has low flows that may make access to the construction area difficult, and would only be expected to be in the area for the beginning portion of the work window, during June and July. Due to Lagoon Creek's shallow nature during this time of the year, it is likely that the underwater pressure propagation distances estimated in Table 3 are overestimates. The relocation of fish while dewatering cofferdam and depressed area may also be beneficial to individual juveniles if present, since any captured and relocated juveniles will be removed from the area expected to experience pile driving pressure waves. Caltrans' choice of bringing in a self-supporting temporary bridge also lessens impact to this ESU as it will not require additional impact pile driving. Overall, the effect of impact pile driving at this location to the CCV steelhead ESU is not expected to result in mortality or injury to juveniles since fish should be relocated from the immediately affected areas, but may result in a few individuals altering behaviors and experiencing increased physiological stress in areas further away than the dewatered sites.

**5) <u>Construction Mobilization of Sediment</u>**

Localized increases in sedimentation and turbidity may result from a number of activities associated with the proposed project. The movement and operation of heavy equipment in water and along the river banks, general barge operations and anchoring, destruction of existing rock and bridge supports, discharge during dewatering, and installation and removal of piles may cause sediment mobilization within the waterways in the two action areas. Sedimentation and turbidity are expected to have varying effects among different listed species and different life stages that are expected to be present in the action area during the proposed in-water construction window. High levels of turbidity can generally result in gill fouling, reduced temperature tolerance, reduced tolerance to fish diseases and toxicants, reduced swimming capacity and reduced forage capacity in lotic fishes (Waters 1995, Wood & Armitage, 1997). In a lab study, juvenile steelhead and Coho salmonids were found to occupy a parcel of water by choice between 57 and 77 nephelometric turbidity units (NTU) (Sigler, Bjornn, & Everest, 1984). This result suggests that juvenile salmonids may not exhibit avoidance behavior in low to moderate turbidities during migration. One effect of turbidity that has important implications for juvenile salmonids is that predator avoidance behavior has been shown to decrease at increased levels of turbidity (Gregory, 1993). Growth and survival amidst increased sediment and turbidity levels has also been shown to decrease resulting from reduced prey detection and availability and physical injury due to increased activity, aggression, and gill fouling (Kemp, Sear, Collins, Naden, & Jones, 2011; Sigler et al., 1984; Suttle, Power, Levine, & McNeely, 2004). Overall, less is known about the specific detrimental physiological effects of sedimentation and turbidity to sturgeon, but green sturgeon tend to spawn where turbidity is less than 10 NTUs (Poytress et al. 2009, 2010, 2011) in contrast to white sturgeon that tend to spawn in turbid areas. In addition, the effects of mobilizing sediments to the water column may be compounded when local

sediments contain legacy pollutants like mercury and disturbance may mobilize those toxic compounds back into the functional ecosystem (Suchanek et al. 2008).

*American River*
In-channel work activities, including 1) barge operations, maneuvering, and anchoring; 2) installation and removal of the piles; 3) removal of existing RSP around the bridge pier footings; 4) installation of the permanent steel sheet piles; and 5) placement of backfill, may result in sediment plumes or turbidity load increases locally. Caltrans has not estimated the amount or types of sediments that may be generated by project actions, since the amount of streambed estimated to be disturbed is limited and disturbance is temporary in nature.

California CV steelhead, CV spring-run Chinook, and sDPS green sturgeon juveniles and adults may be present in the action area, or just downstream of the action area. The action area is not spawning habitat for any listed species, therefore egg/developing life stages are not expected to be affected. Steelhead and Chinook juveniles may rear in the action area, and may be present during the scheduled in-water work window. Although less is known about the timing of rearing and migration of sDPS green sturgeon, both adult and juvenile life stages are known to utilize the Sacramento River basin and may exhibit rearing behavior in the action area as well.

Based on the proposed project description, sedimentation events and elevation of turbidity associated with construction are expected to be minor and transient in nature, and are expected to adversely affect fishes only so long as construction activities are active. Also, avoidance and minimization techniques will be implemented in this project as well as BMPs pertaining to the prevention of mobilized sedimentation and increased turbidity. Therefore, any adverse effects related to suspended or deposited fine sediments generated from the project are expected to be minimal and only cause behavioral changes.

*Lagoon Creek*
In-channel work activities and actions that may result in sediment plumes or turbidity load increases include 1) geotechnical investigation, 2) vegetation removal, 3) installation and dewatering of the temporary cofferdam, 4) cutting and removal of the existing bridge supports, 5) installation of new CISS piles via pile driving, and 6) movement of equipment onsite. Caltrans has not estimated the amount or types of sediments generated by project actions, since the amount of streambed estimated to be disturbed is limited and disturbance is temporary in nature.

Lagoon Creek may provide auxiliary rearing habitat for juvenile CCV steelhead seasonally. To minimize potential negative effects of project-generated mobilized sediment loading while project activities and fish presence may overlap, the project proposes to adhere to an in-water work window when fish are least likely to be present, adhere to standard BMPs to minimize incidental sediment discharge and mobilization, and then relocate entrapped fish to areas outside of the construction zone before major construction activities like removal of existing supports and installation of new supports. The adverse effects associated with suspended or deposited fine sediments generated from the project before the fish capture and relocation associated with dewatering, and are expected to elicit behavioral changes and decreased juvenile fitness during this time period. Adverse effects to fish are not expected to continue once dewatering and fish relocation have been completed.

## 6) Construction-Generated Contaminants/Toxic Chemical Spills

Introduction of chemicals may cause direct mortality, interfere with fish passage, induce physiological stress, and/or reduce the biodiversity of prey in the immediate and downstream areas. Unlike sedimentation, turbidity, and general disturbance type construction-related effects (see above), pollution-related effects are indirect, and may be persistent in the action area well after construction concludes and may affect multiple life stages of the affected species. Accidental waste spills, compromised on-site storage containers, or leaks in construction equipment could also introduce oil, gasoline, hydraulic fluid, or other associated substances into the waterway. The implementation of BMPs are expected to minimize the probability of pollutant incursion into the aquatic habitats, and a SPCCP is expected to help avoid a potential spill or the introduction of harmful chemicals into the aquatic environment. Operations of construction equipment/heavy machinery also have the potential to deposit heavy metals throughout the action area at low levels (Paul & Meyer, 2008).

