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 ECO #: WCR-2023-00003

April 20, 2023

Chris Fazzari
Associate Environmental Planner
Caltrans District 2
1657 Riverside Drive
Redding, California 96001

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson–Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Jelly's Ferry Bridge Replacement Project Reinitiation 2023.

Dear Mr. Fazzari:

Thank you for your letter of January 4, 2023, 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 Jelly's Ferry Bridge Replacement Project. 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 [16 U.S.C. 1855(b)] for this action.

Based on the best available scientific and commercial information, the biological opinion concludes that the Jelly's Ferry Bridge Replacement Project is not likely to jeopardize the continued existence of the federally listed threatened Central Valley (CV) spring-run Chinook salmon evolutionarily significant unit (ESU) (*Oncorhynchus tshawytscha*), threatened California Central Valley (CCV) steelhead distinct population segment (DPS) (*O. mykiss*), endangered Sacramento River winter-run Chinook salmon (*O. tshawytscha*) or the threatened southern DPS (sDPS) of North American green sturgeon (*Acipenser medirostris*) and is not likely to destroy or adversely modify the designated critical habitats of the above listed species. For the above species, NMFS has included an incidental take statement with reasonable and prudent measures and terms and conditions that are necessary and appropriate to avoid, minimize, or monitor incidental take of listed species associated with the project.

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 (National Environmental Policy Act Assignment) with the FHWA effective December 23, 2016. As such, Caltrans serves as the lead Federal Action Agency for the proposed project.

Please contact Ryan McKenzie in the NMFS California Central Valley Office via email at ryan.mckenzie@noaa.gov or via phone at (916) 930-5615 if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

A. Catherine Marcinkevage

Cathy Marcinkevage
Assistant Regional Administrator for
California Central Valley Office

Enclosure

cc: ARN 151422-WCR2023-SA00001

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Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson–Stevens Fishery Conservation and Management Act Essential Fish Habitat Response

Jelly's Ferry Bridge Replacement Project

NMFS Consultation ECO Number: WCR2023-00003

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

Fishery Management Plan That Identifies 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:

Cathy Marcinkevage
Assistant Regional Administrator for California Central Valley Office

Date: **April 20, 2023**

Table Of Contents

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 (opinion) and incidental take statement (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531 et seq.), as amended, and implementing regulations at 50 CFR part 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 U.S.C. 1801 et seq.) and implementing regulations at 50 CFR part 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 (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available within 2 weeks at the NOAA Library Institutional Repository (https://repository.library.noaa.gov/welcome). A complete record of this consultation is on file at the Sacramento NMFS Office.

1.2. Consultation History

- On March 26, 2013, the California Department of Transportation (Caltrans) requested formal consultation with NOAA's National Marine Fisheries Service (NMFS) for the Jelly's Ferry Bridge Replacement Project (project) located in northern Tehama County, California.
- On May 21, 2013, NMFS sent an insufficiency letter to Caltrans requesting additional information which effectively closed out the consultation.
- On October 25, 2013, NMFS received an amended biological assessment (BA) and letter from Caltrans requesting initiation of section 7 formal consultation under the Endangered Species Act (ESA).
- On November 12, 2013, NMFS deemed the formal consultation package from Caltrans complete, and initiated formal consultation.
- On July 2, 2014, NMFS and Caltrans discussed shifting in-water work window to further protect outmigrating juvenile Sacramento River (SR) winter-run Chinook salmon by phone. Caltrans agreed to the shift and sent a subsequent email describing the change to their original project description.
- On July 7, 2014, NMFS issued a Biological Opinion (BO) for the project.
- On June 8, 2020, NMFS received an underwater sound monitoring report from Municon West Coast Inc., the biological consultant for the project. This report showed exceedances in the underwater sound thresholds that were described in the BO. It also detailed the use of 24-inch steel pipe piles, which were larger than those described in the Caltrans BA and NMFS BO.

- On June 25, 2020, NMFS issued a letter notifying Caltrans of these exceedances and recommended that Caltrans request reinitiation of ESA section 7 consultation. Pile driving stopped at this time.
- On June 30, 2020, NMFS received a letter from Caltrans requesting reinitiation of section 7 formal consultation under the ESA for project changes that had occurred. At that time, NMFS deemed the formal consultation package complete and formal consultation was initiated.
- A coordination meeting was held on July 8, 2020, between Caltrans, Tehama County, and NMFS. At that time, Tehama County indicated that additional changes to the project would be proposed.
- Between July 2020 and November 2020 Caltrans, Tehama County, and NMFS participated in various coordination meetings to discuss project changes.
- Caltrans notified NMFS on November 12, 2020, that a BA addendum addressing proposed project changes will be sent after further coordination in the near future.
- On November 17, 2020, NMFS issued Caltrans a notice of consultation hold for the project until additional information was received.
- On November 20, 2020, NMFS received a BA addendum and letter from Caltrans requesting reinitiation of section 7 formal consultation under the ESA. At that time NMFS deemed the formal consultation package complete and formal consultation was initiated.
- On December 7, 2022, Caltrans requested a coordination meeting to seek clarification on proposed mitigation requirements for the project.
- On December 9, 2022, a coordination meeting was held between Caltrans and NMFS to discuss mitigation requirements for the project.
- On January 4, 2023, NMFS received a letter and BA addendum from Caltrans requesting reinitiation of section 7 formal consultation under the ESA due to an increase in expected permanent project impacts (originally 2.09 acres [ac], now 2.25 ac). Additionally, there was an error in the amount of proposed mitigation for the project, the biological opinion included an acreage of 225, but should have been 6.27, and is now 9.04 as a result of the increase in permanent effects and temporal delays in restoration. At that time, NMFS deemed the formal consultation package complete and formal consultation was initiated. This biological opinion includes an updated analysis to include the increased permanent effects, and has corrected the error in the mitigation amount.

On July 5, 2022, the U.S. District Court for the Northern District of California issued an order vacating the 2019 regulations that were revised or added to 50 CFR part 402 in 2019 ("2019 Regulations," see 84 FR 44976, August 27, 2019) without making a finding on the merits. On September 21, 2022, the U.S. Court of Appeals for the Ninth Circuit granted a temporary stay of the district court's July 5 order. On November 14, 2022, the Northern District of California issued an order granting the government's request for voluntary remand without vacating the 2019 regulations. The District Court issued a slightly amended order two days later on November 16, 2022. As a result, the 2019 regulations remain in effect, and we are applying the 2019 regulations here. For purposes of this consultation and in an abundance of caution, we considered whether the substantive analysis and conclusions articulated in the biological opinion and incidental take statement would be any different under the pre-2019 regulations. We have determined that our analysis and conclusions would not be any different.

1.3. Proposed Federal 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 (see 50 CFR 402.02). We considered, under the ESA, whether or not the proposed action would cause any other activities and determined that it would not. Under the MSA, "Federal action" means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a Federal agency (see 50 CFR 600.910).

1.3.1. Project Description

The purpose of the project is to replace the structurally obsolete and seismically deficient existing bridge structure over the Sacramento River. The project is located on Jelly's Ferry Road over the Sacramento River, approximately 9 miles north of Red Bluff and 7.5 miles east of Interstate 5, in northern Tehama County, California (Figures 1 and 2). The proposed project consists of three elements: replacement of the existing bridge, realignment of Jelly's Ferry Road, and relocation of a portion of the Bureau of Land Management (BLM) recreational facilities.

The proposed bridge replacement project requires the realignment of a portion of Jelly's Ferry Road, and temporary and permanent modification of a portion of the adjacent BLM recreational facilities in order to construct the new bridge over the Sacramento River channel. The existing Jelly's Ferry Road is overtopped frequently by overflow from the Sacramento River at two locations. One location, Overflow No. 1, is located just north of the existing Sacramento River Bridge north abutment and the other location, Overflow No. 2, is approximately 2,200 feet north of the existing Sacramento River Bridge north abutment. The proposed bridge replacement project raises the road profile to increase safety by preventing overtopping of the road from Sacramento River overflow during the 100-year flood event. Overflow from the Sacramento River at the Overflow No. 1 location would be conveyed through the longer hydraulic opening of the proposed Sacramento River Bridge. Overflow from the Sacramento River at the Overflow No. 2 location would be conveyed through a new Overflow No. 2 Bridge (via passing under the newly constructed Overflow No. 2 Bridge.

The proposed new bridge and roadway alignment would begin approximately 4.3 miles north of the intersection with Bend Ferry Road and would end just south of the intersection with Saron Fruit Colony Road.

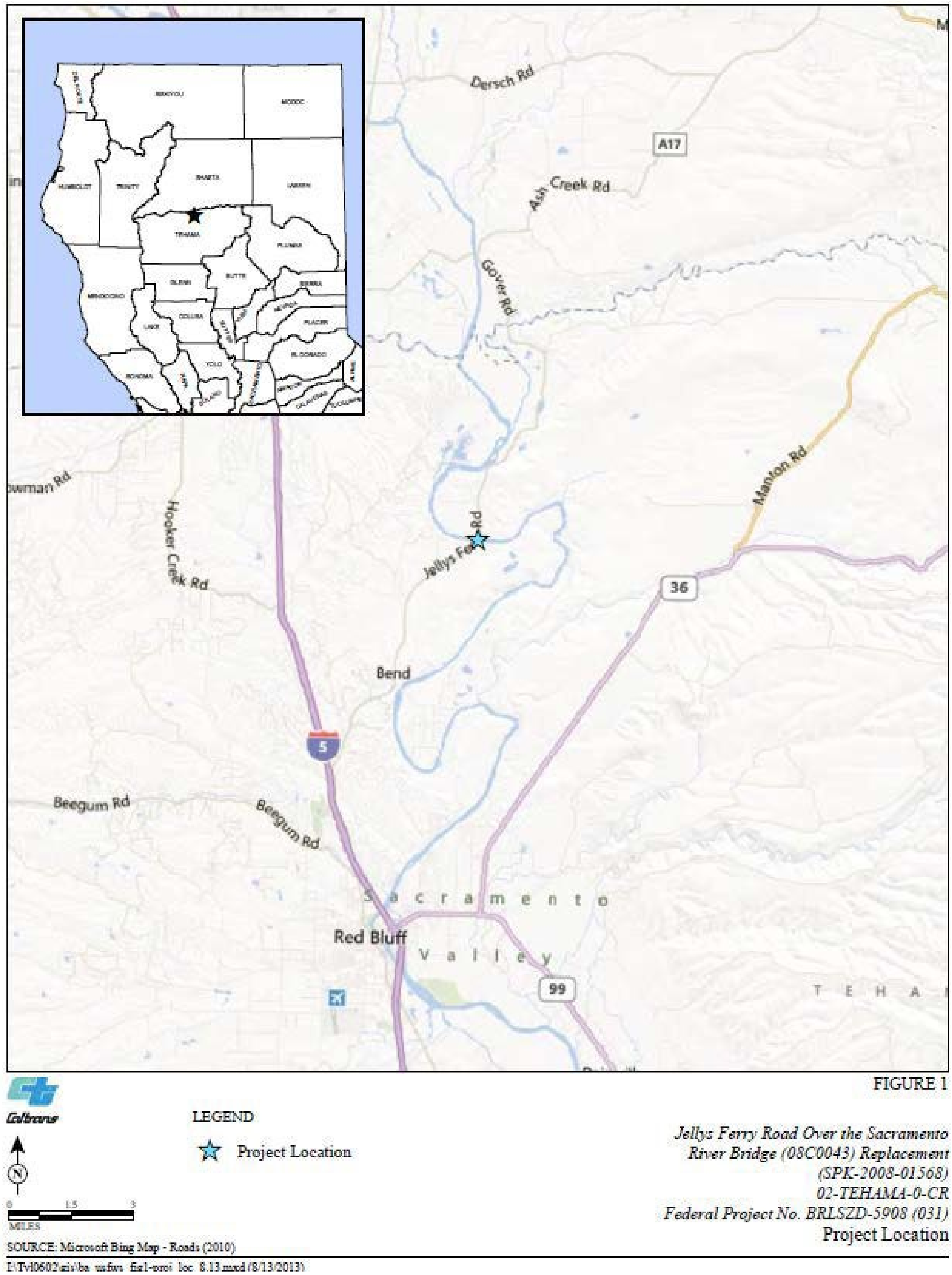

Figure 1- Jelly's Ferry Bridge Project Location (Caltrans 2013).

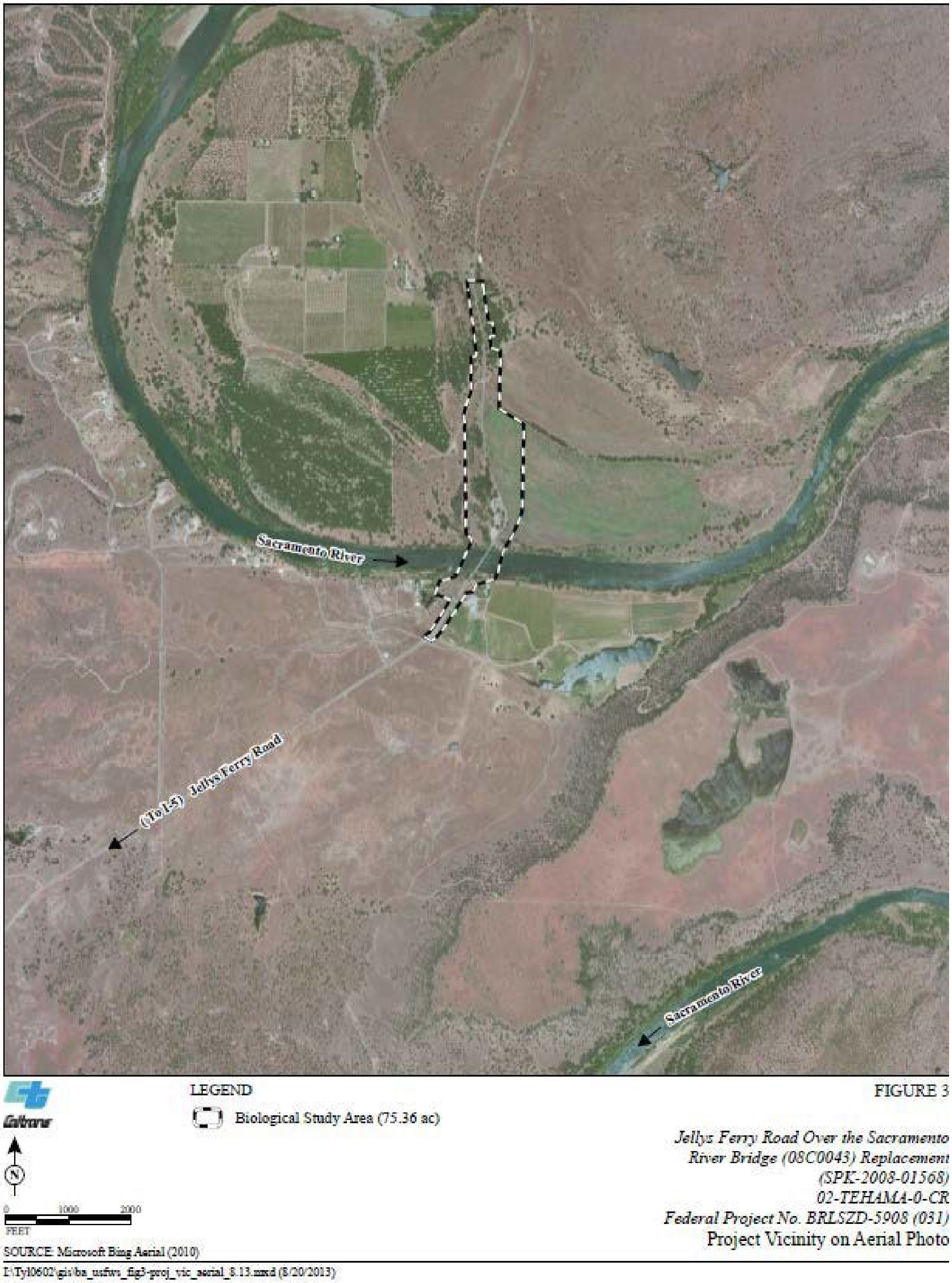

Figure 2- Jelly's Ferry Bridge Project Vicinity (Caltrans 2013).

