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-2021-02831

May 20, 2022

Nancy A. Haley
Section Chief, CA North Section
Sacramento District, California North Section
U.S. Army Corps of Engineers
1325 J Street, Room 1350
Sacramento, California 95814-2922

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson–Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Adobe Road Bank Stabilization Project in Red Bluff, California.

Dear Ms. Haley:

Thank you for your letter of October 21, 2021, 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 the Adobe Road Bank Stabilization Project (SPK-2020-00748).

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. NMFS concluded that the action would adversely affect the EFH of Pacific Coast Salmon. Therefore, we have included the results of that review in Section 3 of this document.

Based on the best available scientific and commercial information, the biological opinion concludes that the Adobe Road Bank Stabilization Project (Project) (SPK-2020-00748) is not likely to jeopardize the continued existence of the federally listed endangered Sacramento River winter-run Chinook salmon evolutionarily significant unit (ESU) (*Oncorhynchus tshawytscha*), the threatened Central Valley spring-run Chinook salmon ESU (*O. tshawytscha*), the threatened California Central Valley steelhead distinct population segment (DPS) (*O. mykiss*), or the threatened southern DPS of North American green sturgeon (*Acipenser medirostris*), and is not likely to destroy or adversely modify their designated critical habitats. 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.

As described in the terms and conditions section of the attached biological opinion, the U.S. Army Corps of Engineers (Corps) will provide NMFS with a post-construction report within

three months following completion of the Project describing extent of critical habitat altered and completion dates. The Applicant will provide NMFS with notification of any incidental take that occurred as a result of this Project and the planting success and monitoring reports. Additionally, the Corps will provide notification that the applicant provided the construction crew with the attached biological opinion outlining their requirements and obligations under this opinion. NMFS further requests that the Corps provide us with a notice of implementation of any of the conservation recommendations provided.

Please contact Yvette Redler-Medina, NOAA Affiliate, California Central Valley Office in Sacramento, CA at (916) 539-7066 or via email yvette.redler-medina@noaa.gov 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 151422-2021-SA00129
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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]

The Adobe Road Bank Stabilization Project

NMFS Consultation ECO Number: WCR2021-02831

Action Agency: U.S. Army Corps of Engineers

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?
Sacramento River winter-run Chinook salmon *(Oncorhynchus tshawytscha)* Evolutionarily Significant Unit (ESU)	Endangered	Yes	No	Yes	No
Central Valley spring-run Chinook salmon *(O. tshawytscha)* ESU	Threatened	Yes	No	Yes	No
California Central Valley steelhead *(O. mykiss)* Distinct Population Segment (DPS)	Threatened	Yes	No	Yes	No
Southern DPS of North American green sturgeon *(Acipenser medirostris)*	Threatened	Yes	No	No	NA

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

A. Catherine Marcinkevage

Issued By: Cathy Marcinkevage
Assistant Regional Administrator for California Central Valley Office

Date: **May 20, 2022**

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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 reviewed the United States Army Corps of Engineers (Corps) consultation request and the Biological Assessment (BA) submitted with the request. Where relevant, we have adopted the information and analyses provided and/or referenced only after our independent, science-based evaluation confirmed they meet our regulatory and scientific standards.

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available 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 NMFS California Central Valley Office (CCVO).

1.2. Consultation History

- On October 21, 2021, NMFS' CCVO received consultation initiation requests and a BA (Vestra 2020) from the Corps for bank stabilization projects for four individual applicants residing on Adobe Road in Red Bluff, CA. Due to the proximity of the applicants and the shared BA, NMFS consolidated the requests into one consultation known as the Adobe Road Bank Stabilization Project (Project).
- On November 3, 2021, NMFS requested additional information on details of the Project including assurances that in-water work would be avoided and clarifications on avoidance and minimization measures to be implemented.
- On November 23, 2021, NMFS received notification from the Corps that one of the four applicants had completed unauthorized work on their property.
- On December 2, 2021, NMFS and the Corps had a phone call to discuss the violation that occurred on 22321 Adobe Road. NMFS decided to provide a notification letter to the owner and applicant of that address and include the Corps in our correspondence to assist the ongoing investigation. We also agreed on the continuation of the consultation for the other three applicants upon receipt of our information request from November 3, 2021.

- On December 16, 2021, we received an update from the Corps that the applicants needed more time to compile and respond to the requested information and we agreed to extend the timeline to the first week of January 2022.
- On January 5, 2022, we received responses to our insufficiency request and formal consultation was initiated.

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 MSA, Federal action means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a Federal Agency (50 CFR 600.910). The Corps regulatory authorities for discharge or fill in Waters of the United States (WOTUS) occur under Section 404 of the Clean Water Act of 1972, as amended (33 U.S.C. § 1344 *et seq*.), and Section 10 of the Rivers and Harbors Act of 1899, as amended (33 U.S.C. § 403 *et seq*.).

The Corps is proposing to permit bank stabilization activities for three private landowners whose property abuts the northern bank of the Sacramento River (approximate river mile [RM] 249). The properties are located on Adobe Road in the city of Red Bluff in Tehama County, CA. Each project includes stabilization and armoring on the bank of the Sacramento River. The bank of the river is severely eroded along several portions of the properties. In these areas, the bank will be restored with rock slope protection (RSP). The remaining areas of the bank along the properties will also be armored with RSP to prevent future erosion. Within the RSP, willow cuttings with also be planted. Without stabilization, the bank along these properties is at risk of eroding further causing potential damage to property structures.

1.3.1. Project Description

The proposed stabilization activities would occur on three discontiguous properties located on Adobe Road. The general site information of each property is summarized in Table 1. The activities include the placement of 16-inch minimum (200-pound) RSP along the bank of the Sacramento River on each property to protect against future erosion and loss of the bank. Before the placement of RSP, portions of the bank will be excavated to form a slope of 1:1 or 1.5:1. Soil will be excavated, RSP fabric will be placed, and the RSP will be installed approximately 2.5 feet thick.

Table 1. Adobe Road property area details. Includes approximate permanent impact to critical habitat.

Lot Address	Lot Number	Assessor's Parcel Number	Approx. Bank Length in Project Area	Approx. Permanent Impact to Critical Habitat
22327 Adobe Road	8	027-170-011-000	70 feet	0.01 acre
22339 Adobe Road	10	027-160-014-000	85 feet	0.01 acre
22357 Adobe Road	13	027-160-011-000	90 feet	0.01 acre

22327 Adobe Road (Lot 8)

Significant erosion has occurred both upstream and downstream of this property. RSP will be placed at a slope of 1:1.5 (~33 degree angle). Vegetation that will be impacted includes Santa Barbara sedge (*Carex barbarae*) and blackberry. No mature healthy trees will be removed. The total volume of RSP to be placed is approximately 87 cubic yards (CY) of which, 45 CY will be placed beneath the ordinary high-water mark (OHWM) of the Sacramento River.

22339 Adobe Road (Lot 10)

Significant erosion has occurred both upstream and downstream of this property. RSP will be placed at a slope of 1:1 (50 degree angle). In addition, a large hole that has eroded on the bank near the western end of the property will be filled with RSP so the river does not cut further into the bank in this area. Vegetation that will be impacted includes a dense mat of Santa Barbara sedge *(Carex barbarae)* and blackberry. The total volume of RSP to be placed will be approximately 40 CY. Approximately 19 CY of RSP will be beneath the OHWM of the Sacramento River.