These materials have been shown to alter juvenile salmonid behavior through disruptions to various physiological mechanisms including sensory disruption, endocrine disruption, neurological dysfunction, and metabolic disruption (Scott & Sloman, 2004). Oil-based products used in combustion engines are known to contain PAHs which have been known to bio-accumulate in other fish taxa such as flatfishes (order Pleuronectiformes) and have carcinogenic, mutagenic and cytotoxic effects (L. L. Johnson, Collier, & Stein, 2002). Studies have shown that increased exposure of salmonids to PAHs results in reduced immunosuppression and therefore increases their susceptibility to pathogens (M. Arkoosh & Collier, 2002; M. R. Arkoosh et al., 1998). In addition, Caltrans routinely uses bentonite as a lubricant for pile placement and geotechnical drilling. Bentonite is potentially lethal to fish and has been shown to reduce growth rates or increase emigration rates in steelhead and Coho salmon when exposed to 125 to 175 mg/L of bentonite (Sigler et al., 1984). Green sturgeon are expected to be similarly affected by contaminants as described above when exposed.

Any of these hazardous materials may also be transported further downstream to new locations and impact areas beyond the active construction zone. The potential magnitude of biological effects resultant from accidental, unintentional, or unavoidable chemical discharges depends on 1) the type, amount, concentration, and solubility of the contaminant; 2) the timing of the discharge and duration the contaminant persists in the environment; and 3) the affected species sensitivity and susceptibility to that particular contaminant, the duration and frequency of their exposure, and their initial health before exposure.

*American River*

At the American River site, the proposed project could include barge operations, pile driving, overwater heavy equipment operations, placement of backfill, and storage of harmful substances near the water body. Improper storage, use, or accidental discharge of toxic materials is possible, and effects to listed species could range from avoidance of the action area to immediate mortality from acute toxicity, including exposure to sub-lethal concentrations of contaminants that decrease fitness. Caltrans may also use bentonite as a lubricant for pile placement and an accidental release of bentonite may occur. If an incursion of contaminants into the American

River portion of the action area were to occur, the discharge could directly or indirectly affect CCV steelhead, CV spring-run Chinook, and/or sDPS green sturgeon. The impacts of such a spill could be immediate, or may manifest after a significant time period, and the severity of the adverse effects could range from significant to unmeasurable, depending on the type of chemical introduced, the localized concentration, duration of the spill, and the timing of the event. Caltrans proposes to implement applicable BMPs to help avoid accidental spills or leaks of toxic chemicals into the river, and minimize adverse impacts of an incident by following measures outlined in the Stormwater Pollution Prevention Plan (SWPPP).

During the installation of the temporary work trestle, water trapped inside the hollow temporary piles will likely have stagnated and become anoxic, however the total amount of water released at a single point in time should be too small to detect, and will quickly be diluted (each pile will be vibrated out one at a time). In other cases, barring a catastrophic spill of a large amount of toxic materials, the introduction of construction-related contaminates is extremely unlikely to occur, therefore adverse effects to listed fish is not expected.

*Lagoon Creek*
Proposed work at the Lagoon Creek Bridges site includes geotechnical investigation, clear-water cofferdam dewatering, removal of existing bridge supports via saw cut and jackhammer, pile driving, near water heavy equipment operations, and storage of harmful substances. Improper storage, use, and accidental discharge of toxic materials is possible, and effects could range from avoidance of the action area to immediate mortality from acute toxicity, including exposure to sub-lethal concentrations of contaminants that decrease fitness. Caltrans may also use bentonite as a lubricant during geotechnical investigation and pile placement, and there is potential for accidental bentonite release during this process. Wet cement can also raise the pH of water that comes in contact with the curing surface, which could result in the injury or death of ESA listed fishes if they in turn came into contact with the affected river water. The effects of any of these different types of spills could be evident at the time of an event or possibly after a significant time period, and the severity of the effects could range from injury or death to not resulting in any adverse effects, depending on the type of chemical introduced, the localized concentration, the duration and extent of the spill, and the timing of the event.

To avoid adversely affecting CCV steelhead at the project footprint and downstream, Caltrans proposed to implement a variety of BMPs by design to avoid spills and minimize introducing contaminants. To minimize adverse effects if a spill were to occur, Caltrans proposes to follow a SWPPP. Incursion of contaminants into the Lagoon Creek action area has the potential to directly or indirectly affect CCV steelhead that may be rearing in that habitat at the time of a pollution event or possibly afterwards. Therefore, barring a catastrophic spill of a large amount of toxic materials or a mishandling of such an event, introduction of construction-related contaminates is extremely unlikely to occur, therefore adverse effects to listed fishes are not expected.

**7) <u>Other Construction Disturbance and Direct Injury</u>**

Construction has the potential to introduce noise, vibration, artificial light, and other physical disturbances into the immediate environment that can result in the harassment of fish by

disrupting or delaying their normal behaviors and use of areas, or less likely, causing injury or mortality. The potential magnitude of effects depends on a number of factors, including type and intensity of disturbance, the proximity of disturbance-generating activities to the water body, the timing of the activities relative to the use and occurrence of the sensitive species in question, the life stages of the species affected, and the frequency and duration of disturbance periods.

Fish may exhibit avoidance movements that displace them from locations they would normally occupy for short or long durations due to the noise generated by displaced rock and sediment or the general operation of construction machinery as the noise permeate the underwater environment. Depending on the innate behavior that is being disrupted, the direct and indirect adverse effects could be varied. An example of a direct adverse effect would be cessation or alteration of migratory behavior. In the context of the proposed action areas, the migratory and rearing behavior of juvenile salmonids and green sturgeon may be affected by various construction-related effects. In the absence of migration blockage, injury, or mortality, general construction disturbance may increase fish physiological stress. In most cases, fish will likely display avoidance behavior of the construction area, but even so, fish vacating protective habitat due to disturbance may experience increased predation rates and decreased survival rates compared to those left undisturbed. For juvenile fish, this may include alteration of behaviors that are essential to their maturation and survival, such as feeding, sheltering, and migratory patterns.

General construction-related effects may also include debris falling into the active channel, tools and/or equipment falling into the active channel. Adults and juveniles could potentially encounter equipment being used or objects being placed in the water, become trapped by piles as they are being installed or removed, or may become trapped between the construction barge and the bottom. Such instances could cause physical injury or death, or acute avoidance of equipment would be an alteration of their normal behaviors and induce physiological stress.

Temporary lighting of work areas during nighttime construction may alter behavior of animals that prey of fishes (e.g., piscivorous birds, mammals, and fishes) in adjacent, affected habitats and make fish more visible to predators. Such situations would increase the probability of mortality of individual fishes which use the affected areas.