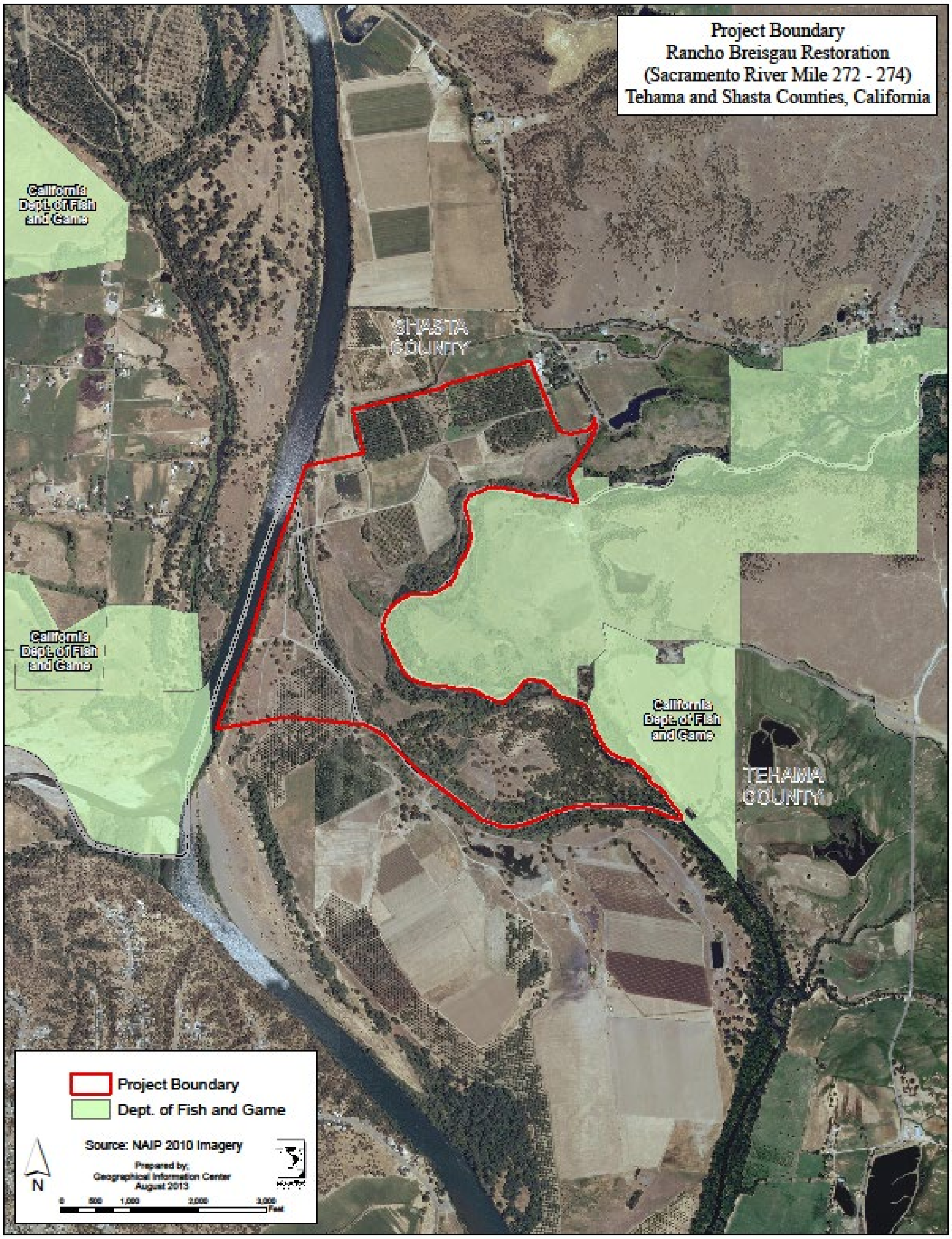

Figure 3- Restoration project boundary of Rancho Briesgau unit where Caltrans will fund riparian habitat restoration for offsite mitigation.

The south approach to the new Sacramento River Bridge would be approximately 800 feet in length with a maximum embankment fill height of approximately 6 to 10 feet. The north approach would be approximately 1,300 feet in length with a maximum embankment fill height of approximately 20 feet. The north approach roadway for the Sacramento River Bridge would be raised to prevent overtopping north of the existing abutment.

The proposed Overflow No. 2 Bridge would prevent frequent overtopping in the low-lying area of Jelly's Ferry Road north of the proposed Sacramento River Bridge north approach by passing flow from the adjacent Sacramento River overflow channel under this second bridge structure. At this location, the maximum embankment fill height would be approximately 11 feet corresponding to the 100-year flood level of hydraulic service to prevent overtopping of the roadway. The south approach roadway length for the Overflow No. 2 Bridge would be approximately 400 feet in length. The approach roadway length from the north end of the overflow bridge to the end of the project would be approximately 1,200 feet.

The proposed new Sacramento River Bridge would be constructed on a new alignment approximately 45 feet west (upstream) of the existing bridge, measured at the south bank of the Sacramento River and approximately 190 feet west (upstream) of the existing bridge measured at the north bank of the Sacramento River. The new bridge would be approximately 1,264 feet in length and would be comprised of a six span cast-in-place post-tensioned box girder superstructure with varying depth supported on single column piers (9-foot diameter columns for the main channel piers 2 and 3, and 6-foot diameter columns for piers 4, 5 and 6) founded on cast-in-drilled hole (CIDH) concrete piles. The bridge end spans would be supported on-seat type abutments with approximately 12 foot by 40 foot spread footings with rock slope protection (RSP) as needed for scour protection. The bridge would be wide enough to accommodate two 12-foot wide undivided lanes, two 6-foot (5-foot minimum, 6-foot preferred) wide shoulders classified as Class II bicycle lanes, and two approximately 2-foot wide solid or "see-through" concrete barriers.

The Overflow No. 2 Bridge would be constructed on a new alignment approximately 130 feet east of the existing road at the south abutment and approximately 50 feet east of the existing road at the north abutment. The Overflow No. 2 Bridge would be approximately 685 feet in length and would be comprised of an eleven-span cast-in place post-tensioned slab bridge supported on multiple drilled shaft extensions at each pier. The end spans would be supported on seat-type abutments founded on CIDH piles. The bridge would be wide enough to accommodate two 12 foot wide undivided lanes, two 6-foot (5-foot minimum, 6-foot preferred) wide shoulders classified as Class II bicycle lanes, and two approximately 2-foot wide solid or "see-through" concrete barriers.

The proposed project would require the relocation of the BLM recreation area access road and realignment of the existing recreational area circulation road to accommodate the shift in alignment of Jelly's Ferry Road. Access to the BLM recreational site would be relocated to the east side of Jelly's Ferry road approximately 550 feet to the north of the existing entrance. The proposed project would also require potential retaining walls, storm water drainage facilities, bank protection, reconstruction of existing residential driveways, replacement or relocation of existing fencing, and the restoration of existing landscaping.

A retaining wall would be required along the west side of the north approach roadway to the Sacramento River Bridge. The wall would vary in height from a maximum of approximately 20 feet at the north abutment to a minimum of approximately 5 feet approximately 450 feet north of the north abutment. The purpose of this retaining wall would be to prevent encroachment of the north approach roadway fill into the adjacent wetlands and jurisdictional waters of the United States at this location.

Storm water run-off from Jelly's Ferry Road south of the proposed Sacramento River Bridge would be collected in roadside ditches. The ditches would convey the run-off south and discharge into an existing ephemeral drainage system. Storm water run-off from the proposed Sacramento River Bridge would be collected in deck drains and conveyed to a new drainage system on the north side of the Sacramento River. This drainage system would consist of a series of ditches along the toe of the roadway embankment which would eventually convey the storm water runoff from the bridge and the north approach roadway into either the overflow channel, on the west side of the north approach, or through the BLM Park where it would eventually empty into the Sacramento River downstream of the Sacramento River Bridge. The drainage system would be designed to discharge water to the overflow channel or Sacramento River.

North of the Sacramento River Bridge, along the south approach of the proposed Overflow No. 2 Bridge, storm water run-off from Jelly's Ferry Road would be collected in ditches along the toe of the roadway embankment on either side of the road and would be conveyed north to discharge into the Overflow No. 2 channel. Storm water run-off from the Overflow No. 2 Bridge would be collected along the curb or in deck drains and would be routed to the drainage systems at each abutment. Run-off from the north half of the bridge would be routed to the drainage system at the north abutment while run-off from the south half of the bridge would be routed to the drainage system at the south abutment. North of the Overflow No. 2 Bridge, storm water-runoff from Jelly's Ferry Road would be collected in ditches at the toe the road embankment and would be conveyed south to eventually discharge into the Overflow No. 2 Channel. Vegetative swales may be used as part of the drainage systems described above to meet the runoff requirements of the County and the Regional Water Quality Control Board (RWQCB).

Bank protection would be likely required at several locations to prevent scour during high flow events. Slope protection may be required at the south abutment of the Sacramento River Bridge to protect the spread footing foundation from high flows in the Sacramento River. Slope protection would likely be required at the north abutment of the Sacramento River Bridge to protect the spread footing foundation and the base of the retaining wall along the west side of the north approach roadway during high flow events. Slope protection may also be required along portions of Jelly's Ferry Road between the Sacramento River and Overflow No. 2 Bridges to protect against scour from high flows in the adjacent Sacramento River Overflow Channel. Slope protection would also likely be required at the south and north abutments of the Overflow No. 2 bridge to protect against scour due to high flows in the Sacramento River Overflow Channel and the Overflow No. 2 channel. Slope protection would be designed based on the anticipated velocities for the various design flood events. Slope protection would consist of RSP or other pervious slope protection measures.

1.3.2. Construction Activities

Staging of construction materials and equipment for periods longer than one construction season would be limited to areas above the 100-year flood plain. The staging of materials for shorter than one construction season, and in periods of relatively dry weather (*i.e.*, the weather forecast indicates there is less than a 50 percent chance of rain), could be possible in other areas as well. The 100-year flood plain of the Sacramento River in the project area extends north into the northern portion of the project limits. All material and equipment stored in the 100-year floodplain would be removed upon notification of a potential for a 100-year flood event.

Staging of construction materials and equipment are proposed at two locations, one on each side of the river. The proposed staging area on the north side of the river is located east of and adjacent to existing Jelly's Ferry Road, north of where the new bridge would touch down. The proposed staging area on the south side of the river is located west of and adjacent to the new south abutment.

The existing Sacramento River Bridge at Jelly's Ferry Road would remain open throughout the construction of the new bridge to provide access across the Sacramento River. One of the first construction activities will be to install temporary access into the Sacramento River for erection of bridge piers, bridge foundation construction, and bridge falsework. Such access may be provided by means of gravel pads and platforms/trestles.

Temporary work platforms are required for construction of the new bridge and removal of the existing bridge. In order to maintain water flows, at least a portion of the temporary work platforms must be an elevated structure (*i.e.*, a trestle) that would be supported on piles. Due to the number of piles required to support the trestles, it would not be feasible from an economic and time standpoint to twist or rotate the piles in place or drill a hole and then insert the pile; consequently, driving the piles is the only feasible method of installation. To minimize the quantity of piles required, and associated acoustic impacts, gravel approach pads would be constructed at both ends of the trestles.

Two gravel approach pads would be placed in the river, one extending from the south bank to pier 2 (approximately 120 feet in length), and one from the north bank extending to pier 3 (approximately 130 feet in length). To accommodate both an upstream and downstream work trestle, each gravel pad would have an approximate top width of 130 feet (approximate bottom width of 180 feet). These pads would consist of 1-inch to 4-inch diameter uncrushed, washed and rounded river rock (i.e., spawning gravel). The gravel pads would vary in height depending on future hydraulic analysis and environmental restrictions with a maximum height of 40 feet and would be reinforced with stepped temporary barrier rail around the perimeter exposed to the river to prevent erosion in the river. A minimum 200-foot wide section of the river would remain open between the two gravel pads, throughout the duration of construction. No water diversions would be required.

Temporary work trestles would be built either upstream and or downstream of the new bridge to span between the gravel pads and access the proposed and existing bridges as required. The trestles would be offset from the proposed edge of deck and cross from the south bank to the north bank. A downstream trestle located between the existing and proposed structures could be used to construct the proposed bridge and could also be used to access the existing structure for removal. The temporary trestles would be up to 40 feet wide with spans of 25 feet to 30 feet. Each temporary trestle would be supported on 24-inch driven steel pipe piles (or equivalent), with an additional piles for finger piers to access and remove the existing bridge piers. This will require a total of approximately 76 piles (assuming two trestles are used). The trestles would be designed to resist the 100-year peak flow for the Sacramento River. The temporary trestle deck would consist of steel W-beams overlaid by timber decking.

It is expected that approximately 6 trestle piles per day could be driven, though it is likely some days fewer than 6 piles would be driven since the contractor would need to alternate pile driving and deck construction. It is estimated that pile driving for the temporary trestles and finger piers would take between 20 and 30 days to complete (Table 1).

Table 1. Summary of Pile Driving Assumptions

Activity	**Pile Type**	**Pile Diameter**	**Total Number of Piles**	**Piles per Day**	**Strikes Per Pile**	**Total Strikes Per Day**	**Total Number of Days of Pile Driving**
Temporary Trestle	Pipe Pile	24-inch	76	4 to 6	200	1,200	13 to 19
Temporary Falsework	Pipe Pile	24-inch	44	4 to 6	200	1,200	7 to 11
Totals	----	----	120	----	----	----	20 to 30

Once the contractor has built the work pads and trestles in the river, the pier foundations for the new bridge would be constructed. For the construction of the CIDH pile foundations, a temporary steel casing would be rotated into the ground or river bed (for the in-water piers) and then excavated to the required pile depth. Pile reinforcement would then be lowered into the pile, concrete would be placed (displacing the water in the pile) and the temporary steel casing would be removed. Water displaced from the pile would be collected and disposed of offsite.

After construction of the CIDH pile shaft, the pier columns above would be formed and poured. Prior to installation of the two CIDH main channel pier support piles, the temporary CIDH pile steel casings would have a 3/32-inch wire mesh attached to the bottom of the casings. The mesh would be installed prior to the casings being lowered into the water. The wire mesh would prevent any fish from being trapped during the installation of the CIDH pile temporary casings. The mesh would be torn up as the casings are rotated into the ground, and excavated out of the center of the pile during pile excavation and clean out.

The next stage of work would be construction of the temporary falsework to support the bridge superstructure. The temporary false work would extend between the upstream and downstream trestles supported by steel beams and approximately 76, 24-inch driven steel pipe piles (or equivalent; Table 1). The temporary steel piles would be designed to resist the 100 year peak flow for the Sacramento River. Some of the false work would also be supported by gravel pads.

Similar to the temporary trestles, it is expected that approximately 6 piles per day could be driven, for a total of approximately 7 to 11 days of pile driving for the falsework (Table 1). Once the false work is in place, the new bridge superstructure can be constructed beginning with the soffit (bottom slab of box girder) and girder stems and ending with the bridge deck. The structure would be "post tensioned" followed by removal of the falsework.

Once the proposed Sacramento River Bridge and approaches have been completed, and are open to traffic, removal of the existing bridge and approaches will begin. Demolition of the existing Jelly's Ferry Road Bridge would start with the removal of the bridge deck. Removal of the deck would require placement of heavy tarps or an equivalent debris collection device under the bridge to prevent materials or liquids from falling into the Sacramento River. The debris collection devices would be supported by the existing structure as long as the existing superstructure remains in place. Once the existing bridge superstructure is removed, work would proceed with removal of the bridge piers. During the removal of the bridge piers, construction equipment and personnel would work from finger piers extending from the downstream trestle to each of the existing piers located in the river channel. Alternatively, the contractor might choose to reconfigure the downstream trestle or use a floating barge system or combination of the two in order to access and support the existing bridge superstructure during demolition. Due to the hard subsurface conditions present and the drilled shaft construction for the existing bridge in-water piers, removal of the existing bridge piers is not anticipated to be possible without the use of a wire saw operated by divers to cut the existing concrete piers in the water as close as possible to the bottom of the river.

Raising the road profile to prevent frequent overtopping of the roadway by the adjacent Sacramento River Overflow Channel No. 2 would require reconstructing Jelly's Ferry Road on an offset alignment east of the existing road and providing a proposed new bridge to convey the flows in the Overflow No. 2 Channel which currently overtop Jelly's Ferry Road. Once construction of the raised roadway has been completed, traffic would be shifted to the raised roadway and the old pavement would be removed and the ground returned to a natural state.

All removed debris and materials used for demolition of the existing structure, approach embankment and approach roadway and not slated for salvage, would become the property of the construction contractor and would be disposed of in conformance with the Caltrans Standard Specifications including any required permits, licenses or environmental clearances. After the existing bridge has been removed the temporary trestle would be removed. When removing the gravel pads, following completion of construction, the bottom one foot of gravel shall be left in the channel to avoid impacts to the natural bed of the river. Finally, the areas of the river banks that were disturbed during construction would be returned to pre-construction conditions.

Construction of the proposed project would last approximately 27 months and span three construction seasons. In-water work activities in the Sacramento River would occur between March 15 and August 30.

The construction contractor would be permitted to work during daylight hours to complete all construction activities associated with construction of the new bridge and demolition of the existing bridge, including construction of the temporary gravel work pads, temporary trestles, and temporary falsework. The contractor may be permitted to work during nighttime hours to complete detour maintenance/traffic control only.

Overall, the installation of gravel pads equates to 0.95 ac of temporary impact to riverine habitat and the installation of two CIDH piles equates to 0.01 ac of permanent impact to riverine habitat. Road realignment equates to 2.26 ac of permanent impacts to riparian habitat.

