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

MAY 26 2016

Refer to NMFS No: WCR-2015-2400

Aaron Allen, Acting Regulatory Branch Chief
U.S. Department of the Army
San Francisco District, Corps of Engineers
1455 Market Street
San Francisco, California 94103-1398

Re: Endangered Species Act Section 7(a)(2) Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Issuance of a Regional General Permit to the California Department of Fish and Wildlife for Implementation of Anadromous Fish Habitat Restoration Projects under the Fisheries Restoration Grants Program (Corps File No. 2003-279220)

Dear Mr. Allen:

Thank you for your letter of December 4, 2015 (received December 7, 2015), requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531 *et seq.*) for the U.S. Army Corps of Engineers (Corps) proposed issuance of a five-year Regional General Permit (RGP) 12 for habitat restoration activities under the California Department of Fish and Wildlife (CDFW) Fisheries Restoration Grants Program (FRGP) in Northern and Central California under Section 404 of the Clean Water Act of 1973, as amended (33U.S.C. Section 1344 *et seq.*). This letter transmits NMFS' final biological opinion and Essential Fish Habitat (EFH) consultation pertaining to the proposed issuance of the five-year RGP. In addition, this letter transmits our response to the Corps' request for concurrence that the proposed RGP is not likely to adversely affect certain ESA listed species.

The enclosed biological opinion concludes formal consultation for activities in the FRGP that will be included under the RGP, including an EFH consultation. The biological opinion is based on information provided in the request to initiate consultation received on December 7, 2015, as well as the revised list of effects determinations received on April 15, 2016. The biological opinion addresses potential adverse effects on the following Evolutionarily Significant Units (ESUs) or Distinct Population Segments (DPSs) and designated critical habitats in accordance with section 7 of the ESA:

> **Southern Oregon/Northern California Coast (SONCC) coho salmon**
> (*Oncorhynchus kisutch*)
> Threatened (70 FR 37160, June 28, 2005)
> Designated Critical Habitat (64 FR 24049, May 5, 1999);

Central California Coast (CCC) coho salmon
Endangered (70 FR 37160, June 28, 2005)
Designated Critical Habitat (64 FR 24049, May 5, 1999);

California Coastal (CC) Chinook salmon (*O. tshawytscha*)
Threatened (70 FR 37160, June 28, 2005)
Designated Critical Habitat (70 FR 52488, September 2, 2005);

Northern California (NC) steelhead (*O. mykiss*)
Threatened (71 FR 834, January 5, 2006)
Designated Critical Habitat (70 FR 52488, September 2, 2005);

CCC steelhead
Threatened (71 FR 834, January 5, 2006)
Designated Critical Habitat (70 FR 52488, September 2, 2005);

South-Central California Coast (S-CCC) steelhead
Threatened (71 FR 834, January 5, 2006)
Designated Critical Habitat (70 FR 52488, September 2, 2005).

Based on the best scientific and commercial information available, NMFS concludes that the RGP, as proposed, is not likely to jeopardize the continued existence of SONCC coho salmon, CCC coho salmon, CC Chinook salmon, NC steelhead, CCC steelhead, or S-CCC steelhead; and is not likely to result in the destruction or adverse modification of designated critical habitat for SONCC coho salmon, CCC coho salmon, CC Chinook salmon, NC steelhead, CCC steelhead, or S-CCC steelhead. NMFS expects that certain activities of the proposed action will result in incidental take of SONCC coho salmon, CCC coho salmon, CC Chinook salmon, NC steelhead, CCC steelhead, or S-CCC steelhead. An incidental take statement is included with the enclosed biological opinion. The incidental take statement includes non-discretionary reasonable and prudent measures and terms and conditions that are expected to reduce incidental take of SONCC coho salmon, CCC coho salmon, CC Chinook salmon, NC steelhead, CCC steelhead, and S-CCC steelhead occurring as a result of the proposed action.

NMFS has also concurred with the Corps' determination that the Pacific eulachon's (*Thaleichthys pacificus*) southern DPS, North American green sturgeon (*Acipenser medirostris*) southern DPS, California Central Valley steelhead (*O. mykiss*), Sacramento River winter-run Chinook salmon (*O. tshawytscha*), and Central Valley spring-run Chinook salmon (*O. tshawytscha*) are not likely to be adversely affected by the proposed action. Additionally, three discretionary conservation recommendations are provided in the biological opinion.

NMFS' analysis of the action's likely effects on EFH was pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA). Based on our review, NMFS concludes that the proposed action would adversely affect EFH for coho salmon and Chinook salmon, species managed under the Pacific Coast Salmon Fishery Management Plan. NMFS has included two EFH conservation recommendations that can be taken by the action agency to avoid, minimize, or otherwise offset potential adverse effects on EFH. Section 305(b)(4)(B) of the MSA requires Federal agencies to provide a detailed written response to NMFS with 30 days of receiving EFH Conservation Recommendations. The final response must include a description of measures proposed to avoid, mitigate, or offset the adverse effects of the activity. If the response is inconsistent with the EFH Conservation Recommendations, an explanation of the reasons for not implementing them must be included.

Please contact Julie Weeder (Northern California Office) at (707) 825-5168 or julie.weeder@noaa.gov, or Rick Rogers (North Central Coast Office) at (707) 578-8552 or rick.rogers@noaa.gov, if you have any questions concerning this section 7 consultation or EFH response, of if you require additional information.

Sincerely,

William W. Stelle, Jr.
Regional Administrator

cc: Justin Yee – Army Corps of Engineers, San Francisco District, San Francisco, California
Karen Carpio – California Department of Fish and Wildlife, Sacramento, California
Copy to AR File #151422WCR2015AR00102
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Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation

Issuance of a Regional General Permit (RGP) to the California Department of Fish and Wildlife (CDFW) for implementation of Anadromous Fish Habitat Restoration Projects under the Fisheries Restoration Grants Program (FRGP) in coastal Northern and Central California

NMFS Consultation Number: WCR-2015-2400
Action Agency: United States Army Corps of Engineers, San Francisco District

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species or Critical Habitat?*	Is Action Likely To Jeopardize the Species?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Southern Oregon/Northern California Coast (SONCC) coho salmon *(Oncorhynchus kisutch)*	Threatened	Yes	No	No
Central California Coast (CCC) coho salmon	Endangered	Yes	No	No
California Coastal (CC) Chinook salmon (*O. tshawytscha*)	Threatened	Yes	No	No
Central Valley spring-run Chinook salmon (*O. tshawytscha*)	Threatened	No	NA	NA
Sacramento River winter-run Chinook salmon (*O. tshawytscha*)	Endangered	No	NA	NA
Northern California (NC) steelhead (*O. mykiss*)	Threatened	Yes	No	No
Central California Coast (CCC) steelhead	Threatened	Yes	No	No

South-Central California Coast (S-CCC) steelhead	Threatened	Yes	No	No
Southern green sturgeon (*Acipenser medirostris*)	Threatened	No	NA	NA
Southern eulachon (*Thaleichthys pacificus*)	Threatened	No	NA	NA

*Please refer to section 2.11 for the analysis of species or critical habitat that are not likely to be adversely affected.

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

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

Issued By: [signature], for
William W. Stelle, Jr.
Regional Administrator

Date: MAY 26 2016

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1. INTRODUCTION

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

1.1 Background

NOAA's National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement 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*.), and implementing regulations at 50 CFR 402.

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

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

1.2 Consultation History

On December 7, 2015, NMFS received a letter from the U.S. Army Corps of Engineers (Corps) requesting initiation of consultation on the project. This letter had seven enclosures: Attachments A, B, and C from the application for a Department of Army permit; a map showing the locations of projects funded in 2014; NMFS-suggested changes to the proposed action regarding four project types (dated July 7, 2015); mitigation, measures, monitoring, and reporting programs from the California Environmental Quality Act Mitigated Negative Declaration; and an explanation of responses to an initial study environmental checklist.

On April 4, 2016, NMFS and CDFW had a meeting via phone to describe anticipated changes to the biological opinion compared to the previous biological opinion. Specifically, the limit on the number of sediment-producing projects per Hydrologic Unit Code (HUC)-10 (the "sideboards") would apply to both new and ongoing projects. Fish screens would no longer be included in the biological opinion. NMFS also indicated that the opinion would set limits on the number of fish that could be relocated each year per ESU/DPS, using FRGP relocation data from the last 10 years. Finally, NMFS noted that the biological opinion would include a term and condition to, within one year, create a team of NMFS and CDFW staff to evaluate the results of the implementation monitoring that has been done for the last 10 years.

On April 15, 2015, the Corps provided NMFS with a revised list of effects determinations for all ESA-listed species in order to confirm which species the Corps determined the project is "Not

Likely to Adversely Affect" and which the Corps determined the project is "Likely to Adversely Affect."

1.3 Proposed Action

"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).

The Corps proposes to issue a five-year (2016-2021) Corps RGP 12 to CDFW pursuant to section 404 of the Federal Clean Water Act of 1972, as amended (33 U.S.C. 1344 *et seq*.), for the placement of fill material into the waters of the United States to annually implement anadromous salmonid habitat restoration projects under the FRGP. The proposed RGP applies to portions of the following coastal counties that are within the regulatory jurisdictional boundaries of the Corps' San Francisco District (Figure 1): San Benito, San Luis Obispo, Monterey, Santa Cruz, San Mateo, Santa Clara, San Francisco, Alameda, Contra Costa, Solano, Napa, Marin, Sonoma, Mendocino, Humboldt, Del Norte, Shasta, Siskiyou, Trinity, Glen, and Lake. The types of projects to be authorized are instream habitat improvement, fish passage improvement, bank stabilization, riparian restoration, streamflow augmentation, and upslope restoration.

"Interrelated actions" are those that are part of a larger action and depend on the larger action for their justification. "Interdependent actions" are those that have no independent utility apart from the action under consideration (50 CFR 402.02). NMFS does not anticipate any interrelated or interdependent actions.

Based on information obtained from the Corps' December 4, 2015, letter and enclosures, and subsequent discussions with the Corps and CDFW, the following is a description of the proposed action. The FRGP has an annual grant cycle, initiated in the spring of each year, which provides both Federal and state funds to applicants to restore anadromous salmonid habitat. Each proposal goes through a rigorous review process by the CDFW Technical Review Team (members include personnel from CDFW, NMFS and the California Coastal Conservancy), regional field evaluators, the California Coastal Salmonid Restoration Grants Peer Review Committee and the Director of CDFW. During the review process, reviewers evaluate the biological soundness, technical feasibility, and cost effectiveness of each proposal and make recommendations for funding based on coast-wide and regional goals and priorities, including recommendations identified in the plans described in Table 1.

Table 1. Documents describing regional goals and priorities that are consulted when reviewing FRGP proposals.

Name of document	Date
Steelhead Restoration and Management Plan for California	CDFG 1996
Recovery Strategy for California Coho Salmon	CDFG 2004
Central California Coast Coho Salmon Recovery Plan	NMFS 2012
Southern California Steelhead Recovery Plan	NMFS 2012
South Central California Coast Steelhead Recovery Plan	NMFS 2013
Recovery Plan for the SONCC ESU of Coho Salmon	NMFS 2014
Coastal Multispecies Public Draft Recovery Plan	NMFS 2015

Projects selected for funding are typically announced the following January. Projects that receive funding from the FRGP are designed to restore anadromous salmonid habitat with the goal of increasing populations of wild anadromous salmonids. Not all projects chosen in January will necessarily be implemented in the following low-flow season. Implementation is dependent upon the scope and scheduling of individual projects, but projects must be implemented within two to five years of receiving the grant. CDFW manages the grant for each project that receives funding and coordinates with each applicant for permitting and implementation. The majority of the FRGP funding goes to restoration projects that improve instream cover, pool habitat, and spawning habitat; remove barriers to fish passage; and reduce or eliminate erosion and sedimentation impacts.

On an annual basis, prior to the summer low-flow construction season, CDFW will provide the Corps and NMFS with a list of the scheduled restoration projects that fall within the scope and coverage of the RGP.

All restoration projects authorized through the proposed RGP will conform to mandates of the California Legislature in the Fish and Game Code and Public Resources Code, and will be consistent with the procedures described in the Restoration Manual (Flosi *et al*. 2010). Part IX of the Restoration Manual (Flosi *et al.* 2010) includes multiple measures to minimize impacts to salmonids and salmonid habitat during implementation of habitat restoration projects. In addition, habitat restoration projects will adhere to current CDFW and/or NMFS Guidelines and Criteria as identified and referenced in the Restoration Manual.

CDFW oversight will include implementation monitoring of 100 percent of projects and effectiveness/validation monitoring of 10 percent of projects.

Dam removal projects, fish ladder projects[1], fish hatchery/fish stocking projects, watershed stewardship training, salmon in the classroom, fish screen installation or monitoring projects, projects involving obstruction blasting (with explosives) or pile driving, fish screen maintenance and repair projects, and projects that would dewater or disturb more than 500 contiguous feet of stream reach were not analyzed in this opinion. These projects will require separate section 7 consultations to determine impacts to listed salmonids.

Although in some cases the restoration manual (Flosi *et al.* 2010) will recommend the use of small explosives to modify a fish passage barrier, this activity will not be analyzed in this opinion due to additional effects associated with using explosives. Thus, projects that utilize explosives will not be authorized through the RGP.

1.3.1 Description of Restoration Project Types

The proposed RGP will authorize minor fill discharges of earth, rock, and wood associated with the implementation and construction of individual habitat restoration projects. Projects authorized through the RGP that require instream restoration activities will be implemented during the summer low-flow period[2] between June 15 and November 1 or the first significant rainfall, whichever comes first. The Restoration Manual (Flosi *et al.* 2010) provides information, guidance, and techniques for proper implementation of various types of salmonid restoration projects. For this consultation, restoration projects have been grouped together by type and are summarized below. A more detailed description of restoration projects is provided in Flosi *et al.* (2010). Implementation of the restoration project types described below may require use of heavy equipment (*e.g.*, self-propelled logging yarders, mechanical excavators, backhoes, *etc.*); however, hand labor will be used when possible.

1.3.1.1 Instream Habitat Improvements

Instream habitat structures and improvements are intended to provide cover for salmonids to rest and hide from predators, increase spawning habitat, improve upstream and downstream migration corridors, improve pool to riffle ratios, or add habitat complexity and diversity. Specific techniques for instream habitat improvements are described in Flosi *et al.* (2010). These techniques include placement of cover structures (divide logs, digger logs, spider logs, and log, root wad, and boulder combinations), boulder structures (boulder weirs, vortex boulder weirs, boulder clusters, and single and opposing log wing-deflectors), log structures (log weirs, upsurge weirs, single and opposing log wing-deflectors, and Hewitt ramps), or placement of imported spawning gravel.

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[1] Small fish ladders associated with road crossings may be included in this consultation if NMFS or CDFW engineers believes those features improve the stability and function of the crossing.

[2] NMFS may grant a project-specific exemption allowing instream work after November 1 if significant precipitation has yet to fall and NMFS determines that the chance of encountering adult salmon/steelhead remains unlikely.

Additional techniques for instream habitat improvements are described in a document provided as an enclosure to the letter from the Corps to NMFS. This document is titled "Suggested changes to proposed action regarding four project types," is dated July 7, 2015, and describes engineered logjams/complex wood jams and establishment of off-channel or side-channel habitat.

Engineered logjams and complex wood jams are one method of recreating pool-forming features in riverine channels. They differ from the large wood placement projects described in Flosi *et al.* (2010) in terms of scale, as they are generally larger (20-30 logs) than structure types identified in the manual and often provide significantly more habitat for the target species than single log features. These structures are built to function like natural logjams by stabilizing banks, catching debris moving downstream, and increasing habitat complexity for juvenile salmonids to utilize. These structures represent channel obstructions that must withstand the full-force of streamflow hydraulics (*e.g.*, the 100-year flood event), and therefore require robust structural design based upon engineering analyses. In reference to those analyses, these large wood structures are colloquially known as engineered log jams.

Habitat may be constructed in off-channel or side channel areas to provide complex slow water habitats essential for juvenile salmonid survival and rearing success. These types of projects include the following:

- Re-connection of existing and naturally formed but abandoned side channel or alcove habitats to restore fish access lost as the result of anthropogenic activities. Re-connection of side channels refers to restoration of hydraulic and hydrologic connection to the main channel by restoring the relative elevation of the channel to the mainstem or removing flow blockages such as levees and sediment plugs.

- Improvement of hydrologic connection between floodplains and main channels.

- Creation of new, self-maintaining side channel or off-channel habitat that mimics or replicates naturally formed and maintained fluvial features, which does not replace or displace other functioning floodplain or riverine environments.

- Re-connection of still water floodplain features that have been isolated from the meandering channel by anthropogenic activities. Oxbow lakes, features of meandering channels that naturally evolve from aquatic to increasingly terrestrial habitat, often represent distinct, biologically rich ecosystems worthy of conservation regardless of their utility to anadromous fishes. Projects that propose altering such habitat will be required to demonstrate the ecological imperative for doing so.

1.3.1.2 Instream Barrier Modification for Fish Passage Improvement

Instream barrier modification projects attempt to improve salmonid fish passage and increase access to currently inaccessible salmonid habitat. All such projects authorized through the RGP will require field review, design review, and design approval from a CDFW or NMFS fish passage specialist prior to project implementation. Techniques for improving fish passage are described in Flosi *et al.* (2010). These activities include modifying logjams (typically less than 10 cubic yards), beaver dams, natural waterfalls and chutes, and landslides, to improve salmonid fish passage. CDFW will only modify natural features such as these if there is a clear benefit to salmonids. This category also includes the removal and/or modification of flashboard dam structures.[3]

CDFW (2015a), which in part describes the Corps' proposed action, describes the removal of small permanent dams. Types of small dams included in the proposed action are permanent, flashboard, and seasonal dams that are not considered high risk. Small dam removals that are considered high risk are those that: (1) mobilize contaminated sediment; (2) potentially impact infrastructure during or following removal; (3) negatively affect valuable limited habitat (*i.e.*, sediment predicted to extend beyond 1,500 feet); (4) expose problematic bedrock or sediment layers (*e.g.* slaking clays); (5) require more than five vertical feet total of grade control to avoid the conditions described in Items 2 through 4; or (6) affect storage of flood flows. These high-risk removals may be considered for funding under FRGP, but will be permitted separately. Dam removals covered by this biological opinion must not contain any of the risks listed above.

1.3.1.3 Stream Bank Stabilization

Reducing sediment delivery to the stream environment will improve fish habitat and fish survival by increasing fish embryo and alevin survival in spawning gravels, reducing juvenile salmonid injury from high concentrations of suspended sediment, and minimizing pool loss from excess sediment deposition. The proposed activities will attempt to reduce sediment delivery from bank erosion by stabilizing stream banks with appropriate site-specific techniques, including: boulder stabilization structures, log stabilization structures, tree revetment, native plant material revetment, willow wall revetment, willow siltation baffles, brush mattresses, check dams, brush check dams, water bars, and exclusionary fencing. Guidelines for stream bank stabilization techniques are described in Flosi *et al.* (2010).

1.3.1.4 Fish Passage Improvement at Stream Road Crossings

Some projects intended to enhance fish passage improve or restore salmonid access to spawning and rearing areas blocked by stream crossings such as culverts, bridges, and paved and unpaved fords. Part IX of the Restoration Manual (Flosi *et al.* 2010), entitled *Fish Passage Evaluation at Stream Crossings*, provides consistent methods for evaluating fish passage through culverts at stream crossings, and will aid in assessing fish passage through other types of stream crossings, such as bridges and paved or hardened fords. Fish passage improvement projects will result in

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[3] Flashboard dams are small hardened sills spanning the stream channel that impound small sections of stream through placing and removing wooden slats; the structures are most often associated with diversion headgates or pumps supplying an agricultural water supply. Flashboard dams are typically small, simple structures that trap little sediment upstream of the sill. The potential effects to salmonids from removing or modifying these structures would be in line with effects resulting from culvert removal or replacement projects (*i.e.*, minor, short-term sediment impacts and potential harm from capturing and relocating fish during project construction).

new or retrofitted crossings that will be at least as wide as the active channel, designed to pass the 100-year storm flow, and have culvert or piling bottoms buried below the streambed. Projects may also contain downstream grade control or small fish ladders, if NMFS and CDFW engineers believe those features improve the stability and function of the crossing. Part XII of the Restoration Manual (Flosi *et al.* 2010) describes methods and designs for improving fish passage at stream crossings.