*American River*

At the American River site, construction activity will be limited to the work window of June 15 to October 15th. This work window somewhat decreases the probability that listed fish will be exposed, due to the seasonal timing of their life history patterns. Even so, there remains a possibility that both adult and juvenile CCV steelhead, CV spring-run (adults only), and juvenile and adult sDPS green sturgeon may occur in this action area and be adversely affected by construction. While an accidental catastrophe may cause direct injury or mortality (e.g., failure of the support trestle, causing heavy equipment to fall into the water), it is far more likely that equipment operation, general construction noises, and human presence may disturb or alter the behavior of listed fishes, such as migratory patterns or result in displacement. The most concerning effects of this harassment would be the potential deterring adult CCV steelhead from accessing spawning grounds further up in the American River and deterring juveniles of various species from using the area for rearing purposes. An additional factor is barge operations and

anchoring to support in-water work, which could injure fishes or scare them away from the immediate area.

Best management practices, avoidance, and minimization techniques will be implemented to the extent feasible and will minimize the probability of construction-related effects in the action area. Nighttime work is not proposed at the American River construction site, and so artificial lighting is not expected to adversely affect listed fishes. Instead, the limiting of work to daylight between two hours after sunrise until two hours before sunset, which will avoid the crepuscular and nighttime periods, is expected to avoid delaying the majority of migrating fishes (Keefer et al. 2013). Therefore general construction is not expected to ~~should~~ alter the number of adult fish that ultimately migrate upstream to spawn though some may still be delayed, and is expected to impact a small number of juvenile fish that move at night. Direct injury or mortality from general construction activity is not expected to occur.

*Lagoon Creek*
Any CCV steelhead juveniles present and rearing at Lagoon Creek during the proposed work window, are expected to be similarly effected described above, general construction activities may alter their normal behaviors. Juveniles may still seek shelter in habitat near construction activities in the action area, and be exposed to noise disturbance, suspended sediments, and temporary alterations of the adjacent aquatic habitats and therefore could experience increased physiological stress, injury, or even death. Temporary lighting of work areas during nighttime construction over or adjacent to waterways may alter animal behavior, especially animals that may prey on juvenile salmonids and may also make the juvenile salmonids more visible to their predators.

However, since the direct construction area will be dewatered for the construction season, the temporary displacement of aquatic habitats should avoid any overlap between potential adverse effects from lighted night work and habitat use of juvenile salmonids. Any CCV steelhead found in the direct work area will be relocated during dewatering. Caltrans also proposes to avoid highlighting water surfaces with artificial lights during night work to avoid increasing the nighttime mortality of any remaining juveniles.

While the importance of Lagoon Creek to CCV steelhead rearing is unknown, anticipated juvenile densities are expected to be very low, if present at all. Therefore, adverse effects associated with construction disturbance at this site are likely to be minimal because they would only occur to a very small proportion of juvenile CCV steelhead.

### 2.5.2 Effects of the Proposed Action to Critical Habitat

*American River*
The installation of the temporary support trestle piles will result in a temporary loss of substrate and water column habitat in the American River, approximately 78.97 square meters (or 0.02 acres) of substrate habitat and approximately 193 cubic meters of water column habitat. Permanent impacts are expected as a result of the permanent sheet piles set two feet away from the existing pile cap foundation to form a wall and the space between dewatered and backfilled, displacing water column habitat area beyond current occupation of the bridge currently in the

habitat. Specifically, the proposed scour mitigation at the American River will result in a permanent loss of 166.68 square meters (or 0.04 acres) of substrate habitat total, and a permanent loss of approximately 413 cubic meters of water column habitat. Removal of riparian vegetation is not proposed for this site. All other construction related effects to critical habitat rearing and migration PBFs are described below.

The PBFs within the American River action area associated with designated critical habitat for CV spring-run Chinook salmon and CCV steelhead are (1) freshwater rearing sites and (2) freshwater migration corridors for both adults and juveniles. Far upstream, the American River supports CCV steelhead spawning below Folsom Dam. Due to the installation of the temporary trestle, there will be additional in-river obstructions and flow turbulence that may increase passage difficultly for juvenile fishes. However, given the width of the American River, that the piles will be aligned in rows in the same direction as the river flow, and have at least one area that will be sufficiently spaced to allow recreational boat passage, the presence of the temporary support trestle should not negatively impact the migration corridors in either direction for CV spring-run and CCV steelhead adults or juveniles. Once the project is completed, the temporary trestle will be completely removed and therefore will no longer affect the critical habitat PBF of freshwater migration corridors.

The most valuable rearing areas for salmonids are side channels and floodplains, neither of which are offered in this section of the American River action area due to existing levees. Furthermore, besides the connection of the temporary trestle to the shore to provide access, a majority of the work will occur in the main channel and not in shallow areas. Therefore, the proposed action is not expected to adversely affect habitat necessary for juvenile rearing, mainly because removal of riparian vegetation is not expected to occur at this location. No other permanent alterations are proposed for this site, therefore the project is not expected to change the functionality of the PBFs used by CV spring-run Chinook or CCV steelhead.

The PBFs within the American River action area associated with designated critical habitat for sDPS green sturgeon affected by the project are: (1) food resources, (2) water quality, and (3) sediment quality.

(1) Food resources for sDPS green sturgeon may occur in the American River action area. Potential prey items may become contaminated from petrochemicals from construction equipment operation (PAHs, trace metals), accidental chemical spills, or from the disturbance of legacy contaminates in the river sediments (mercury). The prey items are expected to be temporarily affected by the construction only as long as activities are occurring and contamination is not likely to persist after construction work is complete. Therefore, green sturgeon food resources are not expected to be permanently affected due to the proposed action.

(2) The American River supplies the lower Sacramento River basin/upper Delta with an input of superior water quality. Various proposed activities are likely to temporarily increase turbidity and potentially mobilize contaminated sediments into the water column due activities like to pile driving, barge operations, pile removal, etc. This indirect effect may temporarily decrease the local water quality of the American River. However, there are several avoidance and mitigation measures designed to minimize the amount of sedimentation to the extent possible and avoid the introduction of toxic materials, and

none of these activities are producing effects that will remain after construction concludes. Therefore, effects and detriments to water quality originating from this action are not expected to persist after construction work is complete and are not expected to be different from the status quo.