1.3.3. Avoidance, Minimization and Conservation Measures

The following measures will be implemented to ensure impacts to SR winter-run Chinook salmon, Central Valley (CV) spring-run Chinook salmon, California Central Valley (CCV) steelhead, and southern distinct population segment (sDPS) green sturgeon and their habitat are minimized to the greatest extent possible:

1) The contractor will prepare a storm water pollution prevention plan (SWPPP) for Caltrans review and approval. Along with the SWPPP preparation, any needed species surveys or awareness training will be conducted including any initial species protection measures that are not ground disturbing;
2) The contractor will protect environmentally sensitive areas with highly visible type environmentally sensitive area temporary fencing;
3) Mobilization of the contractor will begin with the placement of temporary construction entrances at staging areas and construction areas and the completion of any initial species protection measures that are ground disturbing;
4) In-water work will be limited to the period of March 15 to August 30. The spring/summer in-water work window would avoid in-water work during the peak of winter- and spring-run Chinook juvenile outmigration.
5) Temporary gravel work pads would be constructed on either end of the temporary work trestles to minimize the length of the trestles and, therefore, the number of piles required to support the trestles, which results in less pile driving and associated acoustic impacts;
6) Gravel used for the temporary work pads shall consist of 1-inch to 4-inch diameter uncrushed, washed and rounded river rock (aka spawning gravel) and shall meet Caltrans Gravel Cleanliness Specifications (Caltrans 2013). The stable layer that would need to be placed for the gravel approaches shall consist of the cleanest possible materials (*i.e.*, metal sheets similar to air craft landing mats). If unclean materials, such as dirt, need to be used, they shall be enveloped in geotextile fabric over the clean gravel to contain the material and allow for a more complete and clean gravel removal from the river;
7) Following completion of construction, the bottom one-foot of gravel pad shall be left in the channel to avoid impacts to the natural bed of the river and to provide a source of suitable spawning gravel to be dispersed by natural flows in the river;
8) Water collected in the CIDH casings shall be pumped into settling basins on the bank or into trucks for off-site disposal;

9) If the temporary CIDH casing is installed in free-standing water, water trapped inside the casing shall be inspected by a qualified fishery biologist, prior to the next step in CIDH pile construction. This inspection shall be done immediately following embedment of the temporary casing in the stream bead to ensure that no salmonids or sturgeon have been trapped within the casing (3/32-inch wire mesh would be installed on the bottom of the CIDH casing to prevent entrapment of salmonids or sturgeon inside the casing). Any trapped salmonids or sturgeon shall be removed and returned to the river. The fishery biologist shall note the number and condition of individuals trapped, the number of individuals relocated, and the date and time of collection and relocation. One or more of the following NMFS approved capture techniques shall be used: dip net, seine, throw net, minnow trap, or by hand. Electro fishing may be used if NMFS has reviewed the biologist's qualifications and provided written approval. When and if necessary, a qualified fishery biologist may halt work activity and recommend measures for avoiding adverse effects to salmonids and their habitat and inform NMFS of any such occurrences.;
10) Fish salvage will occur in accordance with the Fish Salvage Plan (Alluvion 2020)
11) Any water to be removed from the CIDH casings shall be pumped into settling basins on the bank with no return drainage to the river or into trucks for off-site disposal;
12) Measures consistent with the current Caltrans' Construction BMP Manual, including the SWPPP and Water Pollution Control Plan (WPCP) Manuals, shall be implemented to minimize effects to listed fish and their critical habitat resulting from erosion, siltation, and other water quality impacts during and after construction;
13) Adequate fish passage within the Sacramento River at the project site would be maintained at all times. Approximately 200 feet of river channel width would remain open for fish passage (total width of the river is approximately 300-350 feet). This would allow the opportunity for fish to move away from active work areas and to have unabated passage to and through the project area;
14) Pile driving will occur in accordance with the Hydroacoustic Monitoring and Reporting Plan (Municon 2020)
15) Steel pipe piles driven with an impact hammer will be built using a dual casing system to attenuate pile driving noise. The casings will be bolted together with dampeners comprised of elastomer bearing pads. The space between the dual casings will be filled with chunks of rubber tires to create air bubbles, effectively creating a sound attenuation curtain;
16) During removal of the deck, heavy tarps or an equivalent debris collection device shall be placed under the bridge to minimize the potential for materials or liquids from falling into the Sacramento River; and
17) All construction activities associated with construction of the new bridge and demolition of the existing bridge, including construction of the temporary gravel work pads, temporary trestles, and temporary falsework, shall be conducted during daylight hours. The only allowed exception is minor activities associated with detour maintenance and/or traffic control, which may be conducted during nighttime hours.

Overall the proposed action will result in 0.95 ac of temporary and 0.01 ac of permanent impacts to riverine habitat and 2.26 ac of permanent impacts to riparian habitat. To offset the temporary and permanent impact to riverine habitat, Caltrans will create 0.95 ac of new spawning habitat by leaving the bottom 1 foot of gravel in place following the removal of the temporary gravel work pads. To offset the permanent impacts to riparian habitat, Caltrans will fund restoration of 9.04 ac of riparian habitat on the Rancho Breisgau Unit in coordination with River Partners and the Bureau of Land Management (Figure 3). The total mitigation acreage was calculated using a 3:1 mitigation ratio for the permanent impacts (i.e. 6.78 ac) plus an additional 2.26 ac to account for the temporal delay in restoration implementation. Rancho Breisgau is located on the border of Shasta and Tehama counties, approximately nine miles southeast of Anderson, California, at the confluence of Battle Creek and the Sacramento River. This restoration project is designed to increase the quality and continuity of riparian habitat within the Battle Creek watershed. Restoration will occur in accordance with the Riparian Restoration Plan for Rancho Breisgau (River Partners 2021). The overall restoration project implemented by River Partners plans to restore and enhance 306 acres of native riparian wildlife habitat on the Rancho Breisgau Unit, Caltrans will provide funding for 9.04 of the 306 acres of habitat restoration. Restoration activities will include site preparation (mowing, disking, removing existing walnut orchard), native plant species propagation and planting, weed and invasive species control (mowing and herbicides), and supplemental irrigation with ground water, and performance monitoring for three years. Restoration on the Rancho Breisgau is projected to be begin within 18-24 months after River Partners receives funding in 2023 (Caltrans 2023). Loss of riparian habitat has been identified as a threat to salmonid species in Battle Creek (NMFS 2014). This project would contribute to recovering riparian habitat in an area critical for recovery (see Section 2.7.4).

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 habitat 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 to 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 provide 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 ITS that specifies the impact of any incidental taking and includes reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

2.1. Analytical Approach

This biological opinion includes both a jeopardy analysis and an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "jeopardize the continued existence of" a listed species, which is "to engage in an action that reasonably 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 biological opinion also relies on the regulatory definition of "destruction or adverse modification," which "means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species" (50 CFR 402.02).

The designations of critical habitat for species use the term primary constituent element (PCE) or essential features. The 2016 final rule (81 FR 7414; February 11, 2016) that revised the critical habitat regulations (50 CFR 424.12) replaced 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 biological opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

The ESA Section 7 implementing regulations define effects of the action using the term "consequences" (50 CFR 402.02). As explained in the preamble to the final rule revising the definition and adding this term (84 FR 44976, 44977; August 27, 2019), that revision does not change the scope of our analysis, and in this opinion we use the terms "effects" and "consequences" interchangeably.

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

- Evaluate the rangewide status of the species and critical habitat expected to be adversely affected by the proposed action.
- Evaluate the environmental baseline of the species and critical habitat.
- Evaluate the effects of the proposed action on species and their critical habitat using an exposure–response approach.
- Evaluate cumulative effects.
- In the integration and synthesis, add the effects of the action and cumulative effects to the environmental baseline, and, in light of the status of the species and critical habitat, analyze whether the proposed action is likely to: (1) directly or indirectly 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; or (2) directly or indirectly result in an alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species.
- If necessary, suggest a reasonable and prudent alternative to the proposed action.

2.2. Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each species that is likely to 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' "reproduction, numbers, or distribution" for the jeopardy analysis. The opinion also examines the condition of critical habitat throughout the designated area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the function of the PBFs that are essential for the conservation of the species. See Table 2 for species and Table 3 for critical habitat information.

Table 2. Description of species, current ESA listing classification and summary of species status.

Species and Recovery Plans	Listing Classification and Federal Register Notice	Status Summary
Sacramento River (SR) winter-run Chinook salmon Evolutionarily Significant Unit (ESU) Final Recovery Plan for the ESUs of SR Winter-Run Chinook Salmon and Central Valley Spring-Run Chinook Salmon and the Distinct Population Segment of California Central Valley Steelhead (CV salmonid recovery plan, NMFS 2014)	Endangered, 70 FR 37160; June 28, 2005	According to the previous NMFS species status review (NMFS 2016c), the status of the SR winter-run Chinook salmon ESU, the extinction risk has increased from moderate risk to high risk of extinction since the 2007 and 2010 assessments. Based on the Lindley et al. (2007) criteria, the population is at high extinction risk in 2019. High extinction risk for the population was triggered by the hatchery influence criterion, with a mean of 66 percent hatchery origin spawners from 2016 through 2018. Several listing factors have contributed to the recent decline, including drought, poor ocean conditions, and hatchery influence. Thus, large-scale fish passage and habitat restoration actions are necessary for improving the SR winter-run Chinook salmon ESU viability. The overall status of the SR winter-run Chinook salmon ESU likely has declined since the 2015 viability assessment (Williams et al. 2016) due to the recent increase in hatchery influence. Viability information since the 2015 viability assessment (SWFSC 2022) has been incorporated into the analysis of this consultation and will be reflected in the updated status review in 2022.
Central Valley (CV) spring-run Chinook salmon ESU CV salmonid recovery plan (NMFS 2014)	Threatened, 70 FR 37160; June 28, 2005	According to the NMFS previous species status review (NMFS 2016b), the status of the CV spring-run Chinook salmon ESU, until 2015, had improved since the 2010, 5-year species status review. The improved status is due to extensive restoration, and increases in spatial structure with historically extirpated populations (Battle and Clear Creeks) trending in the positive direction. Recent declines of many of the dependent populations, high pre-spawn and egg mortality during the 2012 to 2016 drought, uncertain juvenile survival during the drought are likely increasing the ESU's extinction risk (Williams et al. 2016). Monitoring data showed sharp declines in adult returns from 2014 through 2020 (CDFW 2022). Viability information since the 2015 viability assessment (SWFSC 2022) has been incorporated into the analysis of this consultation and will be reflected in an updated status review in 2022.

Species and Recovery Plans	Listing Classification and Federal Register Notice	Status Summary
California Central Valley (CCV) steelhead Distinct Population Segment (DPS) CV salmonid recovery plan (NMFS 2014)	Threatened, 71 FR 834; January 5, 2006	According to the NMFS previous species status review (NMFS 2016a), the status of CCV steelhead appears to have remained unchanged since the 2011 status review that concluded that the DPS was likely to become endangered within the foreseeable future throughout all or a significant portion of its range. Most natural-origin CCV 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. The genetic diversity of CCV steelhead has likely been impacted by low population sizes and high numbers of hatchery fish relative to natural-origin 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. While updated data on steelhead in the American River is mostly based on hatchery returns, natural spawning populations within the Sacramento tributaries have fluctuated, but showed a steady decline in the past 10 years (Scriven et al. 2018). Viability information since the 2015 viability assessment (Williams et al. 2016) has been incorporated into the analysis of this consultation (SWFSC 2022) and will be reflected in an updated status review in 2022.
Southern Distinct Population Segment (sDPS) of North American Green Sturgeon Recovery Plan for the Southern DPS of North American Green Sturgeon (*Acipenser medirostris*) (NMFS 2018)	Threatened, 71 FR 17757; April 7, 2006	According to the NMFS recent species status review (NMFS 2021) and the 2018 final recovery plan (NMFS 2018), some threats to the species have recently been eliminated, such as take from commercial fisheries and removal of some passage barriers. Also, several habitat restoration actions have occurred in the Sacramento River Basin, and spawning was documented on the Feather and Yuba rivers. However, the species viability continues to face a moderate risk of extinction because many threats have not been addressed, and the only spawning location that is known to support the sDPS occurs in a single reach of the main stem Sacramento River. Current threats include poaching and habitat degradation. A recent method has been developed to estimate the annual spawning run and population size in the upper Sacramento River so species can be evaluated relative to recovery criteria (Mora et al. 2018). Although passage improvements have occurred at Fremont Weir and spawning events have been documented in the Feather and Yuba rivers, no changes to the species status or threats are evident since the last review (NMFS 2021).

Table 3. Description of critical habitat, designation details, and status summary.

Critical Habitat	Designation Date and Federal Register Notice	Description
Sacramento River (SR) winter-run Chinook salmon ESU	June 16, 1993; 58 FR 33212	Designated critical habitat includes the Sacramento River from Keswick Dam (RM 302) to Chipps Island (RM 0) at the westward margin of the Sacramento-San Joaquin Delta (Delta); all waters from Chipps Island westward to the Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and the Carquinez Strait; all waters of San Pablo Bay westward of the Carquinez Bridge; and all waters of San Francisco Bay north of the San Francisco-Oakland Bay Bridge from San Pablo Bay to the Golden Gate Bridge. The designation includes the river water, river bottom and adjacent riparian zones used by fry and juveniles for rearing. PBFs considered essential to the conservation of the species include: Access from the Pacific Ocean to spawning areas; availability of clean gravel for spawning substrate; adequate river flows for successful spawning, Incubation of eggs, fry development and emergence, and downstream transport of juveniles; water temperatures at 5.8–14.1°C (42.5–57.5°F) for successful spawning, egg incubation, and fry development; riparian and floodplain habitat that provides for successful juvenile development and survival; and access to downstream areas so that juveniles can migrate from spawning grounds to the San Francisco Bay and the Pacific Ocean. Although the current conditions of PBFs for SR winter-run Chinook salmon critical habitat in the Sacramento River are significantly limited and degraded, the habitat remaining is considered highly valuable.
Central Valley (CV) spring-run Chinook salmon ESU	September 2, 2005; 70 FR 52488	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. Critical habitat includes the stream channels in the designated stream reaches and the lateral extent as defined by the ordinary high-water mark. In areas where the ordinary high-water line has not been defined, the lateral extent will be defined by the bankfull elevation. PBFs considered essential to the conservation of the species include: Spawning habitat; freshwater rearing habitat; freshwater migration corridors; and estuarine areas. Although the current conditions of PBFs for CV spring-run Chinook salmon critical habitat in the Central Valley are significantly limited and degraded, the habitat remaining is considered highly valuable.

Critical Habitat	Designation Date and Federal Register Notice	Description
California Central Valley (CCV) steelhead DPS	September 2, 2005; 70 FR 52488	Critical habitat for CCV steelhead 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. Critical habitat includes the stream channels in the designated stream reaches and the lateral extent as defined by the ordinary high-water line. In areas where the ordinary high-water line has not been defined, the lateral extent will be defined by the bankfull elevation. PBFs considered essential to the conservation of the species include: Spawning habitat; freshwater rearing habitat; freshwater migration corridors; and estuarine areas. Although the current conditions of PBFs for steelhead critical habitat in the Central Valley are significantly limited and degraded, the habitat remaining is considered highly valuable.
sDPS of North American Green Sturgeon	October 9, 2009, 74 FR 52300	Critical habitat includes the stream channels and waterways in the Delta to the ordinary high water line. Critical habitat also includes the main stem Sacramento River upstream from the I Street Bridge to Keswick Dam, the Feather River upstream to the fish barrier dam adjacent to the Feather River Fish Hatchery, and the Yuba River upstream to Daguerre Dam. Critical habitat in coastal marine areas include waters out to a depth of 60 fathoms, from Monterey Bay in California, to the Strait of Juan de Fuca in Washington. Coastal estuaries designated as critical habitat include San Francisco Bay, Suisun Bay, San Pablo Bay, and the lower Columbia River estuary. Certain coastal bays and estuaries in California (Humboldt Bay), Oregon (Coos Bay, Winchester Bay, Yaquina Bay, and Nehalem Bay), and Washington (Willapa Bay and Grays Harbor) are included as critical habitat for sDPS green sturgeon. PBFs considered essential to the conservation of the species for freshwater and estuarine habitats include: food resources, substrate type or size, water flow, water quality, migration corridor; water depth, sediment quality. In addition, PBFs include migratory corridor, water quality, and food resources in nearshore coastal marine areas. Although the current conditions of PBFs for sDPS green sturgeon critical habitat in the Central Valley are significantly limited and degraded, the habitat remaining is considered highly valuable.

2.2.1. Recovery Plans

In July 2014, NMFS released a final Recovery Plan for SR winter-run Chinook salmon, CV spring-run Chinook salmon, and CCV steelhead (NMFS 2014, Recovery Plan). The Recovery Plan outlines actions to restore habitat and access, and improve water quality and quantity conditions in the Sacramento River to promote the recovery of listed salmonids. Key recovery actions in the Recovery Plan include conducting landscape-scale restoration throughout the Delta, incorporating ecosystem restoration into Central Valley flood control plans that includes breaching and setting back levees, and restoring flows throughout the Sacramento and San Joaquin River basins and the Delta. In August 2018, NMFS released a final Recovery Plan for the sDPS green sturgeon (NMFS 2018), which focuses on fish screening and passage projects, floodplain and river restoration, and riparian habitat protection in the Sacramento River Basin, the Delta, San Francisco Estuary, and nearshore coastal marine environment as strategies for recovery.

2.2.2. Global Climate Change

One major factor affecting the rangewide status of the threatened and endangered anadromous fish in the Central Valley and 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 *et al.* 2000). Central California has shown trends toward warmer winters since the 1940s (Dettinger and Cayan 1995). Projected warming is expected to affect Central Valley 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 Central Valley Chinook salmon populations can persist (Williams 2006).

For SR winter-run Chinook salmon, the embryonic and larval life stages that are most vulnerable to warmer water temperatures occur during the summer, so this run is particularly at risk from climate warming. CV 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). CV 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. 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 Central Valley, 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). 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.