22357 Adobe Road (Lot 13)

The bank of this property has cracked in the past, separating several feet from the edge of the riverbank, indicating the bank is not stable. RSP will be placed at a slope of 1:1 (50 degree angle). Vegetation that will be impacted includes the annual grass lawn. The total volume of RSP to be placed will be approximately 77 CY of which, 44 CY will be placed beneath the OHWM of the Sacramento River.

Construction Equipment

An excavator and tracked loader will be used to remove material from the bank of the Sacramento River as well as to place RSP. An extended boom may be needed for the excavator to reach some areas of the steep bank. Vegetation will be removed during excavation or by use of hand tools such as chainsaws, weedeaters, or handsaws. The excavator and loader will be operated from the top of the bank of the river. Site grading will be accomplished by using the excavator to pull material back from the riverbank to prevent fall back into the river.

Work Window/Construction Schedule

Construction activities may occur between October and March when dam releases are reduced and the project area is naturally dewatered. Bank stabilization construction activities will only occur when the work area on each property is naturally dewatered during low flows in the Sacramento River. The work areas on each property become naturally dewatered when flows, as measured at the Bend Bridge gauging station (USGS 11377100), are less than 7,000 cubic feet per second (cfs). Dam releases are reduced by late October and absent precipitation events, flows will likely be below 7,000 cfs and Project work could commence and be completed in the fall of 2022. Estimated time to complete the construction activities is two-three days for each property (total of six-nine days for Project completion). Work on each lot is anticipated to be scheduled separately.

Project activities within the riparian zone shall be limited to periods of low rainfall (less than 1/4 inch per 24-hour period), periods with less than a 40% chance of rain, or dry weather periods. The BA states that the Applicant will monitor the National Weather Service (NWS) 72-hour forecast for the project area. If rain is predicted based on the above criteria, within 72 hours during project activity, all activities shall cease until no further rain is forecast. All work will be completed during daylight hours.

Vegetation Removal and Management

The Project will not include removal of any mature, living trees (trees with a trunk greater than (>) 4 inches-in-diameter at breast height (4.5 feet above the ground). The removal of native vegetation will be avoided. Trees within the repair area identified for protection and outside the work limit may require trimming for equipment clearance.

Following the placement of RSP, the area disturbed by construction activities will be planted with native vegetation similar to that currently existing on the bank of the river at each property. Native willow pole cuttings will be planted on Lot 8 and Lot 10 and may consist of species including sandbar willow (*Salix exigua)*, red willow (*Salix laevigata),* and arroyo willow (*Salix lasiolepis),* harvested from local stands near the activity area or procured from a nursery. Approximately 20 cuttings will be installed on each property within the RSP. If feasible, the cuttings will be planted deep enough to extend into the summer water table, therefore it is not anticipated watering will be required. The stakes can be watered during summer months for the first 1 to 2 years until willows are established if needed. The proposed monitoring and success criteria are included in Table 2. Additional native species will be planted on any disturbed areas of the bank above the RSP.

Table 2. Willow Pole Monitoring and Success Criteria

Monitoring Year	Survivorship of Plantings
Year 3	90% (18 plants)
Year 5	80% (16 plants)

On Lot 13, construction activities will not result in the loss of riparian vegetation. Lot 13 currently contains only lawn and grass within the activity area. Areas disturbed by construction

activities will be seeded with a native erosion control seed mix. Disturbed areas where the lawn is currently present will be replanted with lawn grass.

1.3.2. Avoidance and Minimization Measures (AMMs)

The following AMMs and Best Management Practices (BMPs) will be used during project construction.

Protection of Water Quality

a. Silt fencing will be installed around the project areas to prevent sediment from entering the Sacramento River;
b. Straw wattles and silt fences will be used to contain sediment from the bank. Straw wattles and silt fences will be placed at the toe of the slope during excavation and rock placement;
c. Turbidity and settleable solids will be monitored to maintain compliance with the Corps Section 404 and the State Water Resources Control Board 401 permit requirements. If exceedances occur, work will be slowed or paused to allow turbidity to subside before resuming project activities with the stream channel;
d. Since active construction on each property is only anticipated to occur over 2 to 3 days, work can be avoided during rainfall through monitoring of the NWS forecast;
e. If a precipitation event occurs during active construction, work will be halted, and the site will be stabilized by placing geotextiles, plastic covers/erosion control blankets or mats over disturbed areas to protect soil from erosion by water until precipitation has ended;
f. The number of access routes and size of staging and work areas will be limited to the minimum necessary to conduct the repairs;
g. To the extent feasible, work areas will be clearly marked with flagging or fencing. Work will only occur within the marked limits;
h. Equipment will be inspected prior to arrival at the construction area and physical removal, chemical treatment and/or freezing of equipment will be used if needed to avoid the spread of invasive species (*i.e*., mussels, snails, fungus, seeds, *etc*.);
i. All vehicles at staging areas or worksites will be inspected daily for leaks and any leaks will be fixed prior to the start of project work;
j. All construction equipment staging and refueling will be restricted to areas located in an upland area away from water;
k. Spill prevention and cleanup kits will be stored in close proximity to construction areas;
l. All project-related trash items will be removed form repair sites daily and disposed of at an appropriate offsite location.

Minimization of Impacts to Listed Species and Critical Habitat

a. All bank stabilization activities will occur in the dry when the work area is naturally dewatered;
b. A designated biologist or biological monitors will be present during construction to monitor project activities to help minimize disturbance of critical habitat and avoid incidental take of covered species;

c. The designated biologist or monitors will be authorized to stop repair activities that, in the biologist's opinion, threaten to cause unanticipated and/or unpermitted adverse effects to covered species and habitat;
d. Environmental awareness training will be provided by the designated biologist to any personnel working on construction sites. This training will include descriptions of all special-status species potentially occurring in the repair area;
e. The amount of revetment and similar materials used for bank protection and other repair activities will be limited to the amount necessary to ensure proper flood protection;
f. If erosion control fabrics are used, products will not be used with plastic monofilament or cross-joint in the netting that are bound/stitched (such as straw wattles, fiber rolls or erosion control blankets), which could trap fish, frogs and other wildlife;
g. The clearing of vegetation will be kept to the minimum necessary and the affected areas will be revegetated with appropriate native plants.

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 Central Valley (CV) spring-run Chinook salmon, California Central Valley (CCV) steelhead and the Southern DPS (sDPS) of North American green sturgeon 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 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.

Table 3. Description of species, current ESA listing classifications, and summary of species status.

Species and Recovery Plans	Listing Classification and Federal Register Notice	Status Summary
Sacramento River winter-run Chinook salmon evolutionarily significant unit (ESU) Final Recovery Plan for the Evolutionarily Significant Units of Sacramento River 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 NMFS 5-year species status review (NMFS 2016c), the status of the 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 winter-run Chinook salmon ESU viability. The overall status of the 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 has been incorporated into the analysis of this consultation and will be reflected in an updated 5-year status review in 2022.
Central Valley spring-run Chinook salmon ESU CV salmonid recovery plan (NMFS 2014)	Threatened, 70 FR 37160; June 28, 2005	According to the NMFS 5-year 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. Monitoring data showed sharp declines in adult returns from 2014 through 2018 (CDFW 2018). Viability information since the 2015 viability assessment has been incorporated into the analysis of this consultation and will be reflected in an updated 5-year status review in 2022.