(3) Sediment quality is a concern for sDPS green sturgeon and the American River considered impaired due to mercury contamination (EPA 2012), which adheres particles sediments. Project activities may mobilize these sediments. The temporary trestle may also change in flow patterns in the local area while it is in place and alter the sediment size composition in the immediate river bottom downstream of the trestle area but these temporary effects are not expected to have an adverse impact of the functionality of the sediments in the area. However, since the project is not adding to the legacy mercury contamination, nor adding or removing sediments directly, any permanent changes to the sediment quality are not expected to persist after the temporary trestle is removed and all construction activities cease. Therefore, the sediment quality important to sDPS green sturgeon is not expected to be permanently affected due to the proposed action.

Considering the entire action at the American River, overall effects to CV spring-run Chinook, CCV steelhead, and sDPS green sturgeon critical habitat are temporary in nature and are not expected to permanently adversely modify or destroy critical habitat however the placement of the support structure in the American River is likely to have minimal, temporary, adverse effects.

*Lagoon Creek*
Lagoon Creek does not include designated critical habitat, but it may serve as auxiliary rearing habitat for CCV steelhead. As no designated critical habitat occurs within the Lagoon Creek action area, no adverse effects are expected to occur.

## 2.6 Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving federal activities, that are reasonably certain to occur within the action area of the federal action subject to consultation (50 CFR 402.02). 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. Caltrans reviewed the State Clearinghouse website and found no future State or private projects not involving federal activities within the action area listed for the near future.

Some continuing non-federal activities are reasonably certain to contribute to climate effects within the action area. However, it is difficult if not impossible to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the environmental baseline *vs.* cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described in the environmental baseline (Section 2.4).

### 2.6.1 Water Diversions
Unscreened water diversions for municipal, industrial, and agricultural use are found in the two action areas. Depending on the size, location, and season of operation, these diversions entrain and kill many life stages of aquatic species, including juvenile listed anadromous species.

2.6.2 Increased Urbanization

Increases in urbanization and housing developments can impact habitat by altering watershed characteristics, and changing both water use and stormwater runoff patterns. Increased growth will place additional burdens on resource allocations, including natural gas, electricity, and water, as well as on infrastructure such as wastewater sanitation plants, roads and highways, and public utilities. Some of these actions, particularly those which are situated away from waterbodies, will not require federal permits, and thus will not undergo review through the ESA section 7 consultation process with NMFS.

Increased urbanization also is expected to result in increased recreational activities in the region. Among the activities expected to increase in volume and frequency is recreational boating. Boating activities typically result in increased wave action and propeller wash in waterways. This potentially will degrade riparian and wetland habitat by eroding channel banks and mid-channel islands, thereby causing an increase in siltation and turbidity. Wakes and propeller wash also churn up benthic sediments thereby potentially re-suspending contaminated sediments and degrading areas of submerged vegetation. This in turn will reduce habitat quality for the invertebrate forage base required for the survival of juvenile salmonids and green sturgeon moving through the system. Increased recreational boat operation is anticipated to result in more contamination from the operation of gasoline and diesel powered engines on watercraft entering the associated water bodies.

2.6.3 Rock Revetment and Levee Repair Projects

Depending on the scope of the action, some non-federal riprap projects carried out by state or local agencies do not require federal permits. These types of actions and illegal placement of riprap occur within the Sacramento River watershed. The effects of such actions result in continued degradation, simplification and fragmentation of riparian and freshwater habitat.

## 2.7 Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (section 2.5 Effects of the Action) to the environmental baseline (section 2.4) describes the current baseline conditions found in the American River and other Sacramento River tributaries where the proposed action is to occur. The Sacramento basin is a highly manipulated system with water flow and temperature regimes that differ drastically from their historical condition. Reduced summer flows and increased water temperatures will likely be exacerbated by climate change and increase the surface water temperatures in the CV upon which these fishes rely. Cumulative effects (section 2.6) are likely to further decreased water flow, result in increased river traffic and increased stormwater runoff and other non-source pollutants from increased urbanization and degrade water quality in the action areas.

2.7.1 Effects of the Proposed Action on Recovery of Listed Species

Juvenile CCV steelhead emigration from the American River is expected to trail off in June and they may be in low abundance during the overlap, but are expected to cease for the remainder of

the work window to begin again in November. Green sturgeon are assumed to be present at any time but in low numbers, and also do not currently use the American River for spawning. Injury or death may occur if individual fish are present near the construction site during impact pile driving and other construction activities. Non-injurious underwater sound may also elicit temporary behavioral disruptions in the feeding, sheltering, and/or migratory behavior of adult and juvenile salmon, steelhead, or sturgeon, and may affect their probability of survival by reducing their foraging capabilities and growth rates, or increasing their susceptibility to predation and physiological stress. Therefore, the overall numbers of listed fish besides CCV steelhead adults is expected to be low because their normally low numbers in the American River action area during the June 15th to October 15th work window and the known limitations of their use of habitats in the action area.

The greatest adverse effect of this project is the project work window overlap with steelhead migration timing because the peak upstream migration timing of Core 2 and 3 populations of adult CCV steelhead to spawning locations on the American River and tributaries that must be accessed through the active construction zone. To avoid negatively affecting the migration of these adults, Caltrans will limit daylight work hours from two hours past sunrise to two hours before sunset at the American River location to ensure CCV steelhead adults will be undisturbed during the crepuscular hours over which they display the most movement. Night work is not proposed for this location, so there should be adequate time for CCV steelhead adults to move upstream naturally.

It is possible that Lagoon Creek may support CCV steelhead rearing directly as auxiliary floodplain and stream habitat, though limited in capacity. Juvenile CCV steelhead may use Lagoon Creek at similar timing to their regular presence in the Cosumnes and Mokelumne Rivers, and therefore overlap with the work window proposed for Lagoon Creek from June 15th through July at very low abundances. Caltrans proposes to conduct work in the dry, and proposes to relocate juveniles CCV steelhead if found during dewatering.

Climate change invariably increases the risk of extinction of all ESUs/DPSs evaluated in this opinion (section 2.2.6), however since the outcome of the proposed action is not markedly different from the status quo on the American River or Lagoon Creek, this action should not exacerbate the projected effects of climate change on listed species.

Due to the daily work hours at the American River, the seasonal work window, the proposed relocation of juveniles away from the immediate construction zone at Lagoon Creek, and the implementation of numerous avoidance and minimization measures, even if the approved amount of incidental take was fully utilized, it is unlikely that any of the ESUs/DPSs would suffer measurable declines in abundance, see a significant increase to their risk of extinction, or be delayed in their recovery because of this project.

### 2.7.2 Effects of the Proposed Action to the Integrity of Critical Habitat

There are aspects of the project that will temporarily affect the quality and function of the habitat during active construction, and the permanent placement of the protective sheet piling at the American River will take up more space in the water column than the current bridge supports.