Stream flow is a highly important variable and driving mechanism in fluvial ecosystems and climate has been identified as a landscape-scale driver of flow rates (Minshall 1988). Multiple climatological and hydrologic model predictions indicate that flows in the CCV will decrease throughout the 21st century as warming trends continue. Salmonids in the Sacramento River will likely face a decrease in flows, resulting in potentially lethal or sub-lethal water temperatures in summer months, impaired migration and decreased egg to fry recruitment. In addition to altered flow regimes, some other aspects of stream systems that are particularly sensitive to changes in climate are sediment transport/channel alterations, nutrient loading and rates of nutrient cycling, fragmentation and isolation of cold-water habitats, altered exchanges with the riparian zone and life history characteristics of many aquatic insects (Meyer *et al.* 1999). Current warming trends and model predictions indicate that it is likely that climate change will result in some direct and indirect adverse effects to salmonids in the Sacramento River in the 21st century.

In summary, observed and predicted climate change effects are generally detrimental to the species (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 (McClure et al. 2013).

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 proposed project action area consists of two components:

1) The terrestrial component of the action area, which is defined by:
   a. The construction project footprint including all cleared areas, and staging areas;
   b. The offsite restoration site; and
   c. The area where construction noise levels are in excess of ambient conditions.
2) The aquatic component of the action area, which is defined by:
   a. The segment of the Sacramento River upstream and downstream of bridge construction sites where pile driving sound noise levels in water are expected to exceed current threshold criteria (maximum zone of impact distance is 858 meters);
   b. Construction- and restoration-related water quality impacts in excess of ambient conditions; and
   c. Operational stormwater quality impacts in excess of ambient conditions.

The action area includes the construction area located on the Sacramento River (at river mile (RM) 267), the restoration area on the Rancho Breisgau Unit located at the confluence of the Sacramento River and Battle Creek (RM 272-274), and associated floodplains and riparian areas that could be affected directly or indirectly by the project. The action area within the immediate construction area at RM 267 of the Sacramento River extends 32 meters upstream and 32 meters downstream to the outer limits of vibratory effects for the Project. For construction activities, the action area is defined as the entire width of the river. For the offsite restoration area, the action area is defined as the entire 306-acre Rancho Breisgau Unit and adjacent reaches of the

Sacramento River and Battle Creek. Within the action area, the Sacramento River is relatively wide (approximately 350 feet to bankfull channel width from side to side) and Battle Creek narrow (~100 feet to bankfull channel width), with both possessing varied banks composed of a narrow riparian corridor and undeveloped natural habitats (e.g., mixed riparian forest, annual grassland, riverine). In the Sacramento River, the water depth is relatively shallow, ranging from approximately 6 to 8 feet deep in the summer and 14 to 16 feet deep in the winter. The substrate of the channel consists of approximately 20 feet of gravel and cobbles underlain by a cemented volcanic layer. Both the Sacramento River and Battle creek are inhabited by aquatic species that use the river for foraging, migration, and breeding.

2.4. Environmental Baseline

The "environmental baseline" refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. 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 consultations, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

The Sacramento River originates near Mt. Shasta and flows south for 447 miles before reaching the Sacramento-San Joaquin River Delta and San Francisco Bay. Shasta Dam, which is located at RM 311 on the Sacramento River near Redding, California, was completed in 1945. It serves to control floodwaters and store surplus winter runoff for irrigation in the Sacramento and San Joaquin Valleys, maintain navigation flows, provide flows for the conservation of fish in the Sacramento River and water for municipal and industrial use, protect the Sacramento-San Joaquin Delta from intrusion of saline ocean water, and generate hydroelectric power. Keswick Dam (RM 302) was constructed nine miles downstream from Shasta Dam to create a 23,800 acre-foot afterbay for Shasta Lake and the Trinity River Division, which stabilizes uneven water releases from the power plants. Below Keswick Dam, ACID Dam (RM 297) is seasonally in place to raise the water level for diversions into the ACID canal. The 59 mile reach of the Sacramento River between Keswick Dam and RBDD is commonly referred to as the upper Sacramento River.

Coarse sediment from the upper watershed is prevented from being transported downstream by Shasta and Keswick dams, resulting in an alluvial sediment deficit and reduction in fish habitat quality within the Upper Sacramento River reach (Wright and Schoellhamer 2004). In addition to the reduction of sediment supply, recruitment of large woody material to the river channel and floodplain has also declined due to a reduction in bank erosion and blockage of wood transport by Shasta Dam.

The combination of degraded physical habitat characteristics, fish passage barriers, and changes in hydrology resulting from dams and diversions since the mid-1800s has been associated with salmonid and green sturgeon declines within the Sacramento River watershed.

The Rancho Breisgau Unit is located at the confluence of Battle Creek and the Sacramento River (RM 72-74). As reported by River Partners (2021), the restoration area contains very little remnant riparian vegetation. The remnant vegetation is dominated by Valley Oak and Mixed Riparian Forest. There are areas of valley oak with a near continuous understory of Santa Barbara sedge (*Carex barbarae*). The canopy has an abundance of lianas composed of mixtures of Dutchman's pipevine (*Aristolochia californica*), California greenbriar (*Smilax californica*), poison oak (*Toxicodendron diversilobum*), and California wild grape (*Vitis californica*). The southwestern border of the restoration area contains a thin but dense forest of Western sycamore (*Platanus racemosa*), Oregon ash (*Fraxinus latifolia*), Fremont cottonwood (*Populus fremontii*); black (*Salix goodingii*), red (*S. laevigata*), arroyo (*S. lasiolepis*), and sandbar (*S. exigua*) willows; with scattered valley oaks, golden currant (*Ribes aureum*) and elderberry (*Sambucus mexicana*) along the upper portions. Scattered throughout the project area are large fields of cobbles and/or course soils. These areas support annual and perennial native wildflower species such as naked buckwheat (*Eriogonum nudum*), tarweed (*Hemizonia spp.*), Fitch's spikeweed (*Centromadia fitchii*), and vinegar weed (*Trichostema lanceolatum*). Soil found within the project site include Vina loam, Reiff fine sandy loam and Molinos fine sandy loam. There are pockets of hydric soils with seasonal high-water tables (to 153 cm April - June) but this will not adversely affect tree growth on the restoration site. All of the major soil types found within the project area are Class I, prime agricultural soils. These soils are ideal for riparian forest restoration.

2.4.1. Hydrology

Flows in the Sacramento River in the 65 mile reach between Shasta Dam and RBDD are regulated by Shasta Dam and again, just downstream at Keswick Dam. Water stored in the reservoirs during the winter and spring is released in the summer and fall for municipal and industrial supply, irrigation, water quality, power generation, recreation, and fish and wildlife purposes. Historically, the upper Sacramento River was highly responsive to periodic precipitation events and seasonal variation. Since completion of the dams, flows are now lower in the winter and spring and higher in the summer and fall. During July, August, and September, the mean monthly flows of the Sacramento River at Keswick since 1963 are nearly 400 percent higher than the mean monthly flows prior to 1943 (Department of Water Resources 1981, as cited in the Sacramento River Conservation Area Forum (SRCAF) handbook (2003). In this reach, flows are influenced by tributary inflow. Major west-side tributaries to the Sacramento River in this reach of the river include Clear and Cottonwood Creeks. Major east-side tributaries to the Sacramento River in this reach of the river include Battle, Bear, Churn, Cow, and Paynes Creeks.

2.4.2. Land Use

As reported by SRCAF (2003), the Keswick-RBDD reach has a variety of land uses, including urban, residential, industrial, and agricultural. Agriculture use makes up about 35 percent of the area and urban, residential, and industrial uses make up about 12 percent. Industrial land uses within this reach include lumber mills and gravel removal operations. Residential and commercial land uses in the cities of Redding, Anderson, and Red Bluff are common as well. In addition, this reach has the most recreational facilities on the Sacramento River (SRCAF 2003).

Historically, the river between Redding and Anderson supported several gravel mining operations (SRCAF 2003).

2.4.3. Water Quality

The main sources of water in the Sacramento River below Keswick Dam are rain and snowmelt that collect in upstream reservoirs and are released in response to water needs or flood control. The quality of surface water downstream of Keswick Dam is also influenced by other human activities along the Sacramento River downstream of the dam, including historical mining, agricultural, and municipal and industrial activities. The quality of water in the Sacramento River is relatively good; only during conditions of stormwater-driven runoff are water quality objectives typically not met (Domagalski *et al.* 2000). Water quality issues within the upper Sacramento River include the presence of mercury, pesticides such as organochlorine, trace metals, turbidity, and toxicity from unknown origin (CALFED 2000).

Water temperature in the Sacramento River is controlled by releases from Shasta, Whiskeytown, and Keswick Reservoirs. NMFS issued an opinion on the long-term operation of the CVP and SWP (NMFS 2009), which included upper Sacramento River water temperature requirements to protect listed anadromous fish and their critical habitats. However, the ability to meet temperature requirements has proven extremely difficult during drought years.

2.4.4. Predation

Sacramento pikeminnow and striped bass congregate downstream of the dam and prey on juvenile salmon in the tailwaters. The Sacramento pikeminnow is a species native to the Sacramento River basin and has co-evolved with the anadromous salmonids in this system. However, rearing conditions in the Sacramento River today (*e.g*., warm water, low-irregular flow, standing water, and water diversions) compared to its natural state and function decades ago in the pre-dam era, are more conducive to warm water species, such as Sacramento pikeminnow and striped bass than to native salmonids. Tucker *et al.* (1998) reported that predation during the summer months by Sacramento pikeminnow on juvenile salmonids increased to 66 percent of the total weight of stomach contents in the predatory pikeminnow.

2.4.5. Fisheries and Aquatic Habitat

The Upper Sacramento River between Keswick Dam (RM 302) and RBDD (RM 243) currently serves as the only spawning ground for SR winter-run Chinook salmon, and is an important migration corridor for adult and juvenile CV spring-run Chinook salmon and CCV steelhead, particularly populations from Cottonwood Creek, Clear Creek, Cow Creek, and Battle Creek, as well as other smaller tributaries. Green sturgeon utilize the upper Sacramento River as a migratory corridor as well as for spawning and juvenile rearing. Shasta and Keswick Dams have presented impassable barriers to anadromous fish since 1944 (Billington *et al.* 2005). ACID Dam and RBDD presented partial barriers to salmonid migration until improvements were made in 2001 and 2012 (NMFS 2009, 2014a), respectively, although ACID Dam continues to present an impassable barrier to green sturgeon (NMFS 2009).

2.4.5.1 SR winter-run Chinook salmon

The distribution of SR winter-run Chinook salmon spawning and rearing is currently limited to the upper Sacramento River, with managed flows out of Shasta Dam. Keswick Dam re-regulates flows from Shasta Dam and mixes it with water diverted from the Trinity River through the Spring Creek tunnel to control water temperatures below ACID pursuant to actions in the NMFS opinion, to provide cold water throughout the summer, allowing for spawning, egg incubation, and rearing during the mid-summer period (NMFS 2009). Approximately, 299 miles of tributary spawning habitat in the upper Sacramento River above the dams is now inaccessible to SR winter-run Chinook salmon (NMFS 2014). The proportion of the SR winter-run Chinook salmon spawning above ACID has increased since the ladder improvements in 2001 (CDFW 2014 unpublished aerial redd counts). Data on the temporal distribution of SR winter-run Chinook salmon upstream migration suggest that in wet years about 50 percent of the run has passed the RBDD by March, and in dry years, migration is typically earlier, with about 72 percent of the run having passed the RBDD by March (Poytress *et al.* 2014).

The upper Sacramento River contains the only remaining habitat that is currently used by spawning SR winter-run Chinook salmon. As reported by NMFS (2014a), historical SR winter-run Chinook salmon population estimates were as high as over 230,000 adults in 1969, but declined to under 200 fish in the 1990s (Good *et al.* 2005). A rapid decline occurred from 1969 to 1979 after completion of the RBDD. Over the next 20 years, the population eventually reached a low point of only 186 adults in 1994. At that point, SR winter-run Chinook salmon were at a high risk of extinction, as defined by Lindley *et al.* (2007). However, several conservation actions, including a very successful conservation hatchery and captive broodstock program at Livingston Stone National Fish Hatchery (LSNFH), construction of a temperature control device (TCD) on Shasta Dam, maintaining the RBDD gates up for much of the year, and restrictions in ocean harvest, have likely prevented the extinction of natural-origin SR winter-run Chinook salmon. LSNFH, which is located at the base of Keswick Dam, annually supplements the in-river production by releasing on average 180,000 SR winter-run Chinook salmon smolts into the upper Sacramento River. The LSNFH operates under strict guidelines for propagation that include genetic testing of each pair of adults and spawning no more than 10 percent of the hatchery returns. This program and the captive broodstock program (phased out in 2007) were instrumental in stabilizing the SR winter-run Chinook salmon population following very low returns in the 1990s.

Since carcass surveys began in 2001, the highest adult escapement occurred in 2005 and 2006 with 15,839 and 17,296, respectively. Since 2007 SR winter-run Chinook salmon have declined in abundance with a low of 827 spawning adults in 2011 (NMFS 2016c). As reported in the most recent 5-year status review (NMFS 2016c), the 10-year trend in run size is -0.15 which suggests an annual 15% population decline. This declining trend is likely due to a combination of factors such as poor ocean productivity (Lindley *et al.* 2009), drought conditions from 2007 to 2009 and 2012 to 2015, and low in-river survival (NMFS 2016c).

The 2012 to 2015 drought increased water temperatures in the upper Sacramento River. This caused significantly higher mortality (95-97%) in the upper spawning area. Due to the lower than average survival in the drought, hatchery production from the LSNFH conservation program was increased to offset the impact on the naturally spawning fish. Adult SR winter-run Chinook salmon returns in 2016 to 2018 were low, as expected, due to poor in-river conditions for juveniles from brood years 2013-2015 during drought years. The 2018 adult SR winter-run Chinook salmon escapement estimate (2,458) improved from 2017 (1,155), though was similarly dominated by hatchery-origin fish. An estimated 85 percent of the adult SR winter-run Chinook salmon spawners in 2017 were hatchery-origin fish from LSNFH (K. Offill, USFWS, Red Bluff, CA, unpublished data), evidence that the emergency measures enacted at LSNFH were successful at avoiding a complete year-class failure and substantially benefited the abundance of spawners in 2017.

2.4.5.2 CV spring-run Chinook salmon

The upper mainstem of the Sacramento River serves as a primary upstream and downstream migratory corridor for CV spring-run Chinook salmon populations in Clear, Battle, and Cottonwood Creeks. Within the mainstem Sacramento River upstream of RBDD, the CV spring-run Chinook salmon population appears to have declined from a high of 25,000 in the 1970s to an average low of less than 800 counted at RBDD beginning in 1991. Significant hybridization with fall-run has made identification of a CV spring-run Chinook salmon population in the mainstem very difficult to determine, and there is speculation as to whether a true CV spring-run Chinook salmon population still exists below Keswick Dam within the mainstem of the Sacramento River. This shift may have been an artifact of the manner in which CV spring-run Chinook salmon were identified at RBDD. More recently, fewer CV spring-run Chinook salmon were counted at RBDD because an arbitrary date, September 1, was used to determine CV spring-run Chinook salmon, and, beginning in 2012, gates are open year-round (NMFS 2014). The extent of non-hybridized CV spring-run Chinook salmon spawning in the Sacramento River mainstem is unknown. However, the physical habitat conditions below Keswick Dam are capable of supporting CV spring-run Chinook salmon, although in some years high water temperatures can result in substantial levels of egg mortality. Recent redd surveys (2001-2014) have observed an average of 41 salmon redds in September, from Keswick Dam downstream to the RBDD, ranging from zero to 105 redds (CDFG, unpublished data, 2015). This is typically when CV spring-run Chinook salmon spawn, however, there is no peak that can be separated out from fall-run spawning, so these redds also could be early spawning fall-run. Additionally, even though habitat conditions may be suitable for CV spring-run Chinook salmon occupancy, CV spring-run Chinook salmon depend on spatial segregation and geographic isolation from fall-run Chinook salmon to maintain genetic diversity. With the onset of fall-run Chinook salmon spawning occurring at the same time and place as potential CV spring-run Chinook salmon spawning, it is likely to have caused extensive introgression between the populations (CDFW 1998).

2.4.5.3 CCV steelhead

CCV steelhead are well-distributed throughout the Central Valley below the major rim dams (Good *et al.* 2005). The mainstem of the Sacramento River serves as a primary migratory corridor for both upstream and downstream migration for all Sacramento River Basin populations, connecting spawning habitat within the Sacramento River and tributaries to the San Francisco Bay estuary and the Pacific Ocean. Adults can be found in the mainstem Sacramento River primarily during the fall and winter seasons while juveniles occupy the river year-round. Juvenile rearing tends to occur in areas with cool, clear fast-moving water where riffle habitat is predominant over pool habitat (Moyle 2002). Therefore, it is more likely that juveniles found within the action area will be migrating rather than rearing.

United States Fish and Wildlife Service (USFWS) staff operate a weir on Battle Creek that controls all upstream fish movement and steelhead counts at this weir provide a decent data source for CCV steelhead (NMFS 2016a). In the two years prior to the 2016 5-year status review, steelhead returns averaged 2,895 fish (NMFS 2016a). Many of these fish are hatchery origin fish, but the numbers of wild adults remained relatively steady from 2003 to 2014 with about 200-300 fish each year (NMFS 2016a).