Projects that will be authorized through the RGP must be designed and implemented consistent with the CDFW Culvert Criteria for Fish Passage (Appendix IX-A of Flosi *et al.* 2010) and NMFS Southwest Region Guidelines for Salmonid Passage at Stream Crossings (Appendix IX-B of Flosi *et al.* 2010). In addition, all projects authorized through the RGP will require field review, design review, and design approval from a CDFW or NMFS fish passage specialist prior to project implementation.

1.3.1.5 Riparian Habitat Restoration

The goal of riparian restoration is to improve salmonid habitat through improved riparian habitat that will lower stream temperatures through shading and increase future large woody debris (LWD) recruitment, bank stability, and invertebrate production. Riparian habitat restoration projects will also restore riparian habitat by increasing plant numbers and plant groupings. Flosi *et al.* (2010) describes riparian restoration methods and design, including guidance on natural regeneration, livestock exclusionary fencing, bioengineering, and revegetation projects.

1.3.1.6 Upslope Watershed Restoration

Upslope watershed restoration projects reduce excessive sediment delivery to anadromous salmonid streams. Flosi *et al.* 2010 describes methods for identifying and assessing erosion problems, evaluating appropriate treatments, and implementing erosion control treatments in salmonid watersheds. Road-related upslope watershed restoration projects include road decommissioning, upgrading, and storm proofing. The specific project elements may include road ripping or decompacting; installing or maintaining rolling dips (critical dips); installing or maintaining waterbars and crossroad drains; maintaining or cleaning culverts; outsloping roadbeds; revegetating work sites; and excavating stream crossings with spoils stored on site or end-hauled. Only sites that are expected to erode and deliver sediment to the stream are proposed for restoration work (Flosi and Carpio 2010).

1.3.1.7 Streamflow Augmentation

CDFW funds projects to enhance and restore stream flows for anadromous salmonids. The three project types are listed below.

Water Conservation Measures

Eligible water conservation projects are those that provide more efficient use of water extracted from stream systems, enabling reduced water diversions. Ditch lining, piping, stock-water systems, and tail-water recovery/management systems are included in this category. Water saved by these projects must be dedicated to the stream for anadromous salmonid benefits.

Water Measuring Devices (Instream and Water Diversion)

Eligible water measuring device projects are those that will install, test and maintain instream and water diversion-measuring devices. These devices enable diversions from the stream to be controlled so excess withdrawals can be avoided. Project designs must follow guidelines described in the Water Measurement Manual, third edition (USBOR 1997). The instream gauges must be installed so they do not impede fish passage in anadromous streams.

Water Purchase / Lease

Eligible water purchase projects are those that include the purchase, lease, or acquisition of water rights, both short- and long-term, that will protect and improve water quality and quantity. This category includes water conservation purchases or leases that will result in quantifiable amounts of water being made available in streams for fish use. Proposals for water conservation purchases or leases must describe the mechanism that would be used to track downstream travel of water once purchased or leased.

1.3.2 Sideboards and Minimization Measures

1.3.2.1 Sideboards

A key component of this RGP involves the use of "sideboards" that establish a minimum distance between instream projects and limit the number of sediment-producing instream projects annually constructed within a watershed. These sideboards also establish specific, measurable project metrics that, when exceeded, signify that the adverse effects analyzed within the biological opinion may be exceeded, and re-consultation may be necessary. For the following discussion, sediment-producing projects include instream habitat improvement, instream barrier removal, stream bank stabilization, fish passage improvement, and upslope roadwork.

The following are sideboards proposed by CDFW for the proposed action:

Distance between instream projects
Each year, all sediment-producing instream projects will be separated both upstream and downstream from other proposed RGP permitted instream projects by at least 1,500 lineal feet in fish bearing stream reaches. In non-fish bearing reaches, the distance separating sediment-producing projects will be 500 feet.

Annual limit on the number of sediment-producing projects per HUC-10 watershed

CDFW will limit the number of instream projects implemented annually within any HUC-10 watershed in accordance with Table 2.[4]

Table 2. Maximum annual number of proposed instream and upslope projects per HUC-10 watershed.

Size of HUC-10 watershed (mi^2)	Maximum number of instream and upslope projects per year
<50	2
51-100	3
101-150	4
151-250	5
251-350	6
351-500	9
>500	12

[4] NMFS anticipates individual culvert projects that are part of a larger road decommissioning project will not approach an effect level similar to larger fish passage projects, and thus they are not considered when computing maximum project density per watershed. Although road restoration projects may entail culvert replacement or removal, the resulting sediment effect is expected to be significantly smaller when compared to a typical fish passage improvement project. Road restoration projects typically deal with upslope road networks located high within the watershed drainage network. As a result, road crossings in these upslope areas typically occur in higher gradient, first or second order stream channels and feature small (*e.g.,* less than 4-foot diameter) culverts. In contrast, fish passage projects funded through the Program typically focus limited restoration funding on high-priority fish passage issues located on third or fourth order stream networks that, when completed, will re-establish fish access to large expanses of upstream habitat. In effect, both the size and gradient of upslope channels and culverts largely limit downstream sediment impacts during road decommissioning projects. Small, high gradient stream channels typically transport sediment downstream more efficiently (and therefore store less upstream of the culvert) than lower gradient, higher order stream reaches where flow and channel morphology favor sediment deposition. Furthermore, the comparative size of these upslope road culverts (16-48 inch diameter) likely limit the volume of any sediment wedge that can develop upstream of the structure.

The sideboards identified above will help ensure that potential sediment impacts will remain spatially isolated, thus minimizing cumulative turbidity effects. The number of projects allowed per HUC-10 watershed was proportionally derived with regard to watershed size under the assumption that larger watersheds can better absorb project effects since projects will likely be spread over a greater spatial area.

1.3.2.2 Minimization Measures

Fish Relocation and Dewatering

The following project activities authorized through the proposed RGP may require fish relocation and/or dewatering activities when fish are present at a project location: instream habitat improvements, instream barrier modification for fish passage improvement, stream bank stabilization, fish passage improvements at stream crossings, water conservation, and off-channel habitat improvement.

CDFW personnel (or designated agents) will capture and relocate fish and amphibians away from the work area of the restoration project to avoid direct mortality, and minimize injury or death, of listed species. Fish relocation activities will be consistent with the measures presented below, excerpted from Flosi *et al.* (2010).

CDFW will ensure the following measures are followed in order to minimize adverse impacts:

- Prior to dewatering, determine the best means to bypass flow through the work area to minimize disturbance to the channel and avoid direct mortality of fish and other aquatic vertebrates.
- Coordinate project site dewatering with a fisheries biologist qualified to perform fish and amphibian relocation activities.
- Minimize the length of the dewatered stream channel and duration of dewatering.
- Bypass stream flow around the work area while maintaining stream flow below the construction site.
- Periodically pump the work area dry of seepage. Place pumps in flat areas, well away from the stream channel. Secure pumps by tying off to a tree or stake in place to prevent movement by vibration. Refuel in an area well away from the stream channel and place fuel absorbent mats under pump while refueling. Pump intakes should be covered with 1/8-inch mesh to prevent entrainment of fish or amphibians that failed to be removed. Check intake periodically for impingement of fish or amphibians, and relocate them using the same measures outlined above.
- Discharge wastewater from construction area to an upland location where it will not drain sediment-laden water back to the stream channel.

- For minor actions, where the disturbance to construct coffer dams and dewater in order to isolate the work site would be greater than to complete the action (for example, placement of a single boulder cluster), the action will be carried out without dewatering and fish relocation. Measures will be put in place immediately downstream of the work site to capture suspended sediment. This may include installation of silt catchment fences across the stream, or placement of a filter berm of clean river gravel. Silt fences and other non-native materials will be removed from the stream following completion of the activity. Gravel berms may be left in place after breaching, provided they do not impede the stream flow.

Additional measures to minimize injury and mortality of salmonids during fish relocation and dewatering activities are excerpted from Flosi *et al.* (2010) and presented below:

- If feasible, plan to perform initial fish relocation efforts several days prior to the start of construction. This provides the fisheries biologist an opportunity to return to the work area and perform additional electrofishing passes immediately prior to construction. In many instances, additional fish will be captured that eluded the previous day's efforts.

- Prior to dewatering a construction site, fish and amphibian species should be captured and relocated to avoid direct mortality and minimize take. This is especially important if listed species are present within the project site.

- Fish relocation activities must be performed only by qualified fisheries biologists, with a current CDFW collectors permit, and experience with fish capture and handling. Check with a CDFW biologist for assistance.

- Electrofishing should only be conducted by properly trained personnel following CDFW and NMFS guidelines.

- In regions of California with high summer air temperatures, perform relocation activities during morning periods.

- Periodically measure air and water temperatures. Cease activities when instream water temperature exceeds 18°C.

- Exclude fish from reentering the work area by blocking the stream channel above and below the work area with fine-meshed net or screen. Mesh should be no greater than 1/8-inch diameter. Completely secure the bottom edge of net or screen to the channel bed to prevent fish from reentering the work area. Place exclusion screening in areas of low water velocity to minimize fish impingement. Screens should be regularly checked and cleaned of debris to permit free flow of water.

- Prior to capturing fish, determine the most appropriate release location(s). Choose release sites with the following characteristics if possible:

- Similar water temperature as capture location
- Adequate dissolved oxygen
- Ample habitat for captured fish
- Low likelihood of fish reentering work site or becoming impinged on exclusion net or screen.

- Determine the most efficient means for capturing fish. Complex stream habitat generally requires the use of electrofishing equipment, whereas in outlet pools, fish may be concentrated by pumping water out of the pool and then seining or dip netting fish.
- Minimize handling of salmonids. However, when handling is necessary, always wet hands or nets prior to touching fish.
- Temporarily hold fish in cool, shaded, aerated water in a container with a lid. Provide aeration with a battery-powered external aeration device. Protect fish from jostling and noise and do not remove fish from this container until time of release.
- Place a thermometer in holding containers and, if necessary, periodically conduct partial water changes to maintain a stable water temperature. If water temperature reaches or exceeds 18°C, fish should be released and rescue operations ceased.
- Avoid overcrowding in containers. Have at least two containers and segregate young-of-year (YOY) fish from larger age-classes to avoid predation. Place larger amphibians, such as Pacific giant salamanders, in container with larger fish. If fish are abundant, periodically cease capture, and release fish at predetermined locations.
- Visually identify species and estimate year-class of fish at time of release. Count and record the number of fish captured. Avoid anesthetizing or measuring fish.
- Submit reports of fish relocation activities to CDFW and NMFS in a timely fashion.
- If mortality during relocation exceeds 3 percent, stop efforts and immediately contact the appropriate agencies.

Instream Construction

Measures to minimize disturbance associated with instream habitat restoration are excerpted from Flosi *et al.* (2010) and are presented below.

- Construction should occur during the dry period if the channel is seasonally dry.
- Prevent any construction debris from falling into the stream channel. Any material that falls into a stream during construction should be immediately removed in a manner that has minimal impact to the streambed and water quality.

- Where feasible, the construction should occur from the bank, or on a temporary pad underlain with filter fabric.

- Temporary fill must be removed in its entirety from flood-prone areas prior to close of the seasonal work-window.

- Areas for fuel storage, refueling, and servicing of construction equipment must be located in an upland location.

- Prior to use, clean all equipment to remove external oil, grease, dirt, or mud. Wash sites must be located in upland locations so that dirty wash water does not flow into the stream channel or adjacent wetlands. All construction equipment must be in good working condition, showing no signs of fuel or oil leaks.

- Petroleum products, fresh cement, and other deleterious materials must not enter the stream channel.

- Operators must have spill clean-up supplies on site and be knowledgeable in their proper use and deployment.

- In the event of a spill, operators must immediately cease construction, start clean up, and notify the appropriate authorities.

Water Quality

Measures to minimize water quality degradation associated with construction activities are presented below, and are excerpted from Flosi *et al.* (2010).

- Isolate the construction area from flowing water until project materials are installed and erosion protection is in place.

- Erosion control measures shall be in place at all times during construction. Do not start construction until all temporary control devices (straw bales, silt fences, *etc.*) are in place downslope or downstream of project site.

- Maintain a supply of erosion control materials onsite to facilitate a quick response to unanticipated storm events or emergencies.

- Use erosion controls that protect and stabilize stockpiles and exposed soils to prevent movement of materials. Use devices such as plastic sheeting held down with rocks or sandbags over stockpiles, silt fences, or berms of hay bales, to minimize movement of exposed or stockpiled soils.

- Stockpile excavated material in areas where it cannot enter the stream channel. Prior to start of construction, determine if such sites are available at or near the project location. If unavailable, determine location where material will be deposited. If feasible, conserve topsoil for reuse at project location or use in other areas.

- Minimize temporary stockpiling of excavated material.

- When needed, utilize instream grade control structures to control channel scour, sediment routing, and headwall cutting.

- Immediately after project completion and before close of seasonal work window, stabilize all exposed soil with mulch, seeding, and/or placement of erosion control blankets.

- To limit the downstream discharge of sediment following the construction, replacement or retrofitting of a culvert, channel stabilization structure, or any other structure that has accumulated an upstream "wedge" of sediment, at least 80 percent of that wedge must be removed as part of the design and construction of that project. The required volume to be removed may be modified if NMFS or CDFW hydrologists or hydraulic engineers agree that removing a smaller amount will better protect and enhance fish habitat in the area of the project (*e.g.*, leaving some sediment to replenish areas downstream that lack suitable substrate volume or quality).

Riparian Vegetation

Measures to minimize the loss or disturbance of riparian vegetation associated with habitat restoration (other than riparian habitat restoration) are presented below, which are excerpted from Flosi *et al.* (2010).

- Prior to construction, determine locations and equipment access points that minimize riparian disturbance. Avoid affecting unstable areas.

- Retain as much understory brush and as many trees as feasible, emphasizing shade producing and bank stabilizing vegetation.

- Minimize soil compaction by using equipment with a greater reach or that exerts less pressure per square inch on the ground, resulting in less overall area disturbed and less compaction of disturbed areas.

- If riparian vegetation is to be removed with chainsaws, consider using saws that operate with vegetable-based bar oil.

- Decompact the disturbed soils at project completion after heavy equipment exits the construction area.

- Revegetate disturbed and decompacted areas with native species specific to the project location that comprise a diverse community of native woody and herbaceous species.

Streamflow Augmentation

Water conservation projects that include water storage tanks and a Forbearance Agreement for the purpose of storing winter water for summer use require registration of water use pursuant to the Water Code §1228.3, and consultation with CDFW and compliance with all lawful conditions required by CDFW. Diversions to fill storage facilities during the winter and spring months shall be made pursuant to a Small Domestic Use Appropriation (SDU) filed with the State Water Resources Control Board (SWRCB). CDFW will review the appropriation of water to ensure fish and wildlife resources are protected. The following conditions shall then be applied:

- Seasonal Restriction: No pumping is allowed when stream flow drops below 0.7 cubic feet per second (cfs) except as permitted by CDFW in the event of an emergency.
- Bypass Flows: Pumping withdrawal rates shall not exceed 5 percent of stream flow. If CDFW determines that the streamflow monitoring data indicate that fisheries are not adequately protected, then the bypass flows are subject to revision by CDFW and NMFS.
- Cumulative Impacts: Pumping days shall be assigned to participating landowner(s) when streamflows drop below 1.0 cfs to prevent cumulative impacts from multiple pumps operating simultaneously.
- CDFW shall be granted access to inspect the pump system. Access is limited to the portion of the landowner's real property where the pump is located and those additional portions of the real property that must be traversed to gain access to the pump site. Landowner shall be given reasonable notice and any necessary arrangements will be made prior to requested access, including a mutually agreed upon time and date. Notice may be given by mail or by telephone with the landowner, or an authorized representative of the landowner. The landowner shall agree to cooperate in good faith to accommodate CDFW access.

“Interrelated actions” are those that are part of a larger action and depend on the larger action for their justification. “Interdependent actions” are those that have no independent utility apart from the action under consideration (50 CFR 402.02). There are not any interdependent or interrelated activities associated with the proposed action.

1.4 Action Area

“Action area” means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02).

The action area includes all non-tidal stream channels, riparian areas and hydrologically linked upslope areas that will be affected by the implementation of the proposed restoration projects that are authorized under RPG-12 by the Corp’s San Francisco District (Figure 1). The action area encompasses the following counties: Alameda, Contra Costa, Del Norte, Glenn, Humboldt, Lake, Marin, Mendocino, Monterey, Napa, San Benito, San Francisco, San Luis Obispo, San Mateo, Santa Clara, Santa Cruz, Siskiyou, Solano, Sonoma, and Trinity. Effects resulting from most restoration activities will be restricted to the immediate restoration project site, while some activities may result in turbidity for a short distance (1,500 feet) downstream. The specific location for each individual habitat restoration project cannot be described, as it has not yet been identified. The location will vary depending on project type, specific project methods, site conditions, and habitat restoration opportunities.

The action area includes all coastal anadromous California streams from Del Norte County at the Oregon/California border south to San Luis Obispo County, including their estuarine extent, and all streams draining into San Francisco and San Pablo bays eastward to the Napa River (inclusive), excluding the Sacramento-San Joaquin River Basin (Figure 1). The action area for this project encompasses a range of environmental conditions and several listed salmonid ESUs/DPSs, and has been broken into the four geographic areas- North Coast, North Central Coast, San Francisco Bay, and Central Coast (Figure 2).

The action area encompasses approximately 26,693 square miles of the central and northern California Coast Range. Native vegetation varies from old growth redwood (*Sequoia sempervirens*) forest along the lower drainages to Douglas fir (*Pseudotsuga menziesii*) intermixed with hardwoods, to ponderosa pine (*Pinus ponderosa*) and Jeffery pine (*Pinus jefferyi*) stands along the upper elevations. Areas of grasslands are also found along the main ridge tops and south facing slopes of the watersheds.

The action area on the coast has a Mediterranean climate characterized by cool wet winters with typically high runoff, and dry warm summers characterized by greatly reduced instream flows. Fog is a dominant climatic feature along the coast, generally occurring daily in the summer and not infrequently throughout the year. Higher elevations and inland areas tend to be relatively fog free. The Klamath basin extends into the Cascade Mountains. The Eel River basin also extends inland, with some areas at high elevation. In the coastal basins, most precipitation falls during the winter and early spring as rain. Mean rainfall amounts range from nine to 125 inches. Extreme rain events do occur, with over 240 inches being recorded over parts of the action area during 1982-83. In the interior areas of the Klamath and Eel River basins, winters are cold and precipitation often falls as snow, leading to a snowmelt-driven hydrograph.

High seasonal rainfall on bedrock and other geologic units with relatively low permeability, erodible soils, and steep slopes contribute to the flashy nature (stream flows rise and fall quickly) of the watersheds within the action area. In addition, these high natural runoff rates have been increased by extensive road systems and other land uses. High seasonal rainfall combined with rapid runoff rates on unstable soils delivers large amounts of sediment to river systems. As a result, many river systems within the action area contain a relatively large sediment load, typically deposited throughout the lower gradient reaches of these systems.