However, once the temporary trestle is removed, construction activities cease, and disturbed sites are restored to the extent feasible, the value of the critical habitat inside the action area for CCV steelhead, CV spring-run Chinook salmon, and sDPS North American green sturgeon should not be substantially altered or reduced from the status quo, and therefore the project will not be considered to result in an adverse modification to, or in the destruction of, critical habitat.

The action, through the purchase of compensatory mitigation credits, will restore and preserve in perpetuity floodplain or shaded riparian rearing habitat for CCV steelhead as analyzed in this BO. To mitigate the impacts of the project, Caltrans plans to install riparian plantings on the waterside levee slope and purchase mitigation credits off-site at a 3:1 ratio below the OHWM and 2:1 above the OHWM. This is a substantially greater amount of restoration and preservation than the spatial footprint of the levee repair. In addition, the compensatory mitigation serves as a form of advanced mitigation because the habitat at the bank was restored between one year (Bullock Bend Mitigation Bank) and eight years (Cosumnes Floodplain Mitigation Bank) before the impact of the scour repair.

## 2.8 Conclusion

After reviewing and analyzing the current status of the listed species and their critical habitats, the environmental baseline within the action area, the effects of the proposed action, any effects of interrelated and interdependent activities, and cumulative effects, it is NMFS's BO that the proposed action and associated potential adverse effects are not likely to jeopardize the continued existence of CV spring-run Chinook salmon, CCV steelhead, and sDPS green sturgeon or destroy or adversely modify their designated critical habitats.

## 2.9 Incidental Take Statement

Section 9 of the ESA and federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a 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 regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this incidental take statement.

### 2.9.1 Amount or Extent of Take

NMFS anticipates incidental take of adult CV spring-run Chinook salmon, adult and juvenile CCV steelhead, and juvenile to adult sDPS North American green sturgeon in the form of harassment, harm, or mortality. Impacts directly related to underwater sound generated from pile driving and barge operations may impair or alter essential behavior patterns, increased

sedimentation, turbidity, and the introduction of hazardous materials may cause fish avoidance of the work areas or induce detrimental sub-lethal effects, fish may become entrained, and fish may be injured and/or die during fish capture and relocation efforts. Incidental take is expected to occur for the in-water work window season as adult spring-run Chinook salmon, adult and juvenile CCV steelhead, and sDPS North American green sturgeon individuals are present in the American River action area. In the Lagoon Creek action area, incidental take of only juvenile CCV steelhead is expected to occur.

NMFS cannot, using the best available information, quantify and track the amount or number of individuals that are expected to be incidentally taken per species because of the variability and uncertainty associated with the population size of the species, annual variations in the timing of migration, and uncertainties regarding individual habitat use of the project area. However, it is possible to estimate the extent of incidental take by designating as ecological surrogates, those elements of the proposed project that are expected to result in incidental take of some form. These ecological surrogates are more predictable and/or measurable, and Caltrans should able to be monitor the ecological surrogates to determine the extent of incidental take that is occurring to ESA-listed species.

1) Pile Driving and Acoustic Impacts

The most appropriate threshold for incidental take, is an ecological surrogate of temporary habitat disturbance in the area affected by sound pressure waves during pile driving.

The proposed project anticipates installation of temporary steel pipe piles and permanent sheet and CISS piles to be driven by an impact hammer (Table **3** and Table 4). Pile driving with an impact hammer is expected to cause incidental take in the form of injury and mortality to salmonids and sturgeon through exposure to temporary high underwater pressure waves at peak or sustained exposure to lower sound levels above interim threshold levels of fish injury (>206 dB peak or 183 dB SEL for fish less than two gram and 187 dB SEL for fish greater than two grams). The number of listed fish that may be incidentally taken during activities is expected to have been reduced to the extent possible due to the establishment of seasonal work window, daily work hours, and attenuation measures.

American River: Based on the acoustic effects analysis for the American River site (Table 3), peak sound pressures are estimated to be above the thresholds for injury and/or mortality of listed fish within 6 to 22 meters of the impact pile driving depending on the type of piles used and whether sound attenuation techniques are employed. Cumulative sound exposure levels are expected to exceed the 187 and 183 dB threshold for physical injury for fish greater than 2 grams and less than 2 grams, respectively, within 251 to 858 meters of the pile depending on the type of piles and whether sound attenuation techniques are employed. Non-injurious behavioral effects are expected to occur within 1,359 to 6,310 meters of the pile depending on the type of pile and whether sound attenuation techniques are employed.

Lagoon Creek: Based on the acoustic effects analysis for the Lagoon Creek site (Table 4), peak sound pressures are estimated to be above the thresholds for injury and/or mortality of listed fish within less than 10 to 14 meters of the impact pile driving depending on whether sound attenuation techniques are employed. Cumulative sound exposure levels are expected to exceed the 187 and 183 dB threshold for physical injury for fish greater than 2 grams and less than 2 grams, respectively, within 158 to 341 meters of the pile depending on whether sound attenuation techniques are employed. Non-injurious behavioral effects are expected to occur within 858 to 1,848 meters of the pile depending on whether sound attenuation techniques are employed. Take from geotechnical investigations at Lagoon Creek are not anticipated due to low estimated noise levels (Table 2).

If Caltrans' monitoring indicates that sound levels greater than 206 dB peak, 187 dB or 183 dB cumulative SEL, or 150 dB RMS extend beyond the distances expected for the pile size and attenuation types as estimated in Table **3** and Table 4, the amount of incidental take may be exceeded. If these ecological surrogates are not met and maintained, the proposed project will be considered to have exceeded anticipated take levels.

2) Capture/Relocation Related to Dewatering

The proposed project anticipates that dewatering via clear water diversion and/or pumping will be necessary at the Lagoon Creek construction site. Dewatering enclosed/depressed areas will include the capture and relocation of entrapped fish. Only a qualified fish biologist may conduct recovery sweeps through the area, and use electroshock gear and/or seine nets to capture and then relocate fishes. During fish capture/handling/relocation process, total immediate mortality is expected to be equal to or less than 3% of relocated fishes. If this surrogate (overall mortality level) is exceeded, the proposed action will be considered to have exceeded anticipated take levels.

