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

March 24, 2023 **Refer to NMFS No:** WCRO-2023-00205

Julie East
Senior Environmental Scientist–Branch Chief E1
California Department of Transportation
North Region Environmental
1656 Union Street
Eureka, California 95501-3700

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Carlotta Shoulder Widening Project in Humboldt County, California [EA 01-0J890]

Dear Ms. East:

Thank you for your letter of February 13, 2023, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the California Department of Transportation's (Caltrans)[1] proposed Carlotta Shoulder Widening Project (Project), Caltrans reference EA 01-0J890.

The enclosed biological opinion describes NMFS' analysis of effects on threatened Northern California (NC) steelhead (*Oncorhynchus mykiss*) in accordance with section 7 of the ESA. Based on the best scientific and commercial information available, NMFS concludes that the action, as proposed, is not likely to jeopardize the continued existence of the NC steelhead Distinct Population Segment (DPS). NMFS expects the Project would result in incidental take of NC steelhead. An incidental take statement with terms and conditions is included with the enclosed biological opinion.

Please contact Jeffrey Jahn at (707) 825-5173, Northern California Office, Arcata, or via email at Jeffrey.Jahn@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

e-file FRN 151422WCR2023AR00052

[1] Pursuant to 23 USC 327, and through a series of Memorandum of Understandings beginning June 7, 2007, the Federal Highway Administration (FHWA) assigned and Caltrans assumed responsibility for compliance with Section 7 of the federal Endangered Species Act (ESA) for federally-funded transportation projects in California. Therefore, Caltrans is considered the federal action agency for consultations with NMFS for federally funded projects involving FHWA. Caltrans proposes to administer federal funds for the implementation of the proposed action and is, therefore, considered the federal action agency for this consultation.

Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion

Carlotta Shoulder Widening Project
Humboldt County, California

NMFS Consultation Number: WCRO-2023-00205

Action Agency: California Department of Transportation

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely to Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely to Destroy or Adversely Modify Critical Habitat?
Northern California (NC) steelhead (*O. mykiss*)	Threatened	Yes	No	N/A	N/A

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

Issued By:

Alecia Van Atta
Assistant Regional Administrator
California Coastal Office

Date: March 24, 2023

TABLE OF CONTENTS

1. INTRODUCTION

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

1.1. Background

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

1.2. Consultation History

On January 7, 2022, NMFS biologist Mike Kelly participated in a call with the California Department of Transportation's (Caltrans) Environmental staff Risa Okuyama and Cari Williams to discuss needs for the ESA section 7 consultation.

On February 28, 2022, Caltrans obtained an official species list for this location using the NOAA Fisheries' California Species List Tool in Google Earth. (This species list remained correct at the initiation of this consultation.) The species list, which included all ESA-listed species and habitats within the Hydesville U.S. Geological Survey quadrangle, identified Southern Oregon/North California Coast (SONCC) coho salmon (*Oncorhynchus kisutch*), California Coastal (CC) Chinook salmon (*O. tshawytscha*), and Northern California (NC) steelhead (*O. mykiss*) and their critical habitats; and Essential Fish Habitat (EFH) for the Pacific Salmon Fisheries Management Plan (FMP). However, subsequent technical assistance from CDFW, assessment of available habitat by NMFS biologist Mike Kelly and Caltrans staff, along with information provided by local landowners, determined that the action area only provides habitat for NC steelhead, but it is not designated critical habitat for NC steelhead. Based on this information, Caltrans concluded that the project would have "no effect" on SONCC coho salmon or CC Chinook salmon, NC steelhead critical habitat, or EFH.

On April 6, 2022, Caltrans hosted a Level 1 Coordination Meeting about the project with Mike Kelly and Jeff Jahn from NMFS, and Greg Schmidt from the U.S. Fish and Wildlife Service (USFWS).

On June 15, 2022, NMFS biologist Mike Kelly attended a site visit to the Ward Creek crossing with Caltrans staff.

On July 6, 2022, Caltrans hosted a second Level 1 Coordination Meeting on the project with Mike Kelly and Jeff Jahn from NMFS, and various other resource agency representatives including Dan Breen from the U.S. Army Corps of Engineers, Greg O'Connell and Mike Van

Hattem from CDFW, Susan Stewart from the North Coast Water Board, and Greg Schmidt from USFWS.

On September 2, 2022, November 10, 2022, and January 3, 2023, Mike Kelly provided technical assistance to Caltrans staff, including Risa Okuyama, Kari Williams and Susan Leroy about information needs in the BA and how to estimate "take" of NC steelhead due to project activities.

On October 3, 2022, Caltrans provided data concerning the width of the channel migration zone (CMZ) relative to the length of the new bridge to Mike Kelly and CDFW fish passage engineer Kristine Pepper.

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

On November 29, 2022, CDFW fish passage engineer Kristine Pepper provided confirmation to Mike Kelly and Caltrans staff, that the CMZ data and follow-up questions indicated that the project design was on track to meet NMFS' and CDFW's fish passage guidance.

On December 15, 2022, Risa Okuyama provided a draft BA to Mike Kelly for review. Mike Kelly responded with comments on January 2, 2023.

On January 17, 2023, Risa Okuyama provided a second draft BA to Mike Kelly for review. Mike Kelly responded with comments on January 23, 2023, and recommended that Caltrans request initiation of the section 7 consultation for NC steelhead individuals that may be handled during the proposed stream diversion.

On February 8, 2023, Risa Okuyama notified Mike Kelly that minor design changes may require different foundation piles than were described in the draft BA. Potential changes to the effects of the action on NC steelhead was discussed, and it was determined that there would be no additional or different effects; however, the new design information would need to be presented in the BA.

On February 13, 2023, Caltrans provided a final BA and a request for formal consultation. Mike Kelly responded on February 14, 2023 to indicate that NMFS had accepted the request for consultation, which was initiated on February 13, 2023.

On February 15, 2023, Caltrans confirmed that staging areas for equipment and materials will be negotiated by the contractor with local landowners, but all proposed locations are on existing non-vegetated turnouts, parking lots, and road surfaces.

On February 16, 2023, Mike Kelly requested additional information about the fate of roadway stormwater runoff. Typically, Caltrans maps stormwater and designs treatment systems later in their project delivery process, but they agreed to make an initial assessment for the purposes of completing this consultation with as much information as they could provide at this stage. Mike Kelly indicated that the incidental take statement of the final opinion would contain a Term and Condition to require that Caltrans submit the final stormwater mapping and treatment designs to NMFS when available in order to determine whether the designs meet the assumptions made for the consultation.

On March 14, 2023, Risa Okuyama provided additional information about stormwater runoff and treatment measures, which included an initial assessment, preliminary standard design information, and a statement that their intention is to eliminate untreated stormwater discharges in the action area.

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 (50 CFR 402.02).

We considered, under the ESA, whether or not the Project would cause any other activities and determined that it would not. Upgrades to the road and replacement of the Ward Creek culvert with a small bridge will not facilitate use by numbers or types of vehicles that do not already use the road.

The Project is described in detail in Caltrans' BA (Caltrans 2023). Project elements that may affect NC steelhead, and accompanying measures to minimize impacts, are summarized below, while the remaining project description is incorporated by reference to Caltrans' BA.

Caltrans is proposing to modify State Route 36 between Post Mile (PM) 3.90 and PM 6.00 in the action area by widening shoulders, extending passing lanes, replacing guardrails, upgrading storm drainage culverts, and replacing a culvert with a single span bridge over Ward Creek to provide full fish passage. Additionally, Caltrans will remove a defunct bridge and associated roadbed just downstream of the Ward Creek crossing, which will remove an impediment to natural stream function. Caltrans has determined that work outside of the Ward Creek project limits will not impact NC steelhead or their habitat, except that new stormwater treatments may improve water quality within the Yager Creek watershed.

Construction at the Ward Creek location will occur between June 15 and October 15, when the chance of precipitation is lowest and streamflows are at their annual minimum. Caltrans expects construction to require one season with 190 working days.

1.3.1 Access and Staging

Caltrans will clear and grub vegetation and construct two temporary stabilized access roads with a minimum width of 12 feet to accommodate equipment needed for foundation construction at the new Ward Creek bridge location. Crushed rock gravel (Class 2 Aggregate Base) will be used for temporary access road fill. For stability and ease of removal at the end of the project, a geo-fabric will be used as the bottom layer. Where temporary shoring is needed, Caltrans will use 3-foot-tall temporary K-rails backfilled with crushed rock in multiple layers up to 6 feet in height.

Additionally, Caltrans will install a debris containment system at Ward Creek prior to construction to ensure construction debris does not enter the stream channel.

Caltrans will store and stage equipment and materials along the full project route at existing turnouts, parking areas, and road surfaces. Apart from the Ward Creek location, Caltrans will remove no vegetation with riparian function for access and staging.

1.3.2 Construction Site Conservation Measures

To minimize erosion, sediment, and pollutant delivery to waterways, best management practices (BMP's) consistent with *Caltrans' Construction Site BMP Manual* (Caltrans 2017) will be implemented. Caltrans' BA provides details on specific measures and provides the BMP Manual codes for ease of reference. Most of these measures are standard practices that have proven efficacy and are familiar to NMFS' staff. Refer to Caltrans' BA and the above-referenced manual for details.

1.3.3 Vegetation Removal

As described in section 1.3.1, Caltrans will not remove any vegetation with riparian function outside of the Ward Creek location. However, some trees will be removed along the route to improve sight distance and allow widening of the road and curve correction. The remainder of this section describes vegetation removal at the Ward Creek location.

Caltrans will remove riparian vegetation and trees for access and construction, including a radius around proposed crane pads to allow for swinging of the crane boom. Trees to be removed for the bridge replacement would consist of eight redwoods (*Sequoia sempervirens*) with a diameter-at-breast-height (DBH) between 1 to 3.9 feet, five big leaf maple (*Acer macrophyllum*) trees between 0.6 to 1.5 feet DBH, and three alder trees between 1.0 to 1.5 feet DBH.

1.3.4 Stream Diversion, Dewatering, and Fish Relocation

If flowing water is present at the time of construction, Caltrans will dewater up to 400 linear feet of Ward Creek, including approximately 150 feet upstream and 250 feet downstream. This will be accomplished by installing a temporary cofferdam upstream of the existing culvert to divert the stream flow through a diversion pipe downstream of the work area. The water diversion would remain in place during the instream work period. Diversions would be installed on or after June 15. A combination of plastic liner, gravel bags, a water bladder, and/or other impermeable materials would be used to direct water. Dewatering drawdown would occur incrementally to fully assess any fish not captured during initial efforts to avoid stranding. The orientation, siting and type of fish screens used for dewatering operations will be selected to prevent fish entrapment. Water generated from the dewatering operations from cofferdams would be disposed of per the *Field Guide to Construction Site Dewatering* (Caltrans 2014) and the Caltrans-authorized Dewatering Plan. Turbid water will not be discharged back to surface waters. Following construction, cofferdams and other structures used during dewatering will be removed by October 15.

The contractor will be required to prepare and submit a Construction Site Dewatering and Diversion Plan, and an Aquatic Species Relocation Plan, to Caltrans for approval prior to any dewatering. Caltrans will provide NMFS the plans to review 30 days prior to conducting the diversion.

Construction of the temporary diversion and cofferdam will likely require exclusion, capture, and relocation of aquatic species. In the event that any steelhead are removed from the work area, they will be relocated to nearby suitable habitat downstream of the diversion. Fish exclusion and relocation would likely be conducted using seining gear, electrofishing gear, or dip nets. If electrofishing is necessary, it would be performed by a qualified fisheries biologist with appropriate training and experience in electrofishing techniques. Electrofishing for salmonids would comply with *Guidelines for Electrofishing Waters Containing Salmonids Listed under the Endangered Species Act* (NMFS 2000), and all electrofishing would take place as early in the day as practicable. Any seining or other capture and removal techniques would adhere to the *California Salmonid Stream Habitat Restoration Manual* (CDFW 2010).

If unexpected life stages or species of salmonids are observed, or unforeseen injury or mortality of federally or state listed salmonids occurs, NMFS and CDFW would be contacted immediately.

1.3.5 Bridge Construction

The existing crossing at Ward Creek is a 6-foot tall by 10-foot diameter arched culvert with a length of 58.6 feet. According to the *California Passage Assessment Database* (CDFW 2022), the existing culvert is a total barrier to anadromous fish due to depth and velocity. The proposed bridge will be 60 feet wide with a span of 45 feet, and is designed to provide full fish passage.

To limit traffic delays, the Ward Creek Bridge will be built by half-width construction in two stages using Accelerated Bridge Construction methods. During the first stage, Caltrans will demolish the existing westbound half of the culvert structure and install foundation systems and the deck for that half of the new bridge structure. Then Caltrans will repeat this construction method on the eastbound half of the crossing.

Caltrans will construct two crane pads of approximately 30 feet by 30 feet with one near each end of the crossing. Crane pads will be constructed of lumber and base rock. Then Caltrans will demolish the westbound lane and excavate the area needed for piles, wingwalls, and abutments. The existing culvert spread footing will be excavated to a depth of approximately 12 feet, then removed to a minimum of 3 feet below the original grade where in conflict with the proposed new abutment. Shoring, as described in section 1.3.1, will be used to stabilize the roadway and allow the abutment to be graded. Once the foundation is complete, Caltrans will construct the westbound half of the new superstructure using pre-cast concrete slabs, which will be overlaid with either polyester concrete or rapid set concrete. This basic scenario will then be repeated for the eastbound half of the bridge.

Foundation piles will be either 14-inch diameter impact-driven H-piles, or 14-inch diameter impact-driven cast-in-steel-shell (CISS) pipe piles. Spread footings may also be considered. The number and type of piles will be determined during final design, but the proposed scenario in Caltrans' BA considers the most impactful potential alternative.

1.3.6 Stormwater Drainage

Caltrans intends to prevent direct discharge of roadway runoff into surface waters through implementation of stormwater treatment BMPs, which will include composted bioswales, and will accommodate at least the 24-hour, 85th percentile storm event, which is required under their National Pollutant Discharge Elimination System (NPDES) permit. However, Caltrans does not

map stormwater runoff in detail, or design treatment BMPs, until later in their project delivery process.

Caltrans' NPDES Permit prohibits Caltrans from discharging stormwater containing pollutants that have not been reduced to the maximum extent practicable (MEP). MEP, a technology-based standard, is the minimum required performance standard and means that the discharger must employ whatever BMPs are technically feasible and not cost-prohibitive. The NPDES Permit also prohibits discharges that cause or contribute to exceedances of water quality objectives or that unreasonably affect beneficial uses (e.g. rare, threatened and endangered species, aquatic life, recreational use, etc.). Additionally, the NPDES Permit requires stormwater treatment not just for new projects but also requires the development of a BMPs Retrofit Plan that identifies, prioritizes, upgrades, or replaces existing BMPs where there is a lack of adequate treatment of stormwater from already existing infrastructure.

Therefore, Caltrans will implement stormwater treatments, such as vegetated compost-containing bioswales, at all locations where roadway-related stormwater may otherwise discharge directly to surface waters. Their intent is to eliminate all such discharges up to the 24-hour, 85th percentile storm event, which is required under their NPDES permit. All other roadway stormwater will be conveyed to stormwater treatments. Additionally, no new discharge locations will be developed.

Additionally, Caltrans will replace or upgrade four stormwater culvert systems at PM 4.37, PM 4.60, PM 5.29, and PM 5.90. However, these culverts will not create any new discharge locations, and stormwater will be treated as described above.

1.3.7 Demolition

Caltrans will demolish the concrete portions of the existing culvert with a jackhammer and/or a backhoe-mounted hoe ram. Additionally, Caltrans is removing an old defunct bridge with approximately 1,350 square feet of bridge deck and associated roadway downstream of the existing crossing. The bridge will be demolished using similar techniques as used for culvert demolition.

1.3.8 Site Restoration and Revegetation

After completion, all materials will be completely removed from the site. The site would then be restored to a natural setting by regrading and revegetating with native plants, as will be required by the final approved Revegetation and Erosion Control plans.

After completion of the structural work, portions of the bed, bank, and channel of Ward Creek will be graded to restore the channel. Measured from the proposed centerline, the stream restoration limits would begin approximately 122 feet upstream and end 264 feet downstream, totaling 386 feet of Ward Creek. Roughly 300 cubic yards of engineered streambed material will be placed below ordinary high water for the restoration of the creek. Engineered streambed material is determined from sediment gradation and hydraulic conditions at the restored reach, as well as the hydrology of the basin. The proposed channel restoration will match the natural stream conditions as closely as possible to maintain a stable longitudinal channel profile. Grading work will occur during the dry season work window and while the stream is dewatered. Existing large woody debris in the upstream reach of the channel would be maintained or utilized in the restoration.

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 adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provide an opinion stating how the agency's actions would affect listed species and their critical habitats. If incidental take is reasonably certain to occur, section 7(b)(4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

2.1. Analytical Approach

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

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:

- Evaluate the rangewide status of the species expected to be adversely affected by the proposed action.
- Evaluate the environmental baseline of the species in the action area.
- Evaluate the effects of the proposed action on species and their 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, analyze whether the proposed action is likely to 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.
- If necessary, suggest a reasonable and prudent alternative to the proposed action.

In this opinion, we rely on known construction-related impacts to fish and habitat that result from activities such as bridge construction. We then consider the severity of exposure and the number

of NC steelhead that may be exposed. We estimate the number of fish that may be present based on physical habitat conditions, consultation with CDFW, and survey data provided by Caltrans.

The action area is not within designated critical habitat for NC steelhead. Therefore, critical habitat for this species will not be considered in this biological opinion, though habitat impacts that may affect individuals are analyzed.

2.2. Rangewide Status of the Species

This opinion examines the status of each species that would 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.

2.2.1 NC Steelhead Description and General Life History

NC Steelhead exhibit the most complex suite of life history strategies of any salmonid species. They have both anadromous and resident freshwater life histories that can be expressed by individuals in the same watershed. The anadromous fish generally return to freshwater to spawn as 4- or 5-year-old adults. Unlike other Pacific salmon, steelhead can survive spawning and return to the ocean to return to spawn in a future year. It is rare for steelhead to survive more than two spawning cycles. Steelhead typically spawn between December and May. Like other Pacific salmon, the steelhead female deposits her eggs in a redd for incubation. The 0+ age fish emerge from the gravel to begin their freshwater life stage and can rear in their natal stream for 1 to 4 years before migrating to the ocean between March 1 and July 1 each year, although they have been observed as late as September (Ricker et al. 2014).

2.2.2 Status of NC Steelhead

In this biological opinion, NMFS assesses four population viability parameters to help us understand the status NC steelhead and their ability to survive and recover. These population viability parameters are: abundance, population productivity, spatial structure, and diversity (McElhaney et al. 2000). While there is insufficient information to evaluate these population viability parameters in a thorough quantitative sense, NMFS has used existing information, including the Coastal Multispecies Recovery Plan (NMFS 2016) for NC steelhead to determine the general condition of each population and factors responsible for their current status. We use these population viability parameters as surrogates for numbers, reproduction, and distribution, the criteria found within the regulatory definition of jeopardy (50 CFR 402.20).

NC Steelhead Abundance and Productivity: With few exceptions, NC steelhead are present wherever streams are accessible to anadromous fish and have sufficient flows. The most recent status review by Williams et al. (2016) reports that available information for winter-run and summer-run populations of NC steelhead do not suggest an appreciable increase or decrease in extinction risk since publication of the last viability assessment (Williams et al. 2011). Williams et al. (2016) found that population abundance was very low relative to historical estimates, and recent trends are downwards in most stocks.

NC Steelhead Spatial Structure and Diversity: NC steelhead remain broadly distributed throughout their range, with the exception of habitat upstream of dams on both the Mad River and Eel River, which has reduced the extent of available habitat. Extant summer-run steelhead populations exist in Redwood Creek and the Mad, Eel (Middle Fork and Van Duzen,) and Mattole Rivers. The abundance of summer-run steelhead was considered "very low" in 1996 (Good et al. 2005), indicating that an important component of life history diversity in this DPS is at risk. Hatchery practices in this DPS have exposed the wild population to genetic introgression and the potential for deleterious interactions between native stock and introduced steelhead. However, abundance and productivity in this DPS are of most concern, relative to NC steelhead spatial structure and diversity (Williams et al. 2011).

2.2.3 Factors Responsible for the Decline of NC Steelhead

The factors that caused declines include hatchery practices, ocean conditions, habitat loss due to dam building, degradation of freshwater habitats due to a variety of agricultural and forestry practices, water diversions, urbanization, over-fishing, mining, climate change, and severe flood events exacerbated by land use practices (Good et al. 2005, Williams et al. 2016). Sedimentation and loss of spawning gravels associated with poor forestry practices and road building are particularly chronic problems that can reduce the productivity of salmonid populations. Late 1980s and early 1990s droughts and unfavorable ocean conditions were identified as further likely causes of decreased abundance of listed salmonids (Good et al. 2005). The sustained drought in California reduced stream flows and increased temperatures, further exacerbating stress and disease. Ocean conditions have been unfavorable in recent years due to the El Niño in 2015 and 2016. Reduced flows can cause increases in water temperature, resulting in increased heat stress to fish and thermal barriers to migration.

Another factor affecting the range wide status of NC steelhead, and aquatic habitat at large 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).

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 NC 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 1000 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 NC 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 (Frölicher, et al. 2018). In fall 2014, and again in 2019, a marine heatwave, known as "The Blob"[2], 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. 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.

2.3. 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 specific action area for the Project site is summarized below.

The action area for the Project encompasses the entire construction footprint that would be subject to direct impacts due to site access, stream channel isolation and associated fish relocation, riparian vegetation removal, ground and water-borne sound energy from pile driving, and the extent of downstream turbidity excursion, which may extend approximately to 300 feet of downstream waters. Additionally, because the project will open fish passage above the crossing, NMFS considers the action area to include those upstream portions of Ward Creek that allow anadromy.

2.4. Environmental Baseline

The "environmental baseline" refers to the condition of the listed species or its habitat in the action area, without the consequences to the listed species or 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

[2] https://www.fisheries.noaa.gov/feature-story/new-marine-heatwave-emerges-west-coast-resembles-blob

consultation in process. The consequences to listed species or its habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

In the action area, the threat to NC steelhead from climate change is likely to include a continued increase in average summer air temperatures; more extreme heat waves; and an increased frequency of drought (Lindley et al. 2007). In future years and decades, many of these changes are likely to further degrade habitat throughout the watershed by, for example, reducing streamflow during the summer and raising summer water temperatures. Many of these impacts will likely occur in the action area via reduced flows and higher water temperatures.

2.4.1 Status of NC Steelhead in the Action Area

Steelhead occurring in the action area belong to the Van Duzen River population of NC steelhead, which the NMFS Coastal Multispecies Recovery Plan indicates is likely well below the population level needed to be at a low risk of extinction (NMFS 2016).

NC steelhead may be present at the Ward Creek location based on habitat suitability and apparent unrestricted access to the creek below the existing culvert. Caltrans, NMFS, and CDFW found no existing information on the status of Ward Creek in the form of stream inventory reports, watershed assessments, field notes, or personal knowledge. Spot observations by CDFW, Caltrans and NMFS in the action area have found only pikeminnow. The landowner of the adjacent property does not recall seeing adult steelhead in the creek.

However, Caltrans conducted water temperature monitoring at Ward Creek between June 13 and October 15, 2022, and found that temperatures were suitable for steelhead rearing throughout that period (Caltrans 2023). Additionally, there is suitable habitat in the action area and steelhead are frequently observed in Yager Creek, to which Ward Creek is a tributary 0.75 miles downstream. The action area contains a quantity of large and small woody debris, which would provide good cover for rearing steelhead. Pools in the project area are small and shallow; however, the abundance of woody debris and vegetation in the channel would obscure potentially larger rearing pools. Given that steelhead are typically found in any stream to which they have access and adequate flow, NMFS and Caltrans assume there may be juvenile steelhead rearing in the action area in any given year. Caltrans estimates that up to six steelhead could be in the Ward Creek construction area during relocation and pile driving activities, and NMFS believes this is a reasonable conservative estimate.

Historically, the Yager Creek watershed had a run of summer steelhead; however, summer steelhead have not been found in in recent years (CDFG 2013). Additionally, genetic data provided by CDFW, as well as the position of the site within the Van Duzen watershed, indicate that only winter-run steelhead are expected in Ward Creek (Kannry et al. 2020). The Van Duzen River also has an annual run of half-pounder steelhead; however, these fish typically begin entering fresh water in August (Lee 2015), so would not be expected in the Yager Creek watershed at the time of the stream diversion.

2.4.2 Physical Characteristics of the Action Area

The action area includes rural residential housing, private grazing, farmlands, and the highway. Historic timber harvest practices may have influenced Ward Creek in the action area, but the

primary impact to the stream appears to be channelization, which has caused the stream to incise and be disconnected from its floodplain (Caltrans 2022). The upper part of the watershed is well forested, and a narrow but dense riparian canopy exists in the lower part of the watershed, which would support the observed water temperatures and provide adequate food resources in the action area. The action area could provide spawning habitat for steelhead; however, no spawning has been reported.

The topography of the action area is relatively flat, ranging from 115 to 280 feet above sea level. The two primary soil types within the action area are the Weott and Ferndale series (USDA 2022) The Weott series consists of very deep, very poorly-drained soils on depressions and low flood-plain steps on alluvial plains. The Ferndale series consists of very deep, well-drained soils on high flood-plain steps on alluvial plains. The poorly-drained soils occur in depressions, while the well-drained soils occur on higher ground, such as where the road surface is located.

Average daily traffic in the action area on this rural highway is approximately 5,300 vehicles per day. For comparison, the average daily traffic on State Route 101 at the junction of State Route 36 is approximately 20,000.

2.5. Effects of the Action

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

2.5.1 Fish Exclusion and Relocation

Data on fish relocation efforts from water diversion activities since 2004 show most average mortality rates are below three percent for salmonids. Therefore, given the measures that would be implemented to avoid and minimize impacts to fish during relocation efforts, NMFS expects no more than three percent of all relocated fish would be subject to potential injury or mortality.

As detailed in section 1.3, Caltrans proposes to isolate the work area and relocate any fish present. As described in section 2.4.1, Caltrans conservatively estimates that up to six juvenile steelhead may require relocation. While steelhead numbers may vary significantly between years, NMFS agrees that this estimate is reasonable and conservative, and is unlikely to be exceeded in a given year.

If we apply the three-percent mortality rate (rounded up to the nearest whole number) to the total number of juvenile NC steelhead that we estimate could be relocated, we would expect that no more than one juvenile NC steelhead would be injured or killed during relocation. We also estimate that these individuals may belong to any of three cohorts in a given year. These cohorts may consist of young-of-year, and one- and two-year-old steelhead.

2.5.2 Water Quality

Pollutants from construction operations, or from the mobilization of sediment during

construction, have the potential to impact water quality within the action area.

Turbidity and Sedimentation

The activites that would have the greatest chance of producing turbidity will be isolated behind a cofferdam or will not be connected to surface waters. Therefore, we expect only minor turbitiy associated with placing and removing the stream diversion. We do expect some suspended sediment to be delivered to the stream after construction during the first flow-producing rainfall of the season due to ground disturbance.

Increases in suspended sediment or turbidity can affect water quality, which in turn can affect fish health and behavior. Salmonids typically avoid areas of higher suspended sediment, which means they may leave their preferred habitat in order to seek areas with less suspended sediment. Fish unable to avoid suspended sediment can experience negative effects from exposure.

Research has shown that length of exposure to total suspended solids (TSS) plays a more dominant role than TSS concentration (Anderson et al. 1996). Long term exposure to elevated TSS conditions may cause an endocrine stress response (elevated plasma cortisol, glucose, and hematocrits), suggesting an increased physiological burden that could influence growth, fecundity, and longevity (Redding et al. 1987). Therefore, when considering the effects of TSS on listed fish, it is important to consider the frequency and the duration of the exposure, not just the TSS concentration (Newcombe and Jensen 1996).

However, due to anticipated success of BMP's and construction methods, we expect levels and durations to be below thresholds known to elicit avoidance responses in salmonids, and to be well below harm thresholds (Oregon Department of Environmental Quality 2014). Therefore, NMFS considers the potential amounts and duration of turbidity to be unlikely to reduce the fitness of salmonids in the action area.

Pollutants Associated with Stormwater Runoff

Post-construction stormwater discharges, the pollutants they can carry, and the effects on listed salmonids and critical habitat are effects of the action. Pollutants in untreated post-construction runoff are expected to include oil, grease, polycyclic aromatic hydrocarbons (PAH), heavy metals (copper, zinc, etc.) and other toxic substances associated with tires and vehicles. Concentration levels and toxicity will be seasonally affected by rainfall patterns and proximity to a discharge point. The highest concentration levels of constituents and chemical mixtures that are toxic to fish and aquatic life in stormwater runoff are expected to occur at the point of discharge. First-flush rain events after long antecedent dry periods (periods of no rain) will also have higher concentrations of pollutants.

When exposed to urban stormwater, steelhead juveniles did not recover even when transferred to clean water (Chow et al. 2019; French et al 2022). Steelhead mortality can begin as soon as seven hours post exposure (Brinkmann et al. 2022; French et al 2022). Effects appear to be related to cardiorespiratory disruption, consistent with symptoms (surface swimming and gaping followed by loss of equilibrium) and, therefore, sublethal effects such as disruption of behaviors needed for survival (e.g. swimming performance and predator avoidance) are expected. Additional research concerning sublethal effects is lacking.

Tian et al. (2022) identified 6PPD-quinone as the causal factor. Brinkmann et al. (2022) found a LC50 (lethal concentration to 50% of the test subjects) to juvenile steelhead at concentrations of 1 µg/L (parts per billion). Another study (French et al. 2022) established lethality to juvenile steelhead from 24-hour exposures. The parent compound (6PPD) is widely used by multiple tire manufacturers and the tire particles that produce the degradation product have been found to be ubiquitous where both rural and urban roadways drain into waterways (Feist et al. 2018). Tire-derived products used by Caltrans and others, such as asphalt rubber paving, may also contribute 6PPD-quinone to waterways (CADTSC 2022).

Copper (Cu) is another well documented contaminant in stormwater from roadways (Caltrans 2003a, b, 2000) that has been shown to detrimentally affect salmonids at very low and environmentally realistic levels. Hecht et al. (2007) present usable summaries of the impacts of copper to fish and aquatic invertebrates. Environmentally realistic concentrations of copper are noted to impact the resistance of fishes to disease, cause hyperactivity, impair respiration, disrupt osmoregulation or impact olfactory performance. NMFS (Hecht et al. 2007) notes that species mean acute 96-hour LC50 values of 19-108.1 µg Cu/l (parts per billion) were found for species of *Oncorhynchus* in freshwater environments. A large body of scientific literature has shown that fish behaviors can be disrupted at concentrations of dissolved Cu that are at, or slightly above, ambient concentrations (i.e. background) (Sandahl et al. 2007, 2004; Baldwin et al. 2003).

Olfactory function becomes impaired if steelhead are unable to avoid copper pollution within the first few minutes of exposure. Olfactory cues convey important information about habitat quality, predators, mating, and the animal's natal stream, thus substantial copper-induced loss of olfactory capacity will likely impair behaviors essential for the survival or reproductive success of salmon and steelhead (Baldwin et al. 2003).

Zinc is added to tire rubber as part of the vulcanization process and is released to the environment as tires wear on the pavement just like 6PPD. Like copper, it has been found in roadway stormwater at elevated concentrations (Caltrans 2003a, b, 2000). In addition to obvious adverse effects to fish and other aquatic life such as mortality at high concentrations and impacts to benthic macroinvertebrate populations, zinc disrupts aquatic organism' ability to regulate the concentration of calcium across cell membranes (CADTSC 2021). This may lead to issues with the development and maintenance of the skeletal system and fish scales, delayed and stunted growth, atrophy and the misshaped RNA molecules (CADTSC 2021).

PAHs are present in roadway stormwater from sources including vehicle exhaust, fuel leaks and spills, oils and greases, roadway sealants and asphalt paving (CADTSC 2022). Embryonic exposures to PAHs can result in edema (swelling) of the yolk sack, hemorrhaging, disruption of cardiac function, enzyme induction, mutation of progeny, craniofacial and spinal deformities, neuronal cell death, anemia, reduced growth and impaired swimming (Barron et al. 2003, Incardona et al. 2004, 2005). Fish embryos and larvae exposed to PAHs are likely to experience adverse changes in heart physiology and morphology, including pericardial edema and heart failure, leading to mortality, even with only temporary exposure to low concentrations (Hicken et al. 2011; Incardona et al. 2014, 2012; Brette et al. 2014; Incardona and Sholz 2017). Although exposed embryos and larvae may grow to look like normal fish on the outside, internally there are subtle changes in heart shape and also a significant reduction in swimming performance reducing individual survival due to long-term physiological impairment (Hicken et al. 2011). Swimming performance is an individual fitness indicator for migratory salmonids, including

steelhead. Reduced larval feeding associated with pericardial edema can lead to death during the transition period to juvenile stages (Hicken et al. 2011). Other individuals may experience a disturbance in heartbeat rhythm (Brette et al. 2014).

Stormwater runoff can be effectively treated by infiltrating the road runoff through soil media containing organic matter, which results in removal of toxins and contaminants (McIntrye 2015). Caltrans (2003b) reached similar conclusions in their work evaluating roadside vegetated treatment sites at various slopes. Unlike traditional stormwater collection and conveyance practices, such as storm drain systems with direct outfalls to waterways, vegetated filter strips at the edges of paved surfaces or vegetated swales (i.e., bioswales) can collect and convey stormwater in ways that infiltrate into soils with large amounts of organic matter that bind or otherwise remove contaminants from the stormwater before it reaches a stream (Caltrans 2003b; McIntrye et al. 2015). Without post-construction measures to treat or infiltrate stormwater, steelhead in the action area will be exposed to contaminated stormwater runoff originating Caltrans projects and infrastructure.

As described in section 1.3.6, Caltrans intends to implement BMPs that are consistent with their NPDES permit.

Due to the relatively flat geography and soil drainage conditions, much roadway stormwater will continue to sheet-flow from the road and infiltrate before reaching surface water. All other roadway stormwater will be conveyed to stormwater treatments, which are yet to be designed. However, based on preliminary information presented by Caltrans, we assume that their final design will be consistent with the requirements of their NPDES permit. Additionally, no new discharge locations will be developed.

There will be no scuppers on the new Ward Creek Bridge, so water will not drain directly to the creek, but will drain to treatment locations to infiltrate. No work is proposed that would affect drainage from the Yager Creek Bridge, which crosses over an important salmon and steelhead stream, and no work will be conducted on the bridge. This bridge does not contain scuppers, and it is the high point on the road in this section, so stormwater will continue to flow away from the creek and infiltrate without discharging to the creek. Therefore, while the roadway on either side of Yager Creek is within the action area, we do not any expect effects to water quality in Yager Creek.

Temporary erosion control treatments will also be implemented to protect the soil from concentrated stormwater flows that may occur before vegetation is established. All designated stormwater treatment areas will be maintained regularly per Caltrans Standard Specifications. Caltrans will have an exemption from using rubberized hot mix asphalt for this project.

Additionally, Caltrans will replace four culvert systems located at PM 4.37, PM 4.60, PM 5.29 and PM 5.90. These culverts drain stormwater to upland areas only, as verified on project plans and satellite images.

Given Caltrans' requirements and intent to treat all stormwater runoff in the action area, as well as the expectation that local soils and relatively low traffic volumes (as described in section 2.4.2) will potentially minimize toxicity of stormwater discharges, NMFS believes that measures will be adequate to ensure that adverse impacts to NC steelhead related to stormwater discharges will not occur due to the proposed action.

Pollutants Associated with Accidental Spills During Construction

Accidental spills from construction equipment pose a significant risk to water quality, particularly for construction activities in or near watercourses, and at the onset of the rainy season when the first flush could trigger the discharge of spilled materials. However, in-stream activities would be suspended and the area will be cleaned prior to the onset of the rainy season. Furthermore, the proposed minimization measures are expected to prevent chemical contamination during construction. Therefore, NMFS expects the likelihood of an accidental spill of contaminants reaching the stream at a level that would harm salmonids to be improbable.

2.5.3 Temporary Loss of Rearing Habitat

As described in Section 1.3.5 of this opinion, Caltrans will relocate fish and exclude them from approximately 400 feet of stream in the work area (150 feet upstream and 250 feet downstream). So, this habitat would be unavailable to rearing salmonids between June 15 and October 15. However, Caltrans will distribute captured fish into functional rearing habitat downstream of the site. NMFS believes that the small number of fish moved from the marginal-quality rearing habitat into downstream locations that are more likely to remain watered through the season will not create crowding that would reduce feeding success or increase predation in any meaningfully measurable way. Additionally, the stream diversion will allow downstream migration for any aquatic species attempting to migrate, which may occur especially if the stream channel dries up as it does in some years. Therefore, we believe this short-term loss of this habitat will not result in decreased fitness or survival of individual salmonids.

2.5.4 Hydroacoustics

Sound energy levels above 150 dB (re: 1 µPa) can accumulate to cause barotrauma in exposed fish. This cumulative sound exposure level is abbreviated as cSEL. Based on accepted standards of the Fisheries Hydroacoustic Working Group (2008), fish under two grams may suffer barotrauma at a cSEL of 183 dB, and fish over two grams may experience barotrauma at a cSEL of 187 dB. However, levels below these thresholds do not continue to accumulate if fish are not re-exposed within 12 hours. NMFS believes that all steelhead present at the start of construction will be over two grams. Sound energy levels at or above 206 dB (re: 1 µPa) may injure exposed fish with a single pile strike. Additionally, single-strike sound energy above 150 dB (re: 1 µPa) is considered to elicit behavioral responses in fish, and sound energy below this threshold is considered the "effective quiet" level where behavioral responses are not elicited and sound energy does not accumulate toward the injury thresholds.

Vibratory Pile Driving

Caltrans may use vibratory pile driving for initial installation of all temporary piles, and for any necessary sheet piles used for shoring. Compared to impact pile driving, vibratory pile driving generally produces more continuous, lower energy sounds below the thresholds associated with injury. There are currently no established noise thresholds associated with continuous sound waves, and vibratory methods are generally considered effective measures for avoiding or minimizing the risk of injury of fish from pile driving noise. Vibratory installation may cause behavioral reactions; however, NMFS believes that the chances that a fish would be exposed to the behavioral threshold during vibratory pile driving at the distance outside the dewatered streambed are miniscule.

Impact Pile Driving

Caltrans evaluated potential underwater noise levels generated by planned construction activities for two potential pile types, as describe in section 1.3.5, and determined that impact pile installation is unlikely to exceed currently adopted hydroacoustic noise thresholds that may cause injury to fish from single pile strikes. Based on analyses provided in Caltrans' BA and confirmed by NMFS, single strike noise levels that may cause injury to fish would not reach accessible areas of the creek. Therefore, salmonids would not be exposed to single strike injurious noise levels.

Caltrans' BA provides the calculations used to determine the distances from the piles over which injury may be possible due to accumulated sound energy. Based on conservative assumptions, Caltrans predicts that injurious cSEL's could extend up to 10 feet from each H-pile, or 46 feet from each CISS pile. Given the length of dewatered channel, NMFS agrees that exposure of steelhead to injurious sound levels during pile driving will not occur.

Additionally, juvenile steelhead could be exposed to underwater noise levels exceeding the behavior thresholds without reaching the injurious cSEL threshold. Caltrans' analysis predicts that exposure to 150 dB sound levels would occur over a radius of no more than 59 feet from each H-pile and 328 feet for each CISS pile. Therefore, fish may be exposed to behavioral thresholds if CISS piles are used.

Temporary behavioral changes that fish may exhibit in response to percussive noise include startling, altering behavioral displays, avoidance, displacement, and reduced feeding success. Observations of juvenile steelhead exposed to pile driving noise above the 150 dB behavioral threshold at the Mad River Bridges Highway 101 project indicate that juvenile steelhead quickly habituate to the noise and resume normal surface-feeding behavior within a few minutes of the fist pile strikes (Mike Kelly, NMFS, personal observations 2009, 2011). Therefore, NMFS believes that periodic behavioral changes caused by sub-injurious sound exposure will not result in decreased fitness or survival of individual juvenile salmonids.

Demolition

Caltrans will demolish concrete associated with the existing culvert and the defunct bridge 100 feet downstream of the crossing. Hydroacoustic analyses of demolition noise created by jackhammers and hoe rams are difficult because there is little example data available for comparison, and the number of strikes is more difficult to estimate than for impact pile driving. NMFS believes that sound energy produced by impact driving of the H-piles is likely to be similar to the sound energy produced during demolition. However, even if the sound energy is similar to that predicted for the CISS piles, injury thresholds will not extend to occupied habitat regardless of the number of demolition strikes; therefore, no fish would be exposed to injury thresholds during demolition. The behavioral threshold may be reached outside of the dewatered reach; however, as discussed above, NMFS believes that periodic behavioral changes caused by sub-injurious sound exposure will not result in decreased fitness or survival of individual juvenile salmonids.

2.5.5 Combined Effects

The potential exists for simultaneous construction-related impacts to have a synergistic effect that is greater or different than each stressor acting alone. Simultaneous impacts may include

visual impacts from workers and equipment working near or over the water at the same time that fish may be exposed to suspended sediment, for example. However, because combined effects are likely to be of very low intensity, and fish will be relocated outside of the immediate project area, NMFS does not expect any reductions in fitness of salmonids from any combined effects of individual construction elements.

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.

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

NMFS expects ongoing adverse effects on individual listed salmonids in the action area due to private water withdrawals from shallow wells or directly from tributary streams (NMFS 2016) that may lower the mainstem summer base flow. Lower summer base flows reduce available rearing habitat for juvenile salmonids, and may contribute to higher daytime water temperatures due to lower volume of water available to moderate daily temperature swings. State and local groups are making focused efforts to reduce the impacts of private water withdrawals, but the related impacts are likely to persist into the near future before measurable benefits accrue.

Other ongoing adverse effects include the persistence of Ward Creek's incision and disconnection from its floodplain (Caltrans 2022), which arrests habitat forming processes and eliminates access to floodplain high-water refugia habitat.

2.7. Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to species as a result of implementing the proposed action. 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 (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.

2.7.1 Summary of Baseline, Status of the Species, and Cumulative Effects

We describe habitat NC steelhead at the DPS scale as mostly degraded in section 2.2.3. Although there are exceptions, the majority of streams and rivers in the DPS have impaired habitat. Additionally, this habitat often lacks the ability to establish fully functioning features due to

ongoing and past human activities. While habitat generally remains degraded across the DPS, restorative actions have likely improved the conservation value of habitat throughout their ranges.

Steelhead occurring in the action area belong to the Van Duzen River population of NC steelhead, which the NMFS Multispecies Recovery Plan indicates is likely well below the population level needed to be at a low risk of extinction (NMFS 2016).

The cumulative effects of private activities that may occur in the Ward Creek watershed, as discussed in the environmental baseline section, may continue to impair, but not preclude the recovery of habitat in the action area. Additionally, due to the negligible nature of the proposed action's long-term impacts, NMFS does not expect the proposed action to exacerbate the effects of climate change on steelhead in the action area.

2.7.2 Summary of Effects to Individual NC Steelhead

NMFS anticipates miniscule or extremely unlikely effects to NC steelhead from expected levels of increased sediment and turbidity, riverbank stabilization, or potential chemical contamination, during or after construction. However, adverse effects are likely due to capture, handling, and relocation efforts intended to protect fish from potential exposure to in-water work activity.

NMFS predicts that up to six juvenile winter-run steelhead could be relocated. Given our estimate of three percent injury or mortality of relocated juvenile salmonids, NMFS expects that no more than one juvenile winter-run NC steelhead would be injured or killed during relocation.

Overall Individual Effects
NMFS does not expect that the loss of one juvenile winter-run NC steelhead, regardless of cohort, would affect future adult returns. This loss of a single juvenile would represent a miniscule percentage of the overall number of individuals in the population. The overall number of individuals in the populations will likely provide a compensatory effect. Other areas of the Van Duzen River watershed are expected to continue to contribute to the populations during the time period when some juveniles in the action area may be harmed or killed as a result of this proposed project. Therefore, NMFS does not expect any appreciable effects on VSP parameters, and thus, the proposed action is not expected to reduce the survival and recovery of the NC steelhead DPS.

2.8. Conclusion

After reviewing and analyzing the current status of the listed species, the environmental baseline within the action area, the effects of the proposed action, any 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 NC 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). "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:

Take of juvenile steelhead may occur in the form of pursuit and capture during fish relocation. NMFS expects that no more than one juvenile winter-run steelhead would be injured or killed during capture and relocation to adjacent habitat, as detailed in sections 2.5.1 and 2.7.2 above.

2.9.2. Effect of the Take

In the biological opinion, NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to the species.

2.9.3. Reasonable and Prudent Measures

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

NMFS believes the following reasonable and prudent measures are necessary and appropriate to minimize take of NC steelhead:

1. Undertake measures to ensure that harm and mortality to threatened steelhead resulting from fish relocation activities are low.
2. Ensure construction methods, minimization measures, and monitoring are properly implemented during construction.
3. Prepare and submit a post-construction report regarding the effects of fish relocation and construction activities.
4. Contact NMFS when stormwater mapping and BMP design are ready for evaluation.

2.9.4. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the Federal action agency must comply (or must ensure that any applicant complies) with the following terms and conditions. Caltrans or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

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

    a. Qualified biologists with expertise in the areas of anadromous salmonid biology

shall conduct fish relocation activities associated with construction. Caltrans will ensure that all biologists working on the Project are qualified to conduct fish relocation in a manner which minimizes all potential risks to salmonids.

b. Salmonids shall be handled with extreme care and kept in water to the maximum extent possible during rescue activities. All captured fish must be kept in cool, shaded, and aerated water protected from excessive noise, jostling, or overcrowding or potential predators any time they are not in the stream, and fish will not be removed from this water except when released. Captured salmonids will be relocated as soon as possible to an instream location in which suitable habitat conditions are present to allow for adequate survival for transported fish and fish already present. Fish will be distributed between multiple areas if biologists judge that overcrowding may occur in a single area.

c. If any salmonids are found dead or injured, the biologist will contact NMFS South Coast Branch Supervisor at 707-825-5173 or by email Jeffrey.Jahn@noaa.gov as soon as possible. The purpose of the contact is to review the activities resulting in the take and to determine if additional protective measures are required. All salmonid mortalities will be retained, placed in an appropriately-sized sealable plastic bag, labeled with the date and location, fork length, and be frozen as soon as possible. Frozen samples will be retained by the biologist until specific instructions are provided by NMFS. The biologist may not transfer biological samples to anyone other than the NMFS Northern California Office in Arcata, California without obtaining prior written approval from the South Coast Branch Supervisor. Any such transfer will be subject to such conditions as NMFS deems appropriate.

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

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

   b. Caltrans shall contact NMFS within 24 hours of meeting or exceeding take of listed species prior to project completion. Notify Jeff Jahn by phone at 707-825-5173 or via email to Jeffrey.Jahn@noaa.gov. This contact acts to review the activities resulting in take and to determine if additional protective measures are required.

   c. Caltrans shall make available to NMFS data from any monitoring on a real-time basis (i.e., daily monitoring data should be accessible to NMFS upon request).

3. The following term and condition implements reasonable and prudent measure 3:

   a. Caltrans shall provide a written report to NMFS by January 15 in each year following construction of the Project. The report shall be sent to NMFS via email to Jeffrey.Jahn@noaa.gov. The reports shall contain, at a minimum, the following information:

      Construction related activities -- The report will include the dates construction began and was completed; a discussion of any unanticipated

effects or unanticipated levels of effects on NC steelhead, a description of any and all measures taken to minimize those unanticipated effects, and a statement as to whether or not any unanticipated effects had any effect on NC steelhead; the number of NC steelhead killed or injured during Project construction; and photographs taken before, during, and after the activity from photo reference points.

Fish Relocation – The report will include a description of the location from which fish were removed and the release site(s) including photographs; the date and time of the relocation effort; a description of the equipment and methods used to collect, hold, and transport salmonids; the number of fish relocated by species; the number of fish injured or killed by species and a brief narrative of the circumstances surrounding salmonid 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.

4. The following term and condition implements reasonable and prudent measure 4.

   a. Caltrans shall submit the final stormwater mapping and treatment designs to NMFS via email to Jeffrey.Jahn@noaa.gov when available prior to project implementation in order to determine whether the designs meet the assumptions made during our analysis.

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 regarding the development of information (50 CFR 402.02).

NMFS recommends that Caltrans remove larger trees in the access road area with their roots intact, if feasible, and if there are more trees than necessary for planned instream restoration, use the trees for habitat enhancement on other projects or make them available to restoration partners.

2.11 Reinitiation of Consultation

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

3. 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.

3.1 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 Caltrans. Other interested users could include CDFW. Individual copies of this opinion were provided to Caltrans. The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adhere to conventional standards for style.

3.2 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.

3.3 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.

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

4. REFERENCES

Abdul-Aziz, O. I, N. J. Mantua, 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.

Anderson, P. G., B. R. Taylor, and G. C. Balch. 1996. Quantifying the Effects of Sediment Release on Fish and their Habitats. Canadian Manuscript Report of Fisheries and Aquatic Sciences No. 2346, Department of Fisheries and Oceans.

Baldwin, D.H., J.F. Sandahl, J.S. Labenia and N.L. Scholz. 2003. Sublethal Effects of Copper on Coho Salmon: Impacts on Nonoverlapping Receptor Pathways in the Peripheral Olfactory Nervous System. Env. Tox. and Chem. 22:2266-2274.

Barron, M.G., M.G. Carls, R. Heintz, and S.D. Rice. 2003. Evaluation of Fish Early Life-Stage Toxicity Models of Chronic Embryonic Exposures to Complex Polycyclic Aromatic Hydrocarbon Mixtures. Toxicological Sciences 78(1):60-67.

Bartholow, J. M. 2005. Recent water temperature trends in the Lower Klamath River, California. North American Journal of Fisheries Management 25(1):152–162.

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

Brette, F., B.Machado, C. Cros, J.P. Incardona, N.L. Scholz, and B.A. Block 2014. Crude Oil Impairs Cardiac Excitation-Contraction Coupling in Fish, Science v343:772-776 DOI: 10.1126/science.1242747

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. ES&T Letters https://doi.org/10.1021/acs.estlett.2c00050

California Department of Fish and Game (CDFG). 2010. California Salmonid Stream Habitat Restoration Manual. California Department of Fish and Game Wildlife and Fisheries Division. https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=22610&inline

CDFG. 2013. Van Duzen River Watershed Assessment. Coastal Watershed Planning and Assessment Program. Department of Fish and Game, Fortuna, CA.

CDFW (California Department of Fish and Wildlife). 2022. California Passage Assessment Database. https://nrm.dfg.ca.gov/PAD/

CADTSC (California Department of Toxic Substance Control). 2021. Rationale Document for Motor Vehicle Tires Containing Zinc, March 2021 Discussion Draft. California Environmental Protection Agency, Department of Toxic Substances Control, 20 pages. Available at: https://dtsc.ca.gov/wp-content/uploads/sites/31/2021/03/Rationale-Document-Zinc-in-Tires.pdf

CADTSC. 2022. Product-Chemical Profile for Motor Vehicle Tires Containing N-(1,3-Dimethylbutyl)-N′-phenyl-p-phenylenediamine (6PPD), March 2022 Final Version. California Environmental Protection Agency, Department of Toxic Substances Control, 102 pages. Available at: https://dtsc.ca.gov/wp-content/uploads/sites/31/2022/05/6PPD-in-Tires-Priority-Product-Profile_FINAL-VERSION_accessible.pdf

Caltrans (California Department of Transportation) 2000. First flush Study 1999-2000 Report, CTSW-RT-00-016, June 2000. 289 pages

Caltrans. 2003a. Discharge Characterization Study Report, Storm Water Monitoring & Data Management, CTSW-RT-03-065.51.42, Nov 2003. 93 pages.

Caltrans. 2003b. Roadside Vegetated Treatment Sites (RVTS) Study, Final Report, CTSW-RT-03-028, Caltrans Div of Environmental Analysis, Nov 2003. 63 pages

Caltrans. 2014. Field Guide to Construction Site Dewatering. State of California, Department of Transportation, Division of Environmental Analysis, Stormwater Program, Sacramento, California. https://dot.ca.gov/-/media/dot-media/programs/construction/documents/environmental-compliance/field-guide-to-construction-site-dewatering-a11y.pdf

Caltrans. 2017. Construction Site Best Management Practices (BMP) Manual. State of California, Department of Transportation, Division of Environmental Analysis, Stormwater Program, Sacramento, California. https://dot.ca.gov/-/media/dotmedia/programs/construction/documents/environmental-compliance/csbmpmay-2017-final.pdf

Caltrans. 2022. Memorandum from Jeremy Miller-Schulze of Caltrans' North Region Hydraulics branch to Kristine Pepper of CDFW's Conservation Engineering Branch regarding estimates of the Ward Creek channel migration zone. August 12.

Caltrans. 2023. Carlotta Shoulder Widening Project biological assessment. Reference EA 01-0J890. February 2023. Eureka, California.

Chow, M.I., J.I. Lundin, C.J. Mitchell, J.W. Davis, G. Young, N.L. Scholz, and J.K. McIntyre. 2019. An urban stormwater runoff mortality syndrome in juvenile coho salmon. Aquatic Toxicology 214 (2019) 105231

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

Diffenbaugh, N. S., D. L. Swain, and D. Touma (2015), Anthropogenic warming has increased drought risk in California, Proc. Natl. Acad. Sci., 112(13), 3931– 3936.

Doney, S.C., Ruckelshaus, M., Duffy, J.E., Barry, J.P. Chan, F., English C.A., Galindo, H.M., Grebmeier, J.M., Hollowed, A.B., Knowlton, N., Polovina, J., Rabalais, N.N., Sydeman, W.J., and Talley, L.D. 2012. Climate Change Impacts on Marine Ecosystems. Annual Review of Marine Science 2012 4:1, 11-37

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.E. Scholz. 2018. Roads to Ruin: Conservation threats to sentinel species across an urban gradient. Ecological Applications 27(8):2382-2396.

Fisheries Hydroacoustic Working Group. 2008. Agreement in Principle for Interim Criteria for Injury to Fish from Pile Driving Activities. June 11.

French B.F., D. H. Baldwin, J. Cameron, J. Prat, K. King, J. W. Davis, J. K. McIntyre, and N. L. Scholz, 2022. Urban Roadway Runoff Is Lethal to Juvenile Coho, Steelhead, and Chinook Salmonids, But Not Congeneric Sockeye. Environmental Science & Technology Letters DOI: 10.1021/acs.estlett.2c00467

Frölicher, T. L., Laufkötter, C. 2018. Emerging risks from marine heat waves. Nat. Commun. 9, 650 (2018).

Good, T. P., R. S. Waples, and P. Adams (editors). 2005. Updated status of federally listed ESUs of West Coast salmon and steelhead. U.S. Department of Commerce, NOAA Tech. Memo. NMFS-NWFSC-66. 597 pp.

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, volume 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. NOAA Tech. Memo. NMFS-NWFSC-83, 39 p.

Hicken, C.E., T.L. Linbo, D.H. Baldwin, M.L. Willis, M.S. Myers, L. Holland, M. Larsen, M.S. Stekoll, S.D. Rice, T.K. Collier, N.L. Scholz, and J.P. Incardona, 2011. Sublethal exposure to

crude oil during embryonic development alters cardiac morphology and reduces aerobic capacity in adult fish. Proceedings of the National Academy of Science 108(17)7086-7090 https://doi.org/10.1073/pnas.1019031108

Incardona, J.P., T.K. Collier, and N.L. Scholz. 2004. Defects in Cardiac Function Precede Morphological Abnormalities in Fish Embryos Exposed to Polcyclic Aromatic Hydrocarbons. Toxicol. Applied Pharm. 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 v.113(12):1755-1762.

Incardona, J.P., Vines, C.A., Linbo, T.L., Myers, M.S., Labenia, J.S., French, B.L., Olson, O.P., Sol, S.Y., Willis, M.L., Jarvis, M., Newman, J., Meeks, D. Menard, K., Sloan, C.A., Baldwin, D.H., Ylitalo, G.M., Collier, T.K., Cherr, G.N. and Scholz, N.L. 2012 Potent phototoxicity of marine bunker oil to translucent herring embryos after prolonged weathering. PLoS ONE 7(2): e30116.

Incardona, J.P., Gardner, L.D., Linbo, T.L., Swarts, T.L., Esbaugh, A.J., Mager, E.M., Stieglitz, J.D., French, B.L., Labenia, J.S., Laetz, C.A., Tagal, M., Sloan, C.A., Elizur, A., Benetti, D.D., Grosell, M., Block, B.A., and Scholz, N.L. 2014. Deepwater Horizon crude oil toxicity to the developing hearts of large predatory pelagic fish. Proceedings of the National Academy of Sciences, 111: 201320950.

Incardona, J. and N.L. Scholz 2017. Environmental Pollution and the Fish Heart, chapter in Fish Physiology January 2017. 61 pages. DOI: 10.1016/bs.fp.2017.09.006

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, California.

Kannry, S.H., O'Rourke, S.M., Kelson, S.J., Miller, M.R. 2020. On the Ecology and Distribution of Steelhead (*Oncorhynchus mykiss*) in California's Eel River. Journal of Heredity, Volume 111, Issue 6, September 2020, Pages 548–563.

Kelly, M. S. 2009, 2011. Personal observations.

Lee, D. P. 2015. The Half-pounder – a Steelhead Trout, Life History and Fly Fishing. Gardull Graphics. Folsom, CA.

Lindley, S. T., R. S. Schick, E. Mora, P. B. Adams, J. J. Anderson, S. Greene, C. Hanson, B. May, D. 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: Article 4.

McElhany, P., M. H. Ruckelshaus, M. J. Ford, T. C. Wainwright, and E. P. Bjorkstedt. 2000.

Viable salmonid populations and the recovery of evolutionarily significant units. U.S. Dept. Commerce, NOAA Technical Memorandum NMFS-NWFSC-42. 156 pp.

McIntyre, J.K., J.W. Davis, C. Hinman, K.H. Macneale, B.F. Anulacion, N.L. Scholz, and J.D. Stark. 2015. Soil Bioretention Protects Juvenile Salmon and their Prey from the Toxic Impacts of Urban Stormwater Runoff. Chemosphere 132:213-219. http://dx.doi.org/10.1016/j.chemosphere.2014.12.052

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. 2002. Inland Fishes of California. Second Edition. University of California Press. Berkeley, California.

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(4): 693-727.

NMFS (National Marine Fisheries Service). 2000. Guidelines for Electrofishing Waters Containing Salmonids Listed Under the Endangered Species Act. June 2000. Available: http://www.westcoast.fisheries.noaa.gov/publications/reference_documents/esa_refs/section4d/electro2000.pdf.

NMFS. 2016. Final Coastal Multispecies Recovery Plan. National Marine Fisheries Service, West Coast Region, Santa Rosa, California.

Oregon Department of Environmental Quality. 2014. Turbidity Technical Review Summary of Sources, Effects, and Issues Related to Revising the Statewide Water Quality Standard for Turbidity. Portland, Oregon.

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 pp.

Perry, R.W., Risley, J.C., Brewer, S.J., Jones, E.C., and Rondorf, D.W., 2011, Simulating daily water temperatures of the Klamath River under dam removal and climate change scenarios: U.S. Geological Survey Open-File Report 2011-1243. 78 pp.

Redding, J. M., C. B. Schreck, and F. H. Everest. 1987. Physiological Effects on Coho Salmon and Steelhead of Exposure to Suspended Solids. Transactions of the American Fisheries Society, 116(5), 737-744.

Ricker, S., and A. Renger. 2014. South Fork Eel River. 2013 Annual Report. California Department of Fish and Wildlife. Anadromous Fisheries Resource Assessment and

Monitoring Program, Arcata, California.

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, 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.

Sandahl, J. F., D. H. Baldwin, J. J. Jenkins, and N. L. Scholz. 2007. A Sensory System at the Interface between Urban Stormwater Runoff and Salmon Survival. Environmental Science and Technology 41(8):2998–3004.

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.

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.

Swain, D.L., Langenbrunner, B., Neelin, J.D, and Hall, A. 2018. Increasing precipitation volatility in twenty-first-century California. Nature Climate Change. 8. 10.1038/s41558-018-0140-y.

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 2022 9(2), 140-146, DOI: 10.1021/acs.estlett.1c00910

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

United States Department of Agriculture (USDA). 2022. Web Soil Survey. URL: http://websoilsurvey.sc.egov.usda.gov. [accessed September 10, 2022].

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

Williams, T. H., S. T. Lindley, B. C. Spence, and D. A. Boughton. 2011. Status review for Pacific salmon and trout listed under the Endangered Species Act: Southwest. National Marine Fisheries Service, Southwest Fisheries Science Center, Santa Cruz, California.

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. T. 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. April 17.

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. Vol 12, March, 232–234.

Federal Register Notices Cited

50 CFR 222.102. General Requirements—Endangered Species Act of 1973, as Amended.

50 CFR 402.01. Scope—Endangered Species Act of 1973, as Amended.

50 CFR 402.02. Interagency Cooperation—Endangered Species Act of 1973, as Amended.

50 CFR 402.14. Consultation Procedures—Endangered Species Act of 1973, as Amended.

50 CFR 402.16. Reinitiation of Formal Consultation—Endangered Species Act of 1973, as Amended.

50 CFR 402.17. Other Provisions—Endangered Species Act of 1973, as Amended.

50 CFR 402.20, Regulatory Definition of Jeopardy—Endangered Species Act of 1973, as Amended.

50 CFR 424. Listing Endangered and Threatened Species and Designated Critical Habitat.

70 FR 37160. National Marine Fisheries Service. Final Rule. Endangered and Threatened Species: Final Listing Determinations for 16 ESUs of West Coast Salmon, and Final 4(d) Protective Regulations for Threatened Salmonid ESUs. June 28, 2005.

84 FR 44976, 44977. Endangered and Threatened Wildlife and Plants; Regulations for Interagency Cooperation.