Estimates of adult CCV steelhead abundance in the mainstem Sacramento River historically used the RBDD counts for historical trend data. Due to changes in dam operations, counts stopped being collected at RBDD in 1993 (NMFS 2016a). Actual estimates of CCV steelhead spawning in the mainstem Sacramento River below Keswick Dam have never been made due to high flows and poor visibility during the wintertime.

2.4.5.4 sDPS green sturgeon

The upper mainstem Sacramento River is the only area where consistent annual spawning by sDPS green sturgeon has been confirmed via the presence of eggs and larvae (Poytress *et al.* 2015). A migratory corridor is needed for returning adults to access spawning habitat upstream of the action area. The mainstem Sacramento River serves as spawning habitat, juvenile rearing habitat, and as a primary migration corridor for the sDPS of green sturgeon. There is insufficient information available on how long juveniles rear in the mainstem Sacramento River, but it is likely that at least some juvenile rearing occurs in the river prior to their entry into the Delta. Therefore, the exact mechanisms of habitat utilization by juveniles within the action area is unknown, but we do expect subadult green sturgeon could be present in the action area year-round.

In June and July of 2010-2015, Mora *et al.* (2018) estimated that there were between 1,246 and 2,966 sDPS green sturgeon in the reproductive portion of the population. Approximately 45 percent on average (141 fish), of green sturgeon distribution and abundance in the Sacramento River from 2010 to 2014, were observed above RBDD (Mora). Although observations of green sturgeon have been found as far upstream as near the mouth of Cow Creek (RM 280), spawning occurring above RBDD has only been documented as far upstream as the confluence with Ink's Creek (RM 265), and is mostly concentrated in the mid-April to mid-June time period (Poytress *et al.* 2013). Other confirmed spawning sites are at the mouth of Payne's Creek (RM 267), and at the RBDD. Rotary screw trap monitoring of juveniles fish passing RBDD has incidentally captured juvenile green sturgeon between May and the end of August, since 2002, but numbers have been highly variable, with a median of 193 fish (Poytress *et al.* 2014).

2.4.5.5 Status of Critical Habitat

Designated critical habitat occurs within the upper Sacramento River for all four listed species discussed in this opinion. The action area contains PBFs that support rearing and migration for Chinook salmon, steelhead, and sturgeon. Some spawning habitat may occur in the action area, though higher quality spawning habitat is found further upstream for SR winter-run Chinook salmon and sDPS green sturgeon and in upper Sacramento tributaries for CV spring-run Chinook salmon and CCV steelhead. The upper Sacramento River has a high value for the conservation of the species, because it supports several life stage functions for each of the four listed species.

2.4.6. Factors Affecting Species and Critical Habitat

The PBFs of critical habitat for salmonids and sturgeon within the action area include: freshwater spawning habitat, freshwater rearing habitat, and freshwater migration corridors, containing adequate substrate, water quality, water quantity, water temperature, water velocity, shelter, food; riparian vegetation, space, and safe passage conditions. Habitat within the action area primarily is used as freshwater rearing and migration for juveniles and as freshwater migration for adults. The conservation value of the action area is high because its entire length is used for extended periods of time by federally listed fish species. These features have been affected by human activities, such as water management, flood control, agriculture, and urban development throughout the action area.

2.4.7. Climate Change

One major factor affecting threatened and endangered anadromous fish in the Central Valley and 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 *et al.* 2000). Central California has shown trends toward warmer winters since the 1940s (Dettinger and 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 (Roos 1991, Dettinger *et al.* 2004). Specifically, the Sacramento River basin annual runoff amount for April-July has been decreasing since about 1950 (Roos 1987, 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 (VanEheenen *et al.* 2004). Factors modeled by VanEheenen *et al.* (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 (VanEheenen *et al.* 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 Central Valley, where the snowpack is shallower than in the San Joaquin River watersheds to the south.

Projected warming is expected to affect Central Valley Chinook salmon. Because the runs are restricted to low elevations as a result of impassable rim dams, if temperatures rise by 5°C (9°F), it is questionable whether any Central Valley Chinook salmon populations can persist (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 (Dettinger 2005). Chinook salmon in the Central Valley 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.

For SR winter-run Chinook salmon, the embryonic and larval life stages that are most vulnerable to warmer water temperatures occur during the summer, so this run is particularly at risk from climate warming. The only remaining population of SR winter-run Chinook salmon relies on the cold water pool in Shasta Reservoir, which buffers the effects of warm temperatures in most years. The exception occurs during drought years, which are predicted to occur more often with climate change (Yates *et al.* 2008). The long-term projection of operations of the CVP/SWP expects to include the effects of climate change in one of three possible forms: less total precipitation; a shift to more precipitation in the form of rain rather than snow; or, earlier spring snow melt (Reclamation 2008). Additionally, air temperature appears to be increasing at a greater rate than what was previously analyzed (Lindley 2008, Beechie *et al.* 2012, and Dimacali 2013). These factors will compromise the quantity and/or quality of SR winter-run Chinook salmon habitat available downstream of Keswick Dam. It is imperative for additional populations of SR winter-run Chinook salmon to be re-established into historical habitat in Battle Creek and above Shasta Dam for long-term viability of the ESU (NMFS 2014).

CV 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). CV spring-run Chinook salmon spawn primarily in the tributaries to the Sacramento River, and those tributaries without cold water refugia, usually provided by springs, will be more susceptible to impacts of climate change. In years of extended drought and warming water temperatures, unsuitable conditions may occur even in tributaries with cool water springs. 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 *et al.* 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 Central Valley, 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 *et al*. 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 CCV steelhead populations.

The sDPS green sturgeon spawn primarily in the Sacramento River in the spring and summer. 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 temperatures are higher than at 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 Central Valley (*i.e.*, the Feather River) is limited, in part, by late spring and summer water temperatures. Similar to salmonids in the Central Valley, 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 (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 (McClure *et al.* 2013).

2.4.8. Species Survival and Recovery in the Action Area

SR winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and sDPS green sturgeon utilize the Sacramento River and Battle Creek. The upper Sacramento River and Battle Creek have high values for the conservation of these species, because of the location and the habitat features provided that are essential to meeting nearly all of the freshwater life history requirements of these species. Improving population trends and ongoing habitat improvements to the Sacramento River and Battler Creek are needed for these species to continue to survive and recover within the action area. The recovery plan for SR winter-run Chinook salmon, CV spring-run Chinook salmon, and CCV steelhead identifies the mainstem Sacramento as a core 1 population for SR winter-run Chinook salmon, a core 2 population for CV spring-run Chinook salmon, and a core 2 population for CCV steelhead and Battle Creek as a primary population for reintroduction for SR winter-run Chinook Salmon, a core 1 population for CV spring-run Chinook, and a core 1 population for CCV steelhead (NMFS 2014). Core 1 populations have a known ability or potential to support independent viable populations (NMFS 2014). Core 1 populations form the foundation of the recovery strategy and must meet the population-level biological recovery criteria for low risk of extinction, as described in the Recovery Plan (NMFS 2014). Core 2 populations are assumed to have the potential to meet the moderate risk of extinction criteria. Core 2 populations are of secondary importance for recovery efforts. The upper Sacramento River (RM 206 to RM 280) is the only known spawning habitat continuously used by sDPS green sturgeon. After the decommissioning of the Red Bluff Diversion Dam in 2013, sDPS green sturgeon now have volitional passage above the dam during all months that they are present in the river (NMFS 2018). Adults, eggs, and larvae can occur in the spawning area (RM 206 to RM 280) during the spawning (April to July) and rearing periods, and usually move out of the area with environmental cues such as increased flow (NMFS 2018). Restoring habitat below Keswick Dam is a priority recovery action; suitable spawning and rearing habitat downstream of Keswick is needed (NMFS 2018).

2.5. Effects of the Action

Under the ESA, "effects of the action" are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action (see 50 CFR 402.02). A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 CFR 402.17). In our analysis, which describes the effects of the proposed action, we considered the factors set forth in 50 CFR 402.17(a) and (b).

The effects assessment will consider the nature, duration, and extent of the effects of the proposed action relative to the migration timing, behavior, and habitat requirements of federally listed species and the magnitude, timing, frequency, and duration of project impacts to these listed species.

To evaluate the effects of the Jelly's Ferry Bridge Project, NMFS examined the proposed actions in the designated action area. We analyzed construction-related impacts and the expected fish response to habitat modifications. We also reviewed and considered Caltrans' proposed conservation and mitigation measures, which included funding habitat restoration on the Rancho Breisgau Unit. This assessment relied heavily on the information from the BA project description, the habitat restoration plan, and discussions with consulting biologists.

2.5.1. Effects to Species

The proposed Project includes actions that may adversely affect several life stages of SR winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and sDPS green sturgeon. Adverse effects to these species and their habitat may result from changes in water quality from bridge construction, acoustic effects associated with pile driving, and the potential handling of fish from fish salvage operations. The project includes integrated design features to avoid and minimize many of these potential impacts. Below, Table 3 describes the proportion that each species may be affected by the project during the in-water work.

Table 4. Juvenile listed fish exposure to Project effects during in-water work period March 15-August 15

Species Out-migrating	Proportion passing RBDD	Dates exposed to project effects
SR winter-run Chinook salmon	Less than 10%	July 15-August 15
CV spring-run Chinook salmon	Approximately 40 percent	March 15 - April 15
CCV steelhead	Approximately 80 percent	April 1-August 15
sDPS green sturgeon	All	May 1 -August 15

*Source: Poytress *et al.* 2014

2.5.1.1 Placement of Gravel Work Pads and Fish Passage

Construction of the gravel pads could result in injury or death to juveniles, if they are unable to avoid the falling gravel. In addition, temporary impacts will potentially occur during the time period the gravel work pads will be in place, which will result in a total loss of approximately 0.95 ac of riverine habitat that could be used for migration and/or rearing. This riverine habitat will be unavailable during construction. The temporary loss of this habitat, and specifically its location on either bank, will require migrating fish to move into the middle of the river in order to pass through the approximately 200-foot opening between the pads, which could result in migration delays. Pacific Hydrologic, Inc., determined that maximum water velocities through the opening would be approximately 7.8 ft/s at a flow rate of 50,000 cfs, which was used as a maximum flow rate since it has only been exceeded once in the last 15 years (Caltrans 2013). Per Bell (1986), typical cruising speeds for adult Chinook salmon range up to 4 ft/s, while typical sustained speeds range up to 10 ft/s, and darting speeds range up to 22 ft/s. The length of the 200-foot wide opening will be approximately 125 feet, based on the width of the temporary work pads. Consequently, adult Chinook salmon passing through the opening would need to maintain a speed of 7.8 ft/s for approximately 125 feet. Since typical sustained speeds (*i.e.*, high speed for several minutes) for this species range up to 10 ft/s, maintaining a speed of 7.8 ft/s for 125 feet would be well within the range for this species and would not result in delay of migration. If the opening is less than 200-feet, or water level drops during construction, adult salmonids may have difficulty passing the work area. A biologist will ensure that passage remains open at all times, thus delayed migration of adult listed fish species are not expected to occur.

After construction is complete, the bottom one foot of the gravel pads will remain in place to avoid impacts to the river bottom. This is a potential beneficial effect as it may result in some increased spawning habitat.

2.5.1.2 Sedimentation and Turbidity

Construction-(*i.e.*, placement of piles and gravel pads) and offsite restoration-related disturbances (i.e., plantings, disking) to soils, vegetation, and the streambed within the action area will temporarily increase sedimentation and turbidity in the Sacramento River and Battle Creek. A prolonged increase in sedimentation and turbidity affects the growth, survival, and reproductive success of aquatic species. High levels of suspended sediment reduce the ability of listed fish to feed and respire, resulting in increased stress levels and reduced growth rates, and a reduced tolerance to fish diseases and toxicants (Waters 1995).

NMFS anticipates that some local increases in turbidity and suspended sediment above baseline levels will result from in-water construction activities. Indirect effects resulting from the proposed project may include potential water quality impacts following construction and restoration activities until disturbed areas have re-vegetated. NMFS expects these water quality impacts to be minor, short-term increases in turbidity and sedimentation. Water quality impacts are unlikely to affect migrating adults to the extent of injuring them, but may injure some juvenile fish, which are smaller and less mobile, and are actively feeding and growing, by temporarily disrupting normal behaviors that are essential to growth and survival. Increased sedimentation and turbidity resulting from project will be temporary and limited to a small portion of the river during construction and restoration activities. The BMPs incorporated into the project plans will further minimize turbidity effects to listed fish in the project construction and restoration areas.

Responses of salmonids to elevated levels of suspended sediments often fall into three major categories: physiological effects, behavioral effects, and habitat effects (Bash *et al.* 2001). The severity of the effect is a function of concentration and duration (Newcombe and MacDonald 1991; Newcombe and Jensen 1996) so that low concentrations and long exposure periods are frequently as deleterious as short exposures to high concentrations of suspended sediments.

A review by Lloyd (1987) indicated that several behavioral characteristics of salmonids can be altered by even relatively small changes in turbidity (10 to 50 Nephelometric Turbidity Units [NTUs]). Salmonids exposed to slight to moderate increases in turbidity exhibited avoidance, loss of station in the stream, reduced feeding rates and reduced use of overhead cover. Short-term increases in turbidity and suspended sediment may disrupt feeding activities of fish or result in temporary displacement from preferred habitats. Numerous studies show that suspended sediment and turbidity levels moderately elevated above natural background values can result in non-lethal detrimental effects to salmonids.

Suspended sediment affects salmonids by decreasing reproductive success, reducing feeding success and growth, causing avoidance of rearing habitats, and disrupting migration cues (Bash *et al.* 2001). Sigler *et al.* (1984 in Bjornn and Reiser 1991) found that prolonged turbidity between 25 and 50 NTUs reduced growth of juvenile coho salmon and steelhead. MacDonald *et al.* (1991) found that the ability of salmon to find and capture food is impaired at turbidities from 25 to 70 NTUs. Reaction distances of *O. mykiss* to prey were reduced with increases of turbidity of only 15 NTUs over an ambient level of 4 to 6 NTUs in experimental stream channels (Barrett *et al.* 1992). Bisson and Bilby (1982) reported that juvenile coho salmon avoid turbidities exceeding 70 NTUs. Increased turbidity, used as an indicator of increased suspended sediments, also is correlated with a decline in primary productivity, a decline in the abundance of periphyton, and reductions in the abundance and diversity of invertebrate fauna in the affected area (Lloyd 1987; Newcombe and MacDonald 1991). Increased sediment delivery can also fill interstitial substrate spaces and reduce cover for juvenile fish (Platts *et. al*. 1979) and abundance and availability of aquatic invertebrates for food (Bjornn and Reiser 1991).

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 as a migration corridor and may exhibit rearing behavior there as well. Less is known about the specific detrimental physical and physiological effects of sedimentation and turbidity to sturgeon. However, it is thought that high levels of turbidity can generally result in gill fouling, reduced temperature tolerance, reduced swimming capacity and reduced forage capacity in lotic fishes (Wood and Armitage 1997).

Increases in turbidity associated with instream work are likely to be brief and occur only in the vicinity of the site, attenuating downstream as suspended sediment settles out of the water column. Also, avoidance and minimization techniques will be implemented in this project as well as BMPs pertaining to the prevention or minimization of sedimentation and increased turbidity. These actions will minimize the extent and severity of effects associated with the proposed action outside of the construction footprint. Due to their use of the nearshore habitat in the action area, juvenile listed fish in the action area during construction would be subject to mobilized sediment and short-term increases in turbidity resulting in an increase in predation and reduced feeding and survival.

2.5.1.3 Fish Relocation

Per the Project Description outlined in Section 1.3.2 above, 3/32-inch wire mesh with wood template or rock weight will be attached to the bottom of the CIDH pile casings to form a cone shape prior to the casings being lowered to the river bottom during in-water construction. The wire mesh is intended to prevent any fish from being trapped during the installation of the CIDH pile temporary casings. However, the fish salvage plan safeguard measure (Section 1.3.3) will be followed should the wire mesh on the bottom of the CIDH casing be damaged while being lowered into the water, which may result in salmonids or sturgeon being entrained. Although this is unlikely, it has occurred at other Caltrans bridge construction sites, and since Sacramento River flows near the project area (Bends Ferry Road Bridge; RM 45) are fairly swift and in excess of 7,300 cfs (Caltrans 2013), there is the potential for this to occur, so fish relocation would be required in this event. We assume fish capture/relocation will be needed, and expect small numbers of juveniles from each species will be injured or killed.

2.5.1.4 Hazardous Materials and Chemical Spills

Construction-related activities could potentially impair water quality should hazardous chemicals (*e.g*., fuels and petroleum-based lubricants) or other construction materials enter the Sacramento River. Construction-related chemical spills could potentially affect fish and aquatic resources by causing physiological stress, reducing biodiversity, altering primary and secondary production, interfering with fish passage, and causing direct mortality. Construction equipment and heavy machinery will be present in the action area and metals may be deposited through their use and operation (Paul and 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 and 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 (Johnson *et al.* 2002). The exact toxicological effects of PAHs in juvenile salmonids are not well understood, although studies have shown that increased exposure of salmonids to PAHs, reduced immunosuppression, increasing their susceptibility to pathogens (Arkoosh *et al.* 1998, Arkoosh and Collier 2002). Listed fish species are expected to be present in the action area during construction activities and would potentially be directly affected by a pollution event. Listed fish could be indirectly affected by a pollution event if contaminants were to settle within substrate in the active channel of the Sacramento River that may become disturbed at a later time.

Avoidance and minimization measures are described in Section 1.3.3 and will aid in minimizing the potential risk of exposure to contaminants, to the extent exposure is not expected to occur.

2.5.1.5 Pile Driving and Underwater Sound Pressure

Construction of the new bridge will require the use of both vibratory and impact pile driving to install the steel pipe piles for the temporary trestle and falsework. During the construction period, steel pipe piles will be placed into the Sacramento River by combination of vibratory hammer and impact hammer during the proposed in-water work window of March 15 to August 15 for 3 seasons.

Pile driving near or in water has the potential to kill, injure, and cause delayed death to fish through infection of minute internal injuries, or cause sensory impairments leading to increased susceptibility to predation. The pressure waves generated from driving piles into river bed substrate propagate through the water and can damage a fish's swim bladder and other internal organs by causing sudden rapid oscillations in pressure, which translates to rupturing or hemorrhaging tissue in the bladder when the air in swim bladders expand and contract (Gisiner 1998, Popper *et al.* 2006). Sensory cells and other internal organ tissue may also be damaged by pressure waves generated during pile driving activities as sound reverberates through a fish's viscera (Caltrans 2015). In addition, morphological changes to the form and structure of auditory organs (saccular and lagenar maculae) have been observed after intense noise exposure (Hastings and Popper 2005). Smaller fish with lower mass are more susceptible to the impacts of elevated sound fields than larger fish, so acute injuries resulting from acoustic impacts are expected to scale based on the mass of a given fish. Since juveniles and fry have less inertial resistance to a passing sound wave, they are more at risk for non-auditory tissue damage (Popper and Hastings 2009) than larger fish (yearlings and adults) of the same species. Beyond immediate injury, multiple studies have also shown responses in the form of behavioral changes in fish due to human-produced noises (Wardle *et al.* 2001, Slotte *et al.* 2004, Popper and Hastings 2009).

Based on recommendations from the Fisheries Hydroacoustic Working Group, NMFS uses interim dual metric criteria to assess onset of injury for fish exposed to pile-driving sounds (Caltrans 2015). The interim thresholds of underwater sound levels denote the expected instantaneous injury/mortality and cumulative injury, as well as a third threshold criterion for behavioral changes to fish. Vibratory pile driving generally stays below injurious thresholds, but often introduces pressure waves that will incite behavioral changes. Even at great distances from the pile driving location, underwater pressure changes/noises from pile driving is likely to cause flight, hiding, feeding interruption, area avoidance, and movement blockage, as long as pile driving is ongoing.

For a single strike, the peak exposure level (peak) above which injury is expected to occur is 206 decibels (dB) (reference to one 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 to fish is expected to occur is 187 dB for 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 to fish within the estimated distance thresholds. Underwater sound levels below injurious thresholds are expected to produce behavioral changes. NMFS uses a 150 dB root-mean-square (RMS) threshold for behavioral responses in salmonids and green sturgeon.

Caltrans will employ attenuation methods to reduce noise levels while impact pile driving. Attenuation methods can include, deploying a bubble curtain, a double-walled isolation casing or a dewatered isolation casing. Attenuation of up to 10dB is likely based on the analysis by Caltrans (2020), which referenced hydroacoustic monitoring data from measurements taken at two bridge replacement projects which used similar pile type, size, and attenuation methods.

Noise levels for impact pile driving are as follows (summarized in Table 5 and depicted in Figure 4):

The peak level for unattenuated impact driving 24” steel pipe piles in-water are estimated to be 208 dB at 10 meters and the distance to the 206 dB peak criteria is estimated to be 14 meters from the pile. The distance to the 187 dB cumulative SEL criteria would be approximately 83 meters from the pile and the distance to the 183 dB cumulative SEL criteria would be approximately 154 meters from the pile.

Assuming a 5dB attenuation, the peak level for unattenuated impact driving 24” steel pipe piles in-water are estimated to be 208 dB at 10 meters and the distance to the 206 dB peak criteria is estimated to be less than 10 meters from the pile. The distance to the 187 dB cumulative SEL criteria would be approximately 39 meters from the pile and the distance to the 183 dB cumulative SEL criteria would be approximately 71 meters from the pile.

Assuming a 10 dB attenuation, the peak level for unattenuated impact driving 24” steel pipe piles in-water are estimated to be 208 dB at 10 meters and the distance to the 206 dB peak criteria is estimated to be less than 10 meters from the pile. The distance to the 187 dB cumulative SEL criteria would be approximately 18 meters from the pile and the distance to the 183 dB cumulative SEL criteria would be approximately 33 meters from the pile.

The distance that behavioral changes are expected is up to 1848 meters from an unattenuated driven pile, where the RMS sound will be above 150 dB RMS. SELs below 150 dB are assumed not to accumulate and cause fish injury, or be significantly different from ambient conditions (*i.e*., effective quiet). Pressure levels in excess of 150 dB RMS are expected to cause temporary behavioral changes (startle and stress) that could decrease a fish’s ability to avoid predators or delay normal migration past the work site. The background RMS sound pressure levels, or effective quiet, are assumed to be 150 dB RMS and the acoustic impact area is the area where the predicted RMS sound pressure level generated by pile driving exceeds this threshold. Once the pressure waves attenuate below this level, fish are assumed to no longer be adversely affected by pile-driving sounds. Under the concept of effective quiet being less than or equal to 150 dBRMS, the distance fish are expected to be adversely affected during pile driving is out to 1848 meters from the location of the pile being driven, assuming a transmission loss constant of 15 (NMFS 2008). With attenuation of 5 to 10dB this distance is expected to be between 398-858 meters.

Table 5. Summary of Estimated Underwater Sound Exposure Levels

Pile Type	Driver Type	Number of Strikes Per Pile	Strikes Per Day	Reference Distance (m)	Attenuation (dB)	Peak (dB)	SEL (dB)	RMS (dB)	Distance (m) to Threshold- Onset of physical injury- Peak dB 206 dB	Distance (m) to Threshold- Onset of physical injury- Cummulative SEL dB Fish > 2 g, 187 dB	Distance (m) to Threshold- Onset of physical injury- Cummulative SEL dB Fish < 2 g, 183 dB	Distance (m) to Threshold- Behavior – RMS dB 150 dB
24" steel pipe pile	impact hammer	200	1,200	10	0	208	170	184	14	83	154	1848
24" steel pipe pile	impact hammer	200	1,200	10	5	203	165	179	10	39	71	858
24" steel pipe pile	impact hammer	200	1,200	10	10	198	160	174	10	18	33	398

The underwater sound conditions described above would be expected to occur on days when in-water pile driving of 24” steel pipe piles occur. Impact pile driving is expected to injure or kill fishes within certain distance thresholds, depending on the number of strikes used in a day, and whether attenuation measures are being employed. Using the greatest numbers of strikes estimated, it is expected that fish would be killed within up to 10 meters (attenuated) to 14 meters (unattenuated) of the driven pile due to in-water impact pile driving. Fish would be injured within up to 33 (10dB attenuation) to 154 meters (unattenuated). Behavioral effects would occur up to 398 meters (10dB attenuation) to 1848 meters (unattenuated). However, the likelihood for exposure to these effects to occur will be minimized since pile driving will occur during the day, and most fish passage is expected to occur at night. Small numbers of juvenile CCV steelhead, CV spring-run, SR winter-run Chinook salmon and sDPS green sturgeon are expected to be affected.

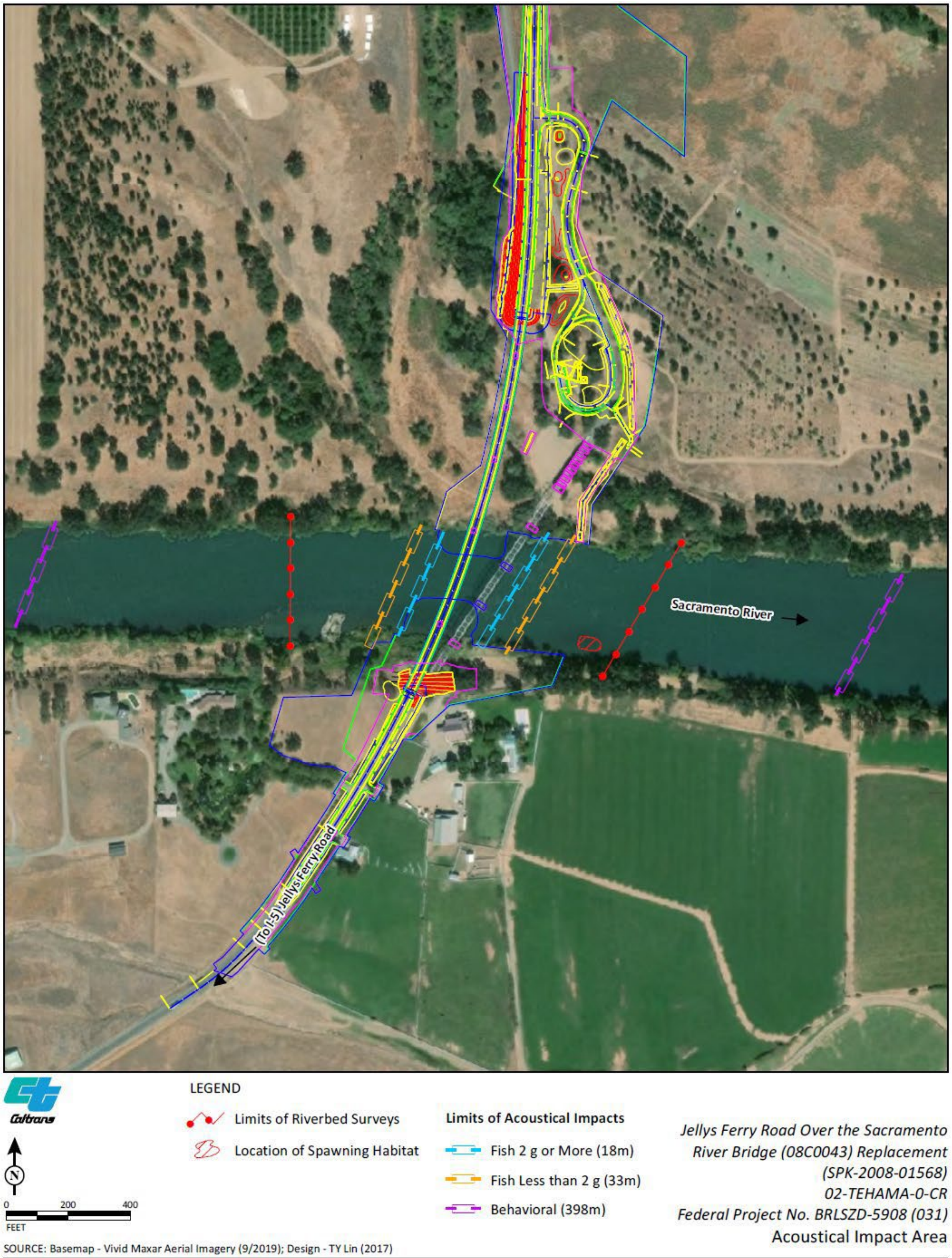

Figure 4. Caltrans Acoustic Impact Area Map (Caltrans 2013).

2.5.2. Effects to Critical Habitat and PBFs

Construction and restoration activities are expected to have short- and long-term effects on habitat quantity and quality, including effects on the PBFs of designated critical habitat of listed species. The PBFs that occur within the action area for SR winter-run Chinook salmon are (1) migratory corridors for both upstream and downstream migration, (2) habitat and prey items that are free of contaminants, and (3) riparian habitat for juvenile rearing. The PBFs within the action area for sDPS green sturgeon are (1) food resources, (2) adequate flow regime for all life stages, (3) water quality, (4) migratory corridors, (5) adequate water depth for all life stages, and (6) adequate sediment quality. The PBFs within the action area for CV spring-run Chinook salmon and CCV steelhead are (1) freshwater rearing sites, and (2) freshwater migration corridors. The Project will temporarily reduce rearing habitat and food resource availability for salmonids. The migratory corridor for juvenile and adult listed salmonids and green sturgeon will be temporarily affected, as will potential spawning habitat for salmonids. Impacts to the migration corridor are only expected to be short-term (during construction activities), and unimpeded passage will be open throughout construction.

2.5.2.1 Effects on Shaded Riverine Aquatic Habitat (SRA)

SRA habitat generally includes the woody vegetation and cover structures associated with “natural” banks that function to provide shade; sediment, nutrient, and chemical regulation; stream bank stability; input of woody debris and leaves that provide cover and serve as substrates for food-producing invertebrates. Permanent effects to SRA habitat, consisting of valley oak riparian totaling 2.26 ac, will occur during construction of the new bridge since it will be located on a different alignment than the existing bridge. The permanent loss of the SRA habitat will decrease shading over the river and may result in reductions of food availability in the form of aquatic invertebrates, structural diversity, such as instream woody material, and warmer stream temperatures. However, because there is suitable habitat for salmon and sturgeon both upstream and downstream of the bridge construction site, the effects of the loss of SRA are expected to be minor.

2.5.2.2 Effects of Structure Shading

The new bridge will shade the Sacramento River by approximately 16,000 square feet. This will degrade the PBF of migratory corridors by increasing the predation risk. Overwater structures can alter underwater light conditions and provide potential holding conditions for juvenile and adult fish, including species that prey on juvenile listed fishes. The increase in riverine shading may result in associated riparian vegetation receiving less sunlight for photosynthesis, as well as in-water vegetation receiving less light for photosynthesis. This can result in decreased fish habitat quality and decreased insect productivity (Pincetich 2019). Salmonids may benefit from the overwater shade as a cooling measure for water temperatures. Blocking light can also prevent stream eutrophication (an overabundance of nutrients in a water body), such as algal blooms. Eutrophication may reduce oxygen levels for fish and other species (Pincetich 2019). However, because there is suitable habitat for salmon and sturgeon both upstream and downstream of the bridge construction site, the effects of the overwater structure are expected to be minor.

2.5.2.3 Effects of Sedimentation

The project will result in the permanent loss of approximately 0.01 ac of riverine or critical habitat for listed fish during construction of the two bridge support columns. This includes PBFs of migratory corridors and juveniles rearing habitat. BMPs are incorporated into the project to minimize effects of increased turbidity to critical habitat. The creation of 0.95 ac of new spawning habitat following removal of the temporary gravel work pads (*i.e.*, leaving the bottom 1 foot of gravel) will offset the permanent loss of 0.01 ac of riverine habitat. Effects of increased turbidity and sedimentation in critical habitat are similar to those described for species. Effects on critical habitat can also reduce fisheries habitat quality by mobilizing sedimentation and increasing turbidity. Sedimentation can decrease or reduce spawning habitat as well as rearing habitat. Increased sedimentation can seal gravel and decrease inter-gravel water flow reducing inter-gravel dissolved oxygen concentrations and result in high biological oxygen demand. Increased turbidity, especially caused by fine inorganic particles, increase drift of macroinvertebrates. Aquatic invertebrate communities may change as a result of sedimentation or turbidity, which in turn could affect salmonid prey items. In addition, suspended materials in slow moving waters can increase absorption of solar energy near the surface causing the heated upper layers to stratify reducing the dispersion of dissolved oxygen and nutrients to lower depths. Due to the extended level of higher base flows in the upper Sacramento River, it is anticipated that, the effects of suspended sediment that may lead to sedimentation in the project action area is expected to be minimal because most, if not all of the suspended sediment will dissipate quickly or be diluted substantially by the high base flows (8,770 cfs late summer flow in September; Caltrans 2013) in the upper Sacramento River and move downstream.

2.5.2.4 Freshwater Migratory Corridor

Safe and unobstructed migratory pathways are necessary for adult salmonids and sturgeon to migrate to and from spawning habitats, and for larval and juveniles to migrate downstream from spawning/rearing habitats within freshwater rivers to rearing habitats within the estuaries. The main migratory corridor in the upper Sacramento River will not be blocked at any time during project implementation so SR winter-run Chinook salmon, CCV steelhead, CV spring-run Chinook salmon and green sturgeon using the area to migrate upstream and downstream in the project action area in this reach of the upper Sacramento River to feed or rest, should not be affected and the effects of the project on the PBFs of migratory corridors for all listed species is minimal. Fish that use the action area as a migratory corridor will be able to continue using the channel during and after construction of the proposed action. The new bridge will shade the Sacramento River which may increase predation risk to juveniles. Overwater structures can alter underwater light conditions and provide potential holding conditions for juvenile and adult fish, including species that prey on juvenile listed fishes. The increase in riverine shading may result in associated riparian vegetation receiving less sunlight for photosynthesis, as well as in-water vegetation receiving less light for photosynthesis. This can result in decreased fish habitat quality and decreased insect productivity (Pincetich 2019). Salmonids may benefit from the overwater shade as a cooling measure for water temperatures. Blocking light can also prevent stream eutrophication (an overabundance of nutrients in a water body) such as algal blooms. Eutrophication may reduce oxygen levels for fish and other species (Pincetich 2019). However, because there is suitable habitat for salmon and sturgeon both upstream and downstream of the action area, the effects of the overwater structure are expected to be minor.

2.5.2.5 Freshwater Spawning and Rearing Habitat

Freshwater rearing habitat provides water quantity, quality, and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility. Rearing habitat condition is strongly affected by habitat complexity, food supply, and presence of predators of juvenile salmonids and green sturgeon. Freshwater rearing habitats have a high intrinsic value to salmonids, as the juvenile life stages are dependent on the function of this habitat for successful survival and recruitment.

As a result of removing the work pads, 0.95 ac of additional spawning habitat will be available to listed fish as the bottom foot of the work pad will remain in river. The project would not result in a permanent direct loss of spawning habitat, but would temporarily make small areas (under 1 ac total) unavailable for spawning during the in-water construction period. The proposed action would not result in a permanent loss of CV spring-run, CCV steelhead and green sturgeon rearing habitat, but would temporarily make small areas (the same as quantified for spawning) unavailable for rearing during construction. These short-term temporary instream disturbances (physical equipment, turbidity, etc.) would likely result in the displacement of fish from their habitat to downstream areas. However, there is suitable rearing habitat for salmonids and sturgeon downstream of the action area and upstream of the RBDD.

Based on the expected behavioral response of juveniles to relocate and the condition of the habitat there, any juveniles that are removed during potential fish salvage activities and displaced downstream, are expected to find adequate cover and food and not suffer any diminishment in their fitness from relocation. Through placement of the spawning sized gravel will result in changes to the particle size distribution in the channel bed and increases to the mobility of the geomorphic landscape of the streambed through localized changes in channel hydraulics; these actions will ultimately have a beneficial effect by increasing the availability of suitable salmonid and sturgeon rearing habitat in the action area.

2.5.2.6 Effects of Offsite Riparian Habitat Restoration

Caltrans will fund restoration of 9.04 ac of riparian habitat on the Rancho Breisgau Unit, which is projected to be completed after construction activities and within 18-24 months after River Partners receives funding in 2023 (Caltrans 2023). Restoration activities include the removal of non-native and invasive plants methods that may result in a short-term loss of shading and habitat within the Rancho Breisgau unit. However, these areas are expected to be revegetated with native vegetation, thereby increasing the quality of the riparian habitat over time. Restoration activities also include the propagation and plantings of additional native vegetation at the site that result in an additional increase in the quantity and quality of riparian and floodplain habitats on the Rancho Breisgau Unit. These actions will benefit the growth and survival of rearing listed-salmonids by providing abundant food in the form of aquatic invertebrates, structural diversity such as instream woody material, and cooler stream temperatures. The restoration of these habitats may also benefit sDPS green sturgeon by improving migratory corridors, improving rearing habitat, and creating additional riparian forest that will provide prey in the form of aquatic invertebrates.

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 and 402.17(a)]. 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.

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 earlier in the discussion of environmental baseline (Section 2.4).

2.6.1. Water Diversions

Water diversions for municipal and industrial use are found near the action area. Depending on the size, location, and season of operation, these unscreened 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 water bodies, 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 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

Cumulative effects include non-Federal riprap 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.

2.6.4. Aquaculture and Fish Hatcheries

More than 32 million fall-run Chinook salmon, 2 million CV spring-run Chinook salmon, 1 million late fall-run Chinook salmon, 0.25 million SR winter-run Chinook salmon, and 2 million steelhead are released annually from six hatcheries producing anadromous salmonids in the Central Valley. All of these facilities are currently operated to mitigate for natural habitats that have already been permanently lost as a result of dam construction. The loss of historical habitat and spawning grounds upstream of dams results in dramatic reductions in natural population abundance, which is mitigated for through the operation of hatcheries. Salmonid hatcheries can, however, have additional negative effects on ESA-listed salmonid populations.

The high level of hatchery production in the Central Valley can result in high harvest-to-escapements ratios for natural stocks. California salmon fishing regulations are set according to the combined abundance of hatchery and natural stocks, which can lead to over-exploitation and reduction in the abundance of wild populations that are indistinguishable and exist in the same system as hatchery populations. Releasing large numbers of hatchery fish can also pose a threat to wild Chinook salmon and steelhead stocks through the spread of disease, genetic impacts, competition for food and other resources, predation of hatchery fish on wild fish, and increased fishing pressure on wild stocks as a result of hatchery production.

Impacts of hatchery fish can occur in both freshwater and the marine ecosystems. Limited marine carrying capacity has implications for naturally produced fish experiencing competition with hatchery production. Increased salmonid abundance in the marine environment may also decrease growth and size at maturity, and reduce fecundity, egg size, age at maturity, and survival (Bigler *et al.* 1996).

2.6.5. Recreational Fishing

While hatchery CCV steelhead and Chinook salmon are targeted, incidental catch of protected species, such as naturally produced CV spring-run Chinook salmon and CCV steelhead, does occur. Since 1998, all hatchery CCV steelhead have been marked with an adipose fin clip, allowing anglers to tell the difference between hatchery and wild CCV steelhead. Current regulations restrict anglers from keeping unmarked CCV steelhead in Central Valley streams, except in the upper Sacramento River.

Current sport fishing regulations do not prevent wild CCV steelhead from being caught and released many times over while on the spawning grounds, where they are more vulnerable to fishing pressure. Recent studies on hooking mortality based on spring-run Chinook salmon have found a 12 percent mortality rate for the Oregon in-river sport fishery (Lindsay *et al.* 2004). Applying a 30 percent contact rate for Central Valley rivers (*i.e.*, the average of estimated Central Valley harvest rates), approximately 3.6 percent of adult steelhead die before spawning from being caught and released in the recreational fishery. Studies have consistently demonstrated that hooking mortality increases with water temperatures. Mortality rates for steelhead may be lower than those for Chinook salmon, due to lower water temperatures.

In addition, survival of CCV steelhead eggs is reduced by anglers walking on redds in spawning areas while targeting hatchery CCV steelhead or salmon. Roberts and White (1992) identified up to 43 percent mortality from a single wading over developing trout eggs, and up to 96 percent mortality from twice daily wading over developing trout eggs. Salmon and trout eggs are sensitive to mechanical shock at all times during development (Leitritz and Lewis 1980). Typically, CCV steelhead and salmon eggs are larger than trout eggs, and are likely more sensitive to disturbance than trout eggs. While state angling regulations have moved towards restrictions on selected sport fishing to protect listed fish species, hook and release mortality of steelhead and trampling of redds by wading anglers may continue to cause a threat.

2.6.6. Habitat Restoration

Voluntary state or private sponsored habitat restoration projects may have short-term negative effects associated with in-water construction work, but these effects typically are temporary, localized, and the overall outcome is expected to benefit listed species and habitats.

2.6.7. Agricultural Practices

Non-Federal actions that may affect the action area include ongoing agricultural activities in the Sacramento River watershed. Farming and ranching activities within or adjacent to or upstream of the action area may have negative effects on water quality due to runoff laden with agricultural chemicals. Stormwater and irrigation discharges related to agricultural activities contain numerous pesticides and herbicides that may adversely affect salmonid reproductive success and survival rates (King *et al.* 2014). Grazing activities from cattle operations can degrade or reduce suitable critical habitat for listed salmonids by increasing erosion and sedimentation as well as introducing nitrogen, ammonia, and other nutrients into the watershed, which then flow into the receiving waters of the associated watersheds. Agricultural practices in the Sacramento River may adversely affect riparian and wetland habitats through upland modifications of the watershed that lead to increased siltation or reductions in water flow.

2.6.8. Mining Activities

Increased water turbidity levels for prolonged periods of time may result from adjacent mining activities, and increased urbanization and/or development of riparian habitat, and could adversely affect the ability of young salmonids to feed effectively, resulting in reduced growth and survival. Turbidity may cause harm, injury, or mortality to juvenile anadromous fish in the vicinity and downstream of the project area. High turbidity levels can reduce the ability of listed fish to feed and respire, resulting in increased stress levels and reduced growth rates, and reduce tolerance to fish diseases and toxicants. Mining activities may adversely affect water quality, riparian function, and stream productivity.

2.7. Integration and Synthesis

The Integration and Synthesis section is the final step in assessing the risk that the proposed action poses to species and critical habitat. In this section, we add the effects of the action

(Section 2.5) to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.6), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminish the value of designated or proposed critical habitat as a whole for the conservation of the species.

SR winter-run Chinook salmon ESU, CV spring-run Chinook salmon ESU, CCV steelhead DPS, and sDPS green sturgeon have experienced significant declines in abundance and available habitat in the California Central Valley relative to historical conditions. The status of the species (Section 2.2) details the current range-wide status of these ESUs and DPSs and their critical habitat. The environmental baseline (Section 2.4) describes the current baseline conditions found in the Sacramento River, where the proposed action is to occur. Section 2.4.7 discusses the vulnerability of listed species and critical habitat to climate change projections in the California Central Valley and specifically in the Sacramento River. Reduced summer flows and increased water temperatures will likely be exacerbated by increasing surface temperatures in the Sacramento River. The Sacramento River is a highly manipulated system with flow and temperature regimes that differ drastically from their historical condition. Cumulative effects (Section 2.6) are likely to include decreased water flow, increased river traffic, and increased stormwater runoff from increased urbanization and from concurrent state and local projects in the action area.

2.7.1. Summary of the Project Effects to Listed Species

The proposed action has the potential to affect adult and juvenile SR winter-run Chinook salmon, CV spring-run Chinook salmon, and CCV steelhead; and adult, juvenile, and subadult sDPS green sturgeon. The project is expected to result in the harassment, injury or death, and predation-related mortality of individuals from the temporary increase in suspended sediment and turbidity, reductions of SRA and spawning and rearing habitats, pile driving, and entrainment/salvage.

Turbidity changes that are within the Central Valley Regional Water Quality Control Board standards would result in sudden localized turbidity increases that would injure juvenile salmonids and sturgeon by temporarily impairing their migration, rearing, feeding, or sheltering behavior. Project-related turbidity increases would also contribute to the susceptibility of juvenile salmonids and sturgeon to increased predation. Turbidity-related injury and predation will be minimized by implementing the avoidance and contingency measures of the SWPPP, and by scheduling in-water work to avoid peak migration periods of listed anadromous salmonids and sturgeon.

The reductions in SRA and spawning and rearing habitats due to constructions activities will affect the behavior of listed fish, resulting in displacement and increased predation, and decreased feeding. In turn, these will result in decreased survival, reduced growth and reduced fitness, respectively. However, these effects on the species are expected to be fully offset over time through the creation of spawning habitat following the removal of the gravel work pads and the off-site riparian habitat restoration activities at Rancho Breisgau.

The expected effects to listed salmonids and sturgeon resulting from the proposed action are harassment of juvenile SR winter-run and CV spring-run Chinook salmon, CCV steelhead, and green sturgeon resulting from the noise of pile driving, and entrainment, capture, and relocation of juveniles from construction activities. Pile driving would result in injury or death to outmigrating juveniles that pass within the 83 m zone of impact. Pile driving is also expected to result in temporary disruptions in the feeding, sheltering, and migratory behavior of adult and juvenile salmon and steelhead and green sturgeon for fish passing outside of the 83 m zone of impact. This disruption would result in reduced growth and increased susceptibility to predation. Adults are not expected to be injured or killed, however would experience temporary migration delays that is not expected to prevent successful spawning. Pile driving is also not expected to prevent salmonids and sturgeon from passing upstream or downstream, because pile driving will not be continuous through the entire day, and will not occur at night, when the majority of fish migrate.

Death as a result of entrainment is expected to be minimized by salvaging and relocating fish away from the project site, if necessary. Fish would be handled by a biologist, and a low mortality rate of juveniles (<10 percent) is expected to result from fish salvage.

2.7.2. Summary of Project Effects to Critical Habitat

Critical habitat has been designated for SR winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead and sDPS green sturgeon within the action area. Relevant PBFs of the designated critical habitats are listed above in section 2.5.2. Based on the effects of the proposed Project described previously in this opinion, the impacts are expected to permanently degrade a small portion of designated critical habitat for all species.

The quality of the current conditions of PBFs in the action area are poor compared to historical conditions (pre-levees). In particular, levees, riprapping, and removal of riparian vegetation have greatly diminished the value of the aquatic habitat in the action area by decreasing rearing area, food resources via food-web degradation, and complexity and diversity of habitat forms necessary for holding and rearing (channel diversity). Perpetuating the overwater structure and in-water structure with the bridge construction would contribute to the degradation of designated critical habitat. The temporary construction impacts to designated critical habitat would negatively affect the ability of listed species to use the action area as spawning habitat, rearing habitat and as migratory corridors during the overlap of migration periods and construction, as discussed in the Effects to Species section.

The project will cause a permanent loss of 2.26 ac of riparian vegetation at the bridge construction site, adversely affecting migration and rearing habitat PBFs of critical habitat through a small reduction of near shore cover and food production. As mitigation for these impacts, Caltrans will fund restoration of 9.04 ac of off-site riparian habitat on the Rancho Breisgau Unit, located approximately 5 RM upstream of the construction site at the confluence of the Sacramento River and Battle Creek, in coordination with River Partners. Restoration is projected to be completed within 18-24 months after construction activities are complete River Partners receives funding in 2023 (Caltrans 2023). The mitigation amount includes 2.26 ac to account for the 18-24 month temporal habitat loss due to timing of construction impacts and restoration activities. Riparian restoration of this site is expected to benefit the PBFs of freshwater rearing habitat and migration corridors for listed species by providing suitable floodplain and riparian habitat. The floodplains and riparian forest on this site will benefit the growth and survival of rearing salmonids by providing habitat with abundant food in the form of aquatic invertebrates, structural diversity, such as instream woody material, and cooler stream temperatures.

There will be a permanent loss of approximately 0.01 ac of riverine habitat from placement of the two bridge support columns from the increased size of the bridge columns. The creation of 0.95 ac of new spawning habitat following removal of the temporary gravel work pads is expected to offset the permanent loss of 0.01 ac riverine habitat.

2.7.3. Effects of the Proposed Action at the Population Level

Based on the geographical location of the action area, core populations of salmonids that may be affected by the Proposed Action include the following Core 1 populations as designated by the Salmonid Recovery Plan: SR winter-run Chinook below Keswick Dam, Battle Creek spring- run Chinook and steelhead, and Clear Creek spring-run Chinook and steelhead. Core 1 watersheds are those that possess the ability or potential to support a viable population. Core 2 populations which may be affected by the Proposed Action include: Sacramento River below Keswick Dam spring-run Chinook and steelhead, Cow Creek steelhead, Redding-area tributary steelhead, and Beegum Creek spring-run Chinook and steelhead. Core 2 watersheds have lower potential to support viable populations, due to lower abundance, or amount and quality of habitat. These populations provide increased life history diversity within the ESU/DPS.

With the exception of loss of SRA habitat, the March 15 to August 15 work window will avoid in-water work during peak juvenile SR winter-run Chinook and CV spring-run Chinook outmigration periods for the above listed populations. There is some likelihood for SR winter-run Chinook salmon juveniles to begin outmigrating in August (less than 10 percent). For this reason, we expect very few SR winter-run Chinook salmon to be outmigrating during this time. CV spring-run Chinook salmon populations upstream of the action area display a second peak of outmigration past RBDD occurring between mid-March and May (Poytress *et al.* 2014) with an average of approximately 40% of Upper Sacramento outmigration occurring during these months. However, the proportion of the ESUs passing the project area are expected to be relatively low since the majority of CV spring-run Chinook salmon production occurs within the Core 1 spring- run populations in Mill, Deer and Butte Creek, downstream of the project. Only CCV steelhead outmigration timing peaks during the in-water work window (80 percent passing), but numbers are likely low with the contribution of only a few major tributaries/populations upstream.

Green sturgeon outmigration occurs during the in-water work window. Within the Sacramento River sDPS green sturgeon spawning has been confirmed between the GCID area (rkm 332.5) and Inks Creek (rkm 426) (Poytress *et al.* 2015). Spawning may occur as far upstream as Cow Creek (rkm 451) based on adult distribution (Heublin *et al.* 2009, Klimley *et al*. 2015, Mora *et al*. 2018). A majority of this spawning area occurs downstream of the action area, so few fish are expected to pass the project area.

Construction effects would last for the entirety of each work season, but would not permanently modify critical habitat function, as noise and turbidity would end after construction ends. The presence of the structure and loss of both in-water and riparian habitats will continue into the foreseeable future, thus creating a minor perpetual source of predation and water quality impacts (both beneficial and adverse, see Section 2.5.2) to the action area, and a permanent adverse effect to rearing PBFs. However, these permanent effects to both the populations and the PBFs are expected to be fully offset by the placement of spawning sized gravel and funding the riparian habitat restoration at the Rancho Breisgau Unit.

2.7.4. Summary of Risk to Diversity Groups for each Species

Project effects to SR winter-run Chinook, CV spring-run Chinook, and CCV steelhead will affect the Basalt and Porous Lava Diversity Group as identified in the Salmonid Recovery Plan (NMFS 2014). Key threats to salmonids within this diversity group (which includes the Upper Sacramento River) include inaccessibility of historic habitat, altered flows and water temperatures below Shasta and Keswick Dams, and lack of spawning gravel. Current Core 1 and 2 populations within this diversity group are described above (Section 2.7.3). The McCloud River and Battle Creek are identified as re-introduction priorities necessary to achieve recovery criteria. Other priority recovery actions within this diversity group include restoration and maintenance of riparian and floodplain ecosystems which provide diverse habitat along the Sacramento River, development and implementation of a long-term gravel augmentation plan to increase and maintain spawning habitat, and operational changes to river flow management to improve water temperature and flow conditions for listed salmonids.

Recovery criteria for SR winter-run Chinook includes maintenance/establishment of three viable populations for the ESU, all located within the Basalt and Porous Lava Diversity Group. Currently the populations of SR winter-run Chinook below Keswick Dam is the only population considered viable within the ESU. The Upper Sacramento River within the action area provides important spawning and rearing PBFs for SR winter-run Chinook. Although the proposed Project is expected to adversely affect a small portion of this population, the work window will avoid peak migration timing. Additionally, the placement of spawning-sized gravel and funding the riparian habitat restoration at the Rancho Breisgau Unit following construction may serve as additional spawning and riparian habitats accessible to the diversity group.

For CV spring-run Chinook salmon, recovery criteria includes maintenance/establishment of two viable populations within the Basalt and Porous Lava Diversity Group, and nine viable populations for the ESU, only one of which is currently considered viable. The Upper Sacramento River within the action area provides important spawning and rearing PBFs for CV spring-run Chinook. Although the proposed Project is expected to adversely affect a small proportion of the ESU for these species, most of the range-wide habitat supporting the species is outside of the action area.

Recovery criteria for CCV steelhead include maintenance and establishment of nine viable populations for the ESU. Of those, two viable populations are to be within the Basalt and Porous Lava Diversity Group. The proposed Project impacts represent a small loss, which is not expected to reach the designation scale for the CCV steelhead DPS as a whole. Permanent project impacts represent a small loss in the scope of available critical habitat at the designation scale for CVV steelhead though the intrinsic value of the action area for conservation of the species remains high.

The sDPS of green sturgeon includes only one spawning population in the Upper Sacramento River. The Recovery Plan for sDPS green sturgeon identifies a no-net loss of sDPS green sturgeon diversity from current levels as a recovery criteria. Diversity refers to individual and population variability in genetic, life history, behavioral, and physiological traits. Maintaining diversity is critical to retaining the species' ability to adapt to a diverse and variable environment. There are currently no methods to directly measure diversity or compare present and historical levels. However, the loss of spawning habitat can be used as a proxy and it is likely that some loss has occurred (NMFS 2018). Because diversity is closely tied with abundance, distribution, and productivity, the recovery criteria of no-net loss of diversity may be met by improving and/or increasing spawning and rearing habitat to a level which increases spawning and/or rearing distribution or success. Although the proposed Project is expected to adversely affect a small proportion of the DPS for these species, no spawning habitat occurs within the action area and most of the range-wide rearing habitat supporting the species is outside of the action area. Permanent project impacts represent a small loss in the scope of available critical habitat at the designation scale for sDPS green sturgeon though the intrinsic value of the action area for conservation of the species remains high.

2.7.5. Summary of Risk to the ESU/DPS for each Species and Critical Habitat at the Designation Level

The Sacramento River contains spawning populations of SR winter-run and CV spring-run Chinook salmon, CCV steelhead, and sDPS green sturgeon, making it an important river in terms of range-wide recovery for these species. Further, the Sacramento River is the only spawning location for SR winter-run Chinook salmon and the only known spawning location for sDPS green sturgeon. This is largely due to the fact that although construction is expected to cause adverse effects to small numbers of listed salmonids, the impacts will be relatively short in duration and will avoid higher river and peak migration time periods, so that abundance would be low within the project footprint. Additionally, most of the effects are not lethal. Construction-related harassment will be temporary and will not impede adult fish from reaching upstream spawning and holding habitat, or juvenile fish from migrating downstream. Long-term impacts of the bridge structure are expected to result in some brief minor behavioral modifications of migrating or rearing juvenile fish, as they move past the structure.

To offset the adverse effects of the project, Caltrans proposes to fund restoration of 9.04 ac of riparian habitat at the Rancho Breisgau Unit in coordination with River Partners. Restoration on the Rancho Breisgau is projected to completed within 18-24 months after construction activities and River Partners receives funding in 2023 (Caltrans 2023). The delay in restoration activities will result in a temporary loss of habitat reducing the fitness of individuals and functioning of critical habitat. The mitigation amount includes 2.26 ac to account for the 18-24 month temporal habitat loss due to timing of construction impacts and restoration activities. Once the restoration activities are completed, the permanent benefits will fully offset the temporary impacts of the project by increasing floodplain and shaded aquatic and riverine habitat for the SR winter-run Chinook and CV spring run Chinook ESUs, the CCV steelhead DPS and sDPS green sturgeon and their corresponding designated critical habitat PBFs. This addresses the priority recovery action of restoration and maintenance of riparian and floodplain ecosystems which provide diverse habitat along the Sacramento River and its tributaries.

Combining the minimal, adverse, and beneficial effects associated with the proposed action described above, including the environmental baseline, cumulative effects, status of the species, and critical habitat, the Project is not expected to reduce appreciably the likelihood of both the survival and recovery of the listed species in the wild by reducing their numbers, reproduction, or distribution; or appreciably diminish the value of designated critical habitat for the conservation of the species.

2.8. Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, the effects of other activities caused by the proposed action, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of SR winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, or sDPS green sturgeon or destroy or adversely modify its designated critical habitat.

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). "Harass" is further defined by interim guidance as to "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering." "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 ITS.

2.9.1. Amount or Extent of Take

In the biological opinion, NMFS determined that incidental take is reasonably certain to occur as follows:

NMFS anticipates incidental take of SR winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and North American green sturgeon from impacts directly on designated critical habitat PBFs, or related to pile driving and impairment of essential behavior patterns as a result of these activities, injury or harm related to the placement of gravel work pads and associated turbidity, potential fish entrainment, relocation and fish passage delays. The incidental take is expected to be in the form of harm, harassment, injury or mortality of SR winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and North American green sturgeon resulting from the installation and removal of temporary and permanent piles during bridge construction. Incidental take is expected to occur for during the in-water work window (March 15 to August 15) when juvenile SR winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and North American green sturgeon individuals are outmigrating past the site.

It is not practical to quantify or track the amount or number of individuals that are expected to be incidentally taken as a result of the proposed action, due to the variability associated with the response of listed fish to the effects of the proposed action, 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 ecological surrogates, and it is practical to quantify and monitor the surrogates to determine the extent of incidental take that is occurring. The most appropriate thresholds for incidental take are ecological surrogates of temporary habitat disturbance expected to occur during in-water construction and pile driving activities and permanent habitat disturbance expected to occur due to riparian removal and bridge structure presence in critical habitat.

Pile driving, turbidity, gravel pad placement capture, and handling result in fish behavioral modifications, entrainment, harm, injury or death. Riparian removal and bridge structure shade reduces primary productivity, decreases prey availability and increase the presence of predatory fish, leading to harm or death. NMFS anticipates incidental take will be limited to the following forms:

1) Take in the form of harm, injury and death to listed fish during placement of the gravel work pads, covering 0.95 ac adjacent to the banks. This habitat disruption will affect the behavior of listed fish, resulting in displacement and increased predation, and decreased feeding. In turn, these will result in decreased survival, reduced growth and reduced fitness, respectively. Due to the timing of the activity, actual numbers for each species is expected to be low.
2) Take in the form of harm, injury and death to listed fish, due to handling during relocation, stranding, or entrainment during pile-driving activities. Based on entrapment at the Deschutes Bridge Replacement, a construction site upstream of the proposed action, no more than 30 juvenile CCV steelhead are expected to be entrapped and captured. Ten percent of fish captured and relocated may be injured or killed.
3) Take in the form of harm, injury and death to listed fish, due to pile driving. Expected impact thresholds for attenuated piles are as follows: The 150dB RMS behavioral threshold is expected to be 858 meters from the pile resulting in stress to fish, interruptions in migration, increased predation and decreased feeding within this range. The 187dB cumulative threshold for injury to fish greater than 2g is expected to be 39 meters from the pile. The 183dB cumulative threshold for injury to fish less than 2g is expected to be 71 meters from the pile. The peak 206dB threshold for injury is expected to be 10 meters from the pile. Impacts to fish within this range includes injury or death. Due to the timing of the activity, actual numbers for each species is expected to be low.
4) Take in the form of harm to listed fish from loss and degradation of riparian habitat leading to injury and death by creating habitat conditions that decrease productivity and prey availability and increase predation associated with the riparian removal and new bridge components. The total area of permanent riparian vegetation removal is 2.26 ac.

5) Take in the form of harm to listed fish from temporary effects of sedimentation and turbidity during pile driving, gravel pad placement and construction activities, leading to displacement, decreased feeding, and increased predation.

If the total acreage of gravel pad placement for the project exceeds 0.95 ac by more than 10 percent (0.095 ac), then anticipated take levels described are also exceeded, triggering the need to reinitiate consultation. If monitoring indicates that sound levels greater than 206 dB peak, 187 dB or 183 dB cumulative SEL, or 150 dB RMS extend beyond the above described expected distances for pile size and attenuation type, work should stop and NMFS should be contacted within 24 hours, to determine if incidental take has been exceeded, or if sound levels can be reduced. If the above described area for riparian removal are exceeded, the anticipated incidental take level described would be exceeded, triggering the need to reinitiate consultation.

2.9.2. Effect of the Take

In the biological opinion, 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 the species or destruction or adverse modification of critical habitat.

2.9.3. Reasonable and Prudent Measures

"Reasonable and prudent measures" are 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 to minimize incidental take of listed anadromous fish during CIDH pile installation;
2. Measures shall be taken to minimize the effect of temporary and permanent habitat loss of riverine and riparian habitat;
3. Measures shall be taken to minimize the number of piles used and duration of pile driving and its potential impacts on listed salmonids and sturgeon, and to monitor the range and distance of high underwater sound levels generated by pile driving operations;
4. Measures shall be taken to minimize sedimentation events and turbidity plumes.
5. Caltrans shall monitor and report on the amount or extent of incidental take, and the progress on the restoration site.

2.9.4. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the Federal action agency must comply (or must ensure that any applicant complies) with the following terms and conditions. The 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 ITS (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. A fish biologist shall be present to recover any individual salmonids or sturgeon entrapped or entrained during the installation of CIDH piles in accordance with the fish salvage plan.

2. The following terms and conditions implement reasonable and prudent measure 2:
    a. Existing vegetation will be protected in place where feasible to provide an effective form of erosion and sediment control as well as watershed protection, landscape beautification, dust control, pollution control, noise reduction, and shade;
    b. To control invasive species, all landscaping and re-vegetation shall consist of Caltrans-approved plants or seed mixes from native, locally adapted species.
    c. Caltrans or the contractor shall monitor and maintain all riparian plantings for five years, and provide irrigation, fertilization and replacement plantings as necessary to ensure full and rapid recovery of disturbed riparian habitat features;
    d. Caltrans shall provide NMFS a post-construction field review and yearly field reviews for five years of the proposed project site, to assure conservation measures were adequately implemented and whether additional plantings are needed to establish adequate riparian vegetation. Caltrans should successfully re-vegetate at a rate of at least 80 percent at the project site. The first review should occur the year following construction completion. The field review shall include the following elements:
        i. Seasonal surveys to determine adequate cover and plant survival throughout the year is being met;
        ii. A survival ratio to ensure planting of new vegetation is implemented during the first five years when necessary; and
        iii. Photo point monitoring shots at the established repair site to be used as a tool to determine success and survival rates. The photos shall be taken annually on the same date, as much as practicable.

3. The following terms and conditions implement reasonable and prudent measure 3:
    a. Attenuation measures shall be used during impact pile driving to control and dampen underwater pressure wave propagation. Effective attenuation measures include:
        i. Use of a bubble curtain around the pile.
        ii. Use of a dual-casing isolation system.
        iii. Use of a cushion block between the hammer and the pile.
    b. Real-time monitoring shall be conducted to ensure that underwater sound levels analyzed in this BO do not exceed the established distances described for pile driving construction. Monitoring shall follow NMFS standard practices of 1-2 hydrophones used, the first being placed at 10 m from the pile, mid-depth in the water column, and the second being placed further away near the isopleth estimated for the cumulative SEL distance;
    c. Caltrans shall monitor underwater sound during all impact hammer pile-driving activities. If underwater sound exceeds the established thresholds at the distances provided above from the piles being driven, then NMFS must be contacted within 24 hours before continuing to drive additional piles.

    d. Caltrans shall submit to NMFS a monitoring and reporting plan that will incorporate provisions to provide daily, monthly, and seasonal summaries of all hydroacoustic monitoring results during the pile driving season for approval at least 60 days prior to the start of construction activities (FHWG 2013). In regards to the daily reports, Caltrans shall submit to NMFS a monitoring report (by close of business of the day following the pile-driving activities) that provides real-time data regarding the distance (actual or estimated using propagation models) to the thresholds (187 dB accumulated SEL and 150 dB RMS) stated in this BO to determine adverse effects to listed species.

4. The following terms and conditions implement reasonable and prudent measure 4:
    a. BMPs shall be implemented to prevent sediment incursion into the active channel.

5. The following terms and conditions implement reasonable and prudent measure 5:
    a. Caltrans shall provide reports of Project construction activities at the Project site and Project restoration activities at Rancho Breisgau to NMFS by December 31 of each construction and restoration year.
    b. The Project construction and restoration activities reports shall include construction and restoration schedules, construction and restoration completions, and details regarding construction and restoration implementation for each given year.
    c. The construction activity report shall also include a summary description of in-water constraint activities, avoidance and minimization measures taken, and any observed take incidents.

Updates and reports required by these terms and conditions shall be submitted (preferably by email) to:

Cathy Marcinkevage
Assistant Regional Administrator
National Marine Fisheries Service
California Central Valley Office
650 Capitol Mall, Suite 5-100
Sacramento California 95814-4607
By email: ccvo.consultationrequests@noaa.gov

2.10. Reinitiation of Consultation

This concludes formal consultation for the Jelly's Ferry Bridge Replacement Project Reinitiation 2023.

Under 50 CFR 402.16(a): "Reinitiation of consultation is required and shall be requested by the Federal agency or by the Service where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and: (1) If the amount or extent of taking specified in the incidental take statement is exceeded; (2) If new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion or written concurrence; or (4) If a new species is listed or critical habitat designated that may be affected by the identified action."

3. MAGNUSON–STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT RESPONSE

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. Under the MSA, this consultation is intended to promote the conservation of EFH as necessary to support sustainable fisheries and the managed species' contribution to a healthy ecosystem. For the purposes of the MSA, EFH means "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity", and includes the physical, biological, and chemical properties that are used by fish (50 CFR 600.10). 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) of the MSA also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH. Such recommendations may include measures to avoid, minimize, mitigate, or otherwise offset the adverse effects of the action on EFH [CFR 600.905(b)].

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 PFMC and approved by the Secretary of Commerce.

3.1. Essential Fish Habitat Affected by the Project

The geographic extent of salmon freshwater EFH is described as all water bodies currently or historically occupied by PFMC managed salmon within the USGS 4th field hydrologic units identified by the fishery management plan (PFMC 2014). This designation includes the Sacramento River for all runs of Chinook salmon that historically and currently use these watersheds (winter-run, spring-run, fall-run, and late fall-run). The Pacific Coast salmon fishery management plan also identifies Habitat Areas of Particular Concern (HAPCs): complex channel and floodplain habitat, spawning habitat, thermal refugia, estuaries, and submerged aquatic vegetation, of which the HAPC for complex channel and floodplain habitat and spawning habitat are expected to be either directly or indirectly adversely affected by the proposed action

3.2. Adverse Effects on Essential Fish Habitat

Effects to Pacific Coast salmon HAPCs for complex channel and floodplain habitat and spawning habitat are discussed in the context of effects to critical habitat PBFs as designated under the ESA and described in section 2.5.2. A list of adverse effects to EFH HAPCs is included in this EFH consultation. The effects are expected to be similar to the impacts affecting critical habitat and include the following: sediment and turbidity, in-channel disturbance from pile driving, and permanent habitat loss/modification.

Sediment and turbidity

- Degraded water quality
- Reduction/change in aquatic macroinvertebrate production

In-channel disturbance from pile driving

- Channel disturbance and noise pollution from pile driving activity and associated piles

Permanent habitat loss/modification

- Reduced shelter from predators
- Reduction/change in aquatic macroinvertebrate production
- Reduced habitat complexity

3.3. Essential Fish Habitat Conservation Recommendations

NMFS determined that the following conservation recommendations are necessary to avoid, minimize, mitigate, or otherwise offset the impact of the proposed action on EFH.

1) Caltrans should recommend to contractors to use biodegradable lubricants and hydraulic fluid in construction machinery. The use of petroleum alternatives can greatly reduce the risk of contaminants from directly or indirectly entering the aquatic ecosystem.

Fully implementing these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in section 3.2, above, for Pacific Coast salmon.

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 the measures proposed by the agency for avoiding, minimizing, mitigating, or otherwise 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 opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion 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 opinion Caltrans and Tehama County. Other interested users could include the U.S. Fish and Wildlife Service or California Department of Fish and Wildlife. Individual copies of this opinion were provided to Caltrans. The document will be available within 2 weeks at the NOAA Library Institutional Repository (https://repository.library.noaa.gov/welcome). The format and naming adhere 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 part 600.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this opinion 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 and MSA implementation, and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

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