3) Increased Sedimentation and Turbidity

The most appropriate threshold for incidental take resulting from in-water sediment mobilized during the installation and removal of piles at either sites, or vegetation removal at the Lagoon Creek action area, is an ecological surrogate of measureable turbidity increases over an acceptable threshold during said activities. The threshold level permitted under the project Water Pollution Control Plan (WPCP) must be maintain and the threshold level established by the CVRWQCB will be used as the measurable surrogate. Incidental take in the form of harm and harassment from temporal increases in turbidity are expected to result in behavior modifications leading to avoidance of the area or increased difficulty in fish respiration. Incidental take will be exceeded if Caltrans fails to stop construction activity and alter tactics as needed to reduce turbidity levels back to established acceptable levels established in the WPCP.

4) Contaminants and Pollution-related Effects

> The most appropriate threshold for incidental take resulting from project related contamination and pollution effects at both action areas is an ecological surrogate of measureable water quality toxicity increases over an acceptable threshold during said activities. The threshold levels of pollutants and contaminants will not exceed those permitted under the project WPCP and that if levels approach or exceed the acceptable criteria established by the CVRWQCB, construction activities will be halted until discharged pollution is controlled according to the WPCP process and water quality toxicity return to acceptable levels. Incidental take will be exceeded if Caltrans fails to stop construction activity as needed to control pollution levels as described and/or does not follow the steps outlined in the WPCP.

2.9.2 Effect of the Take

NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to CV spring-run Chinook salmon, CCV steelhead, or sDPS North American green sturgeon, or the destruction or adverse modification of their designated critical habitats.

2.9.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" are nondiscretionary measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02).

1. Measures shall be taken by Caltrans to minimize sedimentation events and turbidity plumes in the action areas and related direct and indirect effects to listed species and their critical habitat. Caltrans shall enact their WPCP to limit, control, and abate sediment mobilization.

2. Measures shall be taken by Caltrans to minimize pollution or contamination effects to listed species and their critical habitat. Caltrans shall enact their emergency spill plan/WPCP if a spill occurs.

3. Measures shall be taken by Caltrans to reduce the potential underwater sound impacts and other disturbance related to pile driving to listed species and critical habitat.

4. Measures shall be taken by Caltrans to reduce mortality of listed species requiring capture/relocation in association with dewatering and pumping activities.

5. Measures shall be taken by Caltrans to prepare and provide NMFS with a plan and a report describing how listed species in the action area would be protected and/or monitored and to document the observed effects of the action on listed species and critical habitat PBFs in the action areas.

2.9.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and Caltrans or any applicant must comply with them in order to implement the reasonable and prudent measures (50 CFR 402.14). Caltrans or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this incidental take statement (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

1. The following terms and conditions implement reasonable and prudent measure 1:
    a. Caltrans and their contractors shall remain in compliance with all site BMPs specified in the approved WPCP and all other permit conditions to minimize the introduction of sediment into waterways, including preventing, controlling, and abating water quality degradation from soil erosion, vehicles, stormwater, and wastewater.
    b. Best Management Practices for erosion control shall be implemented, and monitored to prevent sediment incursion into the active channel at all locations until the project is completed.
    c. Water discharged into the American River and Lagoon Creek during construction shall be filtered with a filter bag, diverted to a settling tank or infiltration area, and/or treated in a manner to ensure that discharges conform to the water quality requirements of the waste discharge permit issued by the CVRWQCB prior to entering receiving waters.
    d. Turbidity and settable solids shall be monitored according to water quality permits. If acceptable limits are exceeded, work shall be suspended until acceptable measured levels are achieved.
    e. Fill materials used for diversion structures or backfill shall be clean and washed so they are free of "fine" sediments before placement in waterways.
    f. Piles requiring removal shall be removed slowly to reduce turbidity and bottom habitat disturbance.
    g. Pulled piles shall be placed in a containment basin to capture adherent sediment immediately after the pile is pulled from the water to minimize sediment discharge into waterways.
    h. Caltrans shall contact and coordinate with NMFS within 24 hours after an event that exceeds the given sedimentation surrogate, to discuss ways to reduce take back down to anticipated levels.

2. The following terms and conditions implement reasonable and prudent measure 2:
    a. Caltrans and their contractors shall remain in compliance with all site BMPs specified in the approved WPCP and all other permit conditions to minimize the introduction of contaminates into waterways, including preventing, controlling and abating water quality degradation from soil erosion, vehicles, stormwater, and wastewater.
    b. An emergency response plan or SPCCP shall be prepared, approved before initiation of construction, and available on site that is aimed to prevent accidental spills and/or control them should they occur, and should cover refueling, operating, storing, staging, and clean-up of construction-related hazardous materials.

c. Equipment used shall be in good working order and free of engine fluid drips and leaks prior to over-water use.
d. Equipment used for the project shall be thoroughly inspected off-site for drips or leaks prior to over-water use.
e. To the extent practicable, equipment shall be serviced with petroleum or other contaminant sources off-site prior to over-water use.
f. Equipment used for the project shall be thoroughly cleaned off-site to prevent introduction of contaminants prior to over-water use.
g. Caltrans shall contact and coordinate with NMFS within 24 hours after an event that exceeds the given water contamination surrogate, to discuss ways to reduce take back down to anticipated levels.

3. The following terms and conditions implement reasonable and prudent measure 3:
   a. Caltrans shall minimize and control underwater sounds to the extent practical while pile driving by using NMFS-approved aquatic sound attenuation systems, which may include: confined bubble curtains, dewatered attenuation casings, or dewatered cofferdams.
   b. Caltrans or their contractor shall submit a plan detailing the attenuation systems to be used to the Caltrans Engineer prior to beginning pile driving work.
   c. The sound attenuation system must be in place and operating prior to impact pile driving activities at all locations. If the system fails, impact pile driving must cease and may not resume until the system is functional and operating.
   d. Underwater sound monitoring must be conducted to ensure incidental take levels are not exceeded. If produced sound levels exceed estimates of the environmental surrogate, Caltrans shall contact and coordinate with NMFS within 24 hours of exceedance, to reduce the amount of take back to anticipated levels.
   e. Vibratory extraction shall be the preferred method of pile removal, when necessary.

4. The following terms and conditions implement reasonable and prudent measure 4:
   a. During dewatering or water diversion activities, a qualified fish biologist shall be present onsite to make observations, and capture/relocate fish if they become entrapped in the dewatered area or are in danger of being impinged on water pump intake screens.
   b. Only fish biologists trained in salmonid capture and relocation shall remove and relocate fish during dewatering activities.
   c. During dewatering, water shall be incrementally diverted so that fish may be located and recaptured before the area becomes completely dewatered.
   d. Captured juvenile salmonids will be relocated to at least 158 meters away from pile driving locations so that fish will be place into suitable waterbodies at outside of the estimated range on injurious underwater pressures.
   e. Any intakes of dewatering pumps shall be screened to avoid the intake of fish.
   f. Juveniles captured in the Lagoon Creek shall be relocated downstream of the action area when possible, preferably to an area with access to the mainstems of the Cosumnes or Mokelumne Rivers, so they may exit the freshwater system to the Pacific Ocean, therefore improving their likelihood of survival to adulthood.

g. Caltrans shall contact and coordinate with NMFS within 24 hours after a collection/relocation event that exceeds the given mortality percent surrogate, to discuss ways to reduce take back down to anticipated levels.

5. The following terms and conditions implement reasonable and prudent measure 5:
   a. Caltrans shall provide a report of project activities to NMFS by December 31 of each year construction takes place.
   b. The report shall include project schedules, project completions, and details regarding project implementation for each given year.
   c. This report shall include a summary description of in-water construction activities, avoidance and minimization measures taken, and any observed take incidents.

**2.10 Conservation Recommendations**

Section 7(a)(1) of the ESA directs federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).

(1) Caltrans should provide a NMFS-approved Worker Environmental Awareness Training Program for construction personnel to be conducted by a NMFS-approved biologist for all construction workers prior to the commencement of construction activities. The program shall provide workers with information on their responsibilities with regard to federally-listed fish, their critical habitat, an overview of the life-history of all the species, information on take prohibitions, protections under the ESA, and an explanation of terms and conditions identified in this BO. Written documentation of the training should be submitted to NMFS within 30 days of the completion of training. Completion of this training is consistent with agency requirements set forth in section 7(a)(1).

(2) Caltrans should identify and minimize impacts to sensitive biological resources throughout the project area by establishing 'environmentally sensitive areas' outside of the construction impact area on project plans and in project specifications. Provisions may include the use of temporary fencing to identify the limit of work areas adjacent to sensitive areas, or to locate and exclude sensitive areas from construction impacts. These provision shall be implement before other work activities begin and shall remain in place until all other construction activities are complete.

(3) Caltrans shall limit vegetation removal to the absolute minimum amount required for construction. An onsite restoration and revegetation plan will be prepared by a District Biologist and Restoration Specialist and submitted for review and approval prior to construction. Once construction is complete a final site review shall be performed to ensure the areas were appropriately restored/replanted. Disturbed areas that were graded to minimize surface erosion and siltation shall be re-contoured to as close as possible to the pre-project conditions and stabilized, no later than October 15th of each construction year.

(4) To compensate for unavoidable impacts to wetlands and habitat that may be used as rearing habitat by CCV steelhead, Caltrans shall purchase mitigation bank credits, in-lieu fee program credits, or oversee permittee-responsible mitigation at a minimum ratio of 1:1 for above OHWM impacts and a ratio of 3.3:1 for below OHWM impacts (credits to net acreage of permanent impact) that includes the action area in its "service area" (Cosumnes Floodplain Mitigation Bank or Bullock Bend Mitigation Bank). Caltrans shall only purchase credits that will benefit steelhead from a conservation bank that is NMFS-approved, or from the in-lieu fee program. Credits shall be purchased prior to completing the repair.

(5) Caltrans should work cooperatively with other state and federal agencies, private landowners, governments, and local watershed groups to identify opportunities for cooperative analysis and funding to support salmonid and sturgeon habitat restoration projects within the Sacramento River Basin. Implementation of future restoration projects is consistent with agency requirements set forth in section 7(a)(1).

## 2.11 Reinitiation of Consultation

This concludes formal consultation for the Bridge Scour Mitigation Project 03-3F540.

As 50 CFR 402.16 states, 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 taking specified in the incidental take statement 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 BO, (3) 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 BO (e.g., the construction option selected for bridge replacement at Lagoon Creek is substantially different from effects analyzed for Option 3), or (4) a new species is listed or critical habitat designated that may be affected by the action.

## 2.12 "Not Likely to Adversely Affect" Determinations

| Species | Scientific Name | Original Listing Status | Current Listing Status | Critical Habitat Designated |
|---|---|---|---|---|
| Sacramento River winter-run Chinook salmon ESU | *Oncorhynchus tshawytscha* | 1/4/1994<br>59 FR 440<br>Endangered | 6/28/2005<br>70 FR 37160<br>Endangered | *6/16/1993<br>58 FR 33212 |

*****(designated critical habitat does not occur in action area)

The NMFS Recovery Plan (NMFS 2014) did not identify the American River as a core watershed for SR winter-run Chinook salmon, as it was not determined to contain a population historically, though individual adults may occasionally stray into its lower reaches while migrating up the Sacramento River. Additionally, individual juveniles have been observed in the lower reaches, and is considered potential habitat for non-natal rearing (CDFW, 2017). The most recent biological information suggests that the extinction risk for the winter-run ESU has increased from moderate risk to high risk of extinction since 2011 (NMFS, 2016c), and that

several listing factors have contributed to the recent decline, including drought and poor ocean conditions (NMFS 2016c). A preliminary estimate of 2017 escapement suggests this year to be the second lowest escapement estimate since current monitoring methodology was implemented in 2003, with just 1,123 winter-run Chinook salmon returning (CDFW, 2017).

Adult Sacramento River winter-run Chinook salmon distribution is typically limited to the main stem of the Sacramento River. They usually enter the Sacramento River basin starting in November and the run may last until July (Figure 7), though the majority of the adults should be far into the upper Sacramento River basin by June below Keswick Dam to spawn (they are not known to spawn in the American River). The American River Bridge is a short distance the confluence with the Sacramento River main stem (approximately 2 miles); therefore, it is possible that adults may stray into the action area during their upstream migration during the months of June and July.

| Winter run relative abundance | High | | | | Medium | | | | Low | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **a) Adults freshwater** | | | | | | | | | | | | |
| Location | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| Sacramento River basin[a,b] | | | | | | | | | | | | |
| Upper Sacramento River spawning[c] | | | | | | | | | | | | |
| **b) Juvenile emigration** | | | | | | | | | | | | |
| Location | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| Sacramento River at Red Bluff[d] | | | | | | | | | | | | |
| Sacramento River at Knights Landing[e] | | | | | | | | | | | | |
| Sacramento trawl at Sherwood Harbor[f] | | | | | | | | | | | | |
| Midwater trawl at Chipps Island[g] | | | | | | | | | | | | |

Sources: [a]Yoshiyama, Fisher, and Moyle (1998); Moyle (2002); [b]Myers et al. (1998) ; [c] J. G. Williams (2006) ; [d] Martin, Gaines, and Johnson (2001); [e] Knights Landing Rotary Screw Trap Data, CDFW (1999-2011); [f,g] Delta Juvenile Fish Monitoring Program, USFWS (1995-2012)

Figure 7. The temporal occurrence of adult (a) and juvenile (b) winter-run in the Sacramento River. Darker shades indicate months of greatest relative abundance.

Rotary screw trap surveys on the American River have captured emigrating juvenile winter-run Chinook salmon in 2015 (Figure 4). Though low in total abundance, these data indicate that the lower American River does support juvenile winter-run Chinook salmon at least occasionally, whether they are actually using this river for rearing purposes or if they are simply straying on their way to the Delta. The migration peaks of juvenile emigration occur of November through April in the lower Sacramento River (Sherwood Harbor, Figure 7).

The probability of exposure to any action related activities at the American River during the work window of July 15th through October 15th is extremely low because while adults may stray into the American River during their upstream migration, they are far more likely do so earlier in the year because they are typically spawning below Keswick Dam during June and July. Therefore, the proposed work window largely avoids possible interaction with SR winter-run Chinook salmon adults or juveniles. NMFS has therefore determined that the proposed action is not likely to adversely affect SR winter-run Chinook salmon. Sacramento River winter-run Chinook salmon designated critical habitat is outside of the action areas and therefore is not likely to be adversely modified or destroyed by the proposed action.

## 3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT CONSULTATION

Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) directs federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect essential fish habitat (EFH). The MSA (section 3) defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH.

This analysis is based, in part, on the EFH assessment provided by Caltrans and descriptions of EFH for Pacific coast salmon (PFMC 2014) contained in the fishery management plans developed by the Pacific Fishery Management Council and approved by the Secretary of Commerce.

### 3.1 Essential Fish Habitat Affected by the Project

Essential fish habitat designated under the Pacific Coast Salmon Fisheries Management Plan (FMP) may be affected by the proposed action. Additional species to those listed Chinook species described above that utilize EFH designated under this FMP within the action area include fall-run/late fall-run Chinook salmon. Habitat Areas of Particular Concern (HAPCs) that may be either directly or indirectly adversely affected include (1) complex channels and floodplain habitats.

### 3.2 Adverse Effects on Essential Fish Habitat

Effects to the HAPCs listed in section 3.1 are discussed in context of effects to critical habitat PBFs as designated under the ESA in section 2.4.2. A list of adverse effects to EFH HAPCs is

included in this EFH consultation. Affected HAPCs are indicated by number corresponding to the list in section 3.1:

Pile Driving

- Temporary loss of habitat due to temporary support trestle and anchoring of barge at American River bridge (1)
- Permanent loss of habitat due to placement of sheet piles and backfill of space at American River bridge, new CISS piles at Lagoon Creek (1)

Vegetation Trimming and Removal

- Temporary loss of overhanging vegetation which may provide shade, cover, nutrients, and habitat complexity due to vegetation removal or trimming (1)

Sedimentation and Turbidity

- Increased scouring (1)
- Degraded water quality (1)
- Reduction/change in aquatic macroinvertebrate production (1)

Contaminants and Pollution-related Effects

- Degraded water quality (1)
- Reduction in aquatic macroinvertebrate production (1)

**3.3 Essential Fish Habitat Conservation Recommendations**

In addition to the terms and conditions made in the preceding ESA consultation, the following are EFH conservation recommendations for the proposed project:

To address the adverse effects of pile driving:

See: ESA Section 2.9.4 Terms and Conditions 3(a-e).

To address the adverse effects of vegetation trimming and removal:

(1) Protect existing EFH by establishing and maintaining a riparian management zone of appropriate width on all streams when possible. The riparian zone should be wide enough to restore and support riparian functions, including: shading, LWD input, leaf litter inputs, and support of sediment control and bank stabilization.

In addition: ESA Section 2.10 ESA Conservation Recommendations 2, 3, and 4.

To address the adverse effects of sedimentation and turbidity:

(2) When removing piles, place a ring of clean sand around the base of the pile or encircle the pile with a silt curtain to reduce the amount of sediment that would otherwise be suspended during pile removal, to maintain water quality.

In addition: ESA Section 2.9.4 Terms and Conditions 1(a-h).

To address the adverse effects of contaminates and pollution:

(3) Promote the use of oil-absorbing materials in the bilge area of the support barge to reduce amount of oil in the bilge water pumped into EFH.

In addition: ESA Section 2.9.4 Terms and Conditions 2(a-g).

Fully implementing these EFH conservation recommendations would protect 88.29 acres at the American River action area and 50.94 acres at the Lagoon Creek action area, for a total of 139.23 acres of EFH protected and maintained, for Pacific coast salmon by avoiding or minimizing the adverse effects described in Section 3.2. The HAPC "complex channels and floodplain habitats" would benefit from implementation of restoration projects and mitigation banks.

### 3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, Caltrans must provide a detailed response in writing to NMFS within 30 days after receiving an EFH Conservation Recommendation. Such a response must be provided at least 10 days prior to final approval of the action if the response is inconsistent with any of NMFS' EFH conservation recommendations unless NMFS and the federal agency have agreed to use alternative time frames for the federal agency response. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the conservation recommendations, the federal agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects (50 CFR 600.920(k)(1)).

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we ask that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

### 3.5 Supplemental Consultation

Caltrans must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH Conservation Recommendations (50 CFR 600.920(l)).

## 4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

The Data Quality Act (DQA) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the BO addresses these DQA components, documents compliance with the DQA, and certifies that this BO has undergone pre-dissemination review.

### 4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this BO are the California Department of Transportation. Other interested users could include: Sacramento County, the communities of Sacramento and Galt, U.S. Fish and Wildlife Service, and California Department of Fish and Wildlife. Individual copies of this BO were provided to the California Department of Transportation. This BO will be posted on the Public Consultation Tracking System web site (https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts ). The format and naming adheres to conventional standards for style.

### 4.2 Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources', Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

### 4.3 Objectivity

Information Product Category: Natural Resource Plan

***Standards:*** This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA regulations, 50 CFR 402.01 et seq., and the MSA implementing regulations regarding EFH, 50 CFR 600.

***Best Available Information:*** This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this BO and EFH consultation contain more background on information sources and quality.

***Referencing:*** All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

***Review Process:*** This consultation was drafted by NMFS staff with training in ESA MSA implementation and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

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