Species and Recovery Plans	Listing Classification and Federal Register Notice	Status Summary
California Central Valley steelhead distinct population segment (DPS) CV salmonid recovery plan (NMFS 2014)	Threatened, 71 FR 834; January 5, 2006	According to the NMFS 5-year 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 in danger of extinction. 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 has been incorporated into the analysis of this consultation and will be reflected in an updated 5-year status review in 2022.
Southern DPS of North American green sturgeon Recovery Plan for the Southern Distinct Population Segment of North American Green Sturgeon *(Acipenser medirostris)* (NMFS 2018)	Threatened, 71 FR 17757; April 7, 2006	According to the NMFS 5-year 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 4**.** Description of critical habitat, listing, and status summary.

Critical Habitat	Designation Date and Federal Register Notice	Description
Sacramento River 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 winter-run critical habitat in the Sacramento River are significantly limited and degraded, the habitat remaining is considered highly valuable.

Critical Habitat	Designation Date and Federal Register Notice	Description
Central Valley 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 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 CV spring-run Chinook salmon critical habitat in the Central Valley are significantly limited and degraded, the habitat remaining is considered highly valuable.
California Central Valley 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 CCV steelhead 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
Southern DPS 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.

The following list are continued limiting factors in common to all of the above species:

- Dams block access to historical spawning and summer holding areas along with altering river flow regimes and temperatures (up to 90 percent for winter-run and spring-run Chinook salmon).
- Water management/Diversions/Barriers
- Loss of floodplain rearing habitat (levees/bank protection)
- Urbanization and rural development
- Logging
- Grazing
- Agriculture
- Mining – historic hydraulic mining from the California Gold Rush era
- Estuarine modified and degraded, thus reducing developmental opportunities for juvenile salmon
- Predation
- Dredging and sediment disposal
- Contaminants
- Altering prey base for fish (especially for sDPS green sturgeon)
- Fisheries
- Hatcheries
- 'Natural' factors (e.g. ocean conditions)
- Climate change exacerbating flow and water temperature related impacts (see below for more detail)

2.2.1. Recovery Plans

In July 2014, NMFS released a final Recovery Plan for winter-run Chinook salmon, CV spring-run Chinook salmon, and CCV steelhead (NMFS 2014). 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 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. Spring-run Chinook salmon adults are vulnerable to climate change because they over-summer in freshwater streams before spawning in autumn (Thompson *et al.* 2011). Spring-run Chinook salmon spawn primarily in the tributaries to the Sacramento River, and those tributaries without cold water refugia (usually input from springs) will be more susceptible to impacts of climate change. 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.

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 long term projections, 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 Project is located along approximately 500 linear feet on the north bank of the Sacramento River (RM 249), northeast of Red Bluff, California. The action area ranges from 260 to 290 feet above mean sea level. Within the action area, three discontiguous discrete property lots on the Sacramento River bank will be altered; Lot 8 at 70 linear feet, Lot 10 at 85 linear feet and, Lot 13 at 90 linear feet. The action area is approximately 0.3 acres including staging areas and zones of short-term and long-term effects of the Project. Approximately 0.01 acres of critical habitat will be altered on each lot. In total, approximately 0.03 acres of designated critical habitat would be permanently impacted. The action area also includes an additional 250 feet downstream and 100 feet upstream from each property lot to account for where effects of turbidity, hydroacoustic sound, or pollution is expected to occur.

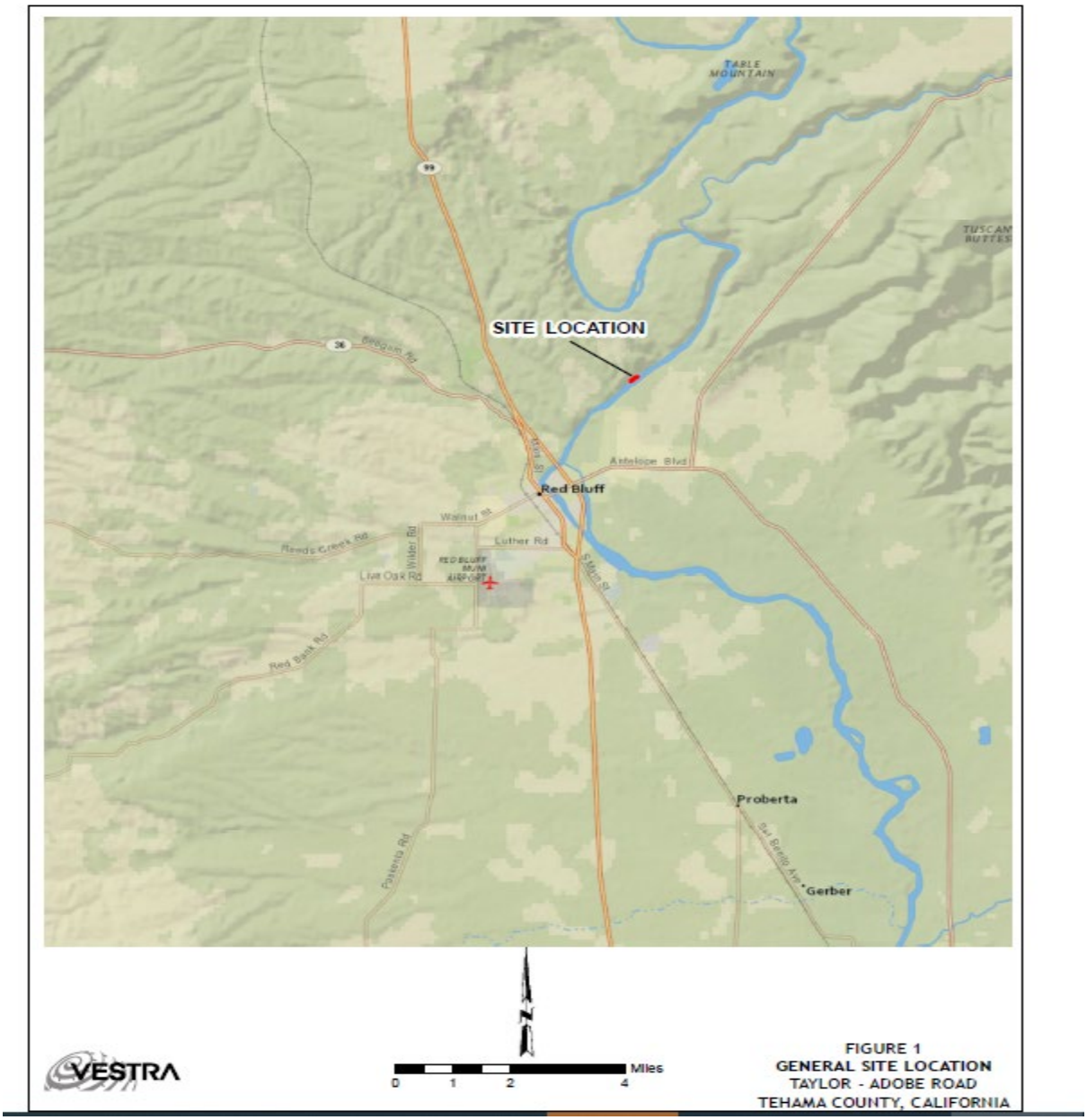

Figure 1. Project Location on the Sacramento River Source: VESTRA 2021

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 powerplants. 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 Red Bluff Diversion Dam (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.

2.4.1. Hydrology

Flows in the upper Sacramento River are regulated by Shasta Dam and released 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 handbook (SRCAF 2003). In late October and early November releases are decreased. Periods of flow below 7,000 cfs, as measured at the Bend Bridge gauge, can occur between October and May. However, high flows also occur during this period but are dependent on precipitation events. The Sacramento River flows to the southwest in the project area and flows are also 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. 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 Central Valley Project (CVP) and State Water Project (SWP) (NMFS 2019), 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.

2.4.3. Land Use

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).

2.4.4. Predation

Sacramento pikeminnow and striped bass congregate downstream of the Keswick 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) is the primary spawning ground for winter-run Chinook salmon and has only recently been supplemented with reintroduced spawning in Battle Creek in 2020. The upper Sacramento River 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 use 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. Sacramento River winter-run Chinook salmon

The distribution of winter-run Chinook salmon spawning and early life stage rearing historically included the upper Sacramento River (upstream of Shasta Dam), McCloud River, Pitt River, and Battle Creek, where springs provided cold water throughout the summer, allowing for spawning, egg incubation, and rearing during the mid-summer period (Yoshiyama *et al.* 1998). The construction of Shasta Dam in 1943 blocked access to approximately 299 miles of tributary spawning habitat in the upper Sacramento River above the dams (NMFS 2014). Battle Creek was still accessible below the dams but had its own impediments to upstream migration (*i.e.*, a number of small hydroelectric dams situated upstream of the Coleman National Fish Hatchery weir). The fish from the populations above Shasta Dam were forced to mix and spawn as one population downstream of Keswick Dam on the Sacramento River. This single population of winter-run Chinook salmon has been supported by cold-water management operations at Shasta Dam. Construction and operation of hydropower facilities in Battle Creek made the creek inhospitable to winter-run Chinook salmon, which resulted in extirpation of the population from that area. However, implementation of the Battle Creek Salmon and Steelhead Restoration Project and the Jumpstart Project (USFWS 2018b) resulted in renewed spawning opportunity for winter-run Chinook salmon in Battle Creek. In March and early April of 2018, progeny of the winter-run Chinook salmon captive broodstock were released into the North Fork Battle Creek. In April of 2020, it was observed that over 1,000 winter-run adult Chinook salmon volitionally passed into the upper reaches of Battle Creek. Both redds and live adult winter-run Chinook salmon were documented (Laurie Earley, USFWS Red Bluff, CA, unpublished data). On July 30, 2020, the U.S. Fish and Wildlife Service (USFWS) captured the first winter-run Chinook salmon fry in the upper Battle Creek rotary screw trap, indicating that Battle Creek can successfully support winter-run Chinook salmon adult spawning and juvenile production.

As reported by NMFS (2014), historical 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, 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 in the raised position, and restrictions in ocean harvest, have likely prevented the extinction of natural-origin 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 winter-run Chinook salmon smolts into the upper Sacramento River. This program and the captive broodstock program (phased out in 2007) were instrumental in stabilizing the winter-run Chinook salmon population

following very low returns in the 1990s. Since the last 5-year status review (NMFS 2016), the description of the hatchery program at LSNFH has been revised to include the captive broodstock component that was restarted in 2015 after being implemented from 1991 to 2007 and then discontinued. The source of fish for both the captive broodstock program and the supplementation program is local, natural-origin winter-run Chinook salmon from the upper Sacramento River. The revised description now defines the Sacramento River winter-run Chinook salmon ESU as including: ‘‘Naturally spawned winter-run Chinook salmon originating from the Sacramento River and its tributaries. Also, winter-run Chinook salmon from the following artificial propagation programs: The Livingston Stone National Fish Hatchery (supplementation and captive broodstock)’’ (85 FR 81822, December 17, 2020).

Data on the temporal distribution of 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). Since carcass surveys began in 2001, the highest adult escapement occurred in 2005 and 2006 with 15,839 and 17,296, respectively. Since 2007 winter-run Chinook salmon have declined in abundance with a low of 827 spawning adults in 2011 (NMFS 2016). As reported in the most recent 5-year status review (NMFS 2016), the 10-year trend in run size is -0.15 which suggests an annual 15 percent 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 2016). The 2012 to 2015 drought increased water temperatures in the Sacramento River. This caused significantly high 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 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 winter-run Chinook salmon escapement estimate (2,458) improved from 2017 (1,155), though was dominated by hatchery-origin fish. In 2017, an estimated 85 percent of the adult winter-run Chinook salmon spawners 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. However, because the increased abundance was attributed to hatchery-origin adult returns, hatchery influence was also increased presenting risks such as increased domestication selection. The percentage of hatchery-origin spawners was also high during 2018 (82%), but decreased substantially in 2019 (37%). In 2019, the total number of mainstem in-river spawners observed was 7,852. This included 2,873 hatchery-origin fish (36.6%) and 4,979 natural-origin fish (63.4%). The return to normal hatchery production levels in 2016 is expected to continue to reduce the percentage of hatchery-origin spawners during subsequent years. However, preliminary information for the 2020 draft 5-year status review will indicate an increased risk of extinction because of the elevated hatchery influence on the population in recent years. In early 2020, Thiamine Deficiency Complex (TDC) had been documented in a number of different Chinook salmon stocks throughout the Central Valley. Abnormal swimming behavior as well as unusually high mortality in natural and hatchery juvenile populations prompted vigorous testing to determine the cause. Scientists hypothesize that TDC is the result of an ecological chain of events in 2019 that led adult Central Valley Chinook salmon in the ocean to feed heavily on

northern anchovy concentrated off the central California Coast Anchovy produce an enzyme called thiaminase, which breaks down thiamine in salmon, and is suspected of contributing to TDC. This simplification of what is typically a more diverse salmon diet exposed salmon to increased levels of thiaminase, leading to thiamine deficiency. Adult Chinook salmon that are thiamine deficient produce offspring with TDC, often resulting in elevated early life stage mortality. Thiamine bath treatments and injections into adult female winter-run Chinook salmon broodstock with thiamine have helped to increase early life-stage survival in juvenile Chinook salmon.

In summary, the most recent biological information suggests that the extinction risk of this ESU has increased since the last status review due to high hatchery influence on the species. The best available information on the biological status of the ESU and new threats to the ESU indicate that its ESA classification as an endangered species is appropriate and should be maintained. However, with the promising improvements to, and expansion of, habitats necessary for the recovery of the species, it is possible that the status of the winter-run Chinook salmon ESU could be downgraded to threatened in the future.

2.4.5.2. CV spring-run Chinook salmon

The mainstem of the upper 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 upper mainstem Sacramento River (above 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. The physical habitat conditions in the mainstem Sacramento River are capable of supporting CV spring-run Chinook salmon, although in some years high water temperatures can result in substantial levels of egg mortality. The current estimate (2010-2020) for spring-run Chinook salmon escapement in the upper Sacramento River is very low, with only three out of ten years indicating a small adult presence (CDFW 2021). 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 believed 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.

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 2016b). In the two years prior to the 2016 5-year status review, steelhead returns averaged 2,895 fish (NMFS 2016b). 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 2016b).

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 2016b). 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, NMFS 2021). However, recent spawning events have been confirmed in the Yuba and Feather Rivers and adult green sturgeon have consistently been seen congregating within potential spawning habitat of these rivers (Beccio 2018, 2019, Seesholtz *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 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. It is likely that downstream emigration from the spawning grounds begins in early to late fall when water temperatures fall below the optimum necessary to promote grow (Mayfield and Cech 2004, Poletto *et al.* 2018). 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 2018). 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 juvenile 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 further upstream for winter-run Chinook salmon. sDPS green sturgeon spawning habitat consists of deep pools that are subject to dynamic flows and are known to be present below and above the action area. Spawning habitat is primarily in Sacramento River 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. Temperatures in California have risen almost 3°F since the beginning of the 20th century (Frankson *et al.* 2022). In the 126-year period of record (1895–2020), the six warmest years have all occurred since 2014 (2014-2020 excluding 2019). The 2015–2020 period saw the highest number of extremely hot days. The greatest number of very warm nights has occurred since 2005, including the six years with the highest values while the number of cold nights has been below average since 1995 (Frankson *et al.* 2022). The warming temperatures are a threat to the viability of salmonids since life stages are temperature dependent and California is historically the southernmost temperate range.

Warmer temperatures associated with climate change reduce snowpack and alter the seasonality and volume of seasonal hydrograph patterns (Cohen *et al.* 2000). 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 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 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 (USBR 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 winter-run Chinook salmon habitat available downstream of Keswick Dam. It is imperative for additional populations of 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 and the Yuba 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.

2.4.8. Species Survival and Recovery in the Action Area

Multiple life stages for winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and sDPS green sturgeon utilize the Sacramento River. The upper Sacramento River has a high value 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 is needed for these species to continue to survive and recover within the action area. The recovery plan for winter-run Chinook salmon, CV spring-run Chinook salmon, and CCV steelhead identifies the mainstem Sacramento as a core 1 population for winter-run Chinook salmon, a core 2 population for CV spring-run Chinook salmon, and a core 2 population for CCV steelhead (NMFS 2014). Core 1 populations have a known ability or potential to support independent viable populations. 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, 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 downstream of 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).

2.5.1. Effects of the Proposed Action to Listed Species

The effects analysis 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. The Project will occur after the summer when dam releases in the Sacramento River are reduced (typically late October) and bank repair areas are exposed thus avoiding in-water work. Duration of construction activity for the Project is not anticipated to exceed nine days. The action area is critical migratory and rearing habitat for multiple listed species who will be exposed to Project effects based on life histories unique to each species as described below.

2.5.1.1. Species Presence in the Action Area

Adult migration of winter-run Chinook salmon in the action area occurs between December and July, with peaks occurring before April (NMFS 2014). The majority of winter-run spawning occurs between RBDD and Keswick Dam primarily between May and August (NMFS 2014).

Adult spring-run Chinook salmon typically migrate towards the action area between March and September, with peaks in May and June (Yoshiyama *et al.* 1998; Moyle 2002). Most spring-run spawn in tributaries below the action area and very few may spawn in the Sacramento River. Some spring-run will spawn in tributaries above the action area including Clear Creek and Battle Creek. Typically, adult steelhead may be in the action are between September to October with spawning in tributaries below and above the action area occurring between December and April (Williams 2006).

Data on juvenile migration of Chinook salmon within the action area is readily available due to long-term rotary screw trap monitoring at RBDD (Table 5) which is located approximately 5 miles downstream from the Project. Winter-run Chinook salmon juveniles may be in the action area during the proposed project. However, it is likely that up to 75 percent of juveniles will have migrated past the action area by November (Table 5). Spring-run Chinook salmon and steelhead spawn in some tributaries of the upper Sacramento River and juveniles will migrate past the action area as young-of-year or yearlings. It is likely that most spring-run juveniles will migrate through between March and April and most steelhead juveniles will migrate through during the summer (Table 5).

Table 5. Juvenile Chinook Salmon Migration timing near Action Area.

Juvenile Migration Timing Red Bluff Diversion Dam (2007-2020 Brood Year)

Percent Passage (median)	5%	50%	75%	95%
Winter-run	08/27	10/06	10/27	12/10
Spring-run	11/25	03/25	04/09	04/26
Steelhead[1]	4/28	08/04	08/19	09/29

[1] 2007-2021 Source: www.cbr.washington.edu/sacramento/data/query_hrt.html (courtesy RBDD data)

Upstream migration and spawning of adult green sturgeon occurs during the spring and summer, therefore, exposure to construction activities are highly unlikely. Green sturgeon larval migration begins in May and is completed by September so this life stage is also unlikely to be affected by construction activities (Figure 2). Post spawn adult green sturgeon may leave after spawning or hold over summer and out migrate during the first fall flow event (Heublein *et al.* 2008). Juvenile green sturgeon may be present in the Sacramento River year-round and therefore exposed to construction activities.

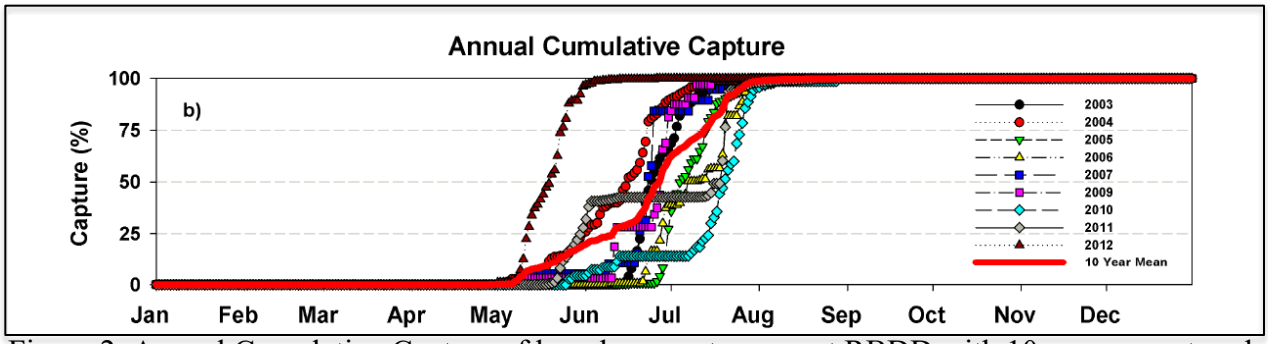

Figure 2. Annual Cumulative Capture of larval green sturgeon at RBDD with 10 year mean trend line (2003-2012). Source: Poytress et al. 2014

2.5.1.2. Specific Impacts under the Proposed Action

The effects analysis will consider the potential short-term impacts to species and critical habitat resulting from the construction components of the proposed action, including:

- displacement, injury or death from river bank work;
- increased turbidity and suspended sediment;
- temporary loss of riparian vegetation; and
- potential for contaminants or hazardous materials entering the water.

Additionally, the analysis will consider the potential long-term impacts to these species and/or critical habitat resulting form completion of the proposed action, including:

- permanent alteration of riverine habitat through the addition of hardscape (*i.e.*, RSP).

Finally, the analysis will consider the potential beneficial impacts to species and critical habitat, including:

- reduction of suspended sediments and turbidity in the river due to erosion control;
- long-term augmentation of riparian vegetation in the action area.

2.5.1.3. Construction Related Effects

Construction-related activities in or near the riverbank have the potential to result in displacement, injury or death to listed fish species. Construction-related effects may include rocks or debris falling into the active channel, tools and/or equipment falling into the active channel, or noise generated by displaced rock and sediment and the operation of construction machinery.

Various species and life stages of listed fish may be present during the construction work window and may be adversely affected by construction-related effects. Adults and juveniles could potentially encounter falling debris that could result in physical injury or death from direct contact. Fish could be startled by construction-related noise or vibration which may alter behavior. An example of a significant short term adverse effect would be cessation or alteration

of migratory behavior or avoidance by juveniles of preferred near shore habitat, potentially increasing predation risk during construction activity. Fish may also be displaced from a position normally occupied in their habitat for short or long durations. Depending on the extent of the disruption resulting in altered behavior, the adverse effects could be varied. This is of particular concern for juvenile fish, as there are innate behaviors that are essential to their maturation and survival such as feeding, sheltering, and migratory patterns.

Based on listed species presence in the action area, the migratory behavior of juvenile salmonids and green sturgeon may be affected by various construction-related effects. Adult salmonids and sturgeon would generally avoid areas of construction activity; therefore, are not expected to be near the bank. Adult salmonids may be migrating up to preferred spawning habitat during the work window but have ample in-river passage area to avoid near bank construction activity. Therefore, migration delays for adult salmonids is unlikely to occur or effects will be minimal. Green sturgeon adults, migrate to and from the upper Sacramento River during the spring and summer and may out-migrate post spawn during flow events. Therefore, they are unlikely to be affected by construction activities occurring in the fall and/or when flows are low.

Fish that are exposed to the project effects of construction activities will encounter short-term (*i.e.*, minutes to hours) construction-related noise and physical disturbance impacts that are expected to result in injury or harm. This is expected to occur through increasing the susceptibility of some individuals to predation by temporarily disrupting normal behaviors and affecting sheltering abilities and potentially crushing or killing juvenile anadromous fish. Several BMPs and AMMs will be implemented to minimize the probability of construction-related effects in the action area, including no in-water work and construction limited to daylight hours. However, a small number of juvenile salmonids and sturgeon are expected to be displaced, resulting in reduced fitness or direct injury and mortality.

2.5.1.4. Increased Turbidity and Suspended Sediment

Increased sedimentation and turbidity in the Sacramento River may result from a number of sources associated with the proposed Project. Site clearing, earthwork, vegetation removal and planting, and placement of RSP will result in disturbance of soil and potential temporary increases in turbidity and suspended sediments. Short-term increases in turbidity and suspended sediment may disrupt feeding activities or result in avoidance or displacement of fish from preferred habitat.

Salmonids have been observed to avoid streams that are chronically turbid (Lloyd 1987) or move laterally or downstream to avoid turbidity plumes (Sigler *et al.* 1984). Chronic exposure to high turbidity and suspended sediment may also affect growth and survival by impairing respiratory function, reducing tolerance to disease and contaminants, and causing physiological stress (Waters 1995). Temporary spikes in suspended sediment may result in behavioral avoidance of the site by fish; several studies have documented active avoidance of turbid areas by juvenile and adult salmonids (*e.g.*, Sigler *et al.* 1984, Lloyd 1987, Servizi and Martens 1992).

Although information is limited about the rearing and migration patterns of green sturgeon juveniles, both adult and juvenile life stages are known to utilize the action area 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). While green sturgeon are lotic fish, as bottom feeders their foraging capacity may not be as impacted as other species due to turbidity and may even be enhanced due to turbidity. Wishingrad *et al.* (2015) found that lake sturgeon (*Acipenser fulvescens*) exhibited greater foraging activity in turbid water than in clear water.

Potential short-term effects of increased sedimentation and turbidity will be minimized using BMPs. No in-water construction activities will occur, as bank stabilization work will take place when the area is naturally dewatered during low flows. In addition, there will be placement of erosion control materials and turbidity and settleable solids will be monitored to maintain compliance with the Corps Section 404 and the State Water Resources Control Board 401 permit requirements. If exceedances occur, work will be slowed or paused to allow turbidity to subside before resuming project activities within the stream channel.

There is still potential for impacts to listed salmonids due to temporary, localized plumes of turbidity expected during bank clearing and RSP installation. However, increased levels of suspended sediment and turbidity during Project activities are anticipated to be minor and localized. The BMPs will minimize the extent of adverse effects associated with the proposed action and any elevated levels of suspended sediment or turbidity are anticipated to rapidly return to background levels after work ceases. Therefore, NMFS expects that adverse effects to listed salmonids are likely to occur but are expected to be short term and minimal. Green sturgeon presence in the action area is expected to be low due to the construction occurring after adult spawning and larval migration. Additionally, green sturgeon are tolerant of levels of turbidity that exceed the levels expected to result from this Project's construction activities thus adverse effects to sturgeon should not occur.

2.5.1.5. Potential for Release of Contaminants or Spills of Hazardous Material

During construction, the potential exists for spills or leakage of toxic substances to enter the Sacramento River. Refueling, operation, and storage of construction equipment and materials could result in accidental spills of pollutants (*e.g.*, fuels, lubricants, sealants, and oil).

High concentrations of contaminants can cause short-term or long-term effects to fish. Immediate effects include mortality from exposure or increased susceptibility to disease that reduces the overall health and survival of the exposed fish. The severity of these effects depends on the contaminant, the concentration, duration of exposure, and sensitivity of the affected life stage. A potential long-term effect of contamination from hazardous material is reduced prey availability; invertebrate prey survival could be reduced following exposure, therefore making food less available for fish. Fish consuming contaminated prey may also absorb toxins directly. For salmonids and sturgeon, potential effects of reduced water quality during Project construction will be addressed with BMPs including measures to prevent spills and contain any materials or waste products. Equipment will be in good working order and free of dripping or leaking fluids. Spill prevention and cleanup kits will be stored in close proximity to construction areas to prevent construction and maintenance materials from entering the river. All construction

equipment staging and refueling will be restricted to areas located in an upland area away from bodies of water.

The BMPs and AMMs described in Section 1.3.2 will minimize the potential risk of spills that could expose listed fish to contaminants, thus adverse effects to listed fish species are not expected to occur.

2.5.2. Effects to Critical Habitat and PBFs

Construction is 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) clean gravel for spawning substrate (3) habitat and prey items that are free of contaminants, and (4) 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 PBFs and food resources, such as organic detritus and terrestrial/aquatic insect availability for juvenile salmonids within the near bank habitat of the action area. This will occur during the short construction window and continue until riparian habitat becomes established in the affected areas. Since no mature riparian trees will be removed, only short-term loss of riparian vegetation and associated food sources will occur. The proposed action will not change sediment composition or alter the benthic communities within the action area, therefore, no meaningful impact to food resources for green sturgeon are likely to occur from this Project.

Possible contamination to habitat or prey items for listed species could occur as a result of this project. Given the BMPs and minimization measures that will be in place to prevent contamination to the river, habitat, and prey items; effects due to pollution or contamination are not likely to occur.

Riparian plantings of willow species will be placed along the bank within the RSP, which is expected to minimize the degraded riparian habitat over the long term. If the planting success criteria is followed, this could result in some level of shaded riverine aquatic habitat. The bank stabilization will reduce sediment or turbidity plumes that may be occurring from the current erosion of the natural bank. Although impacts to constraining natural processes in lateral channel migration tends to degrade critical habitat, it is occurring in a residential area where property loss is at risk and floodplain or side channel habitat would not occur. Therefore, the bio-engineered aspects of the bank stabilization may help restore allochthonous resources and water quality conditions over the long term.

Spawning habitat PBFs will not be affected from Project activities. Winter-run typically spawn further upstream, so deposition of sediment or rock/debris discharge on to spawning habitat is highly unlikely. Spring-run Chinook salmon and CCV steelhead typically spawn in tributaries of

the Sacramento River, so their spawning grounds are not expected to be affected by Project activities. Green sturgeon spawning occurs within the action area if there are suitable deep pools present. However, spawning occurs outside of the construction window and deposition of sediment into suitable spawning habitat is extremely unlikely to occur from this Project. Adequate flow, water depth and sediment quality for all life stages of green sturgeon will not be impacted by the proposed project.

The migratory corridor PBFs for juvenile and adult listed salmonids and green sturgeon will be temporarily affected. Impacts to the migration corridor are only expected to be short-term (during construction) from increased turbidity and ambient construction noise. However, unimpeded passage will be open throughout construction. 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 effects of the project on the PBFs of migratory corridors for all listed species will be short in duration and minimal. Listed species 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.

2.5.2.1. Permanent Alteration of Riverine Habitat through Addition of Hardscape

The placement of RSP associated with the proposed action will permanently modify 0.03 acres of critical habitat below the OHWM. Projects involving bank stabilization and in-channel construction will result in permanent alteration of channel morphology and hydrology. Constricting a natural channel puts a stream into a state of disequilibrium; scour and bank degradation will increase downstream until the system reaches a new state of equilibrium (Henderson 1986; Simon and Johnson 1999). Where channel width is reduced, water velocity will increase and cause corresponding increases in shear stress and degradation along stream banks (Simon and Johnson 1999). Over time, this mechanism widens the stream channel to accommodate the new flow regime, if left unchecked. More typically, this process is halted by stabilizing stream banks with rock or organic materials, thereby preventing bank degradation. The purpose of bank stabilization projects is to constrict stream channels, preventing lateral channel movement and, often, damage to adjacent property or infrastructure. As before, this constriction leads to higher flow velocities, increased scour, and downstream bank degradation in addition to channel incision within the constricted reach. Thus, not only does bank stabilization and in-channel construction alter hydrologic and geomorphic processes, but the impacts of these projects can propagate both upstream and downstream of the project site. Bank stabilization from this Project is highly unlikely to affect PBFs of critical habitat for green sturgeon due to their lotic nature and known feeding habits. Channels modified with hard materials create relatively simple and homogenous habitats that are less suitable for rearing salmonids (Schmetterling at al. 2001; Fischenich 2003; Hellmair *et al.* 2018). Bioengineered elements will be included within the hardscape in an effort to dissipate flow and create complex habitat. Therefore, although altered channel morphology and hydrology from hardscape will likely diminish PBFs of critical habitat for salmonids, the small footprint of the Project and the bioengineered components will not appreciably reduce suitable habitat within this stretch of the river.

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. 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.

2.6.2. 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. Bank stabilization projects constrict stream channels, preventing lateral channel movement and, often, this constriction leads to higher flow velocities, increased scour, and downstream bank degradation. The impacts of these projects can

propagate both upstream and downstream of the project site resulting in more bank stabilization activity and/or permit requests.

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.

Sacramento River 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. 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.

2.7.1. Summary of the Project Effects to Listed Species

The proposed Project has the potential to affect adult and juvenile winter-run Chinook salmon, CV spring-run Chinook salmon, and CCV steelhead; and adult, juvenile, and subadult sDPS green sturgeon due to the action area being located in upper Sacramento River. As discussed in the environmental baseline (Section 2.4), the upper Sacramento River is the primary spawning ground for winter-run Chinook salmon and sDPS green sturgeon and the migratory route for spring-run Chinook salmon CCV steelhead who spawn in the river or tributaries above the action area. The effects of the action (Section 2.5) may include turbidity events during construction that are expected to result in adverse effects to listed salmonid species from displacement or avoidance behavior, physiological stress such as gill fouling, and reduced foraging capability. Mortality or injury may occur through direct contact if construction materials used for RSP accidently falls into the stream channel. Construction-related noise and vibrations from equipment operation near the river during placement of RSP are also expected to result in adverse effects to listed fish species through behavior modification. All species and life stages present in the action area during active construction will likely be impacted by adverse construction-related effects. The extent of exposure to listed species is minimized by the short duration of construction activities lasting only 3 to 9 days during daylight hours and from work on the river bank being conducted out of water. Adverse effects due to contaminants and pollution are expected to be avoided given the BMPs and avoidance and minimization measures that will be implemented.

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 action described previously in this opinion, the impacts are expected to permanently degrade designated critical habitat for SR winter-run Chinook salmon, CV spring-run Chinook salmon and CCV steelhead. The Project will permanently harden approximately 0.03 acres of bank habitat adversely affecting PBFs for migration and rearing through a minor reduction of near shore cover and food production. The increased urbanization and occurrence of future bank stabilization projects, as described in the cumulative effects section (Section 2.6), may further degrade PBFs of critical habitat for listed salmonids. Short-term turbidity events in this primary migratory corridor will be short-term and minimal for all listed species. Construction effects to green sturgeon critical habitat PBFs are expected to be minimal or highly unlikely to occur. Adverse effects to salmonid critical habitat in the action area will in part be mitigated through bioengineered elements that will likely result in an increase of near bank riparian cover and erosion control of exposed bank through native plant seeding.

2.7.3. Effects of the Proposed Action at the ESU/DPS 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.

The adverse effects to Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and North American green sturgeon within the action area are not expected 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. This is largely due to the fact that although construction is expected to cause adverse effects to some listed salmonids, the impacts will be relatively short in duration and will not occur during peak migration time periods that typically coincide with higher river flows, so that abundance would be low within the project footprint. Winter-run Chinook salmon juveniles will migrate past the action area during the fall but by October nearly 50 percent have already passed and by November, nearly 75 percent of the annual population will likely have passed the action area (Table 5). Since juvenile salmonids often migrate downstream in relation to flow events, the AMM of work occurring during lower flows and avoidance of rain events will help to minimize exposure to winter-run juveniles during the construction window. Adult salmonid migration past the action area should not be impeded since work is on the bank and there is ample in-river channel to avoid short-term construction effects. sDPS green sturgeon will have completed their

spawning runs and larval juvenile will have dispersed from spawning grounds before construction in the fall. Additionally, most of the effects are minimal or minor in nature, not lethal. Construction-related effects 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 hardening of the 0.03 acres of river bank is not expected to have a meaningful impact or appreciably diminish the value of critical habitat as a whole for listed salmonids. Although the Project occurs on the main migratory route of winter-run Chinook salmon, it will not impact spawning habitat or appreciably reduce rearing habitat. Winter-run Chinook salmon spawn much further upstream in all but the wettest of years and ample rearing habitat exists above and below the small footprint of the action area. The Core 1 populations of spring-run Chinook salmon and CCV steelhead spawn downstream of the action area and are unlikely to be exposed to any short or long-term effects. Those that are exposed to project activities within the action area during or after construction will experience short-term loss of riparian vegetation or reduced cover within the small footprint. Over the long-term, Project benefits from riparian plantings should help mitigate for lack of vegetation or cover and help replenish allochthonous materials into the river. sDPS green sturgeon pre-spawn adults will avoid the short-term construction impacts to the migratory corridor based on migration timing and for other life-stages of green sturgeon, impacts to PBFs of critical habitat will not occur from this Project or are minor since sturgeon are lotic and less sensitive to changes in turbidity or riparian habitat.