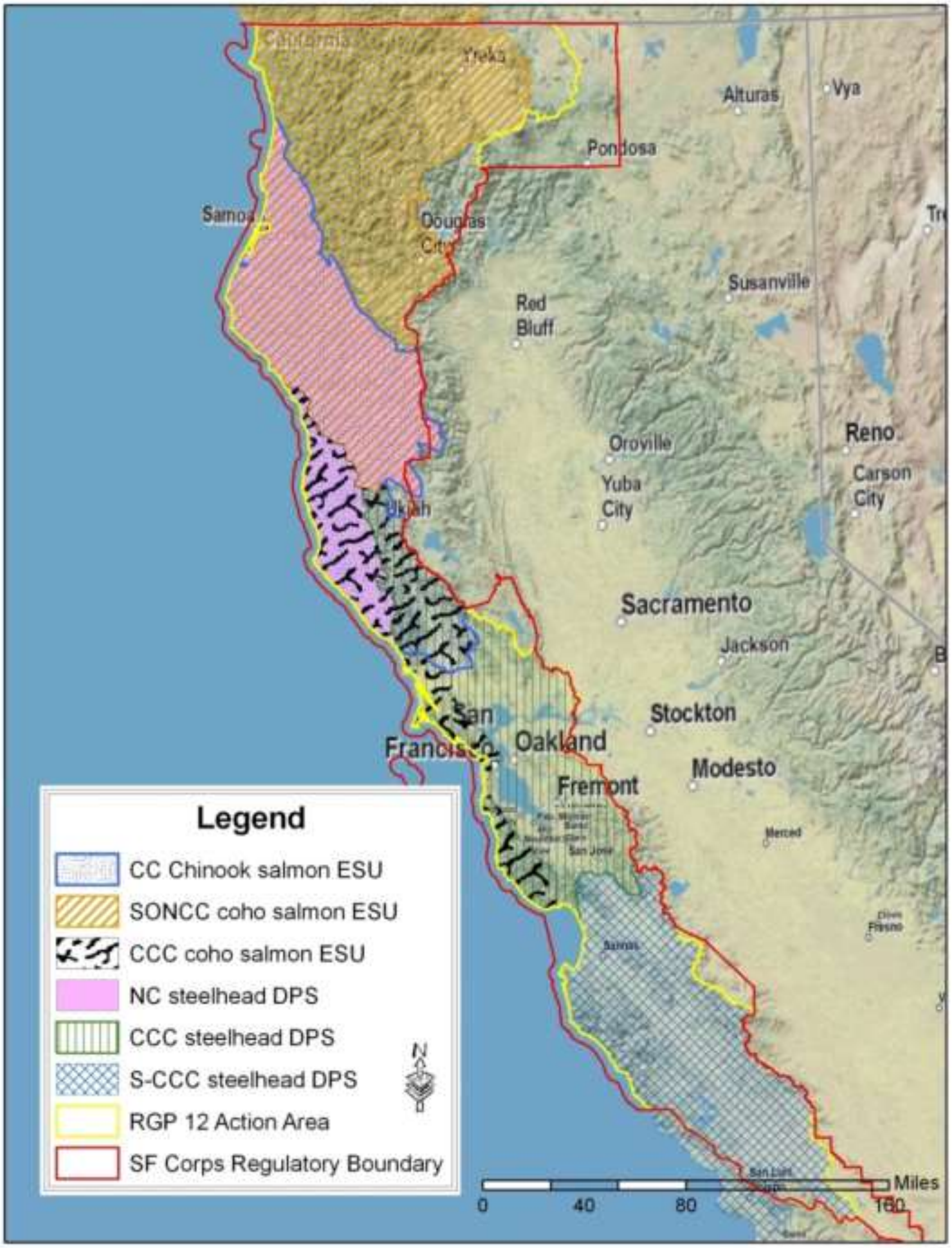

Figure 1. Action area and listed salmonid species range.

Figure 2. The geographic areas within the RGP action area.

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, Federal agencies must ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provides an opinion stating how the agency's actions would affect listed species and their critical habitat. If incidental take is expected, section 7(b)(4) requires NMFS to provide an incidental take statement (ITS) that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures and terms and conditions to minimize such impacts.

The proposed action is not likely to adversely affect the Sacramento River Winter-run Chinook Salmon ESU, the Central Valley Steelhead DPS, the Central Valley Spring-Run Chinook Salmon ESU, Southern DPS Pacific eulachon, or Southern DPS green sturgeon or their critical habitat. The analysis is found in the "Not Likely to Adversely Affect" Determinations section (2.11).

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

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

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

- Identify the rangewide status of the species and critical habitat likely to be adversely affected by the proposed action.

- Describe the environmental baseline in the action area.

- Analyze the effects of the proposed action on both species and their habitat using an "exposure-response-risk" approach.
- Describe any cumulative effects in the action area.
- Integrate and synthesize the above factors to assess the risk that the proposed action poses to species and critical habitat.
- Reach jeopardy and adverse modification conclusions.
- If necessary, define a reasonable and prudent alternative to the proposed action.

2.2 Rangewide Status of the Species and Critical Habitat

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

2.2.1 Life History and Range

2.2.1.1 Coho Salmon

Coho salmon adults migrate to and spawn in small streams that flow directly into the ocean, or tributaries and headwater creeks of larger rivers (Sandercock 1991, Moyle 2002). Adults migrate upstream to spawning grounds from September through late December, peaking in October and November. Spawning occurs mainly November through December, with fry emerging from the gravel in the spring, approximately three to four months after spawning. Juvenile rearing usually occurs in tributary streams with a gradient of 3 percent or less, although they may move up to streams of 4 percent or 5 percent gradient. Juveniles have been found in streams as small as 1 to 2 meters wide. They may spend one to two years rearing in freshwater (Bell and Duffy 2007), or emigrate to an estuary shortly after emerging from spawning gravels (Tschaplinski 1988). With the onset of fall rains, coho salmon juveniles are also known to redistribute into non-natal rearing streams, lakes, or ponds, where they overwinter (Peterson 1982). At a length of 38–45 mm, fry may migrate upstream a considerable distance to reach lakes or other rearing areas (Sandercock 1991, Nickelson *et al.* 1992). Emigration from streams to the estuary and ocean generally takes place from March through June.

The SONCC coho salmon ESU includes all naturally spawned populations of coho salmon in coastal streams from the Elk River, Oregon, through the Mattole River, California. It also includes three artificial propagation programs: Cole Rivers Hatchery in the Rogue River Basin, and the Trinity and Iron Gate Hatcheries in the Klamath-Trinity River Basin.

The CCC coho salmon ESU includes all naturally spawned populations of coho salmon from Punta Gorda in northern California south to and including the San Lorenzo River in central California, as well as populations in tributaries of San Francisco Bay, excluding the Sacramento-San Joaquin River system. In addition, this ESU contains four artificial propagation programs: The Don Clausen Fish Hatchery Captive Broodstock Program, Scott Creek/King Fisher Flats Conservation Program, the Scott Creek Captive Broodstock Program, and the Noyo River Fish Station Egg-Take Program, which was discontinued over a decade ago.

2.2.1.2 Chinook Salmon

Chinook salmon follow the typical life cycle of Pacific salmon in that they hatch in freshwater, migrate to the ocean, and return to freshwater to spawn. Diversity within this life cycle exists, however, in the time spent at each stage. Juvenile Chinook salmon are classified into two groups, ocean-type and stream-type, based on the period of freshwater residence (Healey 1991). Ocean-type Chinook salmon spend a short period of time in freshwater after emergence, typically migrating to the ocean within their first year of life. Stream-type Chinook salmon reside in freshwater for a longer period, typically a year or more, before migrating to the ocean. After emigration, Chinook salmon remain in the ocean for two to five years (Healey 1991) tending to stay in the coastal waters of California and Oregon. Chinook salmon are also characterized by the timing of adult returns to freshwater for spawning, with the most common types referred to as fall-run and spring-run fish. Typically, spring-run fish have a protracted adult freshwater residency, sometimes spawning several months after entering freshwater, and produce stream-type progeny. Fall-run fish spawn shortly after entering freshwater and generally produce ocean-type progeny. Historically, both spring-run and fall-run fish existed in the CC Chinook salmon ESU. At present only fall-run fish appear to be extant in the ESU.

Fall-run Chinook salmon are decidedly ocean-type (Moyle 2002), specifically adapted for spawning in lowland reaches of big rivers and their tributaries (Moyle 2002, Quinn 2005). Adults move into rivers and streams from the ocean in the fall or early winter in a sexually mature state and spawn within a few weeks or days upon arrival on the spawning grounds (Moyle 2002). Juveniles emerge from the gravel in late winter or early spring and within a matter of months, migrate downstream to the estuary and the ocean (Moyle 2002, Quinn 2005). This life history strategy allows fall-run Chinook salmon to utilize quality spawning and rearing areas in the valley reaches of rivers, which are often too warm to support juvenile salmonid rearing in the summer (Moyle 2002).

The CC Chinook salmon ESU includes all naturally spawned populations of Chinook salmon from rivers and streams south of the Klamath River (exclusive) to the Russian River (inclusive). Seven artificial propagation programs are considered part of the ESU: the Humboldt Fish Action Council (Freshwater Creek), Yager Creek, Redwood Creek, Hollow Tree, Van Arsdale Fish Station, Mattole Salmon Group, and Mad River Hatchery fall-run Chinook hatchery programs but these programs were discontinued over a decade ago.

2.2.1.3 Steelhead

Steelhead probably have the most diverse life history of any of any salmonid (Quinn 2005). There are two basic steelhead life history patterns: winter-run and summer-run (Quinn 2005, Moyle 2002). Winter-run steelhead enter rivers and streams from December to March in a sexually mature state and spawn in tributaries of mainstem rivers, often ascending long distances (Moyle 2002). Summer steelhead (also known as spring-run steelhead) enter rivers in a sexually immature state during receding flows in spring, and migrate to headwater reaches of tributary streams where they hold in deep pools until spawning the following winter or spring (Moyle 2002). Spawning for all runs generally takes place in the late winter or early spring. Eggs hatch in 3 to 4 weeks and fry emerge from the gravel 2 to 3 weeks later (Moyle 2002). Juveniles spend 1 to 4 years in freshwater before migrating to estuaries and the ocean where they spend 1 to 3 years before returning to freshwater to spawn. Another expression of the life history diversity of steelhead is the "half pounder" - sexually immature steelhead that spend about 3 months in estuaries or the ocean before returning to lower river reaches on a feeding run (Moyle 2002). Half pounders then return to the ocean where they spend 1 to 3 years before returning to freshwater to spawn. This steelhead life history form has only been observed in the Rogue and Klamath Rivers (of the Klamath Mountain Province steelhead DPS) and the Mad and Eel Rivers (of the NC steelhead DPS, Busby *et al.* 1996). Unlike Pacific salmon, steelhead are iteroparous, or capable of spawning more than once before death (Busby *et al.* 1996). However, it is rare for steelhead to spawn more than twice before dying; most that do so are females (Busby *et al.* 1996). Some steelhead "residualize," becoming resident trout and never adopting the anadromous life history.

The NC steelhead DPS includes all naturally spawned populations of steelhead in California coastal river basins from Redwood Creek (inclusive) southward to the Russian River (exclusive). Two artificial propagation programs are considered part of the DPS: the Yager Creek Hatchery and the North Fork Gualala River Hatchery (Gualala River Steelhead Project), but these programs were discontinued over a decade ago.

The CCC steelhead DPS includes all naturally spawned anadromous *O. mykiss* (steelhead) populations below natural and manmade impassable barriers in California streams from the Russian River (inclusive) to Aptos Creek (inclusive), and the drainages of San Francisco, San Pablo, and Suisun Bays eastward to Chipps Island at the confluence of the Sacramento and San Joaquin Rivers. Tributary streams to Suisun Marsh including Suisun Creek, Green Valley Creek, and an unnamed tributary to Cordelia Slough (commonly referred to as Red Top Creek), excluding the Sacramento-San Joaquin River Basin, as well as two artificial propagation programs: the Don Clausen Fish Hatchery (Russian River), and Kingfisher Flat Hatchery/Scott Creek (Monterey Bay Salmon and Trout Project) steelhead hatchery programs.

The S-CCC steelhead DPS includes all naturally spawned anadromous populations of *O. mykiss* in coastal river basins from the Pajaro River in Monterey County southward to but not including the Santa Maria River in San Luis Obispo County.

2.2.2 Status of the Species

2.2.2.1 Coho salmon

2.2.2.1.1 SONCC Coho Salmon

The following summary is from Williams *et al.* 2016, the most recent biological viability report for SONCC coho salmon.

> Although long-term data on coho abundance in the SONCC Coho Salmon ESU are scarce, all available evidence from more recent trends since the 2011 assessment (Williams *et al.* 2011) indicate little change since the 2011 assessment. The two population-unit scale time series for the ESU both have a trend slope not different from zero. The composite estimate for the Rogue Basin populations was not significantly different from zero ($p > 0.05$) over the past 12 years and significantly positive over the 35 years of the data set ($p = 0.01$). The continued lack of appropriate data remains a concern, although the implementation of the Coastal Monitoring Program (CMP) for California populations is an extremely positive step in the correct direction in terms of providing the types of information to assess and evaluate population and ESU viability. The lack of population spatial scale monitoring sites in Oregon is of great concern and increases the uncertainty when assessing viability. Additionally, it is evident that many independent populations are well below low-risk abundance targets, and several are likely below the high-risk depensation thresholds specified by the TRT and the Recovery Plan (NMFS 2014). Though population-level estimates of abundance for most independent populations are lacking, it does not appear that any of the seven diversity strata currently supports a single viable population as defined by the TRT's viability criteria, although all occupied.
>
> The SONCC Coho Salmon ESU is currently considered likely to become endangered. Of particular concern is the low number of adults counted entering the Shasta River in 2014-15. The lack of increasing abundance trends across the ESU for the populations with adequate data are of concern. Moreover, the loss of population spatial scale estimates from coastal Oregon populations is of great concern. The new information available since [the last status review], while cause for concern, does not appear to suggest a change in extinction risk at this time.

2.2.2.1.2 CCC Coho Salmon

The following summary is from Williams *et al.* 2016, the most recent biological viability report for CCC coho salmon.

Information on population status and trends for CCC coho salmon has improved considerably since the 2011 status review due to recent implementation of the CMP across significant portions of the ESU. Within the Lost Coast – Navarro Point stratum, current population sizes range from 4 percent to 12 percent of proposed recovery targets, with two populations (Albion River and Big River, respectively) at or below their high-risk depensation thresholds. Most independent populations show positive but non-significant population trends; however, the trend in the Noyo River has been positive for the past 5-6 years. Dependent populations within the stratum have declined significantly since 2011, with average adult returns ranging from 417 in Pudding Creek (42 percent of the recovery target) to no adult returns observed within Usal and Cottaneva creeks. Similar results were obtained immediately south within the Navarro Point – Gualala Point stratum, where two of the three largest independent populations, the Navarro and Garcia rivers, have averaged 257 and 46 adult returns, respectively, during the past six years (both populations are at or below their high-risk depensation threshold). Data from the three dependent populations within the stratum (Brush, Greenwood and Elk creeks) suggest little to no adult coho salmon escapement since 2011. In the Russian River and Lagunitas Creek watersheds, which are the two largest within the Central Coast strata, recent coho salmon population trends suggest limited improvement, although both populations remain well below recovery targets. Likewise, most dependent populations within the strata remain at very low levels, although excess broodstock adults from the Russian River and Olema Creek were recently stocked into Salmon Creek and the subsequent capture of juvenile fish indicates successful reproduction occurred. Finally, recent sampling within Pescadero Creek and San Lorenzo River, the only two independent populations within the Santa Cruz Mountains strata, suggest coho salmon have likely been extirpated within both basins. A bright spot appears to be the recent improvement in abundance and spatial distribution noted within the strata's dependent populations; Scott Creek experienced the largest coho salmon run in a decade during 2014/15, and researchers recently detected juvenile coho salmon within four dependent watersheds where they were previously thought to be extirpated (San Vincente, Waddell, Soquel and Laguna creeks).

Summarizing the information to inform the larger ESU, most independent CCC coho salmon populations remain at critically low levels, with those in the southern Santa Cruz Mountains strata likely extirpated. Data suggests some populations show a slight positive trend in annual escapement, but the improvement is not statistically significant. Overall, all CCC coho salmon populations remain, at best, a slight fraction of their recovery target levels, and, aside from the Santa Cruz Mountains strata, the continued extirpation of dependent populations continues to threaten the ESU's future survival and recovery.

2.2.2.2 CC Chinook Salmon

The following summary is from Williams *et al.* 2016, the most recent biological viability report for CC Chinook salmon.

> The lack of long-term population-level estimates of abundance for Chinook salmon populations continues to hinder assessment of status, though the situation has improved with implementation of the CMP in the Mendocino Coast Region and portions of Humboldt County. The available data, a mixture of short-term (6-year or less) population estimates or expanded redd estimates and longer-term partial population estimates and spawner/redd indexes, provide no indication that any of the independent populations (likely to persist in isolation) are approaching viability targets. In addition, there remains high uncertainty regarding key populations, including the Upper and Lower Eel River populations and the Mad River population, due to incomplete monitoring across the spawning habitat of Chinook salmon in these basins (O'Farrell *et al*. 2012). Because of the short duration of most time series for independent populations, little can be concluded from trend information. The longest time series, video counts in the Russian River, indicates the population has remained steady during the 14-year period of record. The longer time series associated with index reaches or partial populations suggest mixed patterns, with some showing significant negative trends (Prairie Creek, Freshwater Creek, Tomki Creek), one showing a significant positive trend (Van Arsdale Station), and the remainder no significant trends.
>
> At the ESU level, the loss of the spring-run life history type represents a significant loss of diversity within the ESU, as has been noted in previous status reviews (Good *et al*. 2005, Williams *et al*. 2011). Concern remains about the extremely low numbers of Chinook salmon in most populations of the North-Central Coast and Central Coast strata, which diminishes connectivity across the ESU. However, the fact that Chinook salmon have regularly been reported in the Ten Mile, Noyo, Big, Navarro, and Garcia rivers represents a significant improvement in our understanding of the status of these populations in watersheds where they were thought to have been extirpated. These observations suggest that spatial gaps between extant populations are not as extensive as previously believed.

In summary, Williams *et al.* (2016) concludes "there is a lack of compelling evidence to suggest that the status of these populations has improved or deteriorated appreciably since the previous status review" and that "the new available information does not appear to suggest there has been a change in the extinction risk of this ESU."

2.2.2.3 Steelhead

2.2.2.3.1 NC Steelhead

The following summary is from Williams *et al.* 2016, the most recent biological viability report for NC steelhead.

> The availability of information on steelhead populations in the NC steelhead DPS has improved considerably in the past 5 years, due to implementation of the CMP across a significant portion of the DPS. Nevertheless, significant information gaps remain, particularly in the Lower Interior and North Mountain Interior diversity strata, where there is very little information from which to assess status (Figure 2). Overall, the available data for winter-run populations—predominately in the North Coastal, North-Central Coastal, and Central Coastal strata— indicate that all populations are well below viability targets, most being between 5% and 13% of these goals…for the two Mendocino Coast populations with the longest time series, Pudding Creek and Noyo River, the 13-year trends have been negative and neutral, respectively (Williams *et al.* 2016). However, the short-term (6-year) trend has been generally positive for all independent populations in the North-Central Coastal and Central Coastal strata, including the Noyo River and Pudding Creek (Williams *et al.* 2016). Data from Van Arsdale Station likewise suggests that, although the long-term trend has been negative, run sizes of natural-origin steelhead have stabilized or are increasing (Williams *et al.* 2016). Thus, we have no strong evidence to indicate conditions for winter-run have worsened appreciably since the last status review.
>
> Summer-run populations continue to be of significant concern because of how few populations currently exist. The Middle Fork Eel River population has remained remarkably stable for nearly five decades and is closer to its viability target than any other population in the DPS (Williams *et al.* 2016). Although the time series is short, the Van Duzen River appears to be supporting a population numbering in the low hundreds. However, the Redwood Creek and Mattole River populations appear small, and little is known about other populations including the Mad River and other tributaries of the Eel River (*i.e.*, Larabee Creek, North Fork Eel, and South Fork Eel).
>
> In summary, the 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 status reviews…most populations for which there are population estimates available remain well below viability targets; however, the short-term increases observed for many populations, despite the occurrence of a prolonged drought in northern California, suggests this DPS is not at immediate risk of extinction.

2.2.2.3.2 CCC Steelhead

The following summary is from Williams *et al.* 2016, the most recent biological viability report for CCC steelhead.

> Steelhead populations in the CCC steelhead are the most poorly monitored salmonid populations in the North-Central California Coast Recovery Domain. Population-level estimates of adult abundance are entirely lacking for 28 populations that constitute the North Coastal, Interior, Coastal San Francisco Bay, and Interior San Francisco Bay diversity strata. Only in the Santa Cruz Mountain stratum has implementation of the CMP been initiated, and here only recently. Thus, with the exception of the life cycle monitoring station in Scott Creek, estimates of abundance span only 1-3 years for populations in this DPS. More limited monitoring efforts have produced data for a few partial populations, but the lack of data continues to make it extraordinarily difficult to assess the status and trends of populations in the DPS. The scarcity of information on steelhead abundance in the CCC steelhead DPS continues to make it difficult to assess whether conditions have changed appreciably since the previous status review of Williams *et al*. (2011), which concluded that the population was likely to become endangered in the foreseeable future. In the North Coastal and Interior strata, steelhead still appear to occur in the majority of watersheds, though in the Russian River basin, the ratio of hatchery fish to natural origin fish returning to spawn remain largely unknown and continues to be a source of concern. New information from 3 years of CMP implementation in the Santa Cruz Mountain stratum indicates that population sizes are perhaps higher than previously thought. However, the downward trend in the Scott Creek population, which has the most robust estimates of abundance, is a source of concern. The status of populations in the two San Francisco Bay diversity strata remains highly uncertain, and it is likely that many populations where historical habitat is now inaccessible due to dams and other passage barriers are at high risk of extinction.
>
> In summary, while data availability for this DPS remains poor, we find little new evidence to suggest that the extinction risk for this DPS has changed appreciably in either direction since publication of the last status review.

2.2.2.3.3 S-CCC Steelhead DPS

The following summary is from Williams *et al.* 2016, the most recent biological viability report for S-CCC steelhead.

> There has been a steady 15-year decline in abundance of anadromous adults in the Carmel River, the one population in the southern domain with a reasonably long history of monitoring. This decline is somewhat surprising since it coincides with a concerted effort to restore habitat in the river system and to improve numbers through a rescue/captive-rearing operation. The decline indicates an increase in extinction risk in the S-CCC steelhead DPS, though it is likely that abundance in other populations show different patterns, and possible that such patterns would show that risk is holding steady or even improving (*i.e.*, lower extinction risk). Currently, viability cannot be adequately assessed due to lack of implementation of

the CMP.

2.2.3 Factors for Decline (ESU or DPS Scale)

2.2.3.1 Timber Harvest

Timber harvest and associated activities occur over a large portion of the range of the affected species. Timber harvest has caused widespread increases in sediment delivery to channels through both increased landsliding and surface erosion from harvest units and log decks. Much of the largest riparian vegetation has been removed, reducing future sources of LWD needed to form and maintain stream habitat that salmonids depend on during various life stages. In the smaller streams, recruited wood does not usually wash away, so logs remain in place and act as check-dams that store sediment eroded from hillsides (Reid 1998). Sediment storage in smaller streams can persist for decades (Nakamura and Swanson 1993).

In fish-bearing streams, LWD originating from mature coniferous forests is important for storing sediment, halting debris flows, and decreasing downstream flood peaks, and its role as a habitat element becomes directly relevant for Pacific salmon species (Reid 1998). LWD alters the longitudinal profile and reduces the local gradient of the channel, especially when log dams create slack pools above or plunge pools below them, or when they are sites of sediment accumulation (Swanston 1991).

Cumulatively, the increased sediment delivery and reduced LWD supply have led to widespread impacts to stream habitats and salmonids. These impacts include reduced spawning habitat quality, loss of pool habitat for adult holding and juvenile rearing, loss of velocity refugia, and increases in the levels and duration of turbidity that reduce the ability of juvenile fish to feed. These changes in habitat have led to widespread decreases in the carrying capacity of streams that support salmonids.

2.2.3.2 Road Construction

Road construction, whether associated with timber harvest or other activities, has caused widespread impacts to salmonids (Furniss *et al.* 1991). Where roads cross salmonid-bearing streams, improperly placed culverts have blocked access to many stream reaches. Land sliding and chronic surface erosion from road surfaces are large sources of sediment across the affected species' ranges. Roads also have the potential to increase peak flows and reduce summer base flows with consequent effects on the stability of stream substrates and banks. Roads have led to widespread impacts on salmonids by increasing the sediment loads. The consequent impacts on habitat include reductions in spawning, rearing, and holding habitat, and increases in turbidity.

The delivery of sediment to streams can be generally considered as either chronic, or episodic. Chronic delivery refers to surface erosion that occurs from rain splash and overland flow. More episodic delivery, on the order of every few years, occurs in the form of mass wasting events, or landslides, that deliver large volumes of sediment during large storm events.

Construction of road networks can also greatly accelerate erosion rates within a watershed (Haupt 1959, Swanson and Dyrness 1975, Swanston and Swanson 1976, Reid and Dunne 1984, Hagans and Weaver 1987). Once constructed, existing road networks are a chronic source of sediment to streams (Swanston 1991) and are generally considered the main cause of accelerated surface erosion in forests across the western United States (Harr and Nichols 1993). Processes initiated or affected by roads include landslides, surface erosion, secondary surface erosion (landslide scars exposed to rain splash), and gullying. Roads and related ditch networks are often connected to streams via surface flow paths, providing a direct conduit for sediment. Where roads and ditches are maintained periodically by blading, the amount of sediment delivered continuously to streams may temporarily increase as bare soil is exposed and ditch roughness features which store and route sediment and armor the ditch are removed. Hagans and Weaver (1987) found that fluvial hillslope erosion associated with roads in the lower portions of the Redwood Creek watershed produced about as much sediment as landslide erosion between 1954 and 1980. In the Mattole River watershed, the Mattole Salmon Group (1997) found that roads, including logging haul roads and skid trails, were the source of 76 percent of all erosion problems mapped in the watershed. This does suggest that, overall, roads are a primary source of sediment in managed watersheds.

Road surface erosion is particularly affected by traffic, which increases sediment yields substantially (Reid and Dunne 1984). Other important factors that affect road surface erosion include condition of the road surface, timing of when the roads are used in relation to rainfall, road prism moisture content, location of the road relative to watercourses, methods used to construct the road, and steepness on which the road is located.

2.2.3.3 Hatcheries

Releasing large numbers of hatchery fish can pose a threat to wild salmon and steelhead stocks through genetic impacts, competition for food and other resources, predation of hatchery fish and wild fish, and increased fishing pressure on wild stocks as a result of hatchery production (Waples 1991). The genetic impacts of artificial propagation programs are primarily caused by the straying of hatchery fish and the subsequent hybridization of hatchery and wild fish. Artificial propagation threatens the genetic integrity and diversity that protects overall productivity against changes in environment (61 FR 56138, October 31, 1996). The potential adverse impacts of artificial propagation programs are well-documented (Waples 1991, Waples 1999, National Research Council 1995).

2.2.3.4 Water Diversions and Habitat Blockages

Stream-flow diversions are common throughout the species' ranges. Unscreened diversions for agricultural, domestic, and industrial uses are a significant factor for salmonid declines in many basins. Reduced stream-flows due to diversions reduce the amount of habitat available to salmonids and can degrade water quality, such as causing elevated water temperatures. Reductions in water quantity can reduce the carrying capacity of the affected stream reach by reducing the amount of available habitat, including by causing discontinuous flow and subsequent disconnected pools. Where warm return flows enter the stream, fish may seek reaches with cooler water, thus increasing competitive pressures in these areas.

Habitat blockages have occurred in relation to road construction as discussed previously. In addition, hydropower, flood control, and water supply dams of different municipal and private entities, have permanently blocked or hindered salmonid access to historical spawning and rearing grounds. The percentage of habitat blocked by dams is likely greatest for steelhead because steelhead were more extensively distributed upstream than Chinook or coho salmon. Because of migrational barriers, salmon and steelhead populations have been confined to lower elevation mainstems that historically only were used for migration and rearing. Population abundances have declined in many streams due to decreased quantity, quality, and spatial distribution of spawning and rearing habitat (Lindley *et al*. 2007).

2.2.3.5 Predation

Predation likely did not play a major role in the decline of salmon populations; however, it may have substantial impacts at local levels. For example, Higgins *et al.* (1992) and CDFG (1994) reported that Sacramento River pikeminnow (*Ptychocheilus grandis*) accidentally introduced to the Eel River basin are a major competitor and predator of the native salmonids found there.

2.2.3.6 Disease

Disease has not been identified as a major factor in the decline of ESA-listed salmonids. However, disease may have substantial impacts in some areas and may limit recovery of local salmon populations. Although naturally occurring, many of the disease issues salmon and steelhead currently face have been exacerbated by human-induced environmental factors such as water regulation (damming and diverting) and habitat alteration. Natural populations of salmonids have co-evolved with pathogens that are endemic to the areas salmonids inhabit and have developed levels of resistance to them. In general, diseases do not cause significant mortality in native salmonid stocks in natural habitats (Bryant 1994, Shapovalov and Taft 1954). However, when this natural habitat is altered or degraded, outbreaks can occur. For example, ceratomyxosis, which is caused by *Ceratomyxa shasta*, has been identified as one of the most significant diseases for juvenile salmon in the Klamath Basin due to its prevalence and impacts there (Nichols *et al.* 2007) that are related to reduced flows and increased water temperatures.

2.2.3.7 Commercial and Recreational Fisheries

Salmon and steelhead once supported extensive tribal, commercial, and recreational fisheries. NMFS has identified over-utilization as a significant factor in their decline. This harvest strongly affected salmonid populations because, each year, it removed adult fish from the ESU before they spawned, reducing the numbers of offspring in the next generation. In modern times, steelhead are rarely caught in ocean salmon fisheries. Directed ocean Chinook salmon fisheries are currently managed by NMFS to achieve Federal conservation goals for west coast salmon in the Pacific Coast Salmon Fishery Management Plan (FMP). The goals specify the numbers of adults that must be allowed to spawn annually, or maximum allowable adult harvest rates. In addition to the FMP goals, salmon fisheries must meet requirements developed through NMFS' intra-agency section 7 consultations, including limiting the incidental mortality rate of ESA-listed salmonids.

2.2.3.8 Climate Change

Global climate change presents a potential threat to salmonids and their critical habitats. Impacts from global climate change are already occurring in California. For example, average annual air temperatures, heat extremes, and sea level have all increased in California over the last century (Kadir *et al.* 2013). Snowmelt from the Sierra Nevada Mountains has declined (Kadir *et al.* 2013). However, total annual precipitation amounts have shown no discernable change (Kadir *et al.* 2013). Listed salmonids may have already experienced some detrimental impacts from climate change. NMFS believes the impacts on listed salmonids to date are likely fairly minor because natural, and local, climate factors likely still drive most of the climatic conditions steelhead experience, and many of these factors have much less influence on steelhead abundance and distribution than human disturbance across the landscape.

The threat to listed salmonids from global climate change will 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; critically dry years may increase (Lindley *et al.* 2007, Schneider 2007, and Moser *et al.* 2012). Wildfires are expected to increase in frequency and magnitude (Westerling *et al.* 2011, Moser *et al.* 2012).

For Northern California, most models project heavier and warmer precipitation. Extreme wet and dry periods are projected, increasing the risk of both flooding and droughts (DWR 2013). Estimates show that snowmelt contribution to runoff in the Sacramento/San Joaquin Delta may decrease by about 20 percent per decade over the next century (Cloern *et al.* 2011). Many of these changes are likely to further degrade listed salmonid habitat by, for example, reducing stream flow during the summer and raising summer water temperatures. Estuaries may also experience changes detrimental to salmonids. 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, and Doney *et al*. 2012). The projections described above are for the mid to late 21st Century. In shorter time frames, climate conditions not caused by the human addition of carbon dioxide to the atmosphere are more likely to predominate (Cox and Stephenson 2007, Santer *et al.* 2011).

2.2.3.9 Ocean Conditions

Variability in ocean productivity affects fisheries production both positively and negatively (Chavez *et al.* 2003). Beamish and Bouillion (1993) showed a strong correlation between North Pacific salmon production and marine environmental factors from 1925 to 1989. Beamish *et al.* (1997a) noted decadal-scale changes in the production of Fraser River sockeye salmon that they attributed to changes in the productivity of the marine environment. Warm ocean regimes are characterized by lower ocean productivity (Behrenfeld *et al.* 2006, Wells *et al.* 2006), which may affect salmon by limiting the availability of nutrients regulating the food supply, thereby increasing competition for food (Beamish and Mahnken 2001). Data from across the range of coho salmon on the coast of California and Oregon reveal there was a 72 percent decline in returning adults in 2007/08 compared to the same cohort in 2004/05 (MacFarlane *et al.* 2008). The Wells Ocean Productivity Index, an accurate measure of Central California ocean productivity, revealed poor conditions during the spring and summer of 2006, when juvenile coho salmon and Chinook salmon from the 2004/05 spawn entered the ocean (McFarlane *et al.* 2008). Data gathered by NMFS suggests that strong upwelling in the spring of 2007 may have resulted in better ocean conditions for the 2007 coho salmon cohort (NMFS 2008). The quick response of salmonid populations to changes in ocean conditions (MacFarlane *et al.* 2008) strongly suggests that density dependent mortality of salmonids is a mechanism at work in the ocean (Beamish *et al.* 1997b, Levin *et al.* 2001, Greene and Beechie 2004).

Predictions for adult returns of coho salmon and Chinook salmon in 2016 are poor and intermediate, respectively, (Table 3) given the primarily poor conditions (as reflected in ocean ecosystem indicator ratings) for juvenile coho salmon survival in the ocean in 2015, and the intermediate conditions for juvenile Chinook salmon in the ocean in 2016 (Peterson *et al.* 2015, Table 3). The poor conditions reflect warmer than average sea surface and deep-sea temperatures associated with a relative lack of lipid-rich species of zooplankton, and krill biomass that was the lowest in the last 20 years (Peterson *et al.* 2015). These warm ocean conditions are attributed to a strengthening El Niño in addition to anomalously warm conditions (the “warm blob”) that began in 2013 (Peterson *et al.* 2015).

Table 3. Ocean ecosystem indicators of the Northern California Current. Colored squares indicate positive (green), neutral (yellow), and negative (red) conditions for salmonids entering the ocean each year. In the two columns to the far right, colored dots indicate the forecast of adult returns based on ocean conditions in 2015 (coho salmon) and 2014 (Chinook salmon).

	Juvenile Migration Year				Adult Return Outlook	
	2012	2013	2014	2015	coho 2016	Chinook 2016
Large– scale ocean and atmospheric indicators						
PDO (May - Sept)	■ (green)	■ (yellow)	■ (yellow)	■ (red)	● (red)	● (yellow)
ONI (Jan - Jun)	■ (green)	■ (yellow)	■ (yellow)	■ (red)	● (red)	● (yellow)
Local and regional physical indicators						
Sea surface temperature	■ (yellow)	■ (yellow)	■ (red)	■ (red)	● (red)	● (red)
Deep water temperature	■ (green)	■ (red)	■ (red)	■ (red)	● (red)	● (red)
Deep water salinity	■ (yellow)	■ (red)	■ (red)	■ (yellow)	● (yellow)	● (red)
Local biological indicators						
Copepod biodiversity	■ (green)	■ (green)	■ (yellow)	■ (red)	● (red)	● (yellow)
Northern copepod anomalies	■ (green)	■ (green)	■ (green)	■ (red)	● (red)	● (green)
Biological spring transition	■ (yellow)	■ (green)	■ (red)	■ (red)	● (red)	● (red)
Winter Ichthyoplankton	■ (yellow)	■ (green)	■ (red)	■ (green)	● (green)	● (red)
Juvenile Chinook Salmon Catch – June	■ (green)	■ (green)	■ (yellow)	■ (red)	● (red)	● (yellow)

Key ■ (green) good conditions for salmon ● (green) good returns expected
■ (yellow) intermediate conditions for salmon -- no data
■ (red) poor conditions for salmon ● (red) poor returns expected

The smolt to adult return rate for coho salmon at Freshwater Creek, a tributary of Humboldt Bay in Northern California, was less than 3 percent from 2011 to 2013 (Anderson *et al.* 2015). Bradford *et al.* (2000) found that the average coastal coho salmon population would be unable to sustain itself when marine survival rates fall below about 3 percent. Ocean conditions are not necessarily the only influence of marine survival; however, if marine survival is below 3 percent, the SONCC coho salmon ESU will have difficulty sustaining itself. Therefore, poor ocean conditions and low marine survival poses a significant threat to the SONCC coho salmon ESU. This is likely the case for other ESUs and DPSs that use the California Current.

2.2.3.10 Drought

The following language is taken from Williams *et al.* 2016, which provides the most recent description of the effects of recent drought conditions on listed salmonids in California.

> California has experienced well below average precipitation in each of the past four

> water years (2012, 2013, 2014, and 2015), record high surface air temperatures the past two water years (2014 and 2015), and record low snowpack in 2015. Some paleoclimate reconstructions suggest that the current four-year drought is the most extreme in the past 500 or perhaps more than 1000 years. Anomalously high surface temperatures have made this a "hot drought," in which high surface temperatures substantially amplified annual water deficits during the period of below average precipitation. Four consecutive years of drought and the past two years of exceptionally high air, stream, and upper-ocean temperatures have together likely had negative impacts on the freshwater, estuary, and marine phases for many populations of Chinook salmon, coho salmon, and steelhead.

2.2.3.11 Marine Derived Nutrients

Marine-derived nutrients (MDN) are nutrients that are accumulated in the biomass of salmonids while they are in the ocean and are then transferred to their freshwater spawning sites where the salmon die. The return of salmonids to rivers makes a significant contribution to the flora and fauna of both terrestrial and riverine ecosystems (Gresh *et al.* 2000), and has been shown to be vital for the growth of juvenile salmonids (Bilby *et al.* 1996, 1998). Evidence of the role of MDN and energy in ecosystems suggests a deficit of MDN may result in an ecosystem failure contributing to the downward spiral of salmonid abundance (Bilby *et al.* 1996). Reduction of MDN to watersheds is a consequence of the past century of decline in salmon abundance (Gresh *et al.* 2000).

2.2.4 Critical Habitat

2.2.4.1 Critical Habitat Description

NMFS is responsible for designating critical habitat for species listed under its jurisdiction. In designating critical habitat, NMFS considers the following requirements of the species: (1) space for individual and population growth, and for normal behavior; (2) food, water, air, light, minerals, or other nutritional or physiological requirements; (3) cover or shelter; (4) sites for breeding, reproduction, or rearing offspring; and, generally, (5) habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of this species (see 50 CFR 424.12(b)). In addition to these factors, NMFS focuses on the known physical and biological features (PBFs) within the designated area that are essential to the conservation of the species and that may require special management considerations or protection. Section 4 of the ESA requires that economic, national security and other relevant impacts are taken into consideration when designating critical habitat. Moreover, section 7 of the ESA requires that Federal agencies (via consultation with NMFS) ensure any action they authorize, fund, or carry out will not result in the destruction or adverse modification of critical habitat. Designated critical habitat for all the species listed below overlaps with the action area.

This opinion analyzes the effects of the Project on critical habitat for SONCC coho salmon, CCC coho salmon, CC Chinook salmon, NC steelhead, CCC steelhead, and S-CCC steelhead. The

ESA defines conservation as "to use all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to the ESA are no longer necessary." As a result, NMFS approaches its "destruction and adverse modification" determinations by examining the effects of actions on the conservation value of the designated critical habitat, that is, the value of the critical habitat for the conservation of threatened or endangered species.

2.2.4.1.1 Coho Salmon

Coho salmon critical habitat consists of "the water, substrate, and adjacent riparian zone [in an ESU] . . . [below] longstanding, naturally impassable barriers (*i.e.*, natural waterfalls in existence for at least several hundred years)" (64 FR 24049, May 5, 1999). NMFS has excluded from coho salmon critical habitat designation all tribal lands in northern California and areas that are upstream of certain dams that block access to historic habitats of listed salmonids. Critical habitat corresponds to all the water, riverbed, and bank areas, and riparian areas within the ESU boundaries except as noted above. Waterways include estuarine areas and tributaries. Adjacent riparian area is defined as "the area adjacent to a stream that provides the following functions: shade, sediment, nutrient, or chemical regulation, stream bank stability, and input of large woody debris or organic matter" (64 FR 24049, May 5, 1999). In other words, riparian areas are those areas that produce physical, biological, and chemical features that help to create biologically productive stream habitat for salmonids. PBFs for coho salmon critical habitat include: juvenile summer and winter rearing areas, juvenile migration corridors, areas for growth and development to adulthood, adult migration corridors, and spawning areas (64 FR 24049, May 5, 1999).[5] The current condition of critical habitat for SONCC coho salmon is discussed below in the Conservation Value of the Critical Habitat section.

2.2.4.1.2 Chinook Salmon and Steelhead

NMFS designated critical habitat for CC Chinook salmon and NC, CCC, and S-CCC steelhead on September 2, 2005 (70 FR 52488). The method and criteria used to define critical habitat focused on identifying the physical or biological features of habitat that are essential to the conservation of the species. These specific PBFs were identified as freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, estuarine areas, nearshore marine areas, and offshore marine areas. Habitat areas within the geographic range of the ESUs/DPSs having these attributes and occupied by the species were considered for designation. Steelhead critical habitat was designated throughout the watersheds occupied by the ESU/DPSs. In general, the extent of critical habitat conforms to the known distribution of NC, CCC, and S-CCC steelhead in streams, rivers, lagoons, and estuaries (NMFS 2005, 70 FR 52488). In some cases, streams containing steelhead were not designated because the economic benefit of exclusion outweighed

[5] These PBFs were originally called PCEs, or Primary Constituent Elements. Regulations have subsequently replaced PCEs with PBFs, or Physical and Biological Features. The shift in terminology does not change the approach used in conducting a “destruction or adverse modification” analysis, which is the same regardless of whether the original designation identified primary constituent elements, physical or biological features, or both.

the benefits of designation. Native American lands and U.S. Department of Defense lands were also excluded.

2.2.4.2 Conservation Value of Critical Habitat

The PBFs of designated critical habitat for SONCC and CCC coho salmon, NC, CCC, and S-CCC steelhead, and CC Chinook salmon are those accessible freshwater habitat areas that support spawning, incubation and rearing, migratory corridors free of obstruction or excessive predation, and estuarine areas with good water quality and that are free of excessive predation. Timber harvest and associated activities, road construction, urbanization and increased impervious surfaces, migration barriers, water diversions, and large dams throughout a large portion of the freshwater range of the ESUs and DPSs continue to result in habitat degradation, reduction of spawning and rearing habitats, and reduction of stream flows. The result of these continuing land management practices in many locations has limited reproductive success, reduced rearing habitat quality and quantity, and caused migration barriers to both juveniles and adults. These factors likely limit the conservation value (*i.e.*, limiting the numbers of salmonids that can be supported) of designated critical habitat within freshwater habitats at the ESU/DPS scale.

Although watershed restoration activities have improved freshwater critical habitat conditions in isolated areas, reduced habitat complexity, poor water quality, and reduced habitat availability because the same land management practices persist in many locations.

2.2.4.3 Condition of Critical Habitat

As part of the critical habitat designation process, NMFS convened Critical Habitat Analytical Review Teams (CHARTs) for steelhead and Chinook salmon. These CHARTs determined the conservation value of Hydrologic Subareas (HSAs) of watersheds under consideration. A CHART was not convened for coho salmon, because critical habitat had already been designated in 1999. NMFS determined the condition of coho salmon critical habitat based on other, readily available information.

2.2.4.3.1 Coho Salmon

The condition of SONCC coho salmon and CCC coho salmon critical habitat, specifically its ability to provide for their conservation, is degraded from conditions known to support viable salmon populations. NMFS has determined that present depressed population conditions are, in part, the result of the following historical and ongoing land management practices affecting critical habitat: logging, agricultural and mining activities, urbanization, stream channelization, dams, freshwater and estuarine wetland loss, and water withdrawals for irrigation. All of these factors were identified when SONCC coho salmon were listed as threatened under the ESA, and all factors continue to negatively affect this ESU.

2.2.4.3.2 Chinook Salmon

For CC Chinook salmon, the CHART identified 45 occupied HSAs within the freshwater and estuarine range of the ESU. Eight HSAs were rated low in conservation value, 10 were rated medium, and 27 were rated high in conservation value (NMFS 2005). Within the ESU, CHART ratings and economic benefits analysis resulted in the designation of critical habitat with biological and physical features for spawning, rearing, and migration in approximately 1,634 miles of occupied habitat. NMFS believes the status of CC Chinook salmon critical habitat in the 45 HSAs has not changed substantially since the 2005 assessment.

2.2.4.3.3 Steelhead

For NC steelhead, the CHART identified 50 occupied HSAs within the freshwater and estuarine range of the DPS. Nine HSAs were rated low in conservation value, 14 were rated medium, and 27 were rated high in conservation value (NMFS 2005). Within the DPS, the CHART ratings and economic benefits analysis resulted in designation of critical habitat with essential features for spawning, rearing, and migration in approximately 3,148 miles of occupied stream habitat. NMFS believes the status of NC steelhead critical habitat in the 50 HSAs has not changed substantially since the 2005 assessment.

For the CCC steelhead, the CHART identified 46 occupied HSAs within the freshwater and estuarine range of the ESU. Within the DPS, the CHART ratings and economic benefits analysis resulted in designation of critical habitat with essential features for spawning, rearing, and migration in approximately 1,832 miles of stream habitat, and 442 square miles of estuarine habitat.

For the S-CCC steelhead, the CHART identified 30 occupied HSAs within the freshwater and estuarine range of the ESU. Six HSAs were rated low in conservation value, 11 were rated medium, and 13 were rated high in conservation value. Essential features for spawning, rearing, and migration are contained in approximately 1,251 miles of occupied stream habitat within the HSAs.

2.2.4.3.4 Summary

Although watershed restoration activities have improved freshwater critical habitat conditions in isolated areas, reduced habitat complexity, poor water quality, and reduced habitat availability as a result of continuing land management practices continue to persist in many locations and are likely limiting the conservation value of designated critical habitat within these freshwater habitats at the ESU scale.

2.3 Environmental Baseline

The "environmental baseline" includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section

7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

2.3.1 Status of Species and Critical Habitat in Action Area

This section provides a synopsis of the four geographic areas of consideration (Figure 2), the ESUs and watersheds present within each area, specific recent information on the status of coho salmon, Chinook salmon, and steelhead, and a summary of the factors affecting the listed species within the action area. The best information presently available demonstrates that a multitude of factors, past and present, have contributed to the decline of west coast salmonids (Weitkamp *et al*. 1995, Busby *et al*. 1996, NMFS 1996, Myers *et al*. 1998, NMFS 1998, CDFG 2002, CRWQCB 2001). The following is a summary of the factors affecting the environment of the species or critical habitat within each watershed.

Information in this section is broken down into the following geographic areas: North Coast Area, North Central Coast Area, San Francisco Bay Area, and the Central Coast Area. Information for the North Coast Area is organized by river system as that area is dominated by rivers so large that multiple watersheds are found within each river system. The other three areas do not contain river systems that large. The discussion of information from the North Central Coast, San Francisco Bay, and Central Coast areas are organized by hydrologic unit codes (HUCs). A few HUCs in these areas contain one river system, but most contain several small systems.

2.3.2.1. North Coast Area

This area includes all coastal streams entering the Pacific Ocean from the Oregon/California Border south to Bear Harbor in Mendocino County, including portions of the following counties: Del Norte, Siskiyou, Humboldt, Trinity, and Mendocino. The area includes the following USGS HUC-8s (4^{th} field HUCs): Upper Klamath, Lower Klamath, Shasta, Scott, Smith, Salmon, Trinity, South Fork Trinity, Mad-Redwood, Lower Eel, South Fork Eel, Middle Fork Eel, and Upper Eel. Urban development within the North Coast Area is found primarily on the estuaries of the larger streams, though there are some small towns and rural residences throughout the area. Forestry is the dominant land-use throughout the area, although agriculture and medical marijuana has become prolific and could be the dominant land use in some areas. The area includes the California portion of the SONCC coho salmon ESU and the northern portion of the CC Chinook salmon ESU and NC steelhead DPS ESU, and contains designated critical habitat for all three species. NMFS excluded habitat above longstanding barriers from the SONCC coho salmon critical habitat designation, including areas above Iron Gate Dam (Klamath River), Dwinnell Dam (Shasta River), Lewiston Dam (Trinity River), and Scott Dam (Eel River).

More detail about the current condition of habitat and threats in each watershed can be found in the recovery plan for SONCC coho salmon (NMFS 2014) and the public draft recovery plan that includes NC steelhead and CC Chinook salmon (NMFS 2015).

2.3.2.1.1. Smith River

SONCC coho salmon are the only listed salmonid occurring in the Smith River. The SONCC coho salmon recovery plan (NMFS 2014) identified the key limiting stresses and threats affecting each population. Key limiting stresses and threats are those stresses and threats that are the most pressing factors limiting recovery of populations. Stresses are the physical, biological, or chemical conditions and associated ecological processes that may impede SONCC coho salmon recovery, and threats are those activities or impacts that cause or contribute to stresses. Impaired estuarine function and lack of floodplain and channel structure are the key limiting stresses, and channelization and diking and agricultural practices are the key limiting threats, that most affect coho salmon recovery in this basin (NMFS 2014). The dominant land uses are agriculture and timber harvest (NMFS 2014).

Until recently, there has been very little information about the status of the Smith River coho salmon population. Spawner surveys and juvenile distribution surveys started in fall 2011. There were, on average, 279 coho salmon redds in the Smith River from 2011 to 2015, which were limited to the Mill Creek watershed (Garwood *et al.* 2014, Walkley and Garwood 2015). Given the observed average sex ratio (F:M) of 1:1.4 (Garwood *et al.* 2014, Walkley and Garwood 2015), the likely number of adult coho salmon is well below the moderate risk target of 1,300 (NMFS 2014), placing the population at high risk of extinction. It should be noted that this conclusion is based on less than the twelve years of data needed for a delisting decision.

2.3.2.1.2. Klamath and Trinity Rivers

SONCC coho salmon are the only ESA-listed salmonid occurring in the Klamath River basin. There are nine coho salmon populations in this basin: Lower Klamath River, Middle Klamath River, Upper Klamath River, Salmon River, Scott River, Shasta River, Lower Trinity River, Upper Trinity River, and South Fork Trinity River. Timber harvest and agriculture are the dominant land uses in most of the populations (NMFS 2014).

Altered hydrologic function, or not having enough water at the right time, is a key limiting stress that affects much of the basin, as does simplified instream and off-channel habitat (NMFS 2014). The most prevalent key limiting threats affecting the basin are dams/diversions and agricultural practices (NMFS 2014).

In the Klamath River, poor water quality conditions during the summer season have been recognized as a major contributing factor to the decline of anadromous fish runs (Bartholow 1995). The main causative factor behind the poor water quality conditions in the mainstem Klamath River is the large-scale water impoundment and diversion projects above Iron Gate Dam (Klamath) and Lewiston Dam (Trinity). Average annual runoff below Iron Gate Dam has declined by more than 370,000 acre-feet since inception of the Bureau of Reclamation's Klamath Project (National Research Council 2003), while up to 53 percent of the Trinity River flow has been annually diverted into the Sacramento River (DOI 2000). The large volume of water diverted from each of these basins significantly affects downstream flow levels and aquatic habitat. After analyzing both pre- and post-Klamath Project hydrologic records, Hecht and Kamman (1996) concluded that variability and timing of mean, minimum, and maximum flows changed significantly after construction of the project. Project operations tend to increase flows in October and November, and decrease flows in the late spring and summer as measured throughout the Klamath mainstem. Low summer flow volumes within the Klamath River can increase daily maximum water temperatures during critical summer months by slowing flow transit rates and increasing thermal loading when compared to higher flow levels (Deas and Orlob 1999). Moreover, further heating the already-warm, nutrient-rich water released from Iron Gate Dam typically results in poor water quality conditions (*i.e.*, low dissolved oxygen, increased algal blooms, *etc.*) in the Klamath River between the dam and Seiad Valley.

Lower summer flows emanating from the Klamath Project (*i.e.*, released at Iron Gate Dam) are exacerbated by diminished inflow from many of the major tributaries to the middle Klamath River. The Shasta and Scott rivers historically supported strong populations of Chinook salmon, coho salmon, and summer-run steelhead (KRBFTF 1991). However, seasonal withdrawals for agriculture in the spring and summer months can drop stream flows by more than 100 cubic feet per second (cfs) over a 24 hour period, potentially stranding large numbers of rearing juvenile salmon and steelhead.

The average number of adult coho salmon counted at the video weir on the Scott River over the last eight years was 810, while the average number of spawners counted at the Shasta River video weir over the last 14 years was 127 (Williams *et al.* 2016). Of particular concern is the small number of spawners estimated to have passed the weir on the Shasta River in 2014 (46), of which only four were likely three year old fish (Williams *et al.* 2016). The estimated numbers of spawners observed recently at these locations are below the moderate risk thresholds (Scott 1,000 adults and Shasta 576 adults; NMFS 2014), putting these populations at high risk of extinction. The Lower Klamath, Middle Klamath, Upper Klamath, Salmon, Lower Trinity, and South Fork Trinity river coho salmon populations are estimated at a high risk of extinction (NMFS 2014).

2.3.2.1.3. Redwood Creek

Coho salmon, Chinook salmon, and steelhead are the listed salmonid species that occur in Redwood Creek. The dominant land uses in Redwood Creek are timber harvest and agriculture (NMFS 2014). The key limiting stresses for coho salmon are a lack of floodplain and channel structure and impaired estuarine function, while the key limiting threats are channelization/ diking and roads (NMFS 2014). The degraded condition of the estuary, disconnection of the creek from floodplain habitat, impaired summer water temperatures, and lack of habitat complexity, including reduced shelter and cover elements, are all factors limiting Chinook salmon and steelhead abundance (NMFS 2015. In addition, steelhead populations are constrained by an in-river sport fishery for hatchery steelhead and by limited deep holding pools (NMFS 2015).

On average, 529 coho salmon redds, 921 Chinook salmon redds and 154 winter steelhead redds have been counted annually over the last four years[6] in Redwood Creek (Table 4; Williams *et al.* 2016). Based on these numbers, the total number of adult coho salmon and Chinook salmon is likely above the moderate risk thresholds (Table 4), placing them at moderate risk of extinction. In contrast, steelhead appear to be below the moderate risk threshold, placing this population at high risk of extinction (Table 4). Based on population estimates over a 14-year period of record that ended in 2012, there were an average of 297 adult coho salmon, 272 adult Chinook salmon and 40 adult steelhead annually in Prairie Creek, a tributary of Redwood Creek (Williams *et al.* 2016). Chinook salmon abundance has shown a significant negative trend ($p=0.015$), while steelhead abundance showed a slight positive but non-significant trend ($p=0.545$) over this period (Williams *et al.* 2016). A partial population estimate of summer steelhead carried out since 1981 found, on average, 10 individuals (Table 4). There has been a negative but non-significant ($p = 0.720$) trend over the entire period of record. The recent (16-year) trend has been positive and marginally significant ($p = 0.077$); however, the population remains at critically low abundance (Williams *et al.* 2016).

[6] These redds were counted during surveys targeted at the spawning period of coho salmon, so this number does not include redds made and destroyed before that survey began, or made after the survey ended.

Table 4. Spawner targets and results of monitoring surveys for Chinook salmon, winter steelhead, and summer steelhead in Redwood Creek and Prairie Creek.

			Average			Estimated average	
Species	**Location**	**Spawner target[a]**	**Number redds[b] 2011-2014**	**Number adults 1981-2014**	**Location**	**Number redds[b] 2011-2014**	**Number adults 1998-2012**
Coho salmon	Redwood Creek	4,900 (604)	529	n/a	Prairie Creek	409	297[c]
Chinook salmon		3,400 (464)	921	n/a		206	272[c]
Winter steelhead		5,400 (1,512)	154	n/a		156	40[c]
Summer steelhead		2,500	n/a	10[d]		n/a	n/a

[a] Low extinction risk threshold over (moderate extinction risk threshold); NMFS 2014 and NMFS 2015
[b] Anderson and Ward 2015.
[c] Based on AUC estimates. Surveys were discontinued after 2012 when basin-wide surveys for Redwood Creek were initiated; Duffy 2012, Williams et al. 2016.
[d] Estimates are from dive counts of a standardized reach of 27 km and thus represent only a partial population estimate; Williams et al. 2016.

2.3.2.1.4 Mad River

Three ESA-listed salmonids occur in the Mad River: coho salmon, Chinook salmon, and steelhead. In the Mad River, the dominant land uses are timber harvest and gravel mining (NMFS 2014). The key limiting stresses for coho salmon are a lack of floodplain and channel structure and altered sediment supply, and the key limiting threats are roads and gravel extraction (NMFS 2014). Strays from Mad River Hatchery likely reduce the overall productivity of the steelhead population (NMFS 2015). Excessive turbidity during the winter months, along with reduced habitat complexity, have reduced the quality and extent of steelhead and Chinook salmon rearing habitat (NMFS 2015). Inadequate stream shading and higher water temperatures also negatively affect steelhead habitat. Gravel scouring events likely play a role in poor Chinook salmon spawner success during years of high precipitation (NMFS 2015). A smaller, simplified estuary has reduced the quality and extent of rearing habitat for Chinook salmon in the Mad River (NMFS 2015).

The paucity of channel structure is reflected in habitat surveys within the Mad River watershed, which detail the low amount and small size of existing LWD (primarily 1-2 foot diameter pieces). Given the current vegetation age structure and past logging history along streams, recruitment of adequately sized woody debris to many tributaries is not likely to occur for several decades. The Mad River watershed is section 303(d) listed for turbidity and sedimentation due to silviculture, resource extraction, and nonpoint sources (CRWQCB 2012). Hydrologically connected road sediments are the principle source of fine sediment.

Little monitoring data are available for the Mad River. In a survey of several index reaches that extended from 1981 to 2013, the maximum average number of adult coho salmon in any reach was seven (NMFS 2014). Coho salmon are likely currently at high risk of extinction because the number of spawners is likely below the high-risk threshold, while Chinook salmon and steelhead are likely at moderate risk of extinction as the number of spawners likely exceeds the moderate risk threshold (NMFS 2014, NMFS 2015).

2.3.2.1.5 Humboldt Bay

All three listed salmonids (SONCC coho salmon, NC steelhead, and CC Chinook salmon) occur in Humboldt Bay. Similar to other nearby watersheds, fish habitat in Humboldt Bay and its tributaries has suffered from the effects of past timber harvest. Currently, the dominant land use is timber production and harvest in the upper portions of tributary watersheds. Agriculture and urban, residential, and industrial development are the dominant land uses in the middle and lower portions of the tributary watersheds. Most land in the upper watershed is owned by commercial timber companies. Urban, residential, and industrial development is concentrated in the floodplains of tributaries to Humboldt Bay including Freshwater Creek.

The key limiting stresses to coho salmon in this population are lack of floodplain and channel structure and impaired estuary/mainstem function, and the key limiting threats are channelization/diking and roads (NMFS 2014). For steelhead and Chinook salmon, the concerns are similar: combined effects of excess sediment filling pools along with the lack of structure to regulate sediment transport or reduce scour significantly reduces the complexity of the instream habitat (NMFS 2015). These species also historically depended on the rich stream-estuary ecotone, and the loss of those areas has further limited rearing opportunities (NMFS 2015).

An estimate of coho salmon spawner abundance over the past 14 years in Freshwater Creek, a Humboldt Bay tributary, shows a trend that is not significantly different than zero ($p > 0.07$) over the 13-year period (Williams *et al.* 2016). The trend in the number of adult Chinook salmon counted at the Freshwater Creek weir has been negative and significant ($p<0.001$) (Williams *et al.* 2016). The steelhead trend has been negative but not significantly so ($p = 0.108$) (Williams *et al.* 2016). The estimated average annual number of adult coho salmon, Chinook salmon, and steelhead in Freshwater Creek over the 14 year period of record shows that coho salmon are the most abundant ESA-listed salmonid in the population area, followed by winter steelhead which are less than a third as abundant and Chinook salmon, which are the least abundant salmonid with numbers reaching less than 10 percent of coho salmon counts (Table 5; Anderson *et al.* 2015). Based on the number of coho salmon redds in Humboldt Bay (Table 5; Anderson and Ward 2015), the number of spawners is likely above the moderate risk threshold but below the low risk threshold, placing this population at moderate risk of extinction. Based on the same information for steelhead and Chinook salmon, both of these species are currently at high risk of extinction as the number of spawners is below the moderate risk threshold.

Table 5. Spawner targets and results of monitoring surveys for coho salmon, Chinook salmon, and winter-run steelhead in the Humboldt Bay watershed and Freshwater Creek.

			Estimated Average		**Estimated Average**	
Species	**Location**	**Spawner target**[a]	**Number redds 2011-2015**[c]	**Location**	**Number redds 2001-2015**[c]	**Number adults 2000-2015**[d,e]
Coho salmon	Humboldt Bay	5,700 (764)	1172	Fresh-water Creek	295	573
Chinook salmon		2,600 (76)	4[b]		4	35
Winter steelhead		4,100 (203)	93		20	169

[a] Low extinction risk threshold over (moderate extinction risk threshold); NMFS 2014 and NMFS 2015.

[b] These redds were counted during a survey targeted at the spawning period and space of coho salmon, so this number may not include the entirety of the steelhead spawning period and space.

[c] Anderson and Ward 2016.

[d] Anderson et al. 2015.

[e] Estimated number of adults based on fish/redd expansions from life cycle monitoring stations.

2.3.2.1.6. Eel River

Coho salmon, Chinook salmon, and steelhead occur in the Eel River basin. Degraded floodplain and channel structure is a key limiting stress for coho salmon in the majority of the basin, and a high or very high stress in the entire basin, due to simplified instream and off-channel habitat resulting from past and current land-use practices. Altered hydrologic function is a key limiting stress to coho salmon in much of the basin due to the Potter Valley Project (see below) and to localized diversions to support marijuana cultivation as well as other uses. An equally prevalent key limiting stress to coho salmon across the basin is impaired water quality, primarily high water temperature, arising from degraded riparian forest conditions and from diversions. The key limiting threats affecting most of the basin are dams/diversions and roads.

Within the Eel River basin, the current conditions with the worst ratings for Chinook salmon across populations were the “quality and extent of the estuary”, “habitat complexity (large wood and shelter)”, and “gravel quality and quantity” (NMFS 2015. Based on high or very high ratings across watersheds, the threat of greatest concern for CC Chinook salmon was “disease, predation and competition” due to the introduction of Sacramento pikeminnow and its predation upon and competition with several Chinook salmon life stages (NMFS 2015). Other threats identified were “channel modification”, “water diversion and impoundments,” and “roads and railroads” (NMFS 2015). While not technically a resource extraction or legal action, marijuana cultivation occurs throughout the Eel River Watershed, and diverts water from the Mad River and its tributaries, dumps chemicals and waste into the environment, damages stream channels (*e.g.*, streambank and channel alterations), and disturbs soil and forest resources (Bauer *et al.* 2015). Marijuana cultivation reduces stream flows, increases chemical pollution, and potentially increases stream temperatures (Bauer *et al.* 2015). Cultivation of medical marijuana has become widespread in the Eel River basin, and is a likely cause of many of the water diversions in the area.

The current conditions most frequently rated as poor/fair across Eel River populations for NC steelhead were “large wood and shelter” and “gravel quality and quantity” (NMFS 2015). Other current conditions that rated poorly for at least two populations were “percent primary pools and pool/riffle/flatwater ratios,” and “baseflow and passage flows” (NMFS 2015). The “quality and extent of the estuary” was rated poor for all populations and life stages, due to substantial loss of habitat and impaired quality in that area (NMFS 2015). The highest-rated threat across watersheds was “roads and railroads,” with seven of ten populations rated high. The threats rated high or very high in at least two Eel River basin populations were “water diversions and impoundments” and “channel modification.”

Historic land and water management, specifically large-scale timber extraction and water diversion projects, contributed to a loss of habitat diversity within the mainstem Eel River and many of its tributaries. The Eel River has been listed under section 303(d) of the Clean Water Act as water quality limited due to sediment and water temperature problems (CSWRCB 2003). Bear, Jordan, and Stitz creeks, tributaries of the lower Eel River, have also been listed by the California Department of Forestry as cumulatively affected for sediment problems. Essential habitat feature limitations include high water temperatures, low instream cover levels, high sediment levels, and low LWD abundance. The average annual suspended sediment load in the Eel River is 10,000 tons per square mile (Brown and Ritter 1971), which is one of the highest sediment yields in the world. As discussed previously, high levels of suspended sediment can affect salmonid populations by degrading essential freshwater habitat as well as harming individual fish health and modifying behavior.

Water diversion within the Eel River basin has occurred since the early 1900s at the Potter Valley facilities. Roughly 160,000 acre-feet (219 cfs average) are diverted at Cape Horn Dam, through a screened diversion, to the Russian River basin annually. Flow releases from the Potter Valley facilities have both reduced the quantity of water in the mainstem Eel River, particularly during spring and fall low-flow periods, as well as dampened the within-year and between-year flow variability that is representative of unimpaired watersheds. Water diversions to support marijuana cultivation place a high demand on a limited amount of water. Together, these conditions have restricted juvenile salmonid rearing habitat, impeded migration of adult fish and late emigrating smolts, and provided ideal low-flow, warm water conditions for predatory Sacramento pikeminnow (NMFS 2002).

The Van Duzen River watershed reflects a long legacy of upstream and upslope impacts coupled with the effects of continued instream disturbances. Much of the available salmonid habitat within the Van Duzen watershed is currently degraded by high levels of sediment, low pool density, high water temperatures, and low instream cover levels. The Van Duzen River has been listed under section 303(d) of the Clean Water Act as water quality limited due to sediment problems (CSWRCB 2003).

The South Fork Eel River provides some suitable habitat for Chinook salmon, coho salmon and steelhead. Existing conditions indicate that the South Fork Eel River has limited rearing habitat due to elevated water temperatures. Cool water seeps, thermal stratification, and habitat complexity all play critical roles in sustaining microhabitat for juvenile and adult salmonids. Spawner surveys on the South Fork Eel River's Sproul Creek have occurred since 1975. There is a negative trend when the entire 39-year period of record is considered, and a positive trend in the more recent 16 years, but neither trend is statistically significant ($P=0.212$ and $p=0.235$, respectively)(Williams *et al.* 2016). In the Upper Eel River, index survey counts at Tomki Creek have averaged 554 (range 3-3,666) over the 34 year period of record, but over the last sixteen years they have averaged only 78 (range 5-226). "The long-term trend in these counts is negative ($p < 0.001$); however, the short-term trend has been positive though marginally significant ($p = 0.060$), primarily because of three relatively strong years in succession from 2010–2011 to 2012–2013. . . it is unclear whether the recent positive trend reflects increases in wild spawners, redistribution of fish associated with changes in flow releases from upstream dams, or legacy effects of past hatchery plantings (Williams *et al.* 2016)." A similar story (i.e., long-term trend negative, short-term trend slightly positive) exists for NC steelhead above the Van Arsdale counting station (Williams *et al.* 2016). All salmon and steelhead populations within the Eel River watershed remain well below their target abundance levels.

Based on the number of coho salmon, Chinook salmon, and steelhead redds in the South Fork Eel River (Table 6), the number of spawners of all three species is likely above the moderate risk threshold but below the viability threshold, placing these populations at moderate risk of extinction, although this conclusion is not based on the twelve years of data needed for a delisting decision (Table 6). In addition, the coho salmon in the Lower Eel/Van Duzen River, the Middle Mainstem Eel River, and the Mainstem Eel River are all at high risk of extinction (NMFS 2014). For coho salmon, the amount of habitat in the remaining populations (North Fork Eel, Middle Fork Eel, Upper Mainstem Eel) is too small to expect them to function as independent populations, so no extinction risk is calculated (NMFS 2014). For Chinook salmon and steelhead, the number of spawners in the North Fork Eel River, Middle Fork Eel, and Upper Mainstem Eel Rivers are likely below the moderate risk threshold, based on the fair to poor ratings for “population abundance and spatial structure” (NMFS 2015), likely putting them at high risk of extinction.

Table 6. Spawner targets and estimated average number redds for 2010-2014 for coho salmon, Chinook salmon, and steelhead in the South Fork Eel River.

Species	Location	Spawner target[a]	Estimated Average Number Redds 2010-2014[b]
Coho salmon	South Fork Eel River	9,300 (1,856)	1,347
Chinook salmon		7,300 (365)	773
Winter steelhead		19,000 (952)	643[c]

[a] Low extinction risk threshold over (moderate extinction risk threshold); NMFS 2014 and NMFS 2015. Target for steelhead includes fish produced by the Lower Eel River population area.
[b] Source: Ricker et al. 2015a-d.
[c] These redds were counted during a survey targeted at the spawning period and space of coho salmon, so this number may not include the entirety of the steelhead spawning period and space.

2.3.2.1.7. Mattole River

SONCC coho salmon, NC steelhead, and CC Chinook salmon all occur in the Mattole River watershed. The main land uses are timber harvest and rural residential development, Medical marijuana cultivation has become prolific and could be the dominant land use in some areas. The key limiting stresses for coho salmon are a lack of floodplain and channel structure and altered hydrologic function, , and the key limiting threats are diversions and urban, residential, and industrial development. Concerns for Chinook salmon and steelhead include lack of channel complexity, excessive water extraction during late spring and summer low flows, low stream shade and low large woody debris recruitment to streams, high sediment production levels, high summer water temperatures, shallow channels, and simplified habitat (NMFS 2015. In addition, juvenile Chinook salmon are limited by poor habitat conditions in the estuary during dry years when water flow in the Mattole River is reduced and the period of mouth closure is extended (NMFS 2015).

With the establishment of rural residences and smaller ranches, water use has increased over the last 50 years. Currently, much of the demand for residential and agricultural use is accommodated through in-stream diversions or shallow wells, which diminish streamflows during summer low-flow periods. Much of the demand occurs in the southern sub-basin where the last known stronghold of coho salmon spawning occurs. Additionally, the southern sub-basin has experienced increasing levels of marijuana cultivation. Many of these operations require water sources during the summer, which coincides with juvenile coho salmon rearing. Water withdrawals in the mid- to late-summer likely play a factor in drying of stream reaches and stranding of juvenile salmon in the late summer. Unscreened water diversions using motorized pumps may entrain or impinge juvenile coho salmon.

Based on methodology adopted in 2012, an average of 47 coho salmon redds have been documented in the Mattole River during the two years of sampling described in the status review (Williams *et al.* 2016), compared to the 1,000 spawners needed for moderate risk of extinction, which means this population is at high risk of extinction, although this conclusion is not based on the twelve years of data needed for a delisting decision (NMFS 2014). The number of Chinook salmon redds averaged 250[7] over two years (Williams *et al.* 2016), putting the spawning population above the moderate risk threshold of 178. Similarly, there were 298 steelhead redds on average over 2 years (Williams *et al.* 2016); given that there are at least two fish per redd, the number of adult steelhead that made those redds was above the 535 needed for a moderate risk of extinction, putting the Mattole population of this species at moderate risk of extinction.

2.3.2.2. North Central Coast Area

The North Central Coast area includes all coastal California streams entering the Pacific Ocean in Mendocino, Sonoma, and Marin counties, excluding streams draining into San Francisco and San Pablo bays. The North Central Coast Area includes portions of three ESUs/DPSs (CCC coho salmon, NC steelhead, and CCC steelhead) and five USGS HUC-8s (4th field HUCs) (Big-Navarro-Garcia, Bodega Bay, Gualala-Salmon, Russian, and Tomales-Drakes Bay). Forestry and agriculture are the dominant land-uses throughout the northern part of this area (north of the Russian River). Agriculture and urbanization are more predominant in the Russian River and areas south.

2.3.2.2.1. Big, Navarro, and Garcia Rivers

This HUC-8 includes all coastal watersheds from Jackass Creek south to, but not including, the Gualala River. This HUC is wholly within Mendocino County and includes most of the coastal streams in the county. There are several medium-sized watersheds present within the HUC: Garcia River, Navarro River, Albion River, Big River, Noyo River, and Ten Mile River. The HUC also includes many smaller watersheds draining directly to the Pacific Ocean. The urban development within the HUC is limited primarily to coastal towns on the estuaries of the larger streams, though there are some small towns in other areas of the HUC. In the larger basins within this HUC, private forest lands average about 75 percent of the total acreage (65 FR 36074). Forestry is the dominant land use activity; in some subwatersheds, significant portions (up to 100 percent) have been harvested (CRWQCB 2001). Excessive sedimentation, low LWD abundance and recruitment, and elevated water temperature are issues throughout the HUC; these issues are largely attributable to forestry activities (NMFS 2015). Agriculture has likely contributed to

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[7]These redds were counted during a survey targeted at the spawning period of coho salmon, so this number does not include the entire spawning period of steelhead.

depressed habitat conditions within the Navarro River watershed, and gravel mining may affect salmonids in the Ten Mile and Garcia River watersheds. The effects of land use activities are exacerbated by the naturally erosive geology, the mountainous and rugged terrain, and legacy impacts from historically large storms (*e.g.*, 1964, 1982). Estuaries throughout the HUC have likely decreased in size due to sedimentation and flood control actions (*e.g.*, diking and channelization). All of the larger watersheds within this HUC are included on the 2012 Clean Water Act section 303(d) list of water quality limited segments (CSWRCB 2012), and have TMDLs in place that address sediment pollution.

This HUC is within the CCC coho salmon ESU, CC Chinook salmon ESU, and NC steelhead DPS. Salmonid abundance has declined throughout the HUC. Steelhead are widespread yet reduced in abundance, and coho salmon have a patchy distribution with populations significantly reduced from historic levels (Weitkamp *et al*. 1995; Busby *et al*. 1996; CRWQCB 2001). The most recent status review noted positive but non-significant population trends for coho salmon within the Ten Mile River, Big River, and Albion River over the last several years, but overall, but most populations remain below or near depensation levels (Williams *et al.* 2016). Small numbers of Chinook salmon continue to appear within the Ten Mile, Noyo, Navarro and Big rivers, although these numbers remain well below depensation thresholds for each population (Williams *et al.* 2016). Recent estimates of NC steelhead abundance within the North-Central Coast Stratum have generally improved during the past several years; yet similar to Chinook and coho salmon, many of these steelhead populations remain at or below population depensation levels. On a positive note, both the Big River and Ten Mile River populations have experienced positive growth trends during the past six years (Williams *et al.* 2016). Likewise, Garcia River steelhead escapement has averaged 326 adults annually for the past 6 years, and the population trend is also positive (although insignificantly so).

2.3.2.2.2. Gualala-Salmon River

This HUC-8 includes the entire Gualala River watershed and all coastal watersheds between the Gualala River watershed and the Russian River watershed. The Gualala River is the only large watershed within the HUC, though there are several small coastal watersheds. There is limited urban development within the HUC. Within the Gualala River watershed, private forestlands make up about 94 percent of the total acreage, and forestry is the dominant land use of the watershed (65 FR 36074). Agriculture has been a significant land use within the Gualala River watershed; historically orchards and grazing were the dominant agricultural activities, though more recently vineyard development and illicit marijuana cultivation has become more common within the basin (NMFS 2014). Gravel mining is largely a historic activity, although a rather large gravel mining operation near the confluence of the Wheatfield Fork remains (Matt Goldsworthy, personal communication, 2016). Gravel extraction is currently limited to 40,000 tons per year, though extractions in the past 10 years have not reached that limit (CRWQCB 2001). The Gualala River is included on the 2012 Clean Water Act section 303(d) list of water quality limited segments (CSWRCB 2012). The pollution factors for the Gualala River are sedimentation, temperature, DO, and a host of chemical pollutants; forestry, agriculture, and land development are listed as the potential sources for those factors. In 2001, a TMDL for sediment was approved for the Gualala River (www.epa.gov).

This HUC contains CCC coho salmon, CC Chinook salmon, and NC steelhead. Higgins *et al.* (1992) considered coho salmon from the Gualala River as being at a high risk of extinction. The CDFG (2002) concluded that the Gualala River contains no known remaining viable coho salmon populations; no population data exists from the past 5 years, and NMFS suspects the number of coho salmon in the Gualala River is very low (Williams *et al.* 2016). Recent steelhead data suggests the Gualala River may contain the largest remaining steelhead population within the CCC DPS (Williams *et al.* 2016). Three small coastal watersheds within this HUC and outside the Gualala River watershed, historically contained coho salmon: Fort Ross Creek, Russian Gulch, and Scotty Creek (Brown and Moyle 1991, Hassler *et al*. 1991).

2.3.2.2.3. Russian River

This HUC-8 contains the entire Russian River basin and no other watersheds. Portions of the HUC are in Sonoma and Mendocino counties. There is significant urban development within this HUC centered on the Highway 101 corridor, though there are small towns and rural residences throughout the HUC. Santa Rosa is the largest city within the HUC. Forestry and agriculture are other significant land uses within the HUC, and there are some in-channel gravel mining operations. Brown and Moyle (1991) reported that logging and mining in combination with naturally erosive geology have led to significant aggradation of up to 10 feet in some areas of Austin Creek - a lower Russian River tributary. NMFS's status reviews (Weitkamp *et al*. 1995; Busby *et al*. 1996; Myers *et al*. 1998) identified two large dams within the Russian River that block access to anadromous fish habitat: Coyote Valley Dam and Warm Springs Dam. Steiner Environmental Consulting (SEC) (1996) cites unpublished data from the California State Water Resources Control Board (CSWRCB), which state that there are over 500 small dams on the Russian River and its tributaries. These dams have a variety of functions including residential, commercial, and agricultural water supply, flood and/or debris control, and recreation. These small dams interfere with fish migration, affect sediment transport, and affect water flow and temperature.

The Corps (1982) concluded that the loss of tributary habitat was the primary factor limiting the recovery of the anadromous fishery in the Russian River. The Russian River is included on the 2013 Clean Water Act section 303(d) list of water quality limited segments (CSWRCB 2012). The pollution factors for the Russian River vary by sub-watershed, but commonly include sediment, temperature, dissolved oxygen, various nutrients, and many chemical pollutants and pathogens. Forestry, agriculture, dams with flow regulation, urban and land development, and nonpoint sources are listed as the potential sources for these factors. Lake Sonoma, a reservoir impounded by Warm Springs Dam, is included on the section 303(d) list because of elevated levels of mercury associated with historic mining. Currently, there is no approved TMDL for the Russian River watershed (www.epa.gov).

Many releases of in-basin and out-of-basin Chinook salmon, coho salmon and steelhead occurred throughout the Russian River since the late 1800s (Weitkamp *et al*. 1995, Busby *et al*. 1996, Myers *et al*. 1998, NMFS 1999). For the last 20 years, the Don Clausen Fish Hatchery operated at Warm Springs Dam and released coho salmon, Chinook salmon, and steelhead into the Russian River watershed. However, significant changes in hatchery operations began in 1998, in which the production of coho salmon and Chinook salmon was discontinued. Traditional production of steelhead continues at Don Clausen Fish Hatchery.

This HUC is within the CCC coho salmon ESU, CC Chinook salmon ESU, and CCC steelhead DPS. The CDFG (2002) reported that recent monitoring data indicate that widespread extirpation of coho salmon has occurred within the Russian River basin. In 2001, a conservation hatchery program was developed for coho salmon at the Don Clausen Fish Hatchery. Juvenile coho salmon from the program have been released for reintroduction into several historical coho salmon Russian River tributaries annually beginning in Fall 2004. Recent monitoring data indicate the coho salmon population in the lower Russian River (Dry Creek downstream, inclusive) ranged from 206 to 536 adult fish during the past four years (Williams *et al.* 2016). The Russian River population of Chinook salmon has shown no discernable trend in population abundance during the past 14-year period, with an average annual escapement counted at the Mirabell counting facility of 3,257 fish (Williams *et al.* 2016). The lack of adequate spawner surveys within the Russian River precludes the estimation of wild steelhead escapement within the basin; however, hatchery returns suggest the vast majority of returning fish are of hatchery origin. Current population abundance for all three species remains a mere fraction of their target recovery levels.

2.3.2.2.4 Bodega Bay

This HUC-8 contains all of the coastal watersheds from the Estero de San Antonio north to the mouth of the Russian River. There are three moderate-sized watersheds within the HUC (Salmon Creek, Americano Creek, and Stemple Creek) and few small coastal watersheds directly tributary to the Pacific Ocean. The Salmon Creek watershed is wholly within Sonoma County, whereas the Americano Creek and Stemple Creek watersheds are in both Sonoma and Marin counties. There is limited urban development within the HUC; agriculture is the dominant land use within all of the watersheds within this HUC, with dairy farming being the primary activity. There are some forest lands in the headwaters of Salmon Creek. A large winter storm in 1982 exacerbated the impact of land use activities and natural erosive geology of Salmon Creek (Brown and Moyle 1991) and negatively affected rearing habitat quality and quantity. Americano Creek and Stemple Creek and their estuaries are included on the 2012 Clean Water Act section 303(d) list of water quality limited segments for elevated levels of nutrients and sediment (CSWRCB 2012). The pollution factors for these streams are sedimentation, nutrients, invasive species, and temperature; Diazinon is listed as a pollutant in Estero de San Antonio. Agriculture and land development are listed as the potential sources for those factors. Many of the streams lack riparian cover, causing increased water temperatures.

This HUC is within the CCC coho salmon ESU and CCC steelhead DPS. The distribution and abundance of salmonids within the HUC are highly reduced. Within this HUC, coho salmon have been found in two watersheds: Salmon Creek and Valley Ford Creek (Brown and Moyle 1991; Hassler *et al*. 1991; Weitkamp *et al*. 1995). Excess coho salmon broodstock fish from Warm Springs Hatchery have been released into Salmon Creek during the past several years in an attempt to re-establish a self-sustaining run within the watershed (Williams *et al.* 2016). NMFS found no historical coho salmon collections from watersheds of this HUC between Valley Ford Creek and Tomales Bay. The watersheds of this HUC historically contained steelhead. Steelhead are found throughout Salmon Creek, but the status of steelhead distribution in tributary streams is unknown. Steelhead are likely extirpated from San Antonio Creek and Americano Creek (Cox 2004).

2.3.2.2.3. Tomales-Drakes Bay

This HUC-8 includes all watersheds draining into the Pacific Ocean from Rodeo Cove north to Tomales Bay. The entire HUC is in Marin County, with the exception of a small portion of the headwaters of Walker Creek, which is in Sonoma County. Most of the watersheds in this HUC are small with the exception of Walker Creek and Lagunitas Creek, both tributaries of Tomales Bay, a prominent artifact of the San Andreas Rift Zone. Urban development within the HUC ranges from single homes to small towns and municipal complexes. Although urbanization has been limited, flood control activities, contaminated runoff from paved lots and roads, and seepage from improperly designed and/or maintained septic systems, continue to impact habitat and water quality in portions of the watershed (Ketcham 2003). Recreation is a significant factor in land use within the HUC as there are county, state, and Federal parks within the HUC. Agriculture is a dominant land-use, particularly in the northern half of the HUC, and forestry was a historic land use activity within the HUC. Lagunitas Creek, Walker Creek, and Tomales Bay are included on the 2012 Clean Water Act section 303(d) list of water quality limited segments (CSWRCB 2012); nutrients, pathogens, and sedimentation are the factors and are attributed to agriculture and urban runoff or storm sewers. Mercury, associated with mining, is an additional factor for Walker Creek and Tomales Bay. The construction of Kent Reservoir and Nicasio Reservoir cut off 50 percent of the historical salmonid habitat within the Lagunitas Creek watershed; and construction of two large reservoirs within the Walker Creek watershed, Laguna Lake, and Soulejoule Reservoir, cut off access to significant amounts of habitat (Weitkamp *et al*. 1995; Busby *et al*. 1996; Myers *et al*. 1998, CDFG 2002, NMFS 2015). Sedimentation has had a profound effect on fish habitat in Walker Creek. Many of the deep, cool pools and gravel that salmonids depend on for spawning and rearing, have been filled in with fine sediment.

Elevated stream temperatures are also a concern within many watersheds throughout the HUC. Summer water temperatures are usually below lethal thresholds for salmonids, but can be high enough to retard growth. It was reported that juvenile salmonids in Lagunitas Creek did not show appreciable growth during the summer of 1984, and it is believed that this lack of growth was due to the relatively high summer water temperatures that occurred during this time (Bratovich and Kelly 1988). The National Park Service has documented water temperatures well over the preferred range for salmonids in Olema Creek and one of its tributaries (Ketcham 2003).

This HUC is within the CCC coho salmon ESU and CCC steelhead DPS. With the exception of Lagunitas Creek, the abundance of coho salmon is very low throughout the HUC. Lagunitas Creek may have the largest populations of coho salmon remaining in the CCC coho salmon ESU. Although Lagunitas Creek is presumed to have a relatively stable and healthy population of coho salmon, at least when compared with other CCC coho salmon streams, NMFS (2001) noted that this stream has experienced a recent reduction in coho salmon abundance. Small persistent populations of coho salmon are in Pine Gulch Creek and Redwood Creek. Anecdotal evidence of a once thriving coho salmon and steelhead run in Walker Creek exists. Yet Adams *et al.* (1999) and CDFG (2002) thought the species was extirpated from the watersheds of this HUC as recently as fifteen years ago. In an attempt to increase population spatial distribution, excess coho salmon broodstock from Warm Spring hatchery were introduced into Walker Creek from 2008-2014, and observations of juvenile coho salmon following those plantings indicate successful spawning by those released broodstock fish (Williams *et al.* 2016).. Small numbers of Chinook salmon are often encountered within Lagunitas Creek, which is outside the current CC ESU boundary that ends at the Russian River. NMFS is currently considering extending the CC ESU boundary to include these fish (Williams *et al.* 2016).

2.3.2.3 San Francisco Bay Area

The San Francisco Bay Area encompasses the region between the Golden Gate Bridge and the confluence of the San Joaquin and Sacramento rivers. All of the watersheds in this area drain into San Francisco Bay, San Pablo Bay, or Suisun Bay at Chipps Island. Watersheds within this area are in portions of several counties: Marin, Sonoma, Napa, Solano, Contra Costa, Alameda, San Mateo, and San Francisco. This area contains four HUC-8s (4th field HUCs): San Pablo Bay, Suisun Bay, San Francisco Bay, and Coyote. Anthropogenic factors affecting listed salmonids in these HUCs are related primarily to urbanization, though agriculture is another prevalent land use in the San Pablo Bay and Suisun HUCs. Urban development is extensive within this area and has negatively affected the quality and quantity of salmonid habitat. Human population within the San Francisco Bay Area is approximately six million, representing the fourth most populous metropolitan area in the United States, and continued growth is expected (www.census.gov). In the past 150 years, the diking and filling of tidal marshes has decreased the surface area of the greater San Francisco Bay by 37 percent. More than 500,000 acres of the estuary's historic tidal wetlands have been converted for farm, salt pond, and urban uses (San Francisco Estuary Project 1992). These changes have diminished tidal marsh habitat, increased pollutant loadings to the estuary, and degraded shoreline habitat due to the installation of docks, shipping wharves, marinas, and miles of rock riprap for erosion protection. Most tributary streams have lost habitat through channelization, riparian vegetation removal, water development, and reduced water quality. Dams blocking anadromy are present on many streams and are used for water supply, aquifer recharge, or recreational activities. Streams have been affected by surface water diversion and groundwater withdrawal. Channelization for flood control, roadway construction, and commercial/residential development have further affected the quality and quantity of available salmonid habitat. Most watersheds within this area are listed under the 2012 Clean Water Act section 303(d) list of impaired water bodies for high levels of industrial pollutants (*e.g*., polychlorinated biphenyl, dichlorodiphenyltrichloroethane, furan compounds, *etc*.), reflecting the impacts of urban and industrial development (CSWRCB 2012). These human induced changes have substantially degraded natural productivity, biodiversity, and ecological integrity in streams throughout the area.

The area provides a critical link in the migratory pathway between the ocean and freshwater habitat in the Central Valley for three listed salmonid ESUs/DPSs: Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead. CCC steelhead occur in tributary streams around the Bay Area. CCC steelhead also utilize the bay for migration and possibly rearing.

2.3.2.3.1. San Pablo Bay Tributaries

This HUC contains all of the watersheds draining into San Pablo Bay located east of the Golden Gate Bridge, north of the San Francisco-Oakland Bay Bridge, and west of the Carquinez Bridge. This HUC contains several small to medium-sized watersheds within portions of six counties: Marin, Sonoma, Napa, Solano, Contra Costa, and San Francisco. Agriculture has been a significant land use within the San Pablo Bay HUC; historically orcharding, dairy, and grazing were the dominant agricultural activities, though more recently vineyard development has become common within the HUC. Agricultural practices have resulted in numerous small dams and water diversions that alter streamflows and water temperature conditions. In addition, agricultural practices have likely altered sedimentation rates of streams. Urbanization is the dominant land use throughout this HUC and has affected habitat through flood control activities, urban runoff, and water development. The following streams are included on the 2012 Clean Water Act section 303(d) list of impaired water bodies for high levels of Diazinon, which can likely be attributed to urban runoff; Arroyo Corte Madera del Presidio, Corte Madera Creek, Coyote Creek, Napa River, Novato Creek, Petaluma River, Pinole Creek, Rodeo Creek, San Antonio Creek, San Pablo Creek, Sonoma Creek, and Wildcat Creek (CSWRCB 2012). In addition, Napa River, Petaluma River, Sonoma Creek are included on the section 303(d) list for nutrients, pathogens, and sedimentation related to agriculture, land development, and urban runoff. The lower Petaluma River has exceeded the California Toxic Rule and National Toxic Rule criteria for nickel; potential sources of nickel are municipal point source, urban runoff, and atmospheric deposition.

Presently, CCC steelhead occur in Arroyo Corte Madera del Presidio, Corte Madera Creek, Napa River, Sonoma Creek, Petaluma River, Novato Creek, and Pinole Creek. Environmental conditions in the upper portions of Arroyo Corte Madera del Presidio, Corte Madera Creek, and Pinole Creek watersheds are protected in parks or open space preserves. Recent surveys confirm steelhead presence in tributaries of San Pablo Bay (*e.g*., Napa River and Petaluma River), but are insufficient to equivocally describe population trends or suggest a status change (Williams *et al.* 2016). Coho salmon are thought to be extirpated from San Pablo Bay tributaries (NMFS 2012).

2.3.2.3.2. Suisun Bay Tributaries

This HUC includes all of the watersheds draining into Suisun Bay located east of the Carquinez Bridge and west of the confluence of the San Joaquin and Sacramento rivers. This HUC contains several small to medium-sized watersheds within Solano and Contra Costa counties. Urbanization, farming, cattle grazing, and vineyard development have all contributed to habitat degradation in streams in the northern portion of the HUC. Urbanization and industrial development have contributed to habitat degradation in the southern portion of the HUC. Laurel Creek, Ledgewood Creek, Mt. Diablo Creek, Pine Creek, and Walnut Creek are included on the 2012 Clean Water Act section 303(d) list of impaired water bodies for high levels of Diazinon attributable to urban runoff (CSWRCB 2012).

Suisun Creek, Green Valley Creek, and an unnamed tributary to Cordelia Slough currently support small populations of CCC steelhead (Williams *et al.* 2016); these streams are all in Solano County. Streams flowing north from eastern Contra Costa County into south Suisun Bay are generally characterized by very dry summer conditions, and these streams do not currently support steelhead (Williams *et al.* 2016).

2.3.2.3.3 San Francisco Bay Tributaries

This HUC includes all of the watersheds draining into San Francisco Bay south of the San Francisco-Oakland Bay Bridge and north of the Dumbarton Bridge. This HUC contains several small to medium-sized watersheds within Alameda and Contra Costa counties and contains the largest watershed draining into San Francisco Bay - Alameda Creek. Urbanization and industrial development are the predominant land use throughout the HUC; most watersheds within the HUC have severely degraded habitat. The following streams are included on the 2012 Clean Water Act section 303(d) list of impaired water bodies for high levels of Diazinon attributable to urban runoff: Alameda Creek, Alamitos Creek, Arroyo de la Laguna, Arroyo del Valle, Arroyo las Positas, Arroyo Mocho, Miller Creek, San Leandro Creek, San Lorenzo Creek, and San Mateo Creek (CSWRCB 2012). Islais Creek and Mission Creek in San Francisco are particularly polluted, and both are included on the 2002 Clean Water Act section 303(d) list of impaired water bodies for factors related to industrial point sources and combined sewer overflow. These streams are included on the list because of high levels of ammonia, chlordane, Chlorpyrifos, chromium, copper, dieldren, endosulfan sulfate, hydrogen sulfide, lead, mercury, mirex, PAHs, PCBs, silver, and zinc (CSWRCB 2012). Alameda Creek, Mount Diablo Creek, San Leandro Creek, San Lorenzo Creek, and Walnut Creek historically supported steelhead, but access is currently blocked by dams, flood control facilities, or other barriers. Habitat conditions in the lower reaches of these streams are highly degraded by urbanization, but large portions of the upper watersheds located within public parkland are protected from anthropogenic pollution and are generally in relatively good condition. Currently, small populations of CCC steelhead are found in Cordinices Creek, San Leandro Creek, and San Lorenzo Creek below dams. Most other drainages that historically supported steelhead presently do not (Leidy *et al.* 2005).

2.3.2.3.4. South San Francisco Bay Tributaries

This HUC includes the watersheds draining into San Francisco Bay south of the Dumbarton Bridge. This HUC contains all of the watersheds within Santa Clara County, and a few small watersheds from San Mateo and Alameda counties. Coyote Creek is the largest watershed within the HUC. Urbanization and industrial development are the predominant land uses throughout the HUC and are the primary factors affecting aquatic habitat. The following streams from this HUC are included on the 2012 Clean Water Act section 303(d) list of impaired water bodies for high levels of Diazinon attributable to urban runoff: Calabazas Creek, Coyote Creek, Guadalupe Creek, Guadalupe River, Los Gatos Creek, Matadero Creek, San Felipe Creek, San Francisquito Creek, Saratoga Creek, and Stevens Creek (CSWRCB 2012). Calero Reservoir, Guadalupe Reservoir, and Guadalupe River are included on the section 303(d) list because of elevated levels of mercury associated with historic surface mining and associated tailings, and San Francisquito Creek is included because of excess sedimentation from nonpoint sources (CSWRCB 2012). Flood control and water development have degraded habitat throughout the HUC and numerous road crossings impair fish passage. In the Guadalupe River watershed, groundwater recharge operations release water imported from the Sacramento-San Joaquin Delta into local stream channels. On Coyote Creek, gravel mining has resulted in large in-channel pools that are populated with non-native predatory bass (*Micropterus* spp.).

Reduced numbers of CCC steelhead occur in a few watersheds of this HUC: Coyote Creek, Guadalupe River, San Francisquito Creek, and Stevens Creek. Anadromy is blocked in each watershed by water supply reservoirs; however, small populations of CCC steelhead continue to persist downstream. Built in 1890, Searsville Dam on San Francisquito Creek blocks access to a major portion of the upper watershed including a large tributary, Corte Madera Creek. Three San Francisquito Creek tributaries downstream of Searsville Dam, Los Trancos, West Union, and Bear creeks, all currently support steelhead populations. Unfortunately, no robust data sets exists within interior San Francisco Bay watersheds that would allow conclusions to be drawn regarding current population status or trends (Williams *et al.* 2016).

2.3.2.4. Central Coast Area

The Central Coast Area encompasses the coastal area from San Francisco County south along the California coast to the southern extent of San Luis Obispo County. This area includes the following seven counties: San Francisco, San Mateo, Santa Cruz, Santa Clara, Monterey, San Benito, and San Luis Obispo. Metropolitan areas within the Central Coast Area include San Francisco, Pacifica, Half Moon Bay, Santa Cruz, the Monterey Peninsula, Hollister, Gilroy, Salinas, and San Luis Obispo. The Central Coast Area includes watersheds that flow into the Pacific Ocean, which support the following three ESUs/DPSs: CCC coho salmon, CCC steelhead and S-CCC steelhead, and includes their designated critical habitats.

In general, available stream flow decreases from north to south within the Central Coast Area. In addition to highly urbanized areas, portions of the Central Coast Area are experiencing low density rural residential development. The majority of the Central Coast Area is privately owned, though there are portions under public ownership including Open Space in San Mateo County, State parklands in Santa Cruz County, and Federal lands in southern Monterey County.

The Central Coast Area contains eight HUC-8s (4th field HUCs): San Francisco Coastal South, San Lorenzo-Soquel, Pajaro, Alisal-Elkhorn Sloughs, Salinas, Estrella, Carmel, and Central Coastal. Anthropogenic factors affecting listed salmonids in these HUCs include dams constructed for water storage and aquifer recharge, summer dams constructed for recreational activities, urbanization, surface water diversion and groundwater withdrawal, in-channel sediment extraction, agriculture, flood control projects, and logging. It is unknown what surface water diversions are screened. Agriculture has had the greatest impact on the Pajaro and Salinas HUCs, while logging and urbanization have had the greatest impact on the San Lorenzo-Soquel HUC.

2.3.2.4.1. San Francisco Coastal South

This HUC contains all of the coastal watersheds from the Golden Gate Strait south to approximately the San Mateo/Santa Cruz county line. The watersheds within this HUC are wholly within San Mateo County. There are seven moderate-sized watersheds within the HUC: Pilarcitos Creek, Arroyo Leon, Purisima Creek, Tunitas Creek, San Gregorio Creek, San Pedro Creek, Pescadero Creek, and Butano Creek. There is limited urban development within this HUC; agriculture (*e.g.*, Brussels sprouts and cattle) is the dominant land use within all of the watersheds. There are several State Parks and Open Space areas within this HUC. Butano Creek, San Gregorio Creek, Pomponio Creek, and Pescadero Creek are included on the 2012 Clean Water Act section 303(d) list of water quality limited segments (CSWRCB 2012). The pollution factors for these streams are high coliform count and sedimentation/siltation. The potential sources of these pollutants are nonpoint sources.

This HUC is within the CCC coho salmon ESU and CCC steelhead DPS. Long-term data on the abundance of coho salmon in this HUC are limited. Historical records document the presence of coho salmon in Butano Creek, Pescadero Creek, and San Gregorio Creek, though coho salmon have not been found during recent stream surveys (NMFS 2001). Five or fewer juvenile coho salmon were observed in Peters Creek in 1999, but no juveniles were observed during surveys conducted in 2000 (NMFS 2001). Aside from artificial coho production supporting the Scott Creek population (and producing strays), the species appears extirpated, or nearly so, within other surrounding watersheds (Williams *et al.* 2016). Steelhead are widely distributed throughout this HUC. Steelhead were once abundant in the San Gregorio Creek watershed but are believed to be at critically low levels. Pescadero Creek likely supports the most viable steelhead population in this HUC (Titus *et al.* 2002). Recent population surveys suggest a few to several hundred adult steelhead return to the largest watersheds within this HUC (San Gregorio and Pescadero) (Williams *et al.* 2016).

2.3.2.4.2. San Lorenzo-Soquel

This HUC begins approximately at the San Mateo/Santa Cruz county line in the north, containing

Arroyo de los Frijoles in southern San Mateo County, south to and including Valencia Creek in Santa Cruz County. The HUC extends eastward to the Santa Cruz/Santa Clara county line. There are several moderate-sized streams within this HUC, including Gazos Creek, Carbonera Creek, Waddell Creek, Laguna Creek, Bear Creek, Bean Creek, Branciforte Creek, and Soquel Creek. The San Lorenzo River is the largest river in the HUC and the largest between the two closest major river systems - the Russian River in Sonoma County to the north and the Salinas River to the south. There is a fair amount of urban development within the HUC. Several State Parks (*e.g.*, Big Basin, Henry Cowell Redwoods, and The Forest of Nisene Marks) are located within this HUC. Forestry operations are conducted on private timberlands and State forest in this HUC, including Big Creek Lumber Company and the Soquel Demonstration State Forest, respectively.

Aptos Creek, Bean Creek, Bear Creek, Boulder Creek, Branciforte Creek, Carbonera Creek, East Branch Waddell Creek, Fall Creek, Kings Creek, San Lorenzo River, San Lorenzo River Lagoon, Soquel Lagoon, Valencia Creek, and Zayante Creek are included on the 2012 Clean Water Act section 303(d) list of water quality limited segments (CSWRCB 2012). The pollutants in these streams are varied, including, but not limited to, pathogens, nutrients, and sedimentation/siltation. The potential sources of these pollutants are also varied. Nonpoint source, urban runoff, and road construction are just a few of the potential sources.

This HUC is within the CCC coho salmon ESU, including designated critical habitat south to, and including, the San Lorenzo River and within the CCC steelhead DPS, including critical habitat south to, and including Aptos Creek. Long-term data on the abundance of coho salmon in this HUC are limited. Historical records document the presence of coho salmon in Waddell Creek, East Branch Waddell Creek, Scott Creek, Big Creek, San Vicente Creek, San Lorenzo River, Hare Creek, Soquel Creek, and Aptos Creek. A coho salmon captive broodstock program operates on Scott Creek at Kingfisher Flat Hatchery, one of two such broodstock programs within the CCC coho salmon ESU (the other is at Warm Springs Hatchery in the Russian River). Records of adult spawners and outmigrating smolts from Waddell Creek between 1932 and 1942 (Shapovalov and Taft 1954) constitute the only historical record of abundance in this HUC (NMFS 2001). The San Lorenzo River represents the southern extent of designated critical habitat for CCC coho salmon although they were historically documented at least as far south as Aptos Creek. Alteration of stream flow (due to in-channel stream flow diversions and pumping via wells for domestic use) and excessive sedimentation are two primary factors affecting CCC steelhead and CCC coho salmon critical habitat in the San Lorenzo River. Rearing juvenile coho salmon were observed in 2005 in the San Lorenzo River for the first time since 1982. Coho salmon are still found in Scott and Waddell Creeks and were rediscovered in San Vicente Creek in 2002 and observed for the first time in Laguna Creek in 2005. Steelhead are widely distributed throughout this HUC. Gazos, Waddell, and Scott Creeks are in relatively good condition, overall, for CCC steelhead.

2.3.2.4.3 Pajaro

This HUC is comprised of the Pajaro River and its tributaries and is located in portions of Santa Cruz, Santa Clara, Monterey, and San Benito counties. Moderate-sized tributaries to the Pajaro

River include Corralitos Creek, Uvas Creek, Llagas Creek, Pacheco Creek, and Santa Ana Creek. The San Benito River is also a tributary to the Pajaro River. This HUC encompasses several municipalities, including the cities of Watsonville, Gilroy, Morgan Hill, and Hollister. Agriculture is the dominant land use within all of the watersheds in this HUC. Clear Creek, Corralitos Creek, Hernandez Reservoir, Llagas Creek, Tequisquita Slough, and Watsonville Slough are included on the 2012 Clean Water Act section 303(d) list of water quality limited segments (CSWRCB 2012). The pollutants in these streams are varied, including, but not limited to, mercury, fecal coliform, and sedimentation/siltation. The potential sources of these pollutants are also varied. Nonpoint source, resource extraction (*e.g.*, via in-channel gravel mining), and pasture grazing are just a few of the potential sources. The Pajaro River is also included on the 2012 Clean Water Act section 303(d) list of water quality limited segments (CSWRCB 2012). The Pajaro River contains the following pollutants: fecal coliform, nutrients, and sedimentation/siltation. Agriculture and pasture grazing are two potential sources of the pollutants.

The Pajaro HUC is within the S-CCC steelhead DPS and designated critical habitat. The distribution and abundance of steelhead within this HUC are significantly reduced. The majority of the streams where steelhead are known to be present, are located in the northwest portion of the HUC (*e.g.*, Uvas, Llagas, Corralitos, and Pachecho creeks). The mainstem Pajaro River once contained suitable spawning and rearing habitat for S-CCC steelhead, but currently functions solely as a migratory corridor because of impacts from flood control projects, agriculture, and water withdrawals for agricultural use.

The San Benito River has been adversely impacted by water withdrawals for agricultural use and in-channel sediment extraction. Steelhead have not been documented in the San Benito River since the mid-1990s, although no formal surveys have been undertaken. However, *O. mykiss* were documented in Bird Creek (San Benito River tributary) adjacent to Hollister Hills State Park in 2003. The San Benito River is also on the 2012 Clean Water Act section 303(d) list of water quality limited segments (CSWRCB 2012) due to fecal coliform and sedimentation/ siltation. The source of fecal coliform is unknown; agriculture, resource extraction, and nonpoint source have been identified as potential sources of this pollutant.

2.3.2.4.4. Alisal-Elkhorn Sloughs

The Alisal-Elkhorn Slough HUC encompasses watersheds between the Pajaro and Salinas rivers. This HUC has little permanent flowing water. S-CCC steelhead have been observed in the headwaters of Gabilan Creek, which contains the best freshwater habitat remaining in the HUC. The HUC features mixed oak woodlands and grasslands on rolling hills overlooking tidal salt marsh. Elkhorn Slough is a principal wetland complex in central California, and is considered one of the most ecologically important estuaries in the state and is part of the National Estuarine Research Reserve System. Land use within this HUC is primarily agriculture, though there is some urban/rural development present. Habitat within the HUC has been degraded. Portions of both nominal watersheds within this HUC are included on the 2002 Clean Water Act section 303(d) list of water quality limited segments (CSWRCB 2012). Alisal Slough and Gabilan Creek are included for high levels of fecal coliform and nitrates attributable to agriculture, urban runoff, natural sources, nonpoint sources, and unknown sources. Elkhorn Slough has high levels of pathogens, pesticides, and sedimentation from agricultural and nonpoint sources.

2.3.2.4.5. Salinas

The Salinas HUC is the largest in the Central Coast Area and contains the largest individual watershed within the Central Coast Area, the Salinas River. This HUC lies within interior Monterey and San Luis Obispo counties, as well as a portion of San Benito County. In addition to the Salinas River, there are three other large rivers in this HUC: the Arroyo Seco River, the San Antonio River, and the Nacimiento River. There are isolated areas of urban development, including Salinas, King City, and Paso Robles. Outside of these urban developments, agriculture is the dominant land use. Portions of the Los Padres National Forest, Ventana Wilderness, Fort Hunter Liggett, and Camp Roberts Military Reservation lie within this HUC. Several water bodies, including, but not limited to, Atascadero Creek, Blanco Drain, Cholame Creek, and the Nacimiento Reservoir, are on the 2012 Clean Water Act section 303(d) list of water quality limited segments (CSWRCB 2012) due to a variety of pollutants from several sources. The Salinas River is also on the 2012 Clean Water Act section 303(d) list of water quality limited segments (CSWRCB 2012) due to fecal coliform, nutrients, pesticides, chloride, and other pollutants derived from a variety of sources, principally agriculture.

The Salinas HUC is within the S-CCC steelhead DPS. The distribution and abundance of steelhead within the HUC are greatly reduced. The Salinas River is used as a migration corridor by S-CCC steelhead. Two of the largest tributaries, the San Antonio and Nacimiento rivers, have been dammed, eliminating steelhead access to valuable spawning and rearing habitat and severely modifying stream flow. These dams, along with an additional dam on the upper mainstem, in-channel sediment extraction, channel modification, and water withdrawals for agricultural use, have significantly affected the Salinas River. The Arroyo Seco River contains the best spawning and rearing habitat for S-CCC steelhead in this HUC. A number of partial passage barriers affect steelhead access to habitat.

2.3.2.4.6 Estrella

This HUC is comprised of the Estrella River and its tributaries. Streams within the HUC include Little Chalome Creek, Cholame Creek, Navajo Creek, Sixteen Spring, and San Juan Creek. Only one creek in this HUC, Cholame Creek, is listed on the 2002 Clean Water Act section 303(d) list of water quality limited segments. Cholame Creek is listed as impaired for boron and fecal coliform (CSWRCB 2012). S-CCC steelhead use of this HUC is believed to be extremely limited due to infrequent and inadequate winter flow regimes in the HUC and the mainstem Salinas River. Critical habitat of S-CCC steelhead was not designated for the Estrella River HUC. Historic occurrences of steelhead have been documented, but it is unknown if steelhead persist in this HUC.

2.3.2.4.7. Carmel

This HUC is comprised of the Carmel River and its tributaries. Moderate-sized streams within the HUC include Las Gazas Creek, Chupines Creek, and Tularcitos Creek. None of the streams within this HUC is on the 2012 Clean Water Act section 303(d) list of water quality limited segments. There is urban development within the Monterey Peninsula and limited rural residential development elsewhere. Portions of the Los Padres National Forest lie within this HUC. The Carmel River presently maintains the largest adult run of steelhead in the S-CCC DPS (Titus *et al.* 2002) and is designated critical habitat. Impacts to S-CCC steelhead include three dams on the mainstem that hinder migration, water withdrawals for domestic use, agricultural, and golf course use, and channel modifications for flood control purposes.

2.3.2.4.8. Central Coastal

This long and narrow HUC contains all of the coastal watersheds from San Jose Creek near Point Lobos State Reserve in Monterey County down to the San Luis Obispo/Monterey County border. Most of the streams in this HUC are short-run and high-gradient, draining directly to the Pacific Ocean. Moderate-sized streams within this HUC include the Little Sur River and the Big Sur River. This HUC is within the S-CCC steelhead DPS and is designated critical habitat. This Central Coastal HUC has experienced the least amount of adverse impacts within the Central Coast Area. The Little Sur River is recognized as the most productive steelhead river (per stream mile) south of San Francisco Bay at this time (Titus *et al.* 2002). The Big Sur River is in relatively good condition as well, but anadromy is limited due to natural barriers.

2.4 Effects of the Action

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

The goal of the recovery plans for the listed salmonids is for ESUs and DPSs to eventually reach a low risk of extinction. In order to achieve this, all population groups (also called diversity strata) that make up the ESU or DPS must be at low risk of extinction. In order for population groups to be at low risk of extinction, the populations within them must achieve their extinction risk goals. If the effects to individual populations are large enough, those populations could suffer an increased extinction risk, which would negatively affect achievement of the target extinction risks for their diversity strata and their ESUs or DPS.

In-water project activities will occur during the summer low-flow period (June 15 – November 1, or the first rainfall), after most or all smolts have left streams and rivers but before most adults return. YOY and 1+ coho salmon, YOY Chinook salmon, and YOY and several age classes of steelhead are the life stages that are most likely to be present at Project sites. Adult Summer run steelhead who rear in deep pools during the summer months, as well as early migrating adult fall

Chinook salmon, may also be present in low numbers in the downstream portions of the action area. Project activities that may adversely affect these species or their designated critical habitats include fish relocation, stream dewatering, increased mobilization of sediment, removal of riparian vegetation, and chemical contamination. Dewatering and fish relocation activities will directly affect listed salmonids because a small percentage of individuals may be injured or killed by the activity. The effects from increased sediment mobilization into streams and riparian alteration are usually indirect effects, where habitat impacts may affect individual listed species after the project is implemented.

2.4.1. Insignificant and Discountable Effects

Although project types listed above have select projects that may adversely affect listed species; these project types may also have select projects that produce effects that are not likely to adversely affect listed species or their critical habitats. This section will focus on only the subset of projects where the effects are expected to be insignificant or discountable as explained further below.

2.4.1.1. Noise, Motion, and Vibration Disturbance from Heavy Equipment Operation

Noise, motion, and vibration produced by heavy equipment operation is expected at most instream restoration sites. However, equipment will be used primarily outside the active channel. In addition, the minimum distance between instream project sites and the maximum number of instream projects covered by the RGP would effectively limit potential aggregated effects of heavy equipment disturbance on listed salmonids. Because of the program sideboards, limited heavy equipment use in the wetted channel, and low levels of acoustic impacts caused by projects, the noise, motion, and vibration and disturbance are expected to cause insignificant effects to listed species and their critical habitat.

2.4.1.2 Disturbance to Riparian Vegetation

Most proposed fisheries restoration actions (other than those targeted at riparian habitat improvement) are expected to avoid disturbing riparian vegetation by using the proposed minimization measures (Section 1.3.2.2). In general, the restorative nature of the FRGP projects is to improve habitat conditions for salmonids, and thus, riparian vegetation damage is expected to be avoided, as best possible. However, there may be limited situations where avoidance is not possible.

In the rare event that streamside riparian vegetation must be removed as part of a larger restoration project (e.g., shrub removed to create access to place large wood structure), NMFS expects the loss of riparian vegetation to be small, and limited to mostly shrubs and an occasional tree. As much understory brush and as many trees as feasible will be retained, emphasizing shade producing and bank-stabilizing vegetation. The riparian vegetation types most likely to be affected are willows and other shrubs, which generally reestablish quickly (usually within one season). In addition, NMFS expects the revegetation of disturbed riparian areas (and planting ratio of two new plants for each plant removed) to further minimize the small, temporary loss of vegetation. Therefore, NMFS anticipates the incidental, temporary loss of riparian vegetation to cause only insignificant effects to individuals and critical habitat.

2.4.1.3 Chemical Contamination from Equipment Fluids

Equipment refueling, fluid leakage, and maintenance activities within and near the stream channel pose some risk of contamination and potential effects to individuals and their critical habitats. In addition to toxic chemicals associated with construction equipment, water that is exposed to wet cement during construction of a restoration project can also adversely affect water quality and cause harm and potential take of listed salmonids. However, all fisheries restoration projects will include the measures outlined Flosi *et al.* (2010) (and described in Section 1.3.2.2), which address and minimize pollution risk from equipment operation and cement construction. Therefore, water quality degradation from toxic chemicals associated with project construction is expected to be insignificant.

2.4.1.4 Streamflow Augmentation

Leasing water and implementing water conservation measures will wholly benefit listed salmonids by keeping flow in the stream where salmonids can continue to rear and migrate. Increasing instream flow levels by diminishing out-of-channel diversions will enhance juvenile salmonid access to suitable rearing and spawning habitat, especially during the summer and early fall when flows are lowest. Installing water measuring devices will likely result in discountable effects to listed species because these activities typically occur in diversion ditches where increased mobilization of sediment is unlikely to reach the stream channel.

2.4.1.5 Riparian Habitat Restoration

Riparian habitat restoration techniques and associated mitigation measures (mitigation measures can be found in Section 1.3.2.2), as outlined within the Restoration Manual (Flosi *et al.* 2010) and in CDFW (2015a), are not likely to adversely affect listed salmonids or their habitat. Riparian restoration may involve ground disturbance adjacent to streams, especially when creating holes to place plants and when removing exotic plants. This disturbance could lead to decreased root strength of remaining plants, reduced soil cohesion, and sediment delivery to streams. However, NMFS expects the magnitude and intensity of this ground disturbance to be small, isolated to the riparian area, and temporary. Where exotic plants are removed, they will be replaced with native plants, which are expected to improve soil cohesion, re-establish root strength, and stabilize exposed sediment as they become established. Because the majority of work will occur during the summer growing season (a few container plants require winter planting), riparian plantings should be sufficiently established to anchor the restoration worksite and minimize the detrimental effects described above prior to the following winter storm season. Every plant removed will be replaced with two new plants, improving the success of revegetation efforts. In addition, all vegetation planting will likely occur on stream banks and floodplains adjacent to the wetted channel and not in flowing water (which would disturb more sediment and immediately introduce it to the stream), and sediment delivery to waterways from plantings on non-submerged soil will be minimized by use of such erosion-control materials as erosion matting and straw baffles. The detrimental effects of riparian restoration are therefore expected to be insignificant.

The long-term benefit from riparian restoration will be the establishment of a vibrant, functional riparian corridor providing juvenile and adult fish with abundant food and cover. By restoring degraded riparian systems throughout the state, listed salmonids will be more likely to survive and recover in the future. Riparian restoration projects will increase stream shading and instream cover habitat for rearing juveniles, moderate stream temperatures, and improve water quality through pollutant filtering. Beneficial effects of constructing livestock exclusionary fencing in or near streams include the rapid regrowth of grasses, shrubs, and other vegetation released from overgrazing, and reduced nitrogen, phosphorous, and sediment loading into the stream environment (Line *et al.* 2000, Brenner and Brenner 1998). Further, Owens *et al.* (1996) found that stream fencing has proven to be an effective means of maintaining appropriate levels of sediment in the streambed. Another documented, beneficial, long-term effect is the reduction in bank full width of the active channel and the subsequent increase in pool area in streams (Magilligan and McDowell 1997).

2.4.1.6 Crowding at relocation sites

In some instances, relocated fish may endure short-term stress from crowding at relocation sites. Relocated fish may also have to compete with other salmonids for available resources such as food and habitat. However, most relocated fish will likely choose not to remain in the relocation sites and will move either upstream or downstream as soon as possible to areas that have either more habitat or lower fish densities. The effects of competition are expected to quickly diminish as fish disperse. Therefore, the effect of increased competition after fish relocation is expected to be insignificant.

2.4.2 Adverse Effects

2.4.2.1 Dewatering and Fish Relocation

2.4.2.1.1 Effects to fishes

Based on monitoring data since 2004, up to 24 percent of FRGP restoration projects implemented each year in the action area required dewatering (Table 7). The dewatering process includes: placing temporary barriers, such as a cofferdam, to hydrologically isolate the work area; re-routing streamflow around the dