UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
777 Sonoma Avenue, Room 325
Santa Rosa, California 95404-4731

June 27, 2024 **Refer to NMFS No:** WCRO-2022-03607

James Mazza
Regulatory Division Chief
U.S. Department of the Army
Corps of Engineers, San Francisco District
450 Golden Gate Avenue
San Francisco, California 94102

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Napa County Stream Maintenance Program (Corps File No. 2019-00081)

Dear Mr. Mazza:

Thank you for your letter of May 12, 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 Napa County Stream Maintenance Program (SMP). The Napa County Flood Control and Water Conservation District (District) has applied for a regional general permit (RGP) from the U.S. Army Corps of Engineers (Corps) pursuant to Section 404 of the Clean Water Act of 1972, as amended, 33 U.S.C. § 1344 *et* seq (Corps File No. 2019-00081). The District is proposing to develop and implement a maintenance program for flood control channels and creeks in Napa County, California.

The enclosed programmatic biological opinion is based on our review of the proposed activities that would be authorized by the RGP and describes NMFS' analysis of potential effects on threatened Central California Coast (CCC) steelhead (*Oncorhynchus mykiss*) and designated critical habitat in accordance with section 7 of the ESA. In the enclosed biological opinion, we conclude that the proposed action will not jeopardize the continued existence of threatened CCC steelhead (*Oncorhynchus mykiss*), and is also not likely to result in the destruction or adverse modification of designated critical habitat for CCC steelhead. However, NMFS anticipates that incidental take of CCC steelhead is reasonably certain to occur as a result of the proposed action. Therefore, an incidental take statement with terms and conditions is included with the enclosed biological opinion. NMFS has also found that the proposed project may affect, but is not likely to adversely affect Southern Distinct Population Segment green sturgeon (*Acipenser medirostris)* or its designated critical habitat in accordance with section 7 of the ESA.

Thank you also for your request for essential fish habitat (EFH) consultation. NMFS reviewed the proposed action for potential effects on EFH pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), implementing regulations at 50 CFR 600.920, and agency guidance for use of the ESA consultation process to complete EFH consultation. We have concluded that the action would adversely affect EFH designated under

the Pacific Coast Salmon, Pacific Coast Groundfish, and Coastal Pelagic Species Fishery Management Plans (FMP). The proposed action includes sufficient measures to avoid or minimize potential adverse effects to EFH, thus no EFH conservation recommendations are provided.

Please contact Brian Meux of the California Coastal Office in Santa Rosa at 707-575-1253 or brian.meux@noaa.gov if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

Alecia Van Atta
Assistant Regional Administrator
California Coastal Office

Enclosure

cc: Kasey Sirkin, Corps of Engineers (l.k.sirkin@usace.army.mil)
Jeremy Sarrow, Napa County (jeremy.sarrow@countyofnapa.org)
Copy to E-File FRN 151422WCR2021SR00096

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

Napa County Stream Maintenance Program

NMFS Consultation Number: WCRO-2022-03607
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?
Central California Coast Steelhead (*Oncorhynchus mykiss*)	Threatened	Yes	No	Yes	No
North American Green Sturgeon, Southern Distinct Population Segment (*Acipenser medirostris*)	Threatened	No	No	No	No

Fishery Management Plan That Identifies EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast Salmon	Yes	No
Coastal Pelagic Species	Yes	No
Pacific Coast Groundfish	Yes	No

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

Issued By:

Alecia Van Atta
Assistant Regional Administrator
California Coastal Office

Date: June 27, 2024

TABLE OF CONTENTS

1. INTRODUCTION

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

1.1. Background

NOAA's National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531 et seq.), as amended, and implementing regulations at 50 CFR part 402. We also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with section 305(b)(2) of the Magnuson–Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801 et seq.) and implementing regulations at 50 CFR part 600.

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at NMFS' North-Central Coast Office in Santa Rosa, California.

1.2. Consultation History

On May 12, 2021, NMFS received an email from the U.S. Army Corps of Engineers (Corps) transmitting the Corps' request for and ESA Section 7 consultation and EFH consultation, and the Corps' biological assessment for the proposed issuance of a regional general permit (RGP) to the Napa County Flood Control and Water Conservation District [District] for the District's program of stream maintenance activities within flood control channels and creeks in Napa County, California (Stream Maintenance Program [SMP]). On June 13, 2021, the Corps transmitted to NMFS the *Napa County Stream Maintenance Manual* (SMP Manual; Napa County Flood Control and Water Conservation District [District], January 2019 Draft) and associated appendices.

On July 1, 2021, NMFS emailed the Corps to provide preliminary questions and request a meeting with the Corps and the District. On July 28, 2021, NMFS, the Corps, and the District met via video conference to discuss the project and NMFS' July 1, 2021, questions. During this meeting the District provided initial responses to NMFS' questions. On July 29, 2021, the Corps provided July 28, 2021, meeting notes and the District's initial written responses to NMFS' July 1, 2021, questions. On this same day, by email correspondence to the Corps and the District, NMFS confirmed the accuracy of the meeting notes and acknowledged receipt of the District's initial written responses.

On January 25, 2022, the Corps provided to NMFS additional information regarding Napa's SMP, including work conducted in prior years (i.e., 2019-2021 Notices of Proposed Work, 2019-2020 Annual Reports).

On May 5, 2022, the Corps and NMFS corresponded via email regarding the status of the project and the District's provision of additional clarifying information. On May 17, 2022, the Corps, NMFS, and the District met via video conference to discuss the remaining information needs. The District and the Corps clarified that the additional information had been provided to the Corps but had not yet been provided to NMFS. The District described the additional information that had been provided to the Corps. During this same meeting the District proposed the addition of fish passage enhancement actions to the SMP as a component of the habitat protection and enhancement action category. NMFS and the Corps informed the District that this could be included in the RGP and the District agreed to prepare a draft written description of the proposed fish passage enhancement actions for NMFS and Corps review. Immediately following the May 17, 2022, virtual meeting, the District transmitted, via email to the Corps and NMFS, information for proposed fish passage enhancement actions. Upon review of this information NMFS and the Corps conferred and determined that fish passage enhancement actions were suitable for inclusion in the program.

By email exchange in October 2022, NMFS provided questions regarding the SMP project description to the Corps and the District, and the District provided clarifying responses to NMFS and the Corps. By email exchange in November 2022, NMFS provided questions to the District regarding proposed fish relocation actions, and the District provided clarifying information. By email exchange in December 2022 the District confirmed that they were updating the SMP Manual to incorporate information shared with the Corps and NMFS during consultation. By email exchange in February and March 2023, the District provided draft SMP Manual updates for NMFS and the Corps review. The District reconfirmed that the SMP Manual will be updated following completion of consultation to capture all agreed upon revisions and clarify SMP activity descriptions.

By email exchange in April 2023, the District provided clarifying information to the Corps and NMFS regarding the District's proposed inclusion of beaver activity management actions in the SMP. During this exchange the District: 1) informed NMFS and the Corps that the District views American beaver as a keystone native Napa County species that contributes to healthy stream systems; 2) identified actions the District undertakes to support beavers in Napa County; and 3) provided a limit on the number of beaver activity management actions that the District would implement during SMP implementation. On April 21, 2023, NMFS received sufficient information to initiate formal ESA consultation and EFH consultation.

By email to NMFS and the Corps on March 12, 2024, the District provided updates to the SMP Manual (collectively, and hereafter: 2024 SMP Manual Addendum [Napa County Flood Control and Water Conservation District 2024]). The 2024 SMP Manual Addendum includes:

- Table 1 of the SMP - Steelhead Streams and Channel Types for Napa SMP (hereafter SMP Manual Table 1);
- Table 1 Napa County Stream Maintenance Program Routine Maintenance Activities that Require USACE Authorization under Clean Water at Section 404 updated 3/11/2024. By email message to NMS and the Corps on June 3, 2024, the District corrected the number of this table to Table 2 of the 2024 SMP Manual Addendum (hereafter 2024 SMP Manual Addendum Table 2);

- Table 4-1 of the SMP Manual - Stream Maintenance Best Management Practices (hereafter SMP Manual Table 4-1);
- Addendum to the Napa Flood Control and Water Conservation District's (District) Stream Maintenance Program describing updates made to specific sections of the SMP Manual (hereafter 2024 SMP Manual Updates).

Updates to the regulations governing interagency consultation (50 CFR part 402) were effective on May 6, 2024 (89 Fed. Reg. 24268). We are applying the updated regulations to this consultation. The 2024 regulatory changes, like those from 2019, were intended to improve and clarify the consultation process, and, with one exception from 2024 (offsetting reasonable and prudent measures), were not intended to result in changes to the Services' existing practice in implementing section 7(a)(2) of the Act. 89 Fed. Reg. at 24268; 84 Fed. Reg. at 45015. We have considered the prior rules and affirm that the substantive analysis and conclusions articulated in this biological opinion and incidental take statement would not have been any different under the 2019 regulations or pre-2019 regulations. [If an incidental take statement relies upon the 2024 regulations and includes one or more offsetting RPMs, then the above paragraph should be modified to acknowledge the inclusion of such measures by adding this clause to the end of the sentence: "except we note that we have included offsetting reasonable and prudent measures in the incidental take statement (an option that was not included in the section 7 regulations prior to 2024).

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 the proposed action would cause any other activities and determined that it would not. Under the MSA, "federal action" means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a federal agency (see 50 CFR 600.910).

The Corps proposes to issue a five-year RGP to the District for the proposed implementation of the SMP, with subsequent renewals occurring every five years for a total program term of up to 20 years (i.e., an initial permit issuance with up to three renewals). The Corps' RGP would provide authorization under Section 404 of the Clean Water Act of 1972, as amended (33 U.S.C. § 1344 et seq.).

Proposed SMP activities are described in the project's Biological Assessment for the Napa County Stream Maintenance Manual (Napa County Flood Control and Water Conservation District 2019a), the SMP Manual (Napa County Flood Control and Water Conservation District 2019b), and the 2024 SMP Manual Addendum (Napa County Flood Control and Water Conservation District 2024). Proposed activities consist of vegetation management, sediment and debris removal, erosion protection and bank stabilization, drainage structure repair and maintenance, unpaved road maintenance, beaver activity management, and habitat protection and enhancement. The program area includes stream channels, detention basins, dredged material rehandling sites, and roadway maintenance sites within Napa County (See Figures 1-1 through 1-7 in the SMP Manual). Streams in the SMP program area that support CCC steelhead are identified in Table 1 of this biological opinion.

Table 1. Steelhead Streams and Channel Types for Napa SMP (Table 1 from the 2024 SMP Manual Addendum [Napa County Flood Control and Water Conservation District 2024])

Stream Name	Natural Channel	Other Channel (Modified[1,2] / Engineered[3])
Napa River (downstream of Imola and upstream of Trancas St.)	x	
Napa River (downstream of Trancas St. and upstream of Imola)		x
Huichica Creek	x	
Carneros Creek (upstream of Napa Valley Marina)	x	
Carneros Creek (downstream of Napa Valley Marina)		x
Suscol Creek (upstream of Devlin Road)	x	
Suscol Creek (downstream of Devlin Road)		x
Tulocay Creek (upstream of S. Terrace Dr)	x	
Tulocay Creek (downstream of S. Terrace Dr)		x
- Camille Creek	x	
- Spencer Creek (downstream of Green Valley Rd fish barrier, no anadromy upstream of barrier)	x	
- Murphy Creek	x	
Napa Creek (upstream of Seminary St.)	x	
Napa Creek (downstream of Seminary Street)		x
- Browns Valley Creek	x	
- Redwood Creek	x	
- Pickle Canyon Creek	x	
Sarco Creek	x	
Milliken Creek	x	
Salvador Creek (downstream of Big Ranch Road)	x	
Salvador Creek (upstream of Big Ranch Road)		x
Salvador Collector		x
Soda Creek	x	
Dry Creek	x	
- Segassia Creek	x	
- Wing Canyon Creek	x	
- Montgomery Creek	x	
- Campbell Creek	x	
Hopper Creek		x
Rector Creek	x	
Conn Creek (upstream of Conn Valley Rd.)	x	
Conn Creek (downstream of Conn Valley Rd.)		x
Bale Slough	x	
Bear Canyon Creek upstream of HWY 29	x	

Stream Name	Natural Channel	Other Channel (Modified[1,2] / Engineered[3])
Sulphur Creek	x	
- Iron Mine Creek	x	
- Heath Canyon Creek	x	
York Creek	x	
Bell Canyon Creek (downstream of dam, no anadromy	x	
Mill Creek	x	
Dutch Henry Creek	x	
Ritchey Creek	x	
Simmons Creek	x	
Diamond Mountain Creek (upstream Hwy 29)	x	
Diamond Mountain Creek (downstream Hwy 29)		x
Cyrus Creek	x	
Garnett Creek	x	
- Jericho Canyon Creek	x	
Suisun Creek	x	
- Wooden Valley Creek	x	

[1] Modified channels have been widened or straightened to increase channel conveyance capacity, but not necessarily engineered to a specific design flow or specification.
[2]Semi-modified channels typically have natural, un-modified stream beds and support a higher percentage of native vegetation to non-native vegetation, and a moderate to mature riparian corridor. The banks of these channels may have been modified to prevent flooding or bank erosion.
[3] Engineered flood control channels are typically v-shaped, trapezoidal channels, or small ditches. In some locations, such channels are referred to as "collectors" where they may typically collect runoff from other small local drainages, often running parallel to major roads.

Among the channels included in the SMP, is the Napa River. Maintenance for three large projects that have already been constructed on the Napa River is included in the SMP: the Napa Flood Project (Figure 1-7 in the SMP Manual); the Rutherford Reach Restoration Project (Figure 1-3 in the SMP Manual); and the Oakville to Oak Knoll Restoration Project (Figure 1-3 in the SMP Manual). Maintenance activities at these large projects will fall within the SMP activity categories described below, but will have separate limit categories due to the prior completion, size, and habitat enhancement characteristics of these projects.

1.3.1. Channel Types

The SMP Manual describes four channel types that occur throughout Napa County where maintenance may occur. The SMP Manual describes these four channel types based on their form:

1. Natural Channel Types (i.e., streams). These are streams and channels that lack modification for flood control or bank protection.
2. Other Channel Types:

a. Engineered channels and "collectors" - Engineered channels and collectors are v-shaped or trapezoidal channels (or ditches where they are small). In some locations, such channels are referred to as "collectors" where they may typically collect runoff from other small local drainages, often running parallel to major roads. Examples of engineered flood control channels include the Yountville Collector and Solano Ditch. "Collector" channels in Napa County, such as the Yountville Collector or Salvador Collector channels typically collect and convey flows near roads and rail lines that may intersect the original pathway of the creek. Collectors were designed with steepened banks (generally 2:1 or less), little to no riparian corridor vegetation, and currently support poor quality habitat for aquatic species, including steelhead (*O. mykiss*).
b. Modified channels - Modified channels are channels that have been widened or straightened to increase channel conveyance capacity, but not necessarily engineered to a specific design flow or specification. These channel reaches were primarily modified to prevent flooding of adjacent agricultural and residential developments. The banks and overall alignment of the creek channel in modified channels is wider and straighter than typical natural channels to allow for increased flow conveyance capacity. Modified channels often support a low flow channel nested within the channel bed and some riparian corridor vegetation.
c. Semi-modified channels - In comparison to modified channels, semi-modified channels typically have natural, un-modified stream beds and support a higher percentage of native vegetation to non-native vegetation, and a moderate to mature riparian corridor. The banks of these channels may have been modified to prevent flooding or bank erosion.

Among the channels included in the SMP, is the Napa River. The Napa River includes numerous channel types. Maintenance for three large projects that have already been constructed on the Napa River is included in the SMP: the Napa Flood Project (Figure 1-7 in the SMP Manual); the Rutherford Reach restoration project (Figure 1-3 in the SMP Manual); and the Oakville to Oak Knoll restoration project (Figure 1-3 in the SMP Manual). These large projects contain multiple channel types, ranging from engineered to natural.

1.3.2. SMP Detention Basins

Detention basins are constructed basins that are intended to improve the quality of urban runoff from impervious surfaces including roads, parking lots, residential neighborhoods, commercial areas and industrial sites by reducing peak stormwater runoff rates, providing temporary storage, and increasing contact with vegetation. This slows the rate of runoff, reduces erosive flows during large storm events, and aids filtration and sediment capture; reducing sediment, pollutant, and debris transport to receiving waters. These basins are located throughout the county, typically within developed areas, or within areas draining developed areas.

1.3.3. SMP Dredged Material Rehandling Sites

Dredged material rehandling sites are used for the beneficial placement of dredged sediments. The SMP includes two such sites: Edgerly Island and Imola Avenue. The Edgerly Island dredged material rehandling site is located approximately 3.5 miles northwest of the City of American

Canyon and bordered by the Napa River to the east and Mud Slough to the west. The 39-acre property has capacity to receive approximately 300,000 cubic yards (CY) of material. The Imola Avenue dredged material rehandling site is an excavated earthen basin located in the City of Napa on the east bank of the Napa River at the previous location of the Napa Sanitation District's wastewater treatment plant. This site has the capacity to receive approximately 50,000 CY of material dredged from the Napa River. Figures 1-1 and 1-4 in the SMP Manual show the locations of these two dredged material rehandling sites.

1.3.4. SMP Maintenance Principles

The District's approach for stream maintenance in Napa County is to avoid any unnecessary maintenance activities, favor hand maintenance over mechanized equipment, and prioritize biotechnical methods. To conserve waterways and reduce environmental impacts, the District will apply the following maintenance principles (SMP Maintenance Principles):

- Apply the minimum maintenance necessary;
- Minimize mechanized maintenance (favor hand maintenance);
- Understand and monitor the river system and identify hydraulic constrictions/limitations;
- Protect and enhance physical processes, landforms, riparian habitat and ecology; and
- Manage stream resources for long-term sustainability and resiliency.

1.3.5. SMP Activities

The following provides an overview of SMP maintenance activities, including project limits, where applicable.

1.3.5.1 Vegetation Management

Vegetation management activities will be conducted to maintain flow conveyance capacity, reduce vegetation directed flow that causes bank erosion, establish a canopy of riparian trees, and control invasive vegetation. Vegetation maintenance activities include tree and understory maintenance, planting of new native trees and shrubs, invasive plant management, and downed tree management.

Locations will vary and will be determined by need. Need will be based on the life history (perennial, annual, evergreen, etc.) of the target invasive plant and optimal timing for treatment in order to maximize treatment and efficacy. Treatment methods include hand trimming and removal using hand-held tools and equipment, mechanical trimming, repositioning, and removal using heavy equipment (e.g., backhoes, rubber-tracked excavators, or cranes to relocate or remove trees within portions of the channel), and herbicide application.

As described in the SMP Manual and 2024 SMP Manual Addendum, the District will prioritize the modification and repositioning of large woody debris and downed trees over downed tree and large woody debris removal, and removal of downed trees and large woody debris will be limited locations where removal is necessary, such as along dikes, levees, berm slopes, and the toe easement of these structures. There is no limit on downed tree and LWD repositioning; however,

removal of downed trees and LWD is limited to 10 projects per year (i.e., no more than 50 removals of LWD or downed trees per each 5-year period).

Modification and removal of large wood, such as downed trees, is generally conducted between June 15 and October 31, when Napa County stream are at their driest, but can occur at any time of the year if imminent danger of a flood threat precludes leaving the wood in place. When modification and removal of large wood is necessary outside of the June 15 through October 31 work period, the District will notify NMFS and the Corps, and will, within two weeks of the action, provide NMFS and the Corps a report detailing the conditions that required the work, the equipment that was used, and the AMMs that were applied (2024 SMP Addendum, Chapter 7.1). Trimming and removal of smaller vegetation with hand-held tools may occur year-round.

Herbicide applications will be limited to glyphosate, imazapyr, and adjuvant surfactants approved for aquatic use by the EPA. The maximum amount of herbicides (including any surfactants) applied on a monthly basis between June and November will be limited to 8 gallons per month, for a maximum total of 40 gallons applied annually. Herbicides will be applied on the banks of channels and on unpaved access roads. Within channel banks, herbicides will only be applied above the high-water mark using focused application methods (e.g., targeted spraying using backpack sprayers and/or direct application using a paintbrush on stumps of trees that have been cut during maintenance). Herbicides will not be applied via targeted spray methods when average wind speeds exceed 10 miles per hour at plant height or when air temperature exceeds 29.4 degrees Celsius (85 degrees Fahrenheit). Herbicides will not be applied under wet conditions due to dense fog, or within 24 hours of predicted rainfall (over 20 percent chance), or until plants are dry following rainfall. Herbicide applications will be limited to the period between June 15 through November 15.

Dewatering and fish relocation will not be used during vegetation management; however, vegetation management may be included as a component of other project types that include dewatering and fish relocation.

1.3.5.2 Sediment and Debris Removal

The District will remove deposited and accumulated excess sediment and debris in District-maintained channels (Figures 1-1 through 1-5 in the SMP Manual) and detention basins to maintain channel capacity and reduce the potential for flooding. All removal sites would be seasonally dry, or dewatered through the use of cofferdams when work is performed. All sediment removal projects within anadromous salmonid streams would be limited to the period between June 15 and October 31. Pre-project assessments for impacts to gravel and instream habitat complexity would be performed (SMP Manual Section 4.2.5).

Sediment and debris removal activities will be implemented within small-scale, localized channel segments ranging between approximately 200 feet long and 400 feet long, with removal amounts ranging between approximately 100 cubic yards (CY) and 500 CY per site. The number of sediment and debris removal projects undertaken annually and the quantity of sediment and debris removed in a given year will depend on recent weather and hydrologic conditions as well as the frequency and extent of past maintenance activities, but based on past maintenance needs

is expected to be up to 3 projects per year (15 total per 5-year period), a total length per year of approximately 750 linear feet of channel, and approximately 1,500 CY of sediment removed.

As described in the SMP Manual (inclusive of the 2024 SMP Manual Addendum), the following limits apply to sediment and debris removal projects on steelhead streams (see Table 1 of this biological opinion for a list of steelhead streams):

- Sediment removal may only be performed at or within 500 feet of a bridge crossing, culvert, detention basin, constructed restoration feature (i.e., logs, rootwads), stream measurement device (i.e., flow gauge), storm drainage facility, or other manmade structure for the purpose of maintaining the structure. The limit of 100 feet may be extended up to 500 linear feet from the said structure.
- For each project site, sediment removal volume may not exceed 500 cubic yards. Sediment removal in exceedance of 500 cubic yards will require Project Specific Notification.
- For each project site, sediment removal may extend up to 500 feet of channel length. Sediment removal in areas greater than 500 linear feet will require Project Specific Notification.
- Removal of downed trees and large woody debris (LWD) from the channel will be minimized by prioritizing realignment and/or relocation of trees and LWD within the channel.
- No more than 10 LWD removal projects per year.
- No limit on LWD repositioning, modification, and relocation projects where beneficial LWD remain in the channel as instream habitat structure.
- No volume limits for removal of trash (i.e., garbage, non-native invasive plants, and other deleterious materials that should be removed from the channel).
- No more than 5 sediment removal projects per year.
- Cumulative sediment removal total may not exceed linear feet of channel.
- For each 5-year period, sediment removal is limited to:
    - 15 sediment and debris removal projects,
    - 3,750 linear feet of channel, and
    - 7,500 CY of sediment removal.
- For the maintenance of restoration features in the Rutherford and Oakville to Oak Knoll reaches of the Napa River:
    - Sediment removal will be limited to less than 200 feet per year and 1,000 feet per 5-year period. Note that the limits for the Rutherford and Oakville to Oak Knoll sites do not count against the limits for all other project sites.
    - Modification of debris jams is limited to less than 200 feet per year and less than 600 feet per 5-year period. Note that the limits for the Rutherford and Oakville to Oak Knoll sites do not count against the limits for all other project sites.

Equipment used for sediment and debris removal activities range from hand tools to mechanized equipment. If mechanized sediment removal is necessary, then the District will prioritize

methods that minimize impacts to the channel (e.g., preferential use of an excavator located outside the channel). For locations where using an excavator from the top-of-bank is not possible, sediment removal may be conducted by lowering smaller equipment directly into the channel from a stream crossing or by accessing the channel with temporary access ramps. If temporary access ramps are required, then the access ramps will be regraded and replanted following the sediment and debris removal activities. Regrading and replanting of access ramps will occur in the same year/construction season in which the maintenance activity was performed. In-channel mechanized equipment may include a small earthmover, skid-steer, walk-behind power-shovel, or similar equipment. A vacuum truck may also be used to remove sediment from smaller culverts and pipes. Sediment removed from the channel is placed in dump trucks and hauled offsite for offsite placement within upland dredged material placement sites (Imola Avenue, Edgerly Island) or the nearest landfill. Testing and disposal of sediment will occur according to BMP number GEN-17 in the SMP Manual.

Dewatering and fish relocation may be used during sediment and debris removal activities (see Fish Handling and Relocation in Section 1.3.4.1 of this opinion and Terms and Conditions to Implement Reasonable and Prudent Measure 1 in Section 2.9.4 of the Incidental Take Statement below).

1.3.5.3 Erosion Protection and Bank Stabilization

The District repairs and stabilizes weakened, unstable, and failing streambanks to protect adjacent properties; maintain public safety, roadways, riparian habitat and other natural resources; and to reduce excessive erosion and conveyance of deleterious concentrations of fine sediment. The District will apply the SMP Maintenance Principles when designing and implementing erosion protection and bank stabilization projects. Erosion protection and bank stabilization activities will primarily involve the use of biotechnical methods to stabilize eroding streambanks, which incorporates live vegetation with other natural elements (e.g., wood, biodegradable erosion control products, rock) to provide structural stability to streambanks. Because the District prioritizes the use of biotechnical methods over hard methods (e.g., armoring, rock placement, concrete, etc.), only a small subset of bank stabilization installed in any given year will use non-biotechnical methods and those that do will trigger mitigation as described in the SMP's mitigation program (See Section 1.3.5 of this opinion).

As described in the SMP Manual (inclusive of the 2024 SMP Manual Addendum), the following limits apply to erosion protection and bank stabilization projects on steelhead streams (see Table 1 of this biological opinion for a list of steelhead streams):

- Project Limits for Natural Channel Types on Steelhead Streams
    - If the project includes placement of rock slope protection, concrete and/or other hardening materials below the ordinary high water mark (OHWM) and exposed hardening materials exceed 25 percent of the structure's surface area, the total project length may not exceed 100 feet without written approval from USACE and NMFS, and significant bioengineering features must be added to the structure (see next bullet). This Project Limit does not apply to hardening materials that are

not exposed, e.g., hybrid bank stabilization projects with native soil and planting material covering imported rock.
    - If the project includes primarily biotechnical materials and exposed rock slope protection, concrete and/or other hardening materials does not exceed 25 percent of the structure's surface area below OHWM, the structure may extend up to 400 feet in channel length. The structure may extend further than 400 feet if hardening materials are unexposed and covered with soil and biotechnical features.
        - No streambank stabilization structure involving exposed hardening materials may exceed 400 feet in channel length without Project Specific Notification and written approval from USACE and NMFS.
    - No more than 5 bank stabilization projects involving exposed hardening materials per year.
    - Cumulative total over each 5-year period may not exceed a total of 1,500 feet of channel length.
- Project Limits for Other Channel Types on Steelhead Streams (engineered, modified, and semi-modified channels)
    - If project includes placement of rock slope protection, concrete and/or other hardening materials below the ordinary high water mark (OHWM) and exposed hardening materials exceed 25 percent of the surface area, significant bioengineering features must be added to the structure and the total project length may not exceed 300 feet without Project Specific Notification and written approval from USACE and NMFS.
    - If project includes primarily biotechnical materials and exposed rock slope protection, concrete and/or other hardening materials does not exceed 25 percent of the structure's surface area below OHWM, the structure may extend up to 1,000 feet in channel length.
    - No streambank stabilization structure involving exposed hardening materials may exceed 1,000 feet in channel length. Restoration focused biotechnical projects with streambank stabilization components may be considered.
    - No more than 10 bank stabilization projects involving exposed hardening materials projects per year.
    - Cumulative total over each 5-year period may not exceed a total of 3,000 feet of channel length.
- For each 5-year period, bank stabilization and erosion protection will be limited to:
    - 15 projects, and
    - No more than 4,500 feet of channel. Per above, for each five year period, this 4,500 feet of channel is comprised of no more than 3,000 feet of channel for Other Channels and no more than 1,500 feet of channel for Natural channels.
- For the maintenance of restoration features in the Rutherford and Oakville to Oak Knoll reaches of the Napa River:
    - Minor grading associated with bank stabilization will be limited to less than 200 feet per year and 500 feet per 5-year period. No limit on the replacement of habitat logs/boulders, will occur as needed. Note that the limits for the Rutherford

and Oakville to Oak Knoll sites do not count against the limits for all other project sites.

Equipment used for construction of erosion protection and bank stabilization structures may include extending arm excavators, small earthmovers (i.e., Bobcat® style equipment), front-end loaders, 10 cubic-yard dump trucks, and similar equipment. Staging for repair activities will occur on adjacent access roads. Soil and rip-rap materials will be staged in areas that have been previously disturbed (i.e., service road, turn-outs, etc.). The majority of the work will take place from the top of bank zone, and care will be taken to minimize the area of disturbance. Overgrown vegetation at bank failure sites will only be removed to the extent necessary to repair the bank. Erosion protection and bank stabilization construction work will be restricted to the period between June 15 and October 31 when streams are at their driest. If work sites are wetted, dewatering and fish relocation may be used if surface water is present. Methods will follow the dewatering and fish handling protocols (see Fish Handling and Relocation in Section 1.3.4.1 of this opinion and Terms and Conditions to Implement Reasonable and Prudent Measure 1 in Section 2.9.4 of the Incidental Take Statement below).

Although erosion protection and bank stabilization will be performed between June 15 and October 31 when streams are at their driest, dewatering and fish relocation may be used if surface water is present. Methods will follow the dewatering and fish handling protocols (see Fish Handling and Relocation in Section 1.3.4.1 of this opinion and Terms and Conditions to Implement Reasonable and Prudent Measure 1 in Section 2.9.4 of the Incidental Take Statement below).

1.3.5.4 Drainage Structure Repair and Maintenance

The District will perform maintenance, repair, and replacement of existing drainage structures, including, but not limited to culverts, flapgates, flow gates, inlets, stormwater outfalls, sediment basins, trash racks, bridges, access ramps, and access roads. No new drainage structures will be installed in the SMP. Repair and maintenance of existing drainage structures by the District and Road Department will be periodically required to ensure continual and safe operation of County and District infrastructure that provide multiple functions including flood prevention and protection, water conveyance and storm drainage which support municipalities and unincorporated residential areas throughout the County. Examples include upgrading stream crossings, culvert replacements, and road-shaping treatments (see Chapters 11 and 12 of the SMP Manual for additional details.

All culverts will be assessed to determine if they are within a stream that supports CCC steelhead and if so, if they will also be assessed to determine if they meet fish passage guidelines (NMFS 2023a, NMFS 2023b). Culverts that are located within the range of CCC steelhead and do not meet fish passage criteria will either be replaced with new infrastructure that is adequately sized and placed to meet fish passage guidelines, or will be developed as a separate, individual project (i.e., not covered by the SMP) in order to provide sufficient time for alternative site-specific passage solutions to be developed. In-kind replacement of culverts that do not meet fish passage criteria is not included in the SMP.

As described in the SMP Manual (inclusive of the 2024 SMP Manual Addendum), the following limits apply to drainage structure repair and maintenance projects on steelhead streams (see Table 1 of this biological opinion for a list of steelhead streams):

- Culvert diameter may not exceed 48 inches, unless larger size is necessary to support compliance with NMFS fish passage guidelines (NMFS 2023a, NMFS 2023b).
- Additional channel length affected by construction (i.e., channel areas adjacent to the drainage structure) may not exceed 20 feet in length, unless additional work area within the channel is needed to support compliance with NMFS fish passage guidelines (NMFS 2023a, NMFS 2023b).
- Repairs and replacements must result in structure that conforms with NMFS fish passage guidelines (NMFS 2023a, NMFS 2023b).
- For the maintenance of features and structures located at the SMP dredged material rehandling sites (Imola Avenue, Edgerly Island):
    - Heavy equipment use in disking of the land surface and annual mowing of the basin levee.
    - Invasive plant control (i.e., eucalyptus tree management and ice plant removal), using hand tools and use of herbicides (see Section 1.3.3.1 of this opinion).
    - Operation and maintenance of flow gates and drainage outfall structures.
        - Vegetation management within drainage channels along the outside edge of the levees (outside of the 45-acre wetland) to ensure stormwater flow.
    - Maintenance of features and structures a the 45-acre wetland mitigation site adjacent to the west of Edgerly Island, including tide gate maintenance. Management of the 45-acre wetland consists of periodically opening of the sluice gate during a medium or high tide event to allow for flushing of interior drainage channels.
        - The sluice gate will be serviced annually.
        - Channel maintenance and vegetation management occurs on an as needed basis.
        - Physical removal of non-native plants using hand tools and equipment.
        - Minor channel excavation on a semi-annual basis using hand tools.
- For each 5-year period:
    - Bridges. Typically repairing damage to fortifications. Work occurs within bridge footprint (*e.g.* abutment, embankments and existing riprap fortifications), or immediately adjacent area. 250 linear-foot limit for 5-year period. Repairs and replacements must result in structure that conforms with NMFS fish passage guidelines (NMFS 2023a, NMFS 2023b).
    - Culverts. 100 linear-foot limit for each 5-year period. No more than 200 linear feet of additional channel (i.e., channel areas adjacent to the drainage structure; 1,000 linear feet total for 5-year period) may be affected for culvert repair/replacement projects per 5-year period, unless additional work area within the channel is needed at one or more sites to comply with NMFS fish passage guidelines (NMFS 2023a, NMFS 2023b).

- Stormwater drainage structures (e.g., outfalls, flapgates, storm drains, trench drains, and wall drain outlets). Minor debris and sediment removal to remove blockages. No more than 5 storm drainage facility maintenance projects per each 5-year period, and no more than 200 linear feet of additional channel per project (i.e., channel areas adjacent to the drainage structure) may be affected for storm drainage facility maintenance projects per 5-year period (1,000 linear feet total for 5-year period).

The District, Roads Department, Napa County Resource Conservation District (Napa RCD) and licensed contractors (working under the direction of these entities) will conduct this maintenance work. These actions will be performed throughout the action area. Work will be completed using a combination of manual labor crews and/or small rubber tracked heavy equipment such as backhoes, mini excavators and skid steers. Work will only be performed from June 15 through October 31 when stream flows are at their lowest. Although drainage structure repair and maintenance will be performed between June 15 and October 31 when streams are at their driest, dewatering and fish relocation may be used if surface water is present. Methods will follow the dewatering and fish handling protocols (see Fish Handling and Relocation in Section 1.3.4.1 of this opinion and Terms and Conditions to Implement Reasonable and Prudent Measure 1 in Section 2.9.4 of the Incidental Take Statement below).

Napa County adopted on June 3, 2008, the "Napa County Post Construction Runoff Management Requirements" and will incorporate Low Impact Development (LID) principles and techniques into its SMP activities to the maximum extent practicable. Applicable LID activities may include installing/retrofitting stormwater/flood control basins and implementing stormwater treatment best management practices (BMPs).

Drainage structure repair and maintenance activities of the SMP are intended to ensure stormwater runoff drainage and treatment structures are in compliance with National Pollutant Discharge Elimination System (NPDES) permits through enhancement of riparian and in-channel features. Additionally, maintenance activities include trash and debris clearing and implementation of maintenance BMPs throughout the watershed. Stream maintenance efforts will also assist with Total Maximum Daily Load (TMDL) compliance requirements. All the incorporated and unincorporated areas within the Napa River watershed are covered under the NPDES General Permit No. CAS000004 Waste Discharge Requirements for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems (MS4) Water Quality Order No. 2013-0001-DWQ (Small MS4 General Permit or Phase II Municipal General Permit), issued by the State Water Resources Control Board (SWRCB). Napa County's MS4 stormwater program is further developed and implemented according to the Napa County Storm Water Management Plan (NCSWMP), referenced in the SMP Manual. The purpose of the MS4 stormwater program is to provide for consistent methods to prevent and minimize stormwater pollution throughout Napa County; protect and enhance water quality in creeks and wetlands; preserve beneficial uses of local waterways; and comply with state and federal regulations. MS4 implementation directly influences the quantity and quality of stormwater received in the channels and structures that are maintained by the District. These goals are met through development of annual action plans, adoption and enforcement of local ordinances, education

and outreach efforts, monitoring, and other activities. Compliance efforts of the Napa County MS4 stormwater program are documented in reports submitted to the SWRCB annually.

1.3.5.5 Unpaved Road Maintenance

To prevent impacts on water quality and stream hydrology caused by runoff from unpaved roads, the District, in partnership with Napa RCD and private landowners, will assist with maintenance of privately-owned unpaved roads throughout the County. Maintenance activities include installing or replacing stream crossings (e.g., ford crossings, armored fill crossings, critical dip, earthen sediment retention basin, culverts), decommissioning stream crossings, installing cross-road drains (deep water bars), and converting unused roads to recreational trails. The District, Roads Department, Napa RCD and licensed contractors (working under the direction of these entities) will conduct this maintenance work. Work will be completed using a combination of manual labor crews and/or small rubber tracked heavy equipment such as backhoes, mini excavators and skid steers. Work will only be performed in the dry season from June 15 through October 31. Unpaved road maintenance activities on ford crossings, armored fill crossings, and culverts that do not include restoration of fish passage according to NMFS fish passage guidelines will be limited to reaches of stream upstream of the limits of anadromy (i.e., structures undergoing repair that do not include fish passage restoration may not be the cause of, nor may they be related to the cause of fish passage impairment).

Although work will be performed between June 15 and October 31, dewatering and fish relocation may be used if surface water is present. If project site is located in a stream within the limits of anadromy (i.e., anadromous fish may be present), handling and relocation of ESA-listed CCC steelhead may occur, and dewatering and fish handling protocols will be followed to best ensure protection of all fish that may be encountered (see Fish Handling and Relocation in Section 1.3.4.1 of this opinion and Terms and Conditions to Implement Reasonable and Prudent Measure 1 in Section 2.9.4 of the Incidental Take Statement below).

As described in the SMP Manual (inclusive of the 2024 SMP Manual Addendum), the following limits apply to unpaved road maintenance projects on steelhead streams (see Table 1 of this biological opinion for a list of steelhead streams):

- 20 sites total for each 5-year period;
- 25 cubic yards below OHWM per project, typically minor sediment removal, occasionally minor fill, less than 140 cubic yards for each 5-year period;
- 0.02 acres impact to waters of the U.S. per project, less than 0.1 acre impact to waters of U.S. for each 5-year period;
- Channel affected by construction at each site may not exceed 200 feet in length; and
- Cumulative total length of channel affected by construction in any 5-year period may not exceed 1,000 linear feet of channel.

1.3.5.6 Beaver Activity Management

The District recognizes American beaver (*Castor canadensis*) as a keystone native Napa County species that contributes to healthy and complex stream habitats for other native species. The

District engages in public outreach to raise awareness of the benefits of beaver activity in Napa County streams and, where possible, encourages beaver activity. Nevertheless, due to the developed nature of the waterways and streamside area within the action area, the District will, occasionally, need to manage beaver activities to avoid or minimize impacts to infrastructure.

Beaver activity management will include one or both of the following: 1) protecting large native riparian trees (wrapping hardware cloth around the base of the tree) where limited riparian habitat exists or where the felling of a large tree in an urban setting could lead to safety issues; or 2) notching a beaver dam that is constructed in an urban reach of a stream in order to provide flood flow conveyance where limited channel capacity exits and excess backwatering behind the dam could lead to localized flooding and/or safety issues.

The District proposes to implement beaver activity management actions no more than twice per year and restrict these beaver activity management actions to stream reaches where beaver activity is adversely affecting already limited riparian habitat (e.g., where beavers may be removing what limited riparian vegetation is present), or channels with limited flow conveyance capacity (e.g., where beaver activity could lead to localized flooding and/or safety issues). Biologists will perform pre- and post-work surveys and will ensure adherence to SMP AMMs (see Section 1.3.4 of this opinion). Work will be completed using a combination of manual labor crews and/or small rubber tracked heavy equipment such as backhoes, mini excavators and skid steers. Work will only be performed from June 15 through October 31.

Dewatering and fish relocation will not be used for projects that are limited to beaver activity management; however, beaver activity management may be included as a component of other maintenance projects types that may require dewatering and fish relocation.

1.3.5.7 Habitat Protection and Enhancement

The District will implement the SMP as an integrated self-mitigating stream management approach that involves protecting and enhancing existing instream resources and creating opportunities for improved future resources while maintaining necessary flood conveyance and bank stability conditions.

The District's primary habitat enhancement goals are to:

- Protect and enhance instream physical processes that create or maintain diverse flow conditions and a range of instream landforms including bars, riffles, pools, and benches (where these landforms are appropriate).
- Protect and enhance instream water quality conditions. While water quality conditions greatly depend on watershed source areas and land uses, instream flow blockages, debris, and other pollution negatively effects water quality. The District protects and enhances instream water quality through alleviating flow blockages to maintain circulation and removing debris and trash.
- Protect and enhance riparian vegetation to develop more continuous vegetated corridors and more complete and more complex canopy structure along the District's stream courses. The District's streamside vegetation enhancement program involves planting

native vegetation, removing invasive plants, and managing emergent vegetation on the channel bed to reduce flow blockages.

- Protect and enhance aquatic instream habitats used by benthic macroinvertebrates, fish, amphibians, birds and other wildlife along the District's stream courses. Instream habitats reflect a complex ecology, integrating the physical processes, water quality, and vegetation conditions.
- In areas of known or observed sensitive species, the District will avoid and minimize maintenance activities to the extent possible and, when maintenance work is needed, the District will limit the work to the minimum amount necessary and will employ best management practices and restoration activities to leave such areas in better ecological condition than they were before the maintenance actions were implemented.

To support the District's overall goal of implementing the SMP as a self-mitigating program that protects and enhances habitat within Napa County waters, the District will implement the following habitat protection and enhancement activities as part of the SMP: riparian planting; instream habitat complexity feature installation; instream gravel augmentation; fish passage improvement; trash removal; and managed streambank retreat. In coordination with other maintenance activities, District stream managers will work with partners to identify and implement protection and enhancement actions within the SMP action area. These actions may be implemented independently, in combination, or as part of a multi-purpose project incorporating maintenance actions with protection and enhancement actions.

Opportunities for riparian planting, instream habitat complexity feature installation, fish passage improvement, and trash removal will be evaluated at all maintenance locations. Opportunities to augment gravel in non-tidal salmonid streams will be assessed annually. Site-specific plans for each project will be developed and submitted to resource agencies (including NMFS) for review during annual coordination cycles (see 1.3.6 SMP Implementation and Oversight). These plans will consider, among other factors, riparian vegetation species suitability, habitat condition and needs, fish passage needs, sediment condition and transport, and channel processes.

Managed streambank retreat will be considered and implemented with landowner partners as a passive restoration approach in agricultural areas along the Napa River. Portions of the riparian corridor will be enhanced by removing portions of vineyards and restoring the area with native riparian and upland plant species or installing alternative agricultural crops that can thrive in a riparian buffer zone. Within the managed streambank retreat zone, the river will be allowed to naturally expand up to an identified managed retreat line. This zone of managed retreat will be site-specific and will be determined in coordination with private landowners. Within this managed retreat zone, the District will support habitat protection and enhancement and may implement bank stabilization actions to stabilize the stream bank before it reaches the identified limits of the site-specific managed retreat zone. The District will collaborate with landowners to manage these areas. Typical maintenance actions will include the planting of native riparian and upland species, invasive plant management, Pierce's disease plant management, biotechnical bank stabilization, and erosion control measures.

Habitat protection and enhancement activities will involve a variety of construction methods and equipment, ranging from hand tools to heavy equipment. For planning purposes, the District

estimates that approximately 5-6 riparian planting projects will be implemented per year (installing approximately 590 trees per year), up to 2 instream habitat projects will be implemented per year, up to 5 gravel augmentation projects will be implemented per year, up to 3 fish passage improvement projects will be implemented per year, and up to 5 managed streambank retreat projects will be implemented per year. Regarding gravel augmentation, projects may range in size from 100 cubic yards to 2,000 cubic yards per year (10,000 cubic yards over 5 years). Pre- and post-project gravel augmentation assessments will be submitted to NMFS.

Performance criteria, monitoring and maintenance for habitat protection and enhancement activities will vary depending on the type of activity performed. Monitoring and maintenance plans for each project will be developed and provided to the resource agencies (including NMFS) with the proposed action during annual coordination cycles (see 1.3.6 SMP Implementation and Oversight). Monitoring and maintenance of Habitat Protection and Enhancement sites will be conducted annually in the summer and included in the District's annual post maintenance report for a period of 5 years (SMP Addendum Chapter 4, Section 4.5).

Habitat protection and enhancement actions in streams with CCC steelhead will be performed between June 15 and October 31 when streams are at their driest. Dewatering and fish relocation may be used if surface water is present. Methods will follow the dewatering and fish handling protocols (see Fish Handling and Relocation in Section 1.3.4.1 of this opinion and Terms and Conditions to Implement Reasonable and Prudent Measure 1 in Section 2.9.4 of the Incidental Take Statement below).

1.3.6. Avoidance and Minimization Measures, Best Management Practices, and Mitigation during Construction

The SMP Manual includes avoidance and minimization measures (AMMs), best management practices (BMPs), and mitigation measures that will be implemented before, during, and after SMP activities to prevent and minimize project-related effects to aquatic resources, including CCC steelhead and their designated critical habitat. These measures include, but are not limited to:

- Restricting instream work to the designated construction work window (June 15 to October 31);
- Restricting herbicide application to the designated herbicide application window (June 1 through November 30);
- Ensuring proper handling and relocation of listed species during dewatering events (see Fish Handling and Relocation in Section 1.3.4.1 of this opinion and Terms and Conditions to Implement Reasonable and Prudent Measure 1 in Section 2.9.4 of the Incidental Take Statement below);
- Implementing erosion control BMPs;
- Minimizing effects to riparian vegetation;
- Invasive species plant removal;
- Preventing contaminant introduction into waterways;
- Testing and disposal of sediment;
- Ensuring complete removal and proper disposal of all construction waste;

- Installing and maintaining instream habitat complexity structures;
- Trash removal;
- Gravel augmentation;
- Mitigating for impacts to native riparian and freshwater wetland habitat and special-status species habitat by revegetating areas with native vegetation (including replacement ratios of 3:1 for trees between 3 and 6 inches diameter at breast height [dbh] and 6:1 for trees 6 inches and greater dbh]); and
- Monitoring and maintaining revegetation sites to ensure revegetation success.

The full description of the SMP's AMMs, BMPs, and mitigation measures can be found in Chapters 4 and 13 of the SMP Manual.

1.3.6.1 Fish Handling and Relocation

The District will implement fish handling and relocation activities when necessary to avoid and minimize the effects of SMP construction activities on native fish species. As described above, fish handling and relocation may be used during sediment and debris removal, erosion protection and bank stabilization, drainage structure repair and maintenance projects, unpaved road maintenance, and habitat protection and enhancement projects.

Fish handling and relocation activities will be performed by qualified biologists using a variety of methods, including hand nets, seine nets, electrofishing equipment. A bypass system would be installed around the work site to allow for stream flow in the creek to continue downstream. If pumps are used to dewater or bypass stream flow, intakes would be screened to NMFS and California Department of Fish and Wildlife (CDFW) criteria. Water diversions would maintain ambient stream flows below the diversion, and waters discharged below the project site would not be diminished or degraded by the diversion. Cofferdams, screened pumps, or other methods may be applied to isolate and dewater work areas and to support fish capture. Captured fish will be kept in cool aerated buckets or other suitable containers (e.g., coolers) and relocations will be expeditiously made to suitable habitat. Records of all fish handling activities will be kept, and will include methods applied, numbers of species captured, and condition and approximate sizes of individuals released. The District will provide an immediate summary report to NMFS following any relocation event, with a full report to be included in the annual program report.

A more detailed description of these measures can be found in see Chapter 4 and Table 4-1 of the SMP Manual.

1.3.7. SMP Implementation and Oversight

The SMP implementation and oversight includes annual assessments, notifications, review, tracking, and reporting, and 5-year reporting. These components are described further in the following sub-sections.

1.3.7.1 Notification and Review

The District will manage the SMP as an annual cycle of assessments, notifications, reviews, and implementation. The District will begin with assessments in the spring, followed by the

development of the maintenance work plan and identification of appropriate AMMs. The District will then notify the relevant regulatory agencies overseeing program implementation in two submittals: Submittal 1 and Submittal 2.

Submittal 1 will be provided by the District to the Corps and NMFS for review no later than April 15 of each year. During this review, proposed projects will be reviewed for suitability for inclusion in the program, including: adherence to project limits; adherence to work windows and other AMMs; and consistency with the SMP's maintenance principles and habitat enhancement goals. Projects will only be eligible for SMP coverage if adverse habitat conditions (e.g., fish passage impediments, habitat impairment or destruction, etc.) will not be inadvertently maintained, exacerbated, or created. NMFS and the Corps will submit questions and suggest changes on Submittal 1 to the District no later than May 15. The District will then address any questions and comments and provide the Corps and NMFS with updates to Submittal 1 no later than June 1. NMFS will then review the updates to Submittal 1 and respond to the Corps in writing no later than June 7. Approval to proceed with activities identified in Submittal 1 will be provided to the District by the Corps following the completion of NMFS' review. Submittal 1 projects affirmed by the Corps to be suitable for SMP coverage will then be implemented within the June 15 to October 31 SMP work season.

Submittal 2 is intended to provide the District with notification and review flexibility for projects identified late in the spring assessment period, which may occur due to late season high flow events or a large amount of maintenance needs in any one year. Submittal 2 will be provided by the District to the Corps and NMFS for review no later than July 15. NMFS and the Corps will submit questions and suggest changes on Submittal 2 to the District no later than August 15. The District will then address any questions and comments and provide the Corps and NMFS with updates to Submittal 2 no later than September 1. NMFS will then review the updates to Submittal 2 and respond to the Corps in writing no later than September 7. Approval to proceed with activities identified in Submittal 2 will be provided to the District by the Corps following the completion of NMFS' review. Submittal 2 projects affirmed by the Corps to be suitable for SMP coverage will then be implemented within the SMP work season and completed by October 31.

1.3.7.2 Tracking and Reporting

The District maintains a database of stream maintenance activities and will continue to use this database into the future to help guide maintenance activities, prescribe site-appropriate avoidance and minimization measures, and ensure adherence to SMP annual and program limits. The SMP Database incorporates GIS mapping and aerial photography to accomplish the following: 1) organize the initial stream assessment and inventory; 2) characterize reach conditions; 3) identify maintenance needs, sensitive habitats, weed populations, or other environmental considerations; 4) document maintenance, restoration, and AMM activities; 5) monitor on-going status of AMM actions; and 6) track all regulatory reporting requirements.

The District will send an annual summary report of the year's maintenance, AMMs, and monitoring activities to the permitting agencies by January 31 of the following year. This report will include a summary of maintenance activities performed, any AMMs implemented, monitoring results, and recommendations for the next season's work plan.

In addition to annual reporting, the District and the relevant regulatory agencies will review the SMP for its overall effectiveness at 5-year intervals concurrent with the Corps' RGP renewal. The District will compile a 5-year summary report containing an assessment of maintenance activities conducted to date, AMMs employed, data management, adequacy of adaptive updates and revisions to the Manual, and overall SMP coordination and communication between the District and the regulatory agencies. Through the 5-year program review process, the District will schedule and hold meetings with relevant regulatory agency staff to review the last 5-year program period and discuss any key updates or revisions planned for the next 5-year program period.

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.

The Corps determined the proposed action is not likely to adversely affect the sDPS of North American green sturgeon or its critical habitat. Our concurrence with the Corps' determination is documented in the "Not Likely to Adversely Affect" Determinations section (Section 2.12) of this opinion.

2.1. Analytical Approach

This 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 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 designation of critical habitat for CCC steelhead uses 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.

To conduct the assessment presented in this opinion, NMFS examined an extensive amount of information from a variety of sources. Detailed background information on the biology and status of the listed species and critical habitat has been published in a number of documents including peer reviewed scientific journals, primary reference materials, and governmental and non-governmental reports. For information that has been taken directly from published, citable documents, those citations have been reference in the text and listed at the end of this document.

Additional information regarding the potential effects of the proposed activities on the listed species, their anticipated response to these actions, and the environmental consequences of the actions was formulated from the aforementioned resources, and the following:

- Final Coastal Multispecies Recovery Plan: CC Chinook Salmon, Northern California Steelhead, CCC Steelhead (NMFS 2016b).
- Biological Assessment for the Napa County Stream Maintenance Manual (Napa County Flood Control and Water Conservation District 2019a).
- Napa County Stream Maintenance Manual, Draft January 2019 (Napa County Flood Control and Water Conservation District 2019b).

- Correspondence, including email correspondence, from Napa County Flood Control and Water Conservation District to NMFS and the Corps received between June 2021 and April 2023.

The issues NMFS is obliged to address in this opinion are wide-ranging, complex, and often not directly referenced in scientific literature. We base many of our conclusions on explicit assumptions informed by the available evidence. By this, we mean to make a reasonable effort to compile the best scientific and commercial empirical evidence related to the analysis and to then apply general and specific information on salmonid biology from the published literature to make inferences and establish our conclusions. In some cases, we have used the results of recent project specific studies or analyses conducted in the action area. In other situations, only more general local data are available on species presence or absence, and habitat condition. Where necessary, we have used this information and combined it with more general information from the scientific literature to infer salmonid response to the proposed action. In several instances, we make reasonable inferences that rely mainly on information in the scientific literature, because local data are not available.

2.2. Rangewide Status of the Species and Critical Habitat

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

NMFS assesses four population viability[1] parameters to discern the status of the listed Distinct Population Segment (DPS) and to assess each species ability to survive and recover. These population viability parameters are: abundance, population growth rate, spatial structure, and diversity (McElhany et al. 2000). While there is insufficient data to evaluate these population viability parameters quantitatively, NMFS has used existing information to determine the general condition of the populations in the CCC steelhead DPS and the factors responsible for the current status of these listed species.

We use these population viability parameters as surrogates for "reproduction, numbers, and distribution" in the regulatory definition of "jeopardize the continued existence of" (50 CFR 402.02). For example, abundance, population growth rate, and distribution are surrogates for numbers, reproduction, and distribution, respectively. The fourth parameter, diversity, is related to all three regulatory criteria. Numbers, reproduction, and distribution are all affected when

[1] NMFS defines a viable salmonid population as "an independent population of any Pacific salmonid (genus *Oncorhynchus*) that has a negligible risk of extinction due to threats from demographic variation, local environmental variation, and genetic diversity changes over a 100-year time frame" (McElhany et al. 2000).

genetic or life history variability is lost or constrained, resulting in reduced population resilience to environmental variation at local or landscape-level scales.

This opinion analyzes the effects of the proposed action on the CCC steelhead DPS and designated critical habitat for CCC steelhead DPS:

> **CCC steelhead DPS**
> Threatened (71 FR 834; January 5, 2006)
> Critical habitat designation (70 FR 52488; September 2, 2005).

2.2.1. CCC Steelhead Status

CCC steelhead was listed as federally threatened in 1996 and updated in 2006 and critical habitat was designated in 2005. This DPS includes all naturally spawned steelhead from the Russian River in Sonoma County to Aptos Creek in Santa Cruz County as well as the drainages of San Francisco, Suisun, and San Pablo Bays eastward to Chipps Island at the confluence of the Sacramento and San Joaquin Rivers. Historically, approximately 70 populations[2] of steelhead existed in the CCC steelhead DPS (Spence et al. 2008, Spence et al. 2012). About 37 of these were considered independent, or potentially independent (Bjorkstedt et al. 2005). The remaining populations were dependent upon immigration from nearby CCC steelhead DPS populations to ensure their viability (McElhany et al. 2000, Bjorkstedt et al. 2005).

While historical and present data on abundance are limited, CCC steelhead numbers are substantially reduced from historical levels. A total of 94,000 adult steelhead were estimated to spawn in the rivers of this DPS in the mid-1960s, including 50,000 fish in the Russian River– the largest population within the DPS (Busby et al. 1996). Though still below historic levels, the trend of adult returns to the Warm Springs and Coyote Valley fish facilities on the Russian River has improved since the 1980s and '90s. Abundance estimates for smaller coastal streams in the DPS indicate low but stable levels with recent estimates for several streams (Lagunitas, Waddell, Scott, San Vicente, Pudding, Caspar creeks) of individual run sizes of 500 fish or less (62 FR 43937; August 18, 1997). Some loss of genetic diversity has been documented and attributed to previous among-basin transfers of stock and local hatchery production in interior populations in the Russian River (Bjorkstedt et al. 2005). In San Francisco Bay streams, reduced population sizes and fragmentation of habitat has likely also led to loss of genetic diversity in these populations.

A 2008 viability assessment of CCC steelhead concluded that populations in watersheds that drain to San Francisco Bay are highly unlikely to be viable, and the limited information available did not indicate that any other CCC steelhead populations were demonstrably viable (Spence et al. 2008). As of 2016, the scarcity of information on CCC steelhead abundance continued to make it difficult to assess whether conditions have changed appreciably since the previous status review assessment (Williams et al. 2016).

[2] Population as defined by Bjorkstedt et al. 2005 and McElhaney et al. 2000 as, in brief summary, a group of fish of the same species that spawns in a particular locality at a particular season and does not interbreed substantially with fish from any other group. Such fish groups may include more than one stream.

In the federal recovery plan, CCC steelhead that occur throughout Napa County are included in the Interior San Francisco Bay Diversity Stratum (NMFS 2016b). Population-level estimates of adult abundance are also lacking for all nine independent populations and three dependent populations of steelhead in the Interior San Francisco Bay Stratum identified as essential or supporting in the federal recovery plan. While data availability in 2023 for this DPS remained generally poor, the new information for CCC steelhead available since the previous viability assessment (Williams et al. 2016) indicates that overall extinction risk is moderate and has not changed appreciably since the prior assessment (Spence 2023). The most recent status update concludes that steelhead in the CCC DPS remain "likely to become endangered in the foreseeable future", as new and additional information does not appear to suggest a change in extinction risk (NMFS 2016a). NMFS concluded that the CCC steelhead DPS shall remain listed as threatened (81 FR 33468; May 26,2016).

A final recovery plan for CCC steelhead was completed by NMFS in October 2016 (NMFS 2016b). The plan describes key threats, actions needed to achieve recovery, and measurable criteria by which NMFS will determine when recovery has been reached. All threats identified at the time of listing continue to impair CCC steelhead and their habitats, and several threats (urbanization, habitat blockages, water diversions, water management, instream habitat problems, and certain agriculture [illegal marijuana cultivation operations]), pose particularly severe threats to the DPS. Recovery plan actions are primarily designed to restore ecological processes that support healthy steelhead populations, and address the various activities that harm these processes and threaten the species' survival. The recovery plan calls for a range of actions including the restoration of floodplains and channel structure, restoring riparian conditions, improving streamflows, restoring fish passage, and protecting and restoring estuarine habitat, among other actions.

2.2.2. Status of Critical Habitat

In designating critical habitat, NMFS considers the following requirements of the species: 1) space for individual and population growth and for normal behavior; 2) food, water, air, light, minerals, or other nutritional or physiological requirements; 3) cover or shelter; 4) sites for spawning, reproduction, and rearing offspring; and 5) habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of the species (50 CFR 424.12(b)). In addition to these factors, NMFS also focuses on PBFs (formerly termed PCEs and/or essential habitat types) within the designated area that are essential to the conservation or protection (81 FR 7414; February 11, 2016).

PBFs for CCC steelhead critical habitat within freshwater include:

- freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development;
- freshwater rearing sites with:
    - water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility;
    - water quality and forage supporting juvenile development;

    - natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks;
- freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.

The condition of designated critical habitat for CCC steelhead, specifically its ability to provide for their conservation, has been degraded from conditions known to support viable salmonid populations. Impairments are due to a suite of water and land developments that lead to degradation of habitat and indirect and direct impacts to steelhead. For example, diversion and storage of river and stream flow has dramatically altered the natural hydrologic cycle in many of the streams within the CCC steelhead DPS. Altered flow regimes can delay or preclude migration, dewater aquatic habitat, strand fish in disconnected pools, entrain juvenile fish, and interrupt channel processes necessary for maintenance of high quality habitat. Similarly, land development has led to channelization of streams and placement of developed areas close to waterways. Stormwater runoff from urbanized areas and roadways can degrade water quality and injure and kill steelhead. For example, recent publications have identified a degradation product of tires (6PPD-quinone) as the causal factor in salmonid mortality at concentrations of less than one part per billion (Tian et al. 2022, Brinkmann et al. 2022, Tian et al. 2020; Peter et al. 2018).

NMFS has determined that currently depressed population conditions are, in part, the result of the following human-induced factors affecting critical habitat[3]: logging, agriculture, mining, urbanization, stream channelization and bank stabilization, dams, wetland loss, and water withdrawals (including unscreened diversions for irrigation). Impacts of concern include altered stream bank and channel morphology, elevated water temperature, lost spawning and rearing habitat, habitat fragmentation, impaired gravel and wood recruitment from upstream sources, degraded water quality, lost riparian vegetation, and increased erosion into streams from upland areas (Weitkamp et al. 1995; Busby et al. 1996; 64 FR 24049; 70 FR 52488).

2.2.3. Additional Threats to Listed Species and Critical Habitat

2.2.3.1 Global Climate Change

Another factor affecting the rangewide status of steelhead and their critical habitat is climate change. Recent work by the NMFS Science Centers ranked the relative vulnerability of west-coast salmon and steelhead to climate change. In California, listed coho and Chinook salmon are generally at greater risk (high to very high risk) than listed steelhead (moderate to high risk) (Crozier et al. 2019).

[3] Other factors, such as overfishing and artificial propagation have also contributed to the current population status of these species. All these human induced factors have exacerbated the adverse effects of natural environmental variability from such factors as drought and poor ocean productivity.

Impacts from global climate change are already occurring in California. For example, average annual air temperatures, heat extremes, and sea level increased in California over the last century (Kadir et al. 2013). Snowmelt from the Sierra Nevada has declined (Kadir et al. 2013). Although CCC steelhead are not dependent on snowmelt driven streams, they have likely already experienced some detrimental impacts from climate change through lower and more variable stream flows, warmer stream temperatures, and changes in ocean conditions. California experienced well below average precipitation during the 2012-2016 drought, as well as record high surface air temperatures in 2014 and 2015, and record low snowpack in 2015 (Williams et al. 2016). Paleoclimate reconstructions suggest the 2012-2016 drought was the most extreme in the past 500 to 1,000 years (Williams et al. 2016, Williams et al. 2020, Williams et al. 2022). Anomalously high surface temperatures substantially amplified annual water deficits during 2012-2016. California entered another period of drought in 2020. These drought periods are now likely part of a larger drought event (Williams et al. 2022). This recent long-term drought, as well as the increased incidence and magnitude of wildfires in California, have likely been exacerbated by climate change (Williams et al. 2020, Williams et al. 2022, Diffenbaugh et al. 2015, Williams et al. 2019).

The threat to CCC steelhead from global climate change is expected to increase in the future. Modeling of climate change impacts in California suggests that average summer air temperatures are expected to continue to increase (Lindley et al. 2007; Moser et al. 2012). Heat waves are expected to occur more often, and heat wave temperatures are likely to be higher (Hayhoe et al. 2004; Moser et al. 2012; Kadir et al. 2013). Total precipitation in California may decline and the magnitude and frequency of dry years may increase (Lindley et al. 2007; Schneider 2007; Moser et al. 2012). Similarly, wildfires are expected to increase in frequency and magnitude (Westerling et al. 2011; Moser et al. 2012). Increases in wide year-to-year variation in precipitation amounts (droughts and floods) are projected to occur (Swain et al. 2018). Estuarine productivity is likely to change based on changes in freshwater flows, nutrient cycling, and sediment amounts (Scavia et al. 2002; Ruggiero et al. 2010).

In marine environments, ecosystems and habitats important to juvenile and adult salmonids are likely to experience changes in temperatures, circulation, water chemistry, and food supplies (Brewer and Barry 2008; Feely 2004; Osgood 2008; Turley 2008; Abdul-Aziz et al. 2011; Doney et al. 2012). Some of these changes, including an increased incidence of marine heat waves, are likely already occurring, and are expected to increase (Frolicher et al. 2018). In fall 2014, and again in 2019, a marine heatwave formed throughout the northeast Pacific Ocean, which greatly affected water temperature and upwelling from the Bering Sea off Alaska, south to the coastline of Mexico (NMFS 2023d). The marine waters in this region of the ocean are utilized by salmonids for foraging as they mature (Beamish 2018). Although the implications of these events on salmonid populations are not fully understood, they are having considerable adverse consequences to the productivity of these ecosystems and presumably contributing to poor marine survival of salmonids.

2.2.3.2 Water Quality

Recently published work has identified stormwater runoff from roadways and streets as causing mortality of adult coho salmon in the wild (Scholz et al. 2011) and laboratory settings (McIntyre et al. 2018). Subsequent laboratory studies showed this morality also occurred in juvenile coho

salmon (Chow et al. 2019) as well as juvenile steelhead and Chinook salmon (Brinkmann et al. 2022). These recent publications have identified a degradation product of tires (6PPD-quinone) as the causal factor in this mortality (Tian et al. 2022, Brinkmann et al. 2022, Tian et al. 2020; Peter et al. 2018). The parent compound (6PPD) is widely used by multiple tire manufacturers and the tire shreds/dust that produce the degradation product have been found to be ubiquitous where both rural and urban roadways drain into waterways (Feist et al. 2018, Sutton et al. 2019).

2.3. Action Area

"Action area" means all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area for this project is the area that will be directly and indirectly impacted by the proposed action and includes stream channels, detention basins, dredged material rehandling sites, and roadway maintenance sites within Napa County, California. The action area also includes work sites (including staging and storage sites), areas adjacent to or proximal to work sites, and channel reaches downstream of work sites, including freshwater stream reaches, and estuarine (tidal) reaches in Napa County, California. The entirety of the RGP's action area is SMP project sites in Napa County (see figures 1-1 through 1-7 of the SMP Manual). While the District may implement SMP actions anywhere in Napa County, the majority of SMP activities will be conducted in the Napa River watershed, specifically on tributaries to the Napa River.

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 impacts to listed species or designated critical habitat from federal agency activities or existing federal agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

The action area experiences a Mediterranean climate characterized by cool, wet winters with typically high runoff and dry, warm summers, which can result in greatly reduced instream flows. Summer maximum temperatures averaging around mid-80 degrees Fahrenheit with minimum temperatures averaging around 50 degrees Fahrenheit. Winter maximum temperatures typically average around 50 degrees Fahrenheit with minimums averaging around 20 degrees Fahrenheit. Mean average precipitation for Napa County varies from 35–40 inches in the western side of county, and 20–25 inches in the eastern side of the County (Watershed Information and Conservation Council of Napa County 2023). Most of the precipitation falls as rain from October through April (the wet season) of each year, with episodes of high rainfall intensity. The topography of Napa County is mixed, ranging from relatively flat lowlands, moderately steep hills, and high gradient coastal mountains. The geology of Napa County is similarly mixed, with erosive, alluvial sediments predominating lowlands, and mixed sediments and bedrock with lower permeability and steep slopes present at moderate and higher elevations. This mixed

topography and geology, combined with seasonal rainfall patterns results in flashy surface water flows and high erosion potential throughout the County. Additionally, these conditions have been exacerbated by road systems, urbanization, and channelization. Streams that previously migrated and deposited their materials across a broad fan or plain surface are now contained in linear channels. As a result, many streams in the action area carry a relatively large sediment load, which is typically deposited throughout lower gradient reaches.

The estuarine portions of the action area are limited to the lower Napa River and the lower southernmost tributaries to the Napa River. This tidally-influenced portion of the action area receives freshwater input from tributary streams, stormwater runoff, and wastewater from municipal and industrial sources that vary in volume depending on the location and seasonal weather patterns. The freshwater outflow pattern is seasonal with the highest outflow occurring in the winter and spring. Current and wave patterns in the estuarine portion of the action area are largely generated by the tides interacting with the bottom and shoreline configurations. The substrate in estuarine channels of the action area is comprised of sand and mud, overlying metamorphic and sedimentary bedrock.

2.4.1. Status of CCC Steelhead and Critical Habitat in the Action Area

CCC steelhead are native to and present throughout accessible reaches of the Napa River and its tributaries, and all SMP activities that may affect steelhead will occur in the Napa River watershed. The Napa River population of CCC steelhead has been identified as an independent population within the Interior San Francisco Bay Diversity Stratum (NMFS 2016b). While the action area supports all freshwater life stages of steelhead, only juvenile steelhead are expected to be present during SMP construction activities due to the program's work window (i.e., June 15 through October 31). Some vegetation maintenance activities may occur outside the work window when adult steelhead are migrating and spawning in streams; however, these actions would be limited to the use of hand-held tools and the infrequent use of larger equipment during actions needed to reduce imminent flood risk.

Lack of data is a persistent limitation to estimating abundances of CCC steelhead populations in streams within the action area. Estimates of adult steelhead returns to the Napa River watershed are not available, but some information is available regarding juvenile steelhead abundance during the summer and fall rearing period. Observed densities of juvenile steelhead have varied widely, with estimates in the Napa River and its tributaries ranging from less than one juvenile steelhead per linear foot of stream to over seven juvenile steelhead per linear foot of stream surveyed (Leidy et al. 2005, Napa RCD 2011, Napa RCD and Prunuske Chatham 2012, Napa County RCD 2020, and Napa RCD 2023, Stillwater Sciences 2007).

Summarized by Spence (2023), spawner surveys primarily targeting Chinook salmon (but occasionally steelhead) have been conducted in recent years in selected portions of the Napa River watershed and its tributaries. These efforts have produced occasional observations of steelhead redds, live fish, or carcasses. Additionally, a rotary screw trap operated near the upper limit of tidal influence has resulted in capture of 31 to 242 smolts annually since 2009. Smolt trap efficiency has averaged about 12 percent during this period, suggesting that total smolt production has generally ranged from a few hundred to perhaps 2,000 fish. These efforts confirm

the continued occurrence of steelhead in this watershed; however, the data are insufficient to determine if the population has increased or decreased since the previous viability assessment.

While juvenile steelhead have been captured throughout the Napa River watershed, low densities during sampling events suggests abundance is low. Drought conditions from 2014 to 2016, and 2020 to 2022, resulted in few and short periods of flow connectivity between headwater areas and San Francisco Bay which significantly reduced opportunities for smolt outmigration as well as adult migration and spawning. Due to degraded instream habitat conditions throughout much of the action area and the impacts of extended drought, steelhead densities are likely low in most streams and tributaries in the action area.

Designated critical habitat within the action area is moderately degraded from properly functioning condition due to impacts from land use in the Napa River watershed (NMFS 2016b). Vegetation, channel form and function, water quality, surface water flows, stormwater runoff, and passage conditions have all been altered by land uses, including road construction and maintenance; urban, suburban, rural, and agricultural development; and flood control and other water management practices (NMFS 2016b). NMFS (2016b) identifies these factors as limiting the viability of the Napa River CCC steelhead population and recommends recovery actions to address these factors, including fish passage improvements, habitat complexity and gravel quality improvement, riparian canopy and stream temperature improvement, and seasonal and summer flow protections (See Napa River Population description, including recover actions, in NMFS 2016b, v. IV, pp 739-767).

2.4.2. Climate Change in the Action Area

As described above in the Status of the Species and Critical Habitat section of this opinion (Section 2.2.4.1), climate change poses a threat to anadromous salmonid populations in central California. In the San Francisco Bay region, warm temperatures generally occur in July and August, but with climate change these events will likely begin in June and could continue through September (Cayan et al. 2012). Climate simulation models indicate the San Francisco region will maintain its Mediterranean climate regime for the 21st century; however, these models predict a high degree of variability in annual precipitation through at least 2050, leaving the region susceptible to drought (Cayan et al. 2012). These models of future precipitation suggest that, during the second half of the 21st century in this region, most years will be drier than the historical annual average (1950-1999). Recent drought conditions in California were likely exacerbated by climate change (Williams et al. 2020, Williams et al. 2022, Diffenbaugh et al. 2015, Williams et al. 2019).

2.4.3. Previous Section 7 Consultations and Section 10 Permits in the Action Area

Numerous previous consultations pursuant to Section 7 of the ESA have occurred in the action area for a wide range of projects, including prior stream maintenance activities performed by Napa County. For the majority of these projects, NMFS determined that they were not likely to adversely affect CCC steelhead or designated critical habitat. For the smaller number of projects with potential adverse effects on threatened steelhead and/or designated critical habitat, NMFS determined that they were not likely to jeopardize the continued existence of listed fish nor adversely modify critical habitat. These formal consultations, where the proposed actions were

likely to adversely affect ESA-listed fish species or their designated critical habitat, resulted in opinions containing RPMs to minimize the impacts of incidental take of listed fish species.

In addition to individual section 7 consultations, NMFS has conducted six programmatic consultations that cover activities in all or portions of the action area. Five of these programmatic consultations resulted in non-jeopardy, non-adverse modification biological opinions containing Reasonable and Prudent Measures (RPMs) to minimize the impacts of incidental take of listed species. The remaining programmatic consultation resulted in a letter of concurrence with the action agency's determination that the proposed program would not adversely affect ESA-listed fish species or critical habitat. Formal and informal consultations covered a range of project types across the action area.

Section 10(a)(1)(A) research and enhancement permits and section 4(d) limits or exceptions could potentially occur in the Napa River watershed, including the action area. Salmonid monitoring approved under these programs includes carcass surveys, smolt outmigration trapping, and juvenile density surveys. In general, these activities are closely monitored and require measures to minimize take during the research activities. The Napa RCD has a section 4(d) authorization for sampling steelhead in the Napa River watershed.

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 but are not part of the action. 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 402.02).

The implementation of the SMP maintenance activities may cause a number of effects on CCC steelhead and their designated critical habitat throughout the action area. The effects are expected to result from dewatering streams and relocation of fish, disruption of fluvial processes with bank stabilization and sediment removal, vegetation removal, heavy equipment operation, exposure to toxic materials and herbicides, and site/habitat restoration. SMP proposed activities are all routine maintenance actions common in the action area and elsewhere in coastal California streams; thus, these activities have predictable effects regardless of where in the action area they are implemented. The effects occur through pathways including:

- Dewatering, and fish collection and relocation;
- Impaired water quality (elevated suspended sediment, small spills and leaks, herbicide use adjacent to streams, stormwater runoff);
- Habitat alterations (riparian and streambank disturbance, changes in stream form and function); and
- Temporary reduction in aquatic invertebrate prey in dewatered isolation areas.

Habitat improvement projects, implemented with other SMP activities, are expected to have long-term beneficial effects to steelhead and their habitat. These beneficial effects may improve

the viability of the steelhead population in the Napa River watershed through increased abundance, productivity, and spatial structure. Habitat improvement projects carried out in critical habitat are likely to improve the conservation value of the PBFs at the project site, and potentially extend to reaches above and below project sites.

The total number of SMP projects and limits on activities are described in Section 1.3 of this opinion (also see Biological Assessment Table 1, updated March 11, 2024, as included in the 2024 SMP Manual Addendum). These represent the maximum amount of such activities that may be authorized by RGP and could occur within the action area per year. Based on the large size of the action area, only a portion of these activities are expected to occur in any one year within or nearby to streams containing CCC steelhead, or their designated critical habitat. Although it is unlikely that all SMP projects will occur in or near steelhead streams, for purposes of analyzing the potential effects of the RGP, NMFS assumes that up to the maximum extent of the SMP activities could occur within or near streams or waterbodies containing CCC steelhead, their critical habitat, or both. While this will likely overestimate impacts on steelhead and critical habitat, the locations of future projects conducted by this program are uncertain.

2.5.1. Dewatering, and Fish Collection and Relocation

Temporarily dewatering stream reaches and capturing and relocating fish may be necessary during the implementation of some RGP activities described in Section 1.3. Whether or not an individual project requires dewatering (and therefore fish collection and relocation) depends on the location, timing, and type of proposed project. In instances where dewatering is necessary, streamflow will be diverted around the project site and fish will be captured and relocated to a stream reach outside of the work area.

Fish collection and relocation activities pose a risk of injury or mortality to rearing juvenile salmonids. Any fish collecting gear, whether passive (Hubert 1996) or active (Hayes et al. 1996) has some associated risk to fish, including stress, disease transmission, injury, or death. The effects of seining and dip-netting on juvenile fish include stress, scale loss, physical damage, suffocation, and desiccation. Electrofishing can kill juvenile fish, and researchers have found serious sub-lethal effects including spinal injuries (Nielsen 1998, Nordwall 1999).

The primary contributing factors to stress and death from handling are differences in water temperatures (between the river and wherever the fish are held), dissolved oxygen conditions, the amount of time that fish are held out of the water, and physical trauma. Stress on salmonids increases rapidly from handling if the water temperature exceeds 18 degrees Celsius (64 degrees Fahrenheit) or dissolved oxygen is below saturation. Fish that are transferred to holding tanks can experience trauma if care is not taken in the transfer process, and fish can experience stress and injury from overcrowding in holding facilities, if the tanks are not emptied on a regular basis. Although sites selected for relocating fish will likely have similar water temperature as the capture site and should have ample habitat, in some instances relocated fish may endure short-term stress from crowding at the relocation sites. Relocated fish may also have to compete with other native and non-native fishes for available resources such as food and habitat. Some of the fish at the relocation sites may move and reside in areas that have more suitable habitat and lower fish densities. As each fish moves, competition is expected to remain localized to a small area or quickly diminish as fish disperse. Capturing and handling all fish causes them stress,

though they typically recover fairly rapidly from the process and therefore the overall effects of the procedure are generally short-lived. Juvenile fish that avoid capture in the project work area will likely die during dewatering activities due to desiccation or thermal stress.

Stress to juvenile steelhead caused by dewatering and handling is not likely to be sufficient to reduce their individual fitness or performance. Restricting the work window to June 15 through October 31 will limit the effects to stream rearing juvenile steelhead. Sites selected for relocation should have similar water temperatures as the capture sites, and should have adequate habitat to allow for survival of transported fish. NMFS cannot accurately estimate the number of fish that may be affected by competition, but based on the small areas to be affected and the relatively small number of steelhead to be relocated we do not expect this short-term stress to reduce the individual performance of juvenile steelhead, or cascade through watershed populations of these species. The AMMs proposed for fish capture and release, use of pump-intake screens during the dewatering phase, and fish passage around the isolation area are based on standard NMFS guidance (NMFS 1996) to reduce the adverse effects of these activities (NMFS 2023c). Key conservation measures in the guidance such as avoiding work during times of high stream temperatures significantly reduces mortality that can occur during work area isolation. Use of properly sized screens during water withdrawal will reduce or nearly eliminate injury or death of fish caused by entrainment.

Given the variable densities of steelhead throughout the permit area, the number of steelhead encountered and estimates of mortality will vary with project location, timing, and magnitude. Fish relocation activities will occur during the summer low-flow period after emigrating smolts have left the proposed project sites and before adult fish travel upstream in the winter. Therefore, steelhead that may be captured will be juveniles, generally young-of-the-year and one-year age classes. Since fish relocation activities will be conducted by qualified fisheries biologists following NMFS electrofishing guidelines (NMFS 2000), injury and mortality of juvenile salmonids during capture and relocation will be minimized. The guidelines provided by NMFS and applicable AMMs are expected to be effective at removing steelhead from work sites and therefore we anticipate that that less than one percent of steelhead in an area will remain in a project site following dewatering. Any fish that remain would likely die during dewatering. Data on fish relocation efforts between 2002 and 2009 show mortality rates from fish capture and relocation are approximately two percent for steelhead (Collins 2004; CDFW 2005, 2006, 2007, 2008, 2009, 2010). Therefore, unintentional mortality of juvenile steelhead expected from dewatering, capture, and handling procedures is not likely to exceed three percent.

2.5.2. Impaired Water Quality

Construction in and near streams has the potential to cause turbidity and sedimentation, as well as the release of contaminants into aquatic habitat.

2.5.2.1 Turbidity and Sedimentation

Turbidity is the degree to which water loses its transparency due to the presence of suspended sediment. Proposed SMP activities have the potential to increase suspended sediment concentrations and turbidity in streams. It is anticipated that juvenile steelhead within the action area may be exposed to small, short-term, pulses of turbidity. These pulses may occur either: 1)

when previously armored sediment in a dry channel is mobilized as the action area re-waters the following fall; or 2) immediately during construction activities that require dewatering. A temporary pulse of elevated turbidity is also expected after flow gates are opened during a medium or high tide event to allow for flushing of interior drainage channels (e.g., 45-acre wetland mitigation site adjacent to Edgerly Island).

Deposition of fine sediments can reduce incubation success (Bell 1991), interfere with primary and secondary productivity (Spence et al. 1996), and degrade cover for juvenile salmonids (Bjornn and Reiser 1991). Chronic, moderate turbidity can harm newly-emerged salmonid fry, juveniles, and even adults by causing physiological stress that reduces feeding and growth and increases basal metabolic requirements (Bjornn and Reiser1991, Servizi and Martens 1992, Spence et al. 1996). Sedimentation leads to increased substrate embeddedness and a reduction in the depth, volume, and frequency of pools. The overall effect of high levels of sediment input is a substantial reduction in the quality and extent of spawning gravels and deep-water refugia for adults and reduced survival of eggs and alevin (Meehan and Bjornn 1991). Sediment deposition can alter macroinvertebrate community composition and reduce the density, biomass, and diversity of aquatic invertebrates available to foraging juveniles. As visual predators, turbid conditions can reduce the foraging efficiency of salmonids thereby reducing growth rates if conditions continue for long periods (Shaw and Richardson 2001). A turbidity level greater than 5 nephelometric turbidity units (NTU) is considered visible and levels above 25 NTU have been shown to cause reductions in salmonid growth (Sigler et al. 1984). Turbidity levels necessary to impair feeding are likely in the 100-150 NTU range (Harvey and White 2008; Gregory and Northcote 1993).

Water quality monitoring performed in Humboldt County at 11 newly replaced stream culverts provides information that is useful in assessing the relative magnitude of construction effects on in-stream water quality (Humboldt County 2002, 2003 and 2004). During the first winter following construction activities, turbidity levels downstream of the 11 culverts increased an average of 19 percent when compared to measurements directly above the culvert (Humboldt County 2002, 2003 and 2004). Although the culvert monitoring results show decreasing sediment effects as projects age from year one to year three, a more important consideration is that most measurements fell within levels that were likely to only cause slight behavioral changes (e.g., increased gill flaring [Berg and Northcote 1985], elevated cough frequency [Servizi and Martens 1992], and avoidance behavior [Sigler et al. 1984]). Only 1 of the 11 sites in Humboldt County recorded levels exceeding 100 NTU (NF Anker Creek, year 1), whereas the majority (81 percent) of downstream readings was less than 20 NTU.

SMP activities are proposed to occur during work windows (June 15-October 31) that coincide with the lowest flows of the year. Conducting work during these times will result in less mobilization of fine sediments, and with the implementation of erosion control BMPs, downstream sediment effects from the proposed SMP activities are expected to extend downstream no further than a few hundred feet below project sites. Within this zone, NMFS anticipates turbidity effects will fall below thresholds that result in the injury or mortality of listed salmonids. Instead, the most likely result of turbidity levels will be minor behavioral responses by affected fish that are unlikely to appreciably reduce their fitness. Therefore, NMFS

expects that any exposure to temporary turbidity pulses will not result in a reduction in survival rates.

2.5.2.2 Contaminants

Construction operations associated with some SMP activities in, over, and near surface waters, have the potential to release debris, hydrocarbons, concrete, wood preservatives, fuels, and similar contaminants into streams. These SMP construction activities are associated with sediment and debris removal, erosion protection and bank stabilization, drainage structure repairs and maintenance, unpaved road maintenance, and habitat protection and enhancement. Similarly, application of herbicides along waterways, as will occur with implementation of the SMP has the potential to introduce chemicals into receiving waters.

Materials used during construction can enter streams directly during construction or via runoff post-construction (equipment spills and discharges, debris leaks, hydrocarbons, concrete, wood preservatives, fuels, and similar contaminants). If introduced into streams, these materials could impair water quality by altering the pH, reducing oxygen concentrations as the debris decompose, or by introducing toxic chemicals such as hydrocarbons or metals into aquatic habitat. Oils and similar substances from construction equipment can contain a wide variety of polynuclear hydrocarbons (PAHs; also known as polycyclic aromatic hydrocarbons) and metals. PAHs can be acutely toxic to salmonid fish and other aquatic organisms at high levels of exposure and can cause sublethal adverse effects to aquatic organisms at lower concentrations (Heintz et al. 1999; Incardona et al. 2004; Incardona et al. 2005; Incardona et al. 2006).

During vegetation maintenance activities, any herbicides reaching surface waters may result in mortality to fish during incubation, or lead to altered development of embryos. Stehr et al. (2009) found that the low levels of herbicide delivered to surface waters are unlikely to be toxic to the embryos of ESA-listed salmon, steelhead, and trout. However, sub-lethal effects such as reduced growth and development, decreased predator avoidance, or modified behavior may occur. Herbicides are likely to also adversely affect the food base for listed salmonids and other fish, which includes terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.

The active ingredients of herbicides (and surfactants) proposed for use in the SMP are approved by the EPA for aquatic use and are considered only slightly toxic or practically nontoxic to fish as defined by EPA. The Effective Concentration 50 (EC50)[4] of over 100 ppm or Lethal Concentration 50 (LC50) between 10-100 parts per million (ppm). NMFS has previously analyzed the effects of these activities using the similar active ingredients and project design criteria for the Habitat Improvement Program conducted by the Bonneville Power Administration (BPA) (NMFS 2020). In this most recent analysis, BPA analyzed the aquatic toxicity of numerous herbicides using EPA's GENEEC modeling software to produce generic estimated environmental concentrations (EECs) assuming direct application of the active

[4] A LC50 is the dose that is acutely lethal to 50 percent of the test subject population, while an EC50 is the dose that produces an acute effect in 50 percent of the test population. More information available at: https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/technical-overview-ecological-risk-assessment-0.

ingredient to a one-acre pond that is one foot deep. These EECs were compared to adverse effect thresholds for listed salmonids defined as either 1/20th of the LC50 value or the lowest acute or chronic "no observable effect concentration", whichever was lower. The glyphosate-based products proposed for use in the SMP underwent this comparison and were found to be of "low concern", for having a risk of adversely affecting listed salmonids (NMFS 2020).

The SMP includes several measures restricting the application of herbicides to prevent the discharge of contaminants into streams with CCC steelhead. Herbicide use will be limited to glyphosate and imazapyr, and may only be applied from June 15 through November 15. The maximum quantities of herbicides applied will be limited to 8 gallons per month (5 gallons glyphosate and 3 gallons imazapyr) for a maximum total of 40 gallons applied annually. Herbicides will not be applied directly to water bodies and aerial spraying of herbicides is prohibited. Within channel banks, herbicides will only be applied above the high-water mark using focused application methods, such as backpack sprayers and/or direct application using a paintbrush. Herbicides will not be applied in advance of precipitation that might result in conveyance of herbicides to receiving waters.

However, due to proximity of construction activities and herbicide use to waterways, including along stream banks, channels, and within riparian habitat, the potential for multiple projects to be implemented in any one year and the large action area, there is the potential that some contaminants could inadvertently enter the aquatic environment. Pathways for contaminants entering streams include unintentional spray drift, accidental spills, or chemical transport by erosion and sediment transport, runoff, or soil percolation. Therefore, despite the inclusion of buffers, restricted application methods, and spill prevention and containment measures, it is reasonably likely that some small amount of these contaminants may reach streams with CCC steelhead and that this could result in exposure of steelhead to low levels of contaminants that may result in some adverse effects. We cannot estimate the precise number of individual CCC steelhead that will experience adverse effects from exposure to contaminants because we cannot predict the number or duration of inadvertent conveyance events nor the number of individual fish that will be exposed during those events. However, contaminants introduced into waters are expected to be limited to a few small, localized events occurring each year, or less. These events are not expected to degrade stream habitat, including CCC steelhead critical habitat, and we expect that only a very small number of CCC steelhead (adults, smolts, eggs, alevins, juveniles) in the dispersed locations or across the broader action area will experience harm (injury or mortality due to poor water quality) over the duration of SMP implementation.

The SMP includes measures to avoid and minimize conveyance of contaminants to waterways. To minimize the risk of contamination from accidental spills or leaks, all ground-disturbing, in-channel SMP construction activities will take place during the low-flow period, between June 15 and October 31. Repair and maintenance equipment and materials will be staged within existing service roads, paved roads, or other pre-determined staging areas away from steelhead-bearing streams. No runoff from the staging areas may be allowed to enter waters of the State, including the creek channel or storm drains, without being subjected to adequate filtration (e.g., vegetated buffer, hay wattles or bales, silt screens). Testing and disposal of sediment disposal activities, including reuse at rehandling sites (Imhola Avenue and Edgerly Island), is expected to prevent contaminant exposure to aquatic species. Additionally, maintenance of detention basins (debris

and sediment removal) will aid the treatment of runoff from developed areas, reducing the conveyance of contaminants from these areas into receiving waters.

2.5.2.3 Stormwater Runoff

Stormwater runoff from repaired and replacement drainage structures (outfalls, basins, drains, gates) will result in delivering a wide variety of pollutants to aquatic ecosystems, such as nutrients, metals, petroleum-related compounds, sediment washed off the road surface, and agricultural chemicals used under this programmatic consultation. No new drainage structures will be installed in the SMP. Stormwater inputs will result in short-term reduction of water quality and an increase in water quantity due to concentrated flows, which are reasonably certain to cause injury to fish depending on the level of exposure. Stormwater contaminants cause a variety of lethal and sublethal effects on fish, including disrupted behavior, reduced olfactory function, immune suppression, reduced growth, disrupted smoltification, hormone disruption, disrupted reproduction, cellular damage, and physical and developmental abnormalities (Fresh et al. 2005; Hecht et al. 2007). Stormwater treatment practices and flow control best management practices described in the proposed project design criteria will prevent pollution, or other adverse effects of stormwater from occurring up to the standards of Napa County's MS4 stormwater program.

The amount of harm, injury, or mortality to fish cannot be accurately quantified as a number of ESA-listed species because, although the relationship between numerical concentrations of stormwater pollutants are easily demonstrated in the lab, the pollutants in actual runoff come from many small sources that cannot be distinguished after they reach a given waterbody. The distribution of those pollutants also vary widely within that waterbody as a function of surrounding land use, pre-rainfall conditions, rainfall intensity and duration, and mixing from other drainage areas. Stormwater runoff events are often relatively brief, especially in urban streams, so that large inputs of runoff and pollutants can occur and dissipate within a few hours. Moreover, the distribution and abundance of fish that occur within the action area is inconsistent over time, affected by habitat quality, interactions with other species, and other influences that cannot be precisely determined by observation or modelling.

In the context of this programmatic consultation addressing actions that will vary spatiotemporally with low predictability, the best available indicator of harm, injury, or mortality to listed steelhead reflects the stormwater management requirements and practices that we assumed in analyzing the stormwater effects of the proposed action (Napa County's MS4 stormwater program). Upland development throughout Napa County complying with the MS4 requirements that are associated with drainage structures of the SMP will not provide a specific measure of watershed health. However, MS4 compliance and review requirements reflects the extent of harm, injury, or mortality because they correlate with the level of stormwater treatment that was assumed in the opinion; any MS4 non-compliance will result in harm, injury, or mortality at levels that were not analyzed in the opinion. Although the surrogate is somewhat coextensive with the proposed action it nevertheless functions as a meaningful reinitiation trigger because the Corps, District, and NMFS can track them in real time. It is expected that SMP drainage structure repair and maintenance activities of the SMP in the Napa River watershed will maintain their function to comply with Napa County's MS4 stormwater program.

2.5.3. Habitat Alterations

SMP actions are likely to affect stream substrate, riparian habitat, and stream channel form and function.

2.5.3.1 Effects to Benthic Habitat

Construction activities in the action area will result in both temporary and permanent effects to stream channels and their substrate. Temporary losses and alteration will also result from dewatering activities. Permanent losses of benthic habitat may result from actions that include placement of new permanent in-channel structures associated with bank stabilization and erosion protection projects.

Dewatering operations may affect steelhead by temporarily preventing juvenile steelhead from accessing the work area for forage. Benthic (bottom dwelling) aquatic macroinvertebrates are an important food source for rearing salmonids; they may be killed, or their abundance reduced when creek habitat is dewatered (Cushman 1985). However, effects to aquatic macroinvertebrates resulting from streamflow diversions and dewatering will be temporary because construction activities will be relatively short-lived. Rapid recolonization is expected following re-watering and typically occurs within one to two months (Cushman 1985, Thomas 1985, Harvey 1986). For this reason, we expect the function of benthic habitat will return to pre-project levels before adults and smolts use the action area for migration. The effect of macroinvertebrate loss on juvenile salmonids is likely to be negligible because food from upstream sources (via drift) would be available downstream of the dewatered areas via streamflow diverted around the project work sites. Thus, NMFS expects steelhead will be able to find food outside of project work sites as needed to maintain their fitness during construction activities.

Bank stabilization conducted under the SMP may result in permanent alteration of benthic and riparian habitats. Urban development along steelhead streams in the action area has constrained the lateral movement of channels and lead to incision, which ultimately results in erosion and bank instability that threatens structures along the top of bank. Projects utilizing riprap to stabilize banks and channelize streams create deep, homogenous channels with limited macroinvertebrate production and poor habitat quality for rearing and spawning salmonids (Sudduth and Meyer 2006; Hellmair et al. 2018). Within these reaches, juvenile salmonid habitat use is low and potential for predation by invasive fish such as smallmouth bass (*Micropterus dolomieu*) is high relative to other habitat types (Hellmair et al. 2018). Projects using bioengineered elements, such as rootwads, large wood, boulders, and submerged vegetation, can increase the diversity and abundance of benthic macroinvertebrates available for forage as well as increase habitat heterogeneity for rearing salmonids (Sudduth and Meyer 2006; Hellmair et al. 2018). Although habitat use by rearing salmonids is consistently higher in unmodified streams, habitat use in modified reaches with bioengineered elements is consistently higher than in homogenous reaches of rock riprap (Hellmair et al. 2018).

For the SMP, the use of hardscape will be limited and biotechnical methods and methods adhering to the SMP Maintenance Principles will be prioritized. The extent of temporary and

permanent losses to benthic habitat is expected to be limited in the steelhead streams of the action area and confined to the minimum amount necessary to protect infrastructure. This approach will help to maintain, and in some cases improve benthic habitat. Additional information regarding the effects of bank stabilization structures and sediment removal on stream channels and benthic habitat in the action area is presented below in Section 2.5.3.3 of this opinion.

The extent of harm to listed adult and juvenile steelhead due to benthic habitat alterations will be limited annually by the SMP. Within Natural Channels, each bank stabilization project with exposed hardened materials may not exceed 100 linear feet. In Other Channels (engineered, modified, and semi-modified channels), each bank stabilization project may not exceed 300 linear feet in length. If projects implement biotechnical features, additional lengths of stabilization may be installed with written consent from the Corps and NMFS. The cumulative limit for all bank stabilization projects combined over each 5-year period is 4,500 linear feet. However, because the SMP does not propose to implement a large number of projects annually or over the course of the program, we expect only a small number of steelhead may be exposed to effects to habitat loss due to bank stabilization and other benthic habitat alteration. Additionally, because the program includes AMMs, SMP Implementation and Oversight procedures, and habitat enhancement actions that will protect steelhead and enhance their habitat, including benthic habitat, we expect that impacts to benthic habitat will be further reduced. Thus, NMFS expects only a very small number of rearing juvenile or adult steelhead will be harmed by effects to benthic habitat disturbance and alteration.

2.5.3.2 Reduced Riparian Vegetation and Removal of Beneficial Instream Debris

SMP activities may require removal of riparian vegetation to access work sites and stage equipment, or to maintain flood control channels, maintain roads, or implement beaver activity management actions. Riparian vegetation helps maintain stream habitat conditions steelhead require. Riparian zones and aquatic vegetation serve important functions in stream ecosystems, such as providing shade (Poole and Berman 2001), sediment storage and filtering (Cooper et al. 1987, Mitsch and Gosselink 2000), nutrient inputs (Murphy and Meehan 1991), water quality improvements (Mitsch and Gosselink 2000), channel and streambank stability (Platts 1991), habitat heterogeneity (Bryant 1983, Lisle 1986, Shirvell 1990), and refugia (Bustard and Narver 1975, Wesche et al. 1987, Murphy and Meehan 1991). Riparian vegetation disturbance and removal can degrade these ecosystem functions and impair stream habitat. Riparian canopy is considered a primary driver of stream temperature (Poole and Berman 2001). Removal of riparian vegetation increases stream exposure to solar radiation, leading to increases in stream temperature.

Under this program, both beneficial instream debris, such as large woody debris (LWD), and detrimental debris, such as trash, may be removed from flood control channels in order to restore hydraulic capacity. Removal of trash and other detrimental debris benefits steelhead and their habitat by removing sources of pollution and contamination. Removal of beneficial instream debris has the potential to impair habitat. For example, reduced amount of LWD and instream and riparian vegetation leads to reduced amount of cover used by salmonids (Bisson et al. 1988; Bjornn and Reiser 1991) and increases potential for scour of stream bedload. According to

Bisson and Bilby (1987), one of the most important functions of LWD in forming salmon habitat is the creation of rearing pools.

While the implementation of the SMP has the potential result in the aforementioned impacts, due to the inclusion of AMMs, the SMP Maintenance Principles, and the SMP Implementation Oversight procedures, the effects of riparian disturbance and removal of beneficial instream debris are expected to be minor. Removal of vegetation and beneficial debris will be minimized and, with regard to riparian vegetation, disturbed areas are expected to regain lost shading and ecosystem function within a few years following construction due to replanting. Some SMP actions, such as bank stabilization, road maintenance, and flood control channel maintenance, may result in permanent losses of riparian habitat. However, by including SMP Maintenance Principles, AMMs, and the SMP Implementation Oversight procedures which prioritize biotechnical methods and support resource agency review, the development and implementation of projects that will impair habitat supported by vegetation and beneficial instream debris is expected to be limited to a very few projects. Additionally, with the SMP's robust revegetation and habitat enhancement activities (see Section 1.3.4.7 Habitat Protection and Enhancement of this opinion), improvements to vegetation and beneficial instream debris are expected to accrue over the course of program implementation, and impacts to vegetation and beneficial instream debris are expected to be further reduced.

The extent of harm to listed adult and juvenile steelhead due to the removal of riparian vegetation or beneficial instream debris cannot be estimated without site-specific projects plans. However, because the SMP does not propose to implement a large number of projects annually or over the course of the program, we expect only a small number of steelhead may be exposed to effects to vegetation and beneficial instream debris. Additionally, because the program includes AMMs, SMP Implementation and Oversight procedures, and habitat enhancement actions that will protect and enhance steelhead and their habitat, including habitat supported by vegetation and beneficial instream debris, we expect that impacts to steelhead resulting from impacts to vegetation and beneficial instream debris will be further reduced. Thus, we expect only a very small number of rearing juvenile or adult steelhead will be harmed by effects to vegetation and beneficial instream debris.

2.5.3.3 Changes in Stream Form and Function

SMP actions such as sediment and debris removal, erosion protection and bank stabilization, drainage structure repair and maintenance, unpaved road maintenance, beaver activity management, and habitat protection and enhancement are likely to alter channel processes. Channel processes are important for the maintenance of high-quality salmonid habitat. For example, in most low gradient streams (as occur through much of the action area), the channel will naturally "meander" by laterally eroding streambanks. This action dissipates hydraulic energy, creates a sinuous longitudinal course and efficiently regulates the erosive forces by lengthening the channel and reducing stream gradient; thus, controlling the ability of the stream to entrain and transport available sediment. Meandering streams also create and maintain both the hydraulic and physical components of instream habitat used by fish and other aquatic species. For salmon and steelhead, a meandering, unconstrained stream channel sorts and deposits gravel and other substrate necessary for optimal food production and spawning success, maintains a

healthy and diverse riparian corridor that supplies LWD to the channel, and inundates adjacent floodplain habitat during appropriate winter/spring flows (Spence et al. 1996).

Sediment, including gravel and cobble, plays a critical role in the physical and biological health of an anadromous salmonid stream. Sediment size is important in determining channel form and changes in sediment size distribution may induce channel changes (Kondolf 1997). Coarse sediment (i.e., gravel and cobble) has a tremendous ecological importance as habitat for benthic macroinvertebrates and as spawning habitat for salmonids. Gravel and cobble create interstitial spaces in the streambed which serve as cover and velocity refugia for small fish, and support through-sediment water flow which helps maintain oxygenation and cool water temperatures. The loss of sediment can reduce or eliminate hyporheic exchange, and the mixing between groundwater and surface water may be too short to significantly affect temperature (Beechie et al. 2012). In these and additional ways, sediment influences the physical habitat features and fish productivity of a stream.

Cover, which is supported by stream processes, is a similarly important habitat component for juvenile salmonids and smolts, both as velocity refuge and as a means of avoiding predation (Shirvell 1990, Meehan and Bjornn 1991, Moyle 2002). Salmonid juveniles will balance their use of cover and foraging habitats based on their competing needs for energy acquisition and safety (Bradford and Higgins 2001). Critical forms of cover include submerged vegetation, woody debris, and the interstitial spaces of stream bed gravel substrate (Raleigh et al. 1984). Juveniles will respond to threats of predation, including overhead motions, by huddling together and/or fleeing to nearby cover (Bugert and Bjornn 1991). Few young-of-the-year are found more than one meter from cover (Raleigh et al. 1984). Juvenile steelhead, particularly the younger, smaller individuals, have a notable response to disturbance; they rely on nearby substrate particles (i.e., gravel) for cover more so than other salmonids (Chapman and Bjornn 1969, Everest and Chapman 1972).

Sediment removal, erosion protection, and bank stabilization activities implemented under the SMP have the potential to impair stream form and function by removing substrate that is integral to channel processes, altering instream structure, and preventing lateral migration that is necessary for the maintenance of channel processes. These impairments to instream form and function have the potential to affect all habitat attributes described above by impacting the physical habitat in two general ways: 1) by changing a dynamic, unrestrained stream that constantly evolves via hydrologic and geomorphic processes into a fixed, simplified channel; and 2) by altering the physical land/water interface (i.e., streambank) that provides shelter, food, and other ecosystem benefits to aquatic species, including steelhead. For sediment and debris removal and beaver activity management, these impairments may be relatively temporary as vegetation will regrow and sediments and debris will be routinely replenished by downstream transport. For erosion protection, bank stabilization, drainage structure repair and maintenance, and unpaved road maintenance actions, impairments will be essentially permanent. For habitat protection and enhancement actions, permanent benefits to instream form and function are expected.

The permanent nature of some SMP activities (e.g., erosion protection, bank stabilization, and drainage structure repair and maintenance actions) will likely manifest as a continued reach-scale

depression in juvenile steelhead carrying capacity at existing impaired sites. However, because the SMP does not propose to implement a large number of projects annually or over the course of the program, we expect only a small number of steelhead may be exposed to effects to instream form and function. We expect that impacts to steelhead resulting from impaired instream form and function will be further reduced because the program includes AMMs, SMP Implementation and Oversight procedures, and habitat enhancement actions that will protect and enhance steelhead and their habitat, including instream form and function. The proposed biotechnical methods will use natural material (e.g., use of engineered back filled soils, erosion control fabric, and live native plantings) to craft a streambank that will resist lateral erosion while providing complex rearing, feeding and sheltering habitat and revegetation actions will provide shade to the active channel, provide foraging habitat, moderate water temperature, and help to trap sediment which helps reduce the need for future sediment management.

Replacing existing poor habitat with structures that include biotechnical stabilization, riparian planting, and habitat enhancement sites may improve existing habitat and improve steelhead growth and survival. We expect juvenile fish will be able to successfully rear in these areas after SMP actions, and adult and juvenile steelhead will be able to successfully migrate through SMP project sites following maintenance actions. Therefore, the amount of loss of habitat elements important for juvenile rearing (e.g., rearing, feeding, and sheltering habitat supported by physical processes, substrate condition, water depths, velocities, and temperatures, and riparian and emergent vegetation) is anticipated to be low due to the SMP's specific limits and protective measures which will reduce the adverse effects to instream habitat, and we expect only a very small number of steelhead will be harmed by effects to instream form and function.
For SMP activities that involve the repair or replacement of culverts on steelhead streams, the District will assess fish passage conditions for the upstream and downstream movement of steelhead. If the culvert does not conform with NMFS fish passage guidelines (NMFS 2023a, NMFS 2023b, NMFS 2023c), the SMP project will modify or replace the culvert with new infrastructure that is adequately sized and placed to meet NMFS fish passage guidelines. By these means, SMP actions at culverts are expected improve conditions for steelhead to access upstream spawning and rearing habitat and improve PBFs of critical habitat associated with migration.

2.5.3.4 Habitat Enhancement Actions

Some SMP activities are expected to incorporate beneficial actions including riparian planting, instream habitat complexity feature installation, instream gravel augmentation, fish passage improvement, trash removal, and managed streambank retreat. Habitat improvement projects implemented with the proposed action are expected to have long-term beneficial effects to CCC steelhead and critical habitat, thereby improving chances of the species' recovery. These actions will help to support the general recovery strategy for the Napa River CCC steelhead population (Section 2.4, above, and NMFS 2016b), including benefits to fish passage, habitat complexity, gravel quality, riparian cover, water temperatures, and surface flows.

Riparian planting, instream habitat complexity feature installation, instream gravel augmentation, managed streambank retreat, and trash removal improve the quantity and quality of available spawning and rearing habitat for listed fish species. Barrier removal or modification improves conditions that support upstream and downstream passage and reestablishes or improves access

to spawning and rearing habitat. These actions improve in-stream habitat values through stabilization of stream banks and upland areas, increased cover, increased stream shading, improved water quality and temperature, and improved access to habitat and will improve PBFs of critical habitat that contribute to juvenile and adult steelhead abundance, productivity, and spatial structure.

2.6. Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving federal activities, that are reasonably certain to occur within the action area of the federal action subject to consultation [50 CFR 402.02]. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Actions occurring outside of the action area may affect the action area. For example, a new water diversion upstream may affect flows in the action area. Therefore, future actions occurring in the watershed may be considered cumulative effects, depending upon their specific location and impact. Future federal actions, including the ongoing operation of dams, hatcheries, fisheries, water withdrawals, and land management activities will be reviewed through separate ESA section 7 consultation processes and are not considered here.

Additional development, tourism, and accompanying infrastructure construction is expected to occur in the affected watersheds based on the general and specific plans of local communities in Napa County. Additional development is likely to lead to increasing water demands, which may impact stream flows if current allocations are not being fully utilized. Agricultural activities surrounding the action area are primarily the cultivation of crops, mainly viticulture. The impacts of this land use on aquatic species include decreased bank stability, loss of shade and cover-producing riparian vegetation, increased sediment inputs, decreased ground and surface water supply, and elevated coliform bacteria levels. Vineyard development and management will continue to impact salmonid habitat by increasing sediment delivery to streams, diverting and decreasing stream flow, and encroaching on riparian habitat.

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 *versus* 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).

2.7. 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.

The action area consists of Napa County streams and waterways, which is part of the Interior San Francisco Bay CCC steelhead diversity stratum. Within this stratum and the action area, the Napa River population of CCC steelhead are considered an independent population and deemed essential to recovery of CCC steelhead (NMFS 2016).

The Napa River watershed, adjacent tidal areas, and small tributaries are primarily confined and surrounded by urbanized and agriculture areas. The existing riparian corridor is extremely narrow and a small remnant of its former extent. These factors have led to a reduction in the native riparian vegetation, the introduction of non-native plants, increased straightening and engineered channelization for flood control purposes, increased erosion and sedimentation, loss of habitat complexity, increased urban runoff, water diversions, and increased fish passage impediments during low and high flow periods. Furthermore, the hydrology and natural geomorphic processes have been severely altered and non-point sources of pollution, such as urban and agricultural stormwater runoff, continue to contribute to the degradation of water quality within the action area. Due to these factors and the factors listed above, NMFS believes that the ability for CCC steelhead to occupy the action area has declined and that critical habitat within the action area is degraded.

There is limited population data for CCC steelhead in the Napa River watershed, tidal areas and small tributaries that are covered under this opinion. What little data exists includes multiple age classes of steelhead, which indicates spawning success in multiple years. CCC steelhead in the Napa River are important to the recovery of the DPS. Although the Napa River steelhead population is substantially reduced from historical numbers, this steelhead population uses the action area, appears to be relatively stable, and is likely to persist with enough resiliency to rebound from limited impacts for the foreseeable future. However, due to their low numbers, the continuation of impacts from current baseline conditions to the population's numbers, distribution, or reproduction could limit their chance of survival and recovery. The recovery of this population will therefore depend upon programs that protect and restore aquatic and riparian habitats in the watershed and the continued reduction of impacts from land use and water withdrawal.

The action area represents a relatively small portion of the overall CCC steelhead geographic range. Small populations are more vulnerable to demographic and environmental fluctuations than are larger populations (Gilpin and Soule 1986, Pimm et al. 1988), while each small population also acts as a buffer against extinction of the species. The species' relatively broad distribution throughout the species’ ranges is a positive indicator because species with broad distributions may allow a species to avoid environmental fluctuations and stochastic events as a whole (Pimm et al. 1988), even if they suffer local extirpation. However, the value of these watersheds to steelhead remains significant given the current degraded condition of habitat throughout the DPS. Because degraded habitat conditions, and thus lowered carrying capacity, throughout the species’ range are not expected to improve dramatically in the near future, remaining areas of habitat which appear to support relatively large sub-populations are judged highly important.

Regarding cumulative effects, additional development, tourism, and accompanying infrastructure construction is expected to occur in the affected watersheds based on the general and specific plans of local communities in Napa County. Additional development is likely to lead to increasing water demands, which may impact stream flows if current allocations are not being fully utilized. Agricultural activities surrounding the action area (primarily viticulture) are expected to continue to occur in the same capacity in the foreseeable future. The impacts of this overall land use on aquatic species include decreased bank stability, loss of shade and cover-producing riparian vegetation, increased sediment and contaminant inputs, decreased ground and surface water supply, and elevated coliform bacteria levels.

Global climate change presents another real threat to the long-term persistence of listed salmonids, especially when combined with the current depressed population status and human caused impacts. Regional (i.e., North America) climate projections for the mid to late 21st Century expect more variable and extreme inter-annual weather patterns, with a gradual warming pattern in general across California and the Pacific Northwest. However, extrapolating these general forecasts to the smaller action area is difficult, given local nuances in geography and other weather-influencing factors. The risk of increased water temperatures, wildfires, and drought will persist in the action area due to climate change over the next several decades, reinforcing the likelihood of reduced carrying capacity in the action area due to loss of habitat.

Of the proposed SMP activities, riparian habitat restoration and fish passage improvements at culverts are expected to have mostly beneficial long-term effects to CCC steelhead and designated critical habitat for CCC steelhead. Other actions (sediment and vegetation management, drainage structure repair and maintenance, unpaved road maintenance, beaver activity management, and erosion protection and bank stabilization) will likely cause a low level of temporary or long-term adverse effects to steelhead. Despite the different scope, size, intensity, and location of these proposed actions, the potential adverse effects to listed steelhead and their habitat are expected to result from the following: dewatering; fish capture, handling, and relocation; increased sediment; streambed and bank alteration; herbicide use; and stormwater runoff. Dewatering and fish relocation will result in direct effects to steelhead, where a small percentage of juveniles are expected to be injured or killed (up to three percent of fish). Long-term stormwater runoff that will occur through the maintenance, repair, and replacement of drainage structures will result in short-term reduction of water quality and an increase in water quantity due to concentrated flows, which are reasonably certain to cause injury or mortality to all life stages of steelhead depending on the pollutants and level of exposure. Implementing actions associated with streambank stabilization and sediment management have the potential to result in long-term adverse effects to designated critical habitat. The effects from increased sediment, contaminants, or herbicides into streams are usually indirect effects to steelhead individuals or critical habitat that occur later in time and are reasonably certain to occur.

Increases in turbidity and degraded water quality may result in behavior modifications that result in short-term behavioral changes of individual fish. The behavioral modifications of steelhead which may result from project impacts, (i.e., reduced feeding rates, occupation of less suitable habitat, and potentially greater intra and/or inter-species competition), will likely result in reduced fitness of individual fish. Because the quality of habitat in and around the action area is adequate to support rearing steelhead, NMFS expects fish will be able to find food and cover in

the vicinity of project sites as needed during construction activities. Reduced fitness of individual fish, along with potentially increased predation risks, may result in a minor reduction in survival rates. The ultimate effect of changes in the distribution and productivity of steelhead due to project impacts will vary with life stage, the duration and severity of the stressor, the frequency of stressful situations, the number and temporal separation between exposures, and the number of contemporaneous stressors experienced (Newcombe and Jensen 1996; Shreck 2000). Overall, the action area is small compared to the total number of miles of critical habitat available in the CCC steelhead recovery domain. The number of individual steelhead that may be adversely affected or killed during proposed activities is expected to make up a very small portion of the individuals within the action area, and subsequently an even smaller portion of the overall DPS.

It is unlikely that the small loss of steelhead freshwater life history stages resulting from this proposed action would impact future adult returns such that impacts would occur to the populations' resilience and persistence over time. As noted in the effects section, effects from the proposed action are likely to be limited to small areas within the action area. In addition, given the small reduction in the growth and survival of fish that will be directly affected, primarily at the fry, parr, and smolt life stages, the relatively low intensity and severity of that reduction at the population level, any adverse effects to fish growth and survival are likely to be inconsequential to the populations inhabiting the action area. Moreover, the restoration component of the proposed action is also reasonably certain to contribute to population enhancement within the vicinity of the action area, including improved growth, development, and survival. Thus, the restoration component will likely having long-term beneficial effects on population structure.

With the implementation of AMMs included in the program, no more than a small number of juvenile steelhead within the Napa River population are expected to be harmed or killed. Thus, it is unlikely that the small losses of steelhead resulting from this proposed action would impact future adult returns. The resilience and persistence of these populations, their numbers, reproduction, and distribution are unlikely to be meaningfully reduced by the proposed action. Habitat changes resulting from this project is limited to a very small area compared to the extent of the action area and the Napa River watershed. Consequently, we do not expect that implementation of the proposed action is likely to reduce appreciably the likelihood of both the survival and recovery of the CCC steelhead DPS in the wild by reducing their numbers, reproduction, or distribution. The SMP is also not likely to further diminish the value of designated critical habitat for CCC steelhead in the action area.

The effects of the proposed action, when added to the environmental baseline, cumulative effects, and species status, are not expected to appreciably reduce the quality and function of critical habitat at the larger DPS level, given: 1) the temporary duration of many of the effects, 2) the small areas within the action area experiencing longer term adverse effects, and 3) the size of these areas compared to the quality and quantity of habitat within the entire action area. While the environmental baseline remains in degraded condition due to urban development, historical agricultural practices (e.g., channelization), stormwater runoff, and other impacts, the District applies a management philosophy that prioritizes biotechnical methods over channel hardening methods, and includes habitat protection and enhancement actions in the proposed program. As a result of this, habitat quality is expected to improve in many portions of the action area.

Although the proposed action will continue some degradation of critical habitat into the future, the proposed action will aid in restoring habitat processes important to steelhead in engineered channels and urbanized portions of the action area. While the proposed action will not directly restore these habitat processes, it will create and maintain many instream habitat components important to steelhead habitat at each site while not precluding additional restoration work in the future. Therefore, the ability of critical habitat to play its intended conservation role of supporting populations of CCC steelhead as a whole will not be appreciably reduced.

2.8. Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, the effects of other activities caused by the proposed action, and the cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of CCC steelhead or destroy or adversely modify designated critical habitat for CCC steelhead.

2.9. Incidental Take Statement

Section 9 of the ESA and federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "Harass" is further defined by interim guidance as to "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering." "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this ITS.

2.9.1. Amount or Extent of Take

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

In this opinion, NMFS determined that a low-level of incidental take of juvenile CCC steelhead in the form of injury, harm, or mortality is reasonably certain to occur as follows during dewatering and fish relocation events that occur during sediment removal, bank stabilization, drainage structure repairs/maintenance, and unpaved road maintenance activities:

> Unintentional mortality of juvenile steelhead during the capture, handling and relocation of fish is not likely to exceed three percent of the total CCC steelhead handled. The amount of incidental take during dewatering and fish relocation will be considered exceeded if more than three percent of the total fish handled are injured or killed during

any dewatering and fish relocation event.

NMFS also determined that a low-level of incidental take (very small numbers of adults, smolts, eggs, alevins, and juveniles) will occur in the form of harm to CCC steelhead from habitat-related impacts (altered stream hydrology/morphology, impaired water quality from sediment, contaminants, herbicide applications, removal of riparian vegetation and LWD, and degraded riparian habitat conditions) due to the implementation of SMP activities. NMFS expects this incidental take to be mostly localized and limited to the footprint of project sites.

Similar to habitat-related impacts, incidental take from ongoing stormwater runoff occurring through the maintenance, repair, and replacement of drainage structures cannot be accurately quantified as a specific number of steelhead individuals because, although the relationship between numerical concentrations of stormwater pollutants are easily demonstrated in the lab, the pollutants in actual runoff come from many small sources that cannot be distinguished after they reach a given waterbody. The distribution of those pollutants also vary widely within the action area as a function of surrounding land use, pre-rainfall conditions, rainfall intensity and duration, and mixing from other drainage areas. Stormwater runoff events are often relatively brief, especially in urban streams, so that large inputs of runoff and pollutants can occur and dissipate within a few hours. Moreover, the distribution and abundance of fish that occur within the action area is inconsistent over time, affected by habitat quality, interactions with other species, and other influences that cannot be precisely determined by observation or modelling. In the context of this programmatic consultation addressing actions that will vary spatiotemporally with low predictability, the best available indicator of take to listed steelhead reflects the stormwater management requirements and practices that we assumed in analyzing the stormwater effects of the proposed action (Napa County's MS4 stormwater program). Upland development throughout Napa County complying with the MS4 program requirements that are associated with drainage structures of the SMP will not provide a specific measure of watershed health. However, MS4 compliance review requirements reflects the extent of take because they correlate with the level of stormwater treatment that was assumed in the opinion; any non-compliance will result in take at levels that were not analyzed in the opinion. Although the surrogate is somewhat coextensive with the proposed action it nevertheless functions as a meaningful reinitiation trigger because the Corps, District, and NMFS can track them in real time.

The precise number of CCC steelhead that are expected to be incidentally taken resulting from these habitat-related impacts cannot be accurately quantified because: 1) some life-stages of steelhead are relatively small (especially as eggs, alevins, and juveniles); 2) these species live in aquatic environments where visibility is often low, hiding cover is often available, and predators feed; and 3) we cannot precisely predict where and when habitat impacts may affect these species later in their life cycles. NMFS will therefore use the following incidental take surrogates pursuant to 50 CFR 402.14(i)(1)(i).

The extent of incidental take will therefore be considered exceeded if:

- The total number of SMP activities and/or project lengths exceed the annual or five-year limits presented in in the SMP Manual and 2024 SMP Manual Update (see Section 1.3.3 of this biological opinion).
- Avoidance and minimization measures are not applied as described in the SMP Manual and 2024 SMP Manual Update (see Section 1.3.4 of this biological opinion).
- Implementation and Oversight procedures are not applied as described in the SMP Manual and 2024 SMP Manual update (see Section 1.3.5 of this biological opinion).
- Any SMP action implemented within the limits of anadromy creates or perpetuates a steelhead passage impairment.
- Projects implemented under this programmatic consultation in the Napa River watershed that require post-construction stormwater management shall comply with the MS4 stormwater program.

2.9.2. Effect of the Take

In this 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" refer to those actions the Director considers necessary or appropriate to minimize the impact of the incidental take on the species (50 CFR 402.02).

1. Measures shall be taken to minimize the amount or extent of incidental take due to the implementation of SMP activities.

2. Measures shall be taken to monitor the amount and extent of incidental take by reporting the results of fish relocation activities as well as other project details.

2.9.4. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the District must comply with the following terms and conditions. The District 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 terms and condition, protective coverage for the proposed action would likely lapse.

The following terms and conditions implement reasonable and prudent measure 1:

a) The District will retain qualified biologists[5] with expertise in the area of anadromous

[5] A qualified biologist (including those specializing in botany, wildlife, and fisheries) is determined by a combination of academic training and professional experience in biological sciences and related resource management activities. The District may also utilize appropriately experienced and/or trained environmental staff. Resumes of qualified biologists shall be made available to NMFS upon request.

salmonid biology, including handling, collecting, and relocating salmonids; salmonid/habitat relationships; and biological monitoring of salmonids for overseeing in-water work, dewatering, and fish relocation. The District will ensure that all biologists working on projects are qualified to conduct fish collections in a manner which minimizes all potential risks to steelhead. Electrofishing, if used, will be performed by a qualified biologist and conducted according to the NMFS (2000), 'Guidelines for Electrofishing Waters Containing Salmonids Listed Under the Endangered Species Act,' (https://media.fisheries.noaa.gov/dam-migration/electro2000.pdf).

b) The biologists will monitor the construction sites during placement and removal of cofferdams and channel diversions to ensure that any adverse effects to salmonids are minimized. The biologists will be on site during all dewatering events to capture, handle, and safely relocate steelhead to an appropriate location.

c) Steelhead will be handled with extreme care and kept in water to the maximum extent possible during rescue activities. All captured fish will be kept in cool, shaded, aerated water protected from excessive noise, jostling, or overcrowding any time they are not in the stream, and fish will not be removed from this water except when released. To avoid predation, the biologists will have at least two containers and segregate young-of-year form larger age classes and other potential aquatic predators. Captured steelhead will be relocated, as soon as possible, to a suitable instream location in which suitable habitat conditions are present to allow for adequate survival of transported fish and fish already present.

d) Before fish relocation begins, a qualified biologist must identify the most appropriate release location(s). Release locations must include the following aspects: ample quality stream habitat for released fish; suitable water quality (e.g., temperature, turbidity, dissolved oxygen); avoiding the possibility of re-entry to the work area, and avoiding areas where individual fish could become impinged on the exclusion net or screen.

e) Any pumps used to divert live streamflow, outside the dewatered work areas, will be screened and maintained throughout the construction period to comply with NMFS Screen Design Specifications in Section 8.5 of the 2023 NOAA Fisheries WCR Anadromous Salmonid Design Manual (NMFS 2023c; https://www.fisheries.noaa.gov/resource/document/anadromous-salmonid-passage-facility-design-manual)

f) If any salmonids are found dead or injured, the biological monitor will contact the NMFS North Central Coast Office in Santa Rosa, California at (707) 575-6050. The purpose of the contact is to review the activities resulting in take, determine if additional protective measures are required, and to ensure appropriate collection and transfer of salmonid mortalities and tissue samples. All salmonid mortalities will be retained. Tissue samples are to be acquired from each salmonid mortality per the methods identified in the NMFS Southwest Fisheries Science Center Genetic Repository protocols (contact the above NMFS office at the phone number provided) and sent to: NOAA Coastal California Genetic Repository, Southwest Fisheries Science Center, 110 McAllister Way, Santa

Cruz, California 95060.

g) Any injuries or mortality that exceeds three percent shall be reported to the NMFS Santa Rosa Office by email within 48 hours and construction activities shall cease until a NMFS biologist approves avoidance and minimization measures to minimize harm, injury, and mortality during fish handling and relocation activities.

The following terms and conditions implement reasonable and prudent measure 2:

a) The District will allow any NMFS employee(s), or any other person designated by NMFS, to accompany field personnel to visit the project sites during activities described in this opinion.

b) By January 31 of each year following SMP activities, the District will submit a Post-Maintenance Summary Report to NMFS. The report should include the following:

   i) **Dates and Details for all SMP maintenance activities.** This must include initiation and completion dates, photographs taken before, during, and after the activity from photo reference points, a discussion of any unanticipated effects or unanticipated levels of effects on steelhead and their habitat, a description of all measures taken to minimize those unanticipated effects, and a statement as to whether or not the unanticipated effects resulted in any injury or mortality to steelhead.
   ii) **Revegetation Details**. This must include locations planted or seeded, the area (m^2) revegetated, a plant palette, planting or seeding methods, the efforts taken to ensure success of new plantings, performance or success criteria, and pre- and post-planting photographs of the revegetated area.
   iii) **Dewatering Details.** This must include a list of waterways dewatered and length of reaches where dewatering was required.
   iv) **Fish Relocation.** This must include a description from which fish were removed and the release site including photographs; the date and time of the relocation effort; a description of water quality at release sites at the time of release, including, a minimum, water temperature and dissolved oxygen levels; a description of the equipment and methods used to collect, hold, and transport salmonids; if an electro-shocker was used for fish collection, the number of fish relocated by species; the number of fish injured or killed by species and a brief narrative of the circumstances surrounding any steelhead injuries or mortalities; and a description of any problems which may have arisen during the relocation activities and a statement as to whether or not the activities had any unforeseen effects.
   v) **Herbicide Use**. This must include a list of all herbicides and surfactants used, and applicable AMMs measures that were implemented.
   vi) **Stormwater Runoff.** This must include a list of projects that included maintenance, repair, and replacement of drainage structures that convey stormwater runoff. Information will include each project's inspection, maintenance, and reporting of stormwater facilities that assure that the stormwater treatment system continues to reduce the concentration of pollutants in stormwater runoff as designed.

2.10. Conservation Recommendations

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

1. To maximize the efficacy of the restoration efforts and to aid in recovery of CCC steelhead, the District and the Corps should work collaboratively with NMFS to identify and prioritize specific areas to implement instream habitat restoration and enhancement actions for CCC steelhead. We encourage the District and the Corps to pursue recovery actions for CCC steelhead (habitat complexity, riparian, sediment, water quality, viability, channel modification, etc.) identified in NMFS Multispecies Recovery Plan (NMFS 2016b) for the Napa River watershed.

2.11. Reinitiation of Consultation

This concludes formal consultation under the ESA for the SMP in Napa County, California.

Under 50 CFR 402.16(a): "Reinitiation of consultation is required and shall be requested by the federal agency, or where discretionary federal 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 ITS 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."

2.12. "Not Likely to Adversely Affect" Determinations

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. 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 (50 CFR 402.02). In our analysis, which describes the effects of the proposed action, we considered 50 CFR 402.17(a) and (b). When evaluating whether the proposed action is not likely to adversely affect listed species or critical habitat, NMFS considers whether the effects are expected to be completely beneficial, insignificant, or discountable. Completely beneficial effects are contemporaneous positive effects without any adverse effects to the species or critical habitat. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Effects are considered discountable if they are extremely unlikely to occur.

The Corps has determined that the proposed action is not likely to adversely affect the following species and critical habitat:

North American green sturgeon Southern DPS (*Acipenser medirostris*)
Threatened (71 FR 17757; April 7, 2006)
Critical Habitat (74 FR 52299; October 9, 2009).

The life history of green sturgeon in California is summarized in Adams et al. (2002) and NMFS (2018). The Southern DPS (sDPS) of North American green sturgeon are anadromous, making migrations as adults to the Sacramento River in the spring (Moyle et al. 1995). As juvenile green sturgeon age, they migrate downstream and live in the lower delta and bays, spending from 3 to 4 years there before entering the ocean. Individuals are present in San Francisco Bay and the estuary provides rearing habitat for juveniles and foraging habitat for non-spawning adults and subadults.

Within the action area, the tidally-influenced reaches of the Napa River, its tributaries, and other tidal areas within Napa County adjacent to San Francisco Bay provide rearing habitat for juvenile, subadult, and adult green sturgeon. Critical habitat for sDPS green sturgeon includes all tidally influenced areas of San Francisco Bay and extends up to the elevation of mean higher high water.

Napa SMP activities conducted within or adjacent to tidal reaches could affect sDPS green sturgeon or their habitat. Similarly, Napa SMP activities conducted in freshwater reaches could extend downstream into tidal reaches and affect sDPS green sturgeon and their habitat. Section 2.5 of the accompanying biological opinion identifies potential effects of the Napa SMP as dewatering and fish collection and relocation; impaired water quality (turbidity and contaminants); and habitat alterations (effects to benthic habitat) (Sections 2.5.1, 2.5.2, and 2.5.3, of the accompanying biological opinion, respectively). Dewatering and fish collection and relocation in reaches where sDPS are expected is not included in the Napa SMP; therefore the potential for dewatering and fish collection and relocation to affect sDPS green sturgeon is considered to be discountable.

The effects resulting from implementation of Napa SMP that may affect sDPS green sturgeon and their critical habitat are impaired water quality, and benthic habitat alterations. As described in Section 2.5.2 of the accompanying biological opinion, Napa SMP activities could introduce sediment and contaminants into aquatic habitat. Also, as described in Section 2.5.3 of the accompanying biological opinion, benthic habitat may be altered during Napa SMP activities. Exposure to impaired water quality could result in contact with contaminants that could harm sDPS green sturgeon. Sedimentation could smother benthic habitat and prey necessary for sDPS green sturgeon forage. Similarly, alteration of benthic habitat has the potential to reduce prey abundance and/or sDPS forage success. Exposure to these effects has the potential to harm sDPS green sturgeon by reducing their ability to feed and exposing them injurious chemicals; exposures that, depending on severity, could result in reduced fitness, injury, or mortality. However, because the Napa SMP includes AMMs that will reduce the potential for Napa SMP actions to impair water quality and benthic habitat (see Sections 1.3, 2.5.2, and 2.5.3 the

accompanying biological opinion, and Chapter 4 and Table 4-1 of the SMP Manual) effects to sDPS green sturgeon and their critical habitat are expected to be minor and insignificant. Based on this analysis, NMFS concurs with the Corps that the proposed action is not likely to adversely affect sDPS green sturgeon or its designated critical habitat.

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

Section 305(b) of the MSA directs federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. Under the MSA, this consultation is intended to promote the conservation of EFH as necessary to support sustainable fisheries and the managed species' contribution to a healthy ecosystem. For the purposes of the MSA, EFH means "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity", and includes the physical, biological, and chemical properties that are used by fish (50 CFR 600.10). Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) of the MSA also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH. Such recommendations may include measures to avoid, minimize, mitigate, or otherwise offset the adverse effects of the action on EFH [CFR 600.905(b)].

This analysis is based, in part, on the EFH assessment provided by the Corps and the District, 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 Corps has determined that the proposed action may adversely affect EFH. Within the project area, the Napa River is designated EFH for various life stages of fish species managed under the Pacific Coast Salmon Fishery Management Plan (FMP). Estuarine (tidal) reaches of San Francisco Bay are designated as EFH for various life stages of fish species managed under the Pacific Coast Salmon, Coastal Pelagic Species, and Pacific Coast Groundfish FMPs.

3.2. Adverse Effects on Essential Fish Habitat

NMFS determined the proposed action would adversely affect EFH for various life stages of fish species managed with the Pacific Coast Salmon FMP, the Coastal Pelagic Species FMP, and the Pacific Coast Groundfish FMP through (1) increased turbidity in the water column, (2) suspension of sediment-associated contaminants, (3) disturbance of benthic habitat and (4) long term loss of form and function of alluvial processes. Napa SMP activities associated with fish passage improvements and habitat restoration actions may have beneficial effects on EFH for Pacific Coast Salmon.

3.3. Essential Fish Habitat Conservation Recommendations

Section 305(b)(4)(A) of the MSA authorizes NMFS to provide EFH Conservation Recommendations that will minimize adverse effects of an activity on EFH. Although temporary potential adverse effects are anticipated as a result of the project activities, the proposed minimization and avoidance measures, and BMPs in the accompanying biological opinion are sufficient to avoid, minimize, and/or mitigate for the anticipated effects. Therefore, NMFS has no practical EFH Conservation Recommendations to provide to further avoid or reduce the magnitude of effects to EFH. This concludes the EFH consultation.

3.4. 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 user of this opinion is the Corps and the District. Other interested users could include citizens of affected areas, or others interested in the conservation of steelhead. Individual copies of this opinion were provided to the Corps and the District. The document will be available within two weeks at the NOAA Library Institutional Repository at: 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.

5. REFERENCES

62 FR 43937. 1997. Endangered and threatened species: listing of several evolutionarily significant units (ESUs) of west coast steelhead. Federal Register 62:43937-43954.

64 FR 24049. 1999. Designated Critical Habitat; Central California Coast and Southern Oregon/Northern California Coasts Coho Salmon. Federal Register 64:24049-24062.

70 FR 52488: Endangered and Threatened Species; Designation of Critical Habitat for Seven Evolutionarily Significant Units of Pacific Salmon and Steelhead in California; Final Rule. Federal Register 70:52488-52536. September 2, 2005.

71 FR 834: National Marine Fisheries Service. Final rule: Listing Determinations for 10 Distinct Population Segments of West Coast Steelhead. Federal Register 71:834-862. January 5, 2006.

71 FR 17757. 2006. Endangered and threatened wildlife and plants: Threatened Status for Southern Distinct Population Segment of North American Green Sturgeon. Federal Register 71:17757-17766.

74 FR 52299. 2009. Final Rule: Endangered and Threatened Wildlife and Plants: Final Rulemaking To Designate Critical Habitat for the Threatened Southern Distinct Population Segment of North American Green Sturgeon. Federal Register 74:52300-52351.

81 FR 7414. 2016. Listing endangered and threatened species and designating critical habitat; implementing changes to the regulations for designating critical habitat. Federal Register 81:7414-7440.

81 FR 33468. 2016. Endangered and Threatened Species; 5-Year Reviews for 28 Listed Species of Pacific Salmon, Steelhead, and Eulachon. Federal Register 81:33468-33469.

84 FR 44976. 2019. Endangered and Threatened Wildlife and Plants; Regulations for Interagency Cooperation. Federal Register 84:44976-45018.

Abdul-Aziz, O. I., N. J. Mantua, and K. W. Myers. 2011. Potential climate change impacts on thermal habitats of Pacific salmon (*Oncorhynchus spp.)* in the North Pacific Ocean and adjacent seas. Canadian Journal of Fisheries and Aquatic Sciences 68(9):1660-1680.

Adams, P. B., C. B. Grimes, J.E. Hightower, S. T. Lindley, and M. L. Moser. 2002. Status review for North American green sturgeon, Acipenser medirostris. NMFS, SWFSC, USGS, North Carolina State University, NWFSC, Santa Cruz, Raleigh, Seattle.

Beamish, R.J., editor. 2018. The ocean ecology of Pacific salmon and trout. American Fisheries Society, Bethesda, Maryland.

Beechie, T., H. Imaki, J. Greene, A. Wade, H. Wu, G. Pess, P. Roni, J. Kimball, J. Stanford, P. Kiffney, and N. Mantua. 2012. Restoring salmon habitat for a climate change. River Research and Applications. Published online in Wiley Online Library (wileyonlinelibrary.com) DOI: 10.1002/rra.2590.

Bell, M.C. 1991. Fisheries handbook of engineering requirements and biological criteria. United States Army Corps of Engineers, Portland, OR.

Bisson, P. A., R. E. Bilby, M. D. Bryant, A. C. Dolloff, G. B. Grette, R. A. House, M. L. Murphy, K. V. Koski, and J. R. Sedell. 1987. Large woody debris in forested steams in the Pacific northwest: past, present, and future. E. O. Salo, and T. W. Cundy, editors. Streamside management: forestry and fishery interactions, volume Chapter five. University of Washington, Seattle, WA.

Bisson, P. A., K. Sullivan, and J. L. Nielson. 1988. Channel hydraulics, habitat use, and body form of juvenile coho salmon, steelhead, and cutthroat trout in streams. Transactions of the American Fisheries Society 117:262-273.

Bjorkstedt, E.P., B.C. Spence, J.C. Garza, D.G. Hankin, D. Fuller, W.E. Jones, J.J. Smith, and R. Macedo. 2005. An analysis of historical population structure for evolutionarily significant units of Chinook salmon, coho salmon, and steelhead in the north-central California coast recovery domain. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center. 210 pp.

Bjornn, T.C., and D.W. Reiser. 1991. Habitat requirements of salmonids in streams. Pages 83-138 in W.R. Meehan, editor. Influences of Forest and Rangeland Management on Salmonid Fishes and their Habitats. American Fisheries Society Special Publication 19. American Fisheries Society. Bethesda, Maryland. 751 pp.

Bradford, M., and S.P. Higgins. 2001. Habitat-, season- and size-specific variation in diel activity patterns of juvenile Chinook salmon (*Oncorhynchus tshawytscha*) and steelhead trout (*Oncorhynchus mykiss*). Canadian Journal of Fisheries and Aquatic Sciences. 58. 10.1139/f00- 253.

Brewer, P.G., and J. Barry. 2008. Rising Acidity in the Ocean: The Other CO2 Problem. Scientific American. October 7, 2008.

Brinkmann, M., D. Montgomery, S. Selinger, J.G.P. Miller, E. Stock, A.J. Alcaraz, J.K. Challis, L. Weber, D. Janz, M. Hecker, and S. Wiseman. 2022. Acute Toxicity of the Tire Rubber-Derived Chemical 6PPD-quinone to Four Fishes of Commercial, Cultural, and Ecological Importance. Environmental Science & Technology Letters 9(4):333-338.

Bryant, M. D. 1983. The role and management of woody debris in west coast salmonid nursery streams. North American Journal of Fisheries Management 3:322-330.

Bugert, R.M., T.C. Bjornn. 1991. Habitat use by steelhead and coho salmon and their responses to predators and cover in laboratory streams. Transactions of the American Fisheries Society 120:486-493.

Busby, P.J., T.C. Wainwright, G.J. Bryant., L. Lierheimer, R.S. Waples, F.W. Waknitz and I.V. Lagomarsino. 1996. Status review of west coast steelhead from Washington, Idaho, Oregon and California. United States Department of Commerce, National Oceanic and Atmospheric Administration Technical Memorandum NMFS-NWFSC-27. 261 pp.

Bustard, D. R., and D. W. Narver. 1975. Aspects of the winter ecology of juvenile coho salmon (*Oncorhynchus kisutch*) and steelhead trout (*Salmo gairdneri*). Journal of the Fisheries Research Board of Canada 32(5):667-680.

Cayan, D., M. Tyree, and S. Iacobellis. 2012. Climate Change Scenarios for the San Francisco Region. Prepared for California Energy Commission. Publication number: CEC-500-2012-042. Scripps Institution of Oceanography, University of California, San Diego.

CDFW (California Department of Fish and Wildlife). 2005. Report to the National Marine Fisheries Service for Fisheries Restoration Grant Program Projects conducted under Department of the Army Regional General Permit No. 12 (Corps File No. 27922N) within the United States Army Corps of Engineers, San Francisco District, January 1, 2004 through December 31, 2004. March 1, 2005.

CDFW (California Department of Fish and Wildlife). 2006. Annual Report to the National Marine Fisheries Service for Fisheries Restoration Grant Program Projects conducted under Department of the Army Regional General Permit No. 12 (Corps File No. 27922N) within the United States Army Corps of Engineers, San Francisco District, January 1, 2005 through December 31, 2005. March 1, 2006, CDFW Region 1, Fortuna Office.

CDFW (California Department of Fish and Wildlife). 2007. Annual Report to the National Marine Fisheries Service for Fisheries Restoration Grant Program Projects conducted under Department of the Army Regional General Permit No. 12 (Corps File No. 27922N) within the United States Army Corps of Engineers, San Francisco District, January 1, 2006 through December 31, 2006. March 1, 2007, CDFW Region 1, Fortuna Office.

CDFW (California Department of Fish and Wildlife). 2008. Annual Report to the National Marine Fisheries Service for Fisheries Restoration Grant Program Projects conducted under Department of the Army Regional General Permit No. 12 (Corps File No. 27922N) within the United States Army Corps of Engineers, San Francisco District, January 1, 2007 through December 31, 2007. March 1, 2008, CDFW Region 1, Fortuna Office.

CDFW (California Department of Fish and Wildlife). 2009. Annual Report to the National Marine Fisheries Service for Fisheries Restoration Grant Program Projects conducted under Department of the Army Regional General Permit No. 12 (Corps File No. 27922N) within the United States Army Corps of Engineers, San Francisco District, January 1, 2008 through 8 December 31, 2008. March 1, 2009, CDFW Region 1, Fortuna Office.

CDFW (California Department of Fish and Wildlife). 2010. Annual Report to the National Marine Fisheries Service for Fisheries Restoration Grant Program Projects conducted under Department of the Army Regional General Permit No. 12 (Corps File No. 27922N) within the United States Army Corps of Engineers, San Francisco District, January 1, 2009 through 8 December 31, 2009. March 1, 2010, CDFW Region 1, Fortuna Office.

Chapman, D.W., and T.C. Bjornn. 1969. Distribution of salmonids in streams, with special reference to food and feeding. Pages 153-176. in: T.G. Northcote, editor. Symposium on Salmon and Trout in Streams. H.R. Macmillan Lectures in Fisheries. Institute of Fisheries, University of British Columbia, Vancouver, British Columbia.

Chow, M., J.I. Lundin, C.J. Mitchell, J.W. Davis, and G. Young. 2019. An urban stormwater runoff mortality syndrome in juvenile coho salmon. Aquatic Toxicology 214. 10 pp.

Collins, B. W. 2004. Annual report to the National Marine Fisheries Service for scientific research activities conducted under ESA section 10, Permit 1067 California Department of Fish and Game, Fortuna, California.

Cooper J.R., J. W. G., R.B. Daniels, and W.P. Robarge. 1987. Riparian areas as filters for agricultural sediment. Soil Science Society of America Journal 51:416–420.

Crozier L.G., M.M. McClure, T. Beechie, S.J. Bograd, D.A. Boughton, and M. Carr. 2019. Climate vulnerability assessment for Pacific salmon and steelhead in the California Current Large Marine Ecosystem. PLoS ONE 14(7): e0217711. https://doi.org/10.1371/journal.pone.0217711

Cushman, R.M. 1985. Review of ecological effects of rapidly varying flows downstream from hydroelectric facilities. North American Journal of Fisheries Management. 5: 330-339.

Diffenbaugh N.S., D.L. Swain, and D. Touma. 2015. Anthropogenic warming has increased drought risk in California. PNAS Early Edition. www.pnas.org/cgi/doi/10.1073/pnas.1422385112.

Doney, S. C., M. Ruckelshaus, J. E. Duffy, J. P. Barry, F. Chan, C. A. English, H. M. Galindo, J. M. Grebmeier, A. B. Hollowed, N. Knowlton, J. Polovina, N. N. Rabalais, W. J. Sydeman, and L. D. Talley. 2012. Climate Change Impacts on Marine Ecosystems. Annual Review of Marine Science 4:11-37.

Everest, F.H., and D.W. Chapman. 1972. Habitat selection and spatial interactions by juvenile Chinook salmon and steelhead trout. Journal of the Fisheries Research Board of Canada 29:91-100.

Feely, R.A., C.L. Sabine, K. Lee, W. Berelson, J. Kleypas, V.J. Fabry, and F.J. Millero. 2004. Impact of anthropogenic CO2 on the CaCO3 system in the oceans. Science 305, 362-366.

Feist, B.E., E.R. Buhle, D.H. Baldwin, J.A. Spromberg, S.E. Damm, J.W. Davis, and N.L. Scholz. 2018. Roads to Ruin: Conservation Threats to Sentinel Species across an Urban Gradient. Ecological Applications 27(8):2382-2396.

Fresh, K. L., E. Casillas, L.L. Johnson, and D.L. Bottom. 2005. Role of the estuary in the recovery of Columbia River Basin salmon and steelhead: An evaluation of the effects of selected factors on salmonid population viability, U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-69.

Frölicher, T.L., E. M. Fischer, and N. Gruber. 2018. Marine heatwaves under global warming. Nature (Letter). 560:360.

Gilpin, M.E., and M.E. Soule. 1986. Minimum viable populations: Processes of species extinction. In: Conservation Biology. M.E. Soule (editor). Sinauer Associates, Massachusetts.

Goss, M., D.L. Swain, J.T. Abatzoglou, A. Sarhadi, C.A. Kolden, A.P. Williams, and N.S. Diffenbaugh. 2020. Climate Change is Increasing the Likelihood of Extreme Autumn Wildfire Conditions Across California. Environmental Research Letters. 15. 094016.

Gregory, R., and T. Northcote. 1993. Surface, planktonic, and benthic foraging by juvenile chinook salmon (*Oncorhynchus tshawytscha*) in turbid laboratory conditions. Canadian Journal of Fisheries and Aquatic Sciences 50(2):233-240.

Harvey, B.C. 1986. Effects of gold dredging on fish and invertebrates in two California streams. North American Journal of Fisheries Management. 6:401-409.

Harvey, B. C., and J. L. White. 2008. Use of Benthic Prey by Salmonids under Turbid Conditions in a Laboratory Stream. Transactions of the American Fisheries Society

137(6):1756-1763.

Hayes, D.B., C.P. Ferreri, and W.W. Taylor. 1996. Active fish capture methods. Pp. 193-220 in B.R. Murphy and D.W. Willis (Editors). Fisheries Techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

Hayhoe, K., D. Cayan, C.B. Field, P.C. Frumhoff, E.P. Maurer, N.L. Miller, S.C. Moser, S. H. Schneider, K.N. Cahill, E.E. Cleland, L. Dale, R. Drapek, R.M. Hanemann, L.S. Kalkstein, J. Lenihan, C.K. Lunch, R.P. Neilson, S.C. Sheridan, and J.H. Verville. 2004. Emissions pathways, climate change, and impacts on California. Proceedings of the National Academy of Sciences of the United States of America. 101: 12422-12427.

Hecht, S. A., D. H. Baldwin, C. A. Mebane, T. Hawkes, S. J. Gross, and N. L. Scholz. 2007. An overview of sensory effects on juvenile salmonids exposed to dissolved copper: applying a benchmark concentration approach to evaluate sublethal neurobehavioral toxicity. Citeseer, U.S. Department of Commerce, NOAA Fisheries, NOAA Technical Memorandum NMFS-NWFSC-83.

Heintz, R. A., J. W. Short, and S. D. Rice. 1999. Sensitivity of fish embryos to weathered crude oil:: Part II.: Increased mortality of pink salmon (*Oncorhynchus gorbuscha*) embryos incubating downstream from weathered Exxon Valdez crude oil. Environmental Toxicology and Chemistry 18(3):494-503.

Hellmair, M., M. Peterson, B. Mulvey, K. Young, J. Montgomery, and A. Fuller. 2018. Physical Characteristics Influencing Nearshore Habitat Use by Juvenile Chinook Salmon in the Sacramento River, California. North American Journal of Fisheries Management 38(4):959-970.

Hubert, W. A. 1996. Passive capture techniques, American Fisheries Society {a}Suite 110, 5410 Grosvenor Lane, Bethesda, Maryland 20814-2199, USA.

Humboldt County. 2002. Memo from Ann Glubczynski, County of Humboldt Public Works, to Margaret Tauzer, National Marine Fisheries Society, titled "2002 Monitoring Report – Five Fish Passage Enhancement Projects". June 27, 2002.

Humboldt County. 2003. Memo from Ann Glubczynski, County of Humboldt Public Works, to Margaret Tauzer, National Marine Fisheries Society, titled "2003 Monitoring Report - Eleven Culvert Replacements for Fish Passage." June 23, 2003.

Humboldt County. 2004. Memo from Ann Glubczynski, County of Humboldt Public Works, to Margaret Tauzer, National Marine Fisheries Society, titled "2004 Monitoring Report - Eleven Culvert Replacements for Fish Passage." June 10, 2004. 2 pages

Incardona, J.P., T.K. Collier, and N.L. Scholz. 2004. Defects in cardiac function precede morphological abnormalities in fish embryos exposed to polycyclic aromatic hydrocarbons. Toxicology and Applied Pharmacology 196:191-205.

Incardona, J.P., M.G. Carls, H. Teraoka, C.A. Sloan, T.K. Collier, and N.L. Scholz. 2005. Aryl hydrocarbon receptor-independent toxicity of weathered crude oil during fish development. Environmental Health Perspectives 113:1755-1762.

Incardona, J.P., H.L. Day, T.K. Collier, and N.L. Scholz. 2006. Developmental toxicity of 4-ring polycyclic aromatic hydrocarbons in zebrafish is differentially dependent on AH receptor isoforms and hepatic cytochrome P450 1A metabolism. Toxicology and Applied Pharmacology 217:308-321.

Kadir, T., L. Mazur, C. Milanes, and K. Randles. 2013. Indicators of Climate Change in California. California Environmental Protection Agency, Office of Environmental Health Hazard Assessment Sacramento, Californian.

Kondolf, G. M. 1997. Hungry water: effects of dams and gravel mining on river channels. Environmental Management 21(4):533-551.

Leidy, R. A., G.S. Becker, and B.N. Harvey. 2005. Historical distribution and current status of steelhead/rainbow trout (Oncorhynchus mykiss) in streams of the San Francisco Estuary, California. Center for Ecosystem Management and Restoration, Oakland, CA.

Lindley, S.T., R.S. Schick, E. Mora, P.B. Adams, J.J. Anderson, S. Greene, C. Hanson, B.P. May, D.R. McEwan, R.B. MacFarlane, C. Swanson, and J.G. Williams. 2007. Framework for assessing viability of threatened and endangered Chinook salmon and steelhead in the Sacramento-San Joaquin Basin. San Francisco Estuary and Watershed Science. 5.

Lisle, T. E. 1986. Effects of woody debris on anadromous salmonid habitat, Prince of Wales Island, Southeast Alaska. North American Journal of Fisheries Management 6:538-550.

Mankin, J.S., I. Simpson, A. Hoell, R. Fu, J. Lisonbee, A. Sheffield, D. Barrie. 2021. NOAA Drought Task Force Report on the 2020–2021 Southwestern U.S. Drought. NOAA Drought Task Force, MAPP, and NIDIS. 20 pp.

McElhany, P., M. H. Rucklelshaus, M. J. Ford, T. C. Wainwright, and E. P. Bjorkstedt. 2000. Viable Salmonid Populations and the Recovery of Evolutionarily Significant Units. United States Department of Commerce, National Oceanic and Atmospheric Administration Technical Memorandum NMFS-NWFSC-42. 156 pp.

McIntyre, J.K., J.I. Lundin, J.R. Cameron, M.I. Chow, J.W. Davis, J.P. Incardona, and N.L. Scholz. 2018. Interspecies Variation in the Susceptibility of adult Pacific salmon to Toxic Urban Stormwater Runoff. Environmental Pollution 238:196-203.

Meehan, W.R., and T.C. Bjornn. 1991. Salmonid distribution and life histories. Pp. 47-82 in Influences of Forest and Rangeland Management on Salmonid Fishes and their Habitats. W.R. Meehan, editor. American Fisheries Society Special Publication 19. American

Fisheries Society. Bethesda, Maryland. 751 pp.

Mitsch, W. J. and J.G. Gosselink. 2000. Wetlands, 3rd ed, John Wiley & Sons, New York, 2000.

Moser, S., J. Ekstrom, and G. Franco. 2012. Our Changing Climate 2012 Vulnerability and Adaptation to the Increasing Risks from Climate Change in California. A Summary Report on the Third Assessment from the California Climate change Center. July. CEC-500-20102-007S.

Moyle, P. B., R. M. Yoshiyama, J. E. Williams, and E. D. Wikramanayake. 1995. Fish species of special concern in California. California Department of Fish and Game, Davis.

Moyle, P. B. 2002. Inland Fishes of California, Revised and Expanded. University of California Press, Berkeley, California.

Murphy, M. L., and W. R. Meehan. 1991. Stream ecosystems. Pages 17-46 in W. R. Meehan, editor. Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. American Fisheries Society, Special Publication Number 19. American Fisheries Society, Bethesda, MD.

Napa RCD (Napa County Resource Conservation District). 2011. Napa River Steelhead and Salmon Monitoring Program. Annual Report - Year 3. Napa County Resource Conservation District. 1303 Jefferson St. Suite 500B. Napa, California 94559.

Napa RCD (Napa County Resource Conservation District) and Prunuske Chatham, Inc. 2012. Northern Napa River Tributary Streams Survey Report, City of St. Helena, 1480 Main Street, St. Helena, CA 94574.

Napa RCD (Napa County Resource Conservation District). 2020. Napa River Steelhead and Salmon Monitoring Program, Napa County Resource Conservation District, 1303 Jefferson St. Suite 500B Napa, California 94559.

Napa RCD (Napa County Resource Conservation District). 2023. Napa River Steelhead and Salmon Monitoring Program 2021-2023 Report, Napa County Resource Conservation District, 1303 Jefferson St. Suite 500B, Napa, California 94559.

Newcombe, C.P., and J.O.T. Jensen. 1996. Channel suspended sediment and fisheries: A synthesis for quantitative assessment of risk and impact, North American Journal of Fisheries Management. 16:693-727.

Nielsen, J. L. 1998. Electrofishing California's endangered fish populations. Fisheries 23:6-12.

Napa County Flood Control and Water Conservation District (District). 2019a. Biological Assessment for the Napa County Stream Maintenance. 134 pp.

Napa County Flood Control and Water Conservation District (District). 2019b Napa County

Stream Maintenance Manual. 372 pp.

Napa County Flood Control and Water Conservation District (District). 2024. 2024 Napa County Stream Maintenance Program (SMP) Manual Addendum, comprised of: Table 1 - Steelhead Streams and Channel Types for Napa SMP; Biological Assessment Table 1 - Napa County Stream Maintenance Program Routine Maintenance Activities that Require USACE Authorization under Clean Water At Section 404 (updated 3/11/2024); Table 4-1 Stream Maintenance Best Management Practices; and updates made to specific sections of the SMP Manual.

NMFS (National Marine Fisheries Service). 1996. Juvenile fish screen criteria for pump intakes. National Marine Fisheries Service Environmental & Technical Services Division. Portland, Oregon. May 1996. https://media.fisheries.noaa.gov/dam-migration/fish_screen_criteria_for_pumped_water_intakes.pdf

NMFS (National Marine Fisheries Service). 2000. Guidelines for electrofishing waters containing salmonids listed under the endangered species act. June 2000. https://media.fisheries.noaa.gov/dam-migration/electro2000.pdf

NMFS (National Marine Fisheries Service). 2005. Final rule designating critical habitat for seven evolutionarily significant units of Pacific salmon and steelhead in California. National Marine Fisheries Service, Federal Register. Federal Register, Volume 70, page 52488.

NMFS (National Marine Fisheries Service). 2016a. 5-year review: summary & evaluation of Central California Coast Steelhead. National Marine Fisheries Service West Coast Region. April 2016.

NMFS (National Marine Fisheries Service). 2016b. NOAA Fisheries Service Coastal Multispecies Recovery Plan. California Coast Chinook Salmon, Northern California Steelhead, Central California Coast Steelhead.
October 2016.

NMFS. 2018. Recovery Plan for the Southern Distinct Population Segment of North American Green Sturgeon (*Acipenser medirostris*), National Marine Fisheries Service, Sacramento, California

NMFS (National Marine Fisheries Service). 2020. Endangered Species Act Section 7(a)(2) Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Fish and Wildlife Habitat Improvement Program (HIP 4) in Oregon, Washington and Idaho. May 7, 2020. 186 pp.

NMFS (National Marine Fisheries Service). 2023a. Guidelines for salmonid passage at stream crossings, for applications in California at engineered stream crossings to facilitate passage of anadromous salmonids. Feb 2023. NMFS West Coast Region, Engineering and Physical Sciences Branch, Portland, Oregon.

https://www.fisheries.noaa.gov/resource/document/guidelines-salmonid-passage-stream-crossings-california.

NMFS (National Marine Fisheries Service). 2023b. NOAA fisheries pre-design guidelines for California fish passage projects. Feb 2023. NMFS West Coast Region, Engineering and Physical Sciences Branch, Portland, Oregon. https://www.fisheries.noaa.gov/resource/document/pre-design-guidelines-california-fish-passage-facilities

NMFS. 2023c. NOAA Fisheries West Coast Region Anadromous Salmonid Passage Design Manual, NMFS West Coast Region, Engineering and Physical Sciences Branch, Portland, Oregon. https://www.fisheries.noaa.gov/resource/document/anadromous-salmonid-passage-facility-design.

NMFS (National Marine Fisheries Service). 2023d. NOAA News. New marine heatwave emerges off West Coast, resembles "the Blob". September 2019; updated April 2023. https://www.fisheries.noaa.gov/feature-story/new-marine-heatwave-emerges-west-coast-resembles-blob

Nordwall, F. 1999. Movements of brown trout in a small stream: effects of electrofishing and consequences for population estimates. North American Journal of Fisheries Management 19:462-469.

Osgood, K.E. (editor). 2008. Climate Impacts on U.S. Living Marine Resources: National Marine Fisheries Service Concerns, Activities and Needs. U.S. Dep. Commerce, NOAA Tech. Memo. NMFSF/ SPO-89, 118 p.

Peter, K.T., Z. Tian, C. Wu, P. Lin, S. White, B. Du, J.K. McIntyre, N.L. Scholz, and E.P. Kolodziej. 2018. Using High-resolution Mass Spectrometry to Identify Organic contaminants linked to Urban Stormwater Mortality Syndrome in Coho salmon. Environmental Science and Technology 52:10317-10327.

Pimm, S.L., H.L. Jones, and l. Diamond. 1988. On the risk of extinction. American Naturalist. 132(6):757-785.

Platts, W. S. 1991. Livestock grazing. In W.R. Meehan (ed.) Influence of forest and rangeland management on Salmonid fishes and their habitats. American Fisheries Society. Special Publication 19:389-423.

Poole, G. C., and C. H. Berman. 2001. An ecological perspective on in-stream temperature: Natural heat dynamics and mechanisms of human-caused thermal degradation. Environmental Management 27(6):787-802.

Raleigh, R.F., T. Hickman, R.C. Solomon, and P.C. Nelson. 1984. Habitat suitability information: rainbow trout. U.S. Fish Wildlife Service. FWS/OBS-82/10.60. 64 pp.

Ruggiero, P., C. A. Brown, P. D. Komar, J. C. Allan, D. A. Reusser, H. Lee, S. S. Rumrill, P. Corcoran, H. Baron, H. Moritz, and J. Saarinen. 2010. Impacts of climate change on Oregon's coasts and estuaries. Pages 241-256 in K.D. Dellow and P. W. Mote, editors. Oregon Climate Assessment Report. College of Oceanic and Atmospheric Sciences, Oregon State University, Corvallis, Oregon.

Rundio, D.E., and S.T. Lindley. 2008. Seasonal patterns of terrestrial and aquatic prey abundance and use by *Oncorhynchus mykiss* in a California coastal basin with a Mediterranean climate. Transactions of the American Fisheries Society. 137:467–480.

Scavia, D., J.C. Field, D.F. Boesch, R.W. Buddemeier, V. Burkett, D.R. Cayan, M. Fogarty, M.A. Harwell, R.W. Howarth, C. Mason, D.J. Reed, T.C. Royer, A.H. Sallenger, and J.G. Titus. 2002. Climate Change Impacts on U.S. Coastal and Marine Ecosystems. Estuaries, volume 25(2): 149-164.

Schmetterling, D.A., C.G. Clancy, & T.M. Brandt. 2001. Effects of riprap bank reinforcement on stream salmonids in the Western United States. Fisheries 26(7):6–13.

Schneider, S.H. 2007. The unique risks to California from human-induced climate change. California State Motor Vehicle Pollution Control Standards; Request for Waiver of Federal Preemption, presentation. May 22, 2007.

Scholz, N.L., M.S. Myers, S.G. McCarthy, J.S. Labenia, J.K. McIntyre, G.M. Yitalo, L.D. Rhodes, C.A. Laetz, C.M. Stehr, B.L. French, B. McMillan, D. Wilson, L. Reed, K.D. Lynch, S. Damm, J.W. Davis, and T.K. Collier. 2011. Recurrent Die-Offs of Adult Coho Salmon Returning to Spawn in Puget Sound Lowland Urban Streams. PloS ONE 6(12).

Servizi, J.A., and D.W. Martens. 1992. Sublethal responses of coho salmon *(Oncorhynchus kisutch*) to suspended sediments. Canadian Journal of Fisheries and Aquatic Sciences 49:1389-1395.

Shaw, E. A., and J. S. Richardson. 2001. Direct and indirect effects of sediment pulse duration on stream invertebrate assemblages and rainbow trout (*Oncorhynchus mykiss*) growth and survival. Canadian Journal of Fisheries and Aquatic Sciences 58(11):2213-2221.

Shirvell, C. 1990. Role of instream rootwads as juvenile coho salmon (*Oncorhynchus kisutch*) and steelhead trout (O. mykiss) cover habitat under varying streamflows. Canadian Journal of Fisheries and Aquatic Sciences. 47: 852-861.

Shreck, C.B. 2000. Accumulation and long-term effects of stress in fish. Pages 147-158. In: The biology of animal stress - basic principles and implications for animal welfare. G.P. Moberg, and J.A. Mench (editors). CABI Publishing. Cambridge, Massachusetts.

Sigler, J.W., T.C. Bjournn, and F.H. Everest. 1984. Effects of chronic turbidity on density and growth of steelhead and coho salmon. Transactions of the American Fisheries Society 113:142-150.

Skinner, J. E. 1962. Fish and Wildlife Resources of the San Francisco Bay Area.

Spence, B.C., G.A. Lomnicky, R.M. Hughes, and R.P. Novitzki. 1996. An ecosystem approach to salmonid conservation. TR-4501-96-6057. ManTech Environmental Research Services, Inc. Corvallis, Oregon. December. Report. National Marine Fisheries Service, Portland, Oregon.

Spence, B. 2006. Preliminary biological viability criteria for salmonid ESUs in the north-central California coast recovery domain. NOAA's National Marine Fisheries Service, Southwest Fisheries Science Center, Santa Cruz.

Spence, B.C., E.P. Bjorkstedt, J.C. Garza, J.J. Smith, D. G. Hankin, D. Fuller, W.E. Jones, R. Macedo, T.H. Williams, E. Mora. 2008. A framework for assessing the viability of threatened and endangered salmon and steelhead in the North-Central California Coast recovery domain. NOAA-TM-NMFS-SWFSC-423. NOAA Technical Memorandum NMFS. 194 pp.

Spence, B.C., E.P. Bjorkstedt, S. Paddock, and L. Nanus. 2012. Updates to biological viability criteria for threatened steelhead populations in the North-Central California Coast Recovery Domain. National Marine Fisheries Service. Southwest Fisheries Science Center, Fisheries Ecology Division. March 23.

Spence, B. C. 2023. North-Central California Coast Recovery Domain. Pages 56-142 in Southwest Fisheries Science Center. 2023. Viability assessment for Pacific salmon and steelhead listed under the Endangered Species Act: Southwest, U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SWFSC-686.

Stillwater Sciences. 2007. Napa River tributary steelhead growth analysis. Final report. Prepared by Stillwater Sciences, Berkeley, California for U.S. Army Corps of Engineers, San Francisco, California.

Stehr, C.M., T.L. Linbo, D.H. Baldwin, N.L. Scholz and J.P. Incardona. 2009. Evaluating the effects of forestry herbicides on fish development using rapid phenotypic screens. North American Journal of Fisheries Management 29(4):975-984.

Sudduth, E. B., and J. L. Meyer. 2006. Effects of bioengineered streambank stabilization on bank habitat and macroinvertebrates in urban streams. Environmental Management 38(2):218-226.

Sutton, R., L.D. Sedlak, M. Box, C. Gilbreath, A. Holleman, R. Miller, L. Wong, A. Munno, K. X, Zhu, and C. Rochman. 2019. Understanding Microplastic Levels, Pathways, and Transport in the San Francisco Bay Region, SFEI-ASC Publication #950, October 2019, 402 pages. https://www.sfei.org/sites/default/files/biblio_files/Microplastic%20Levels%20in%20SF%20Bay%20-%20Final%20Report.pdf.

Swain, D. L., B. Langenbrunner, J. D. Neelin, and A. Hall. 2018. Increasing precipitation

volatility in twenty-first-century California. Nature Climate Change 8(5):427-433.

Thomas, W.G. 1985. Experimentally determined impacts of a small, suction gold dredge on a Montana stream. North American Journal of Fisheries Management. 5:480-488.

Tian Z., H. Zhao, K.T. Peter, M. Gonzalez, J. Wetzel, C. Wu, X. Hu, J. Prat, E.Mudrock, R. Hettinger, A. . Cortina, R.G. Biswas, F.V.C Kock, R. Soong, A. Jenne, B. Du, F. Hou, H. He, R. Lundeen, A. Gibreath, R. Sutten, N.L. Scholz, J.W. Davis, M.C. Dodd, A. Simpson, J.K. McIntyre, and E.P. Kolodziej. 2020. A ubiquitous tire rubber-derived chemical induces acute mortality in coho salmon. Science. 10.1126/science.abd6951.

Tian Z., M. Gonzalez, C.A. Rideout, H.N. Zhao, X. Hu, J. Wetzel, E. Mudrock, C.A. James, J.K. McIntyre, and E.P. Kolodziej. 2022. 6PPD-Quinone: Revised Toxicity Assessment and Quantification with a Commercial Standard. Environmental Science & Technology Letters 9(2):140-146.

Turley, C. 2008. Impacts of changing ocean chemistry in a high-CO2 world. Mineralogical Magazine, February 2008, 72(1). 359-362.

Watershed Information and Conservation Council of Napa County. 2023. Climate + Weather. Website accessed April 12, 2023. https://www.napawatersheds.org/app_pages/view/119

Weitkamp, L.A., T.C. Wainwright, G.J. Bryant, G.B. Milner, D.J. Teel, R.G. Kope, and R.S. Waples. 1995. Status review of coho salmon from Washington, Oregon, and California. United States Department of Commerce, National Oceanic and Atmospheric Administration Technical Memorandum NMFS-NWFSC-24. 258 pp.

Wesche, T. A., C. M. Goertler, and C. B. Frye. 1987. Contribution of Riparian Vegetation to Trout Cover in Small Streams. North American Journal of Fisheries Management 7:151-153.

Westerling, A. L., B. P. Bryant, H. K. Preisler, T. P. Holmes, H. G. Hidalgo, T. Das, and S. R. Shrestha. 2011. Climate change and growth scenarios for California wildfire. Climate Change 109(1):445-463.

Williams, T.H., B.C. Spence, D.A. Boughton, R.C. Johnson, L. Crozier, N. Mantua, M. O'Farrell, and S.T. Lindley. 2016. Viability assessment for Pacific salmon and steelhead listed under the Endangered Species Act: Southwest. 2 February 2016 Report to National Marine Fisheries Service – West Coast Region from Southwest Fisheries Science Center, Fisheries Ecology Division 110 Shaffer Road, Santa Cruz, California 95060.

Williams, A.P., J.T. Abatzoglou, A. Gershunov, J. Guzman-Morales, D.A. Bishop, J.K. Balch, and D.P. Lettenmaier. 2019. Observed Impacts of Anthropogenic Climate Change on Wildfire in California. Earth's Future 7:892–910. https://doi.org/10.1029/2019EF001210.

Williams, A.P., E.R. Cook, J.E. Smerdon, B.I. Cook, J. Abatzoglou, K. Bolles, S.H. Baek, A.M.

Badger, and B. Livneh. 2020. Large contribution from anthropogenic warming to an emerging North American megadrought. Science 268:314-318.

Williams, A.P., B. I. Cook, and J. E. Smerdon. 2022. Rapid intensification of the emerging southwestern North American megadrought in 2020–2021. Nature Climate Change 12:232–234.

Zika, U., and A. Peter. 2002. The introduction of woody debris into a channelized stream: effect on trout populations and habitat. River Research Applications. 18: 355–366.