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, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, or the sDPS of North American green sturgeon or destroy or adversely modify their 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. The

take exemption conferred by this incidental take statement is based upon the proposed action occurring as described in the BO and in more detail in the Vestra Biological Assessment (BA 2020)

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 adult and juvenile winter-run Chinook salmon, adult and juvenile CV spring-run Chinook salmon and adult and juvenile CCV steelhead from impacts during construction and to designated critical habitat PBFs. Incidental take is expected to occur in the form of harassment, harm, injury or mortality of listed fish due to impacts resulting from increased sedimentation and turbidity, construction-related effects, short-term impacts from loss of riparian vegetation and long-term degradation of habitat from addition of RSP into the natural bank. Additionally, NMFS determined that incidental take of adult and juvenile sDPS green sturgeon is reasonably certain to occur from short-term construction-related effects that disrupt behaviors or displace individual fish, resulting in reduced fitness or direct injury and mortality.

NMFS cannot precisely quantify and track the amount or number of individuals per species that are expected to be taken incidentally as a result of the proposed project. This is due to the variability and uncertainty associated with the response of listed species to the effects of the proposed action, the varying population size of each species, annual variations in the timing of migration, individual habitat use within the action area, and difficulty in observing injured or dead fishes. However, it is possible to estimate the extent of incidental take by designating as ecological surrogates, those elements of the project that are expected to result in incidental take. Ecological surrogates are more predictable and/or measurable and monitoring those surrogates will determine the extent to which incidental take is occurring. The most appropriate threshold for incidental take are ecological surrogates of temporary habitat disturbance during the project construction activities.

The behavioral modifications or fish responses that result from habitat disturbance are described below. NMFS anticipates incidental take will be limited to the following forms:

(1) Harassment, harm, or mortality resulting from habitat-related disturbances during construction activities, resulting in turbidity increases that may extend up to 100 feet from the bank and 250 feet downstream of each lot. Increases in turbidity are reasonably certain to result in harm to listed salmonids through modification or degradation of the PBFs for rearing and migration that will result in physiological impacts (i.e., to the gills of fishes), temporary displacement of individuals, reduced feeding, and increased predation. A very small proportion of fish present could potentially die as a result of turbidity increases.

(2) Harassment, harm, or mortality during construction 100 feet beyond the construction footprint in all directions on the river side of the project, from incidental moving, removal, or addition of material into the active channel during placement of the RSP. Salmonids or sturgeon present in the action area would startle and move to adjacent deeper water which is expected to result in increased predation and reduced survival.

Salmonids or sturgeon present and unable to avoid falling debris or rocks would be crushed and killed.

(3) NMFS anticipates incidental take in the form of harm and death from habitat modifications resulting in degradation of PBFs for salmonids at the Project site. This harm is expected due to reduced quantity and quality of rearing habitat and by creating habitat conditions that increase the likelihood of predation. The ecological surrogates for incidental take associated with the action is the permanent loss of 0.03 acres of unaltered riverbank habitat through addition of RSP below the OHWM and the temporary loss of approximately 0.1 acres of riparian vegetation on adjacent riverbank. This loss of habitat is expected to result in reduced growth and fitness for listed salmonid species.

If any specific parameter of these ecological surrogates are exceeded, the anticipated incidental take levels described are also 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) The Corps shall include the following in the permit:

a. In accordance with the AMMs listed in Section 1.3.2, additional measures shall be taken by the applicant to minimize impacts to riparian vegetation in the action area and its short- and long-term effects to critical habitat.

b. Measures shall be taken by the applicant to ensure that contractors, construction workers, and all other parties involved with these projects implement the AMMs and BMPs as detailed in the BA and this opinion.

(2) Measures shall be taken by the Corps and the applicant to monitor and provide NMFS with a report associated with the proposed action within the timeline(s) indicated.

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 Corps 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. Equipment used for the project shall be thoroughly cleaned off-site to remove any invasive plant material or invasive aquatic biota prior to use in the action area.

b. Environmentally sensitive areas, sensitive plant species, and wetland areas shall be avoided during project activities to the maximum extent practicable. High visibility fencing shall be placed around these areas to minimize disturbance.

c. Soil and excavated material and/or fill material shall be stockpiled in existing clearings when possible.

d. Stockpiles shall be covered prior to a rain event or when there is a greater than 50 percent possibility of rain forecasted by the National Weather Service during the next 24 hours.

(2) The following terms and conditions implement reasonable and prudent measure 1(b):

a. The Corps and the applicant shall provide a copy of this opinion to the construction crew, making them responsible for implementing all requirements and obligations included in this document and for educating and informing all other contractors involved in the project as to the requirements of this opinion. A notification that the construction crew have been supplied with this information shall be provided to the reporting address below. A copy of this opinion will be available on-site at all times during work activity.

(3) The following terms and conditions implement reasonable and prudent measure 2:

a. The Corps shall provide a post construction report three (3) months after Project activities are completed.

b. The report shall provide property lot construction schedules and completion dates with details regarding Project implementation such as adherence to Project stated limits of habitat alteration or disturbance.

c. The Applicant shall provide planting success criteria within three (3) months of Project completion and include number of willow poles planted per lot and/or

description of native seed mix distributed upon disturbed areas. A report by December 31st of year 3 and year 5 shall be provided with pictures showing succession of riparian vegetation as guided by the willow pole monitoring and success criteria outlined in the Project description (Table 5).

d. The Applicant shall provide a post construction report containing a summary description of avoidance and minimization measures taken and any observed take incidents.

Updates and reports required by these terms and conditions shall be submitted to:

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

2.10. Conservation Recommendations

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

Due to the proposed AMMs and BMPS, along with the riparian planting monitoring and success criteria plan, no additional conservation measures have been identified for this Project.

2.11. Reinitiation of Consultation

This concludes formal consultation for the Adobe Road Bank Stabilization Project.

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 short-term or long-term 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 the Corps 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 are expected to be 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 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 temporary and permanent 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 we conclude that the following adverse effects on EFH designated for Pacific Coast Salmon are reasonably certain to occur:

- Complex channel and floodplain habitat
    1. Permanent habitat loss/modification.
    2. Temporary reduction of input of terrestrial food resources.
    3. Temporary reduction in shade.
    4. Temporary degradation of water quality.

3.3. Essential Fish Habitat Conservation Recommendations

NMFS determined that the following conservation recommendations are necessary to avoid, minimize, mitigate, or otherwise offset the impacts of the proposed action on EFH. These recommendations are included under the Project Description and associated AMMs and BMPs of this Project and are referenced here.

1. Permanent habitat loss/modification
    - There are no practical measures to address loss of potential floodplain habitat in residential neighborhoods where the action area exists, however actions taken to maintain complexity in channel include measures c, e and j under *Minimization of Impacts to Listed Species and Critical Habitat* (Section 1.3.2) and implementation of the willow pole planting and monitoring program (Table 5, Section 1.3.1).

2. Temporary reduction of input of terrestrial food resources.
    - Measures c, b and j under *Minimization of Impacts to Listed Species and Critical Habitat* (Section 1.3.2) and implementation of the willow pole planting and monitoring program (Table 5, Section 1.3.1).

3. Temporary reduction in shade.
    - Measures c, b and j under *Minimization of Impacts to Listed Species and Critical Habitat* (Section 1.3.2) and implementation of the willow pole planting and monitoring program (Table 5, Section 1.3.1).

4. Temporary degradation of water quality
    - Measure a under *Minimization of Impacts to Listed Species and Critical Habitat* (Section 1.3.2) and Measures a through l under *Protection of Water Quality* (Section 1.3.2).

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, the Corps 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

The Corps 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 are the Corps and the Applicants. Individual copies of this opinion were provided to the Corps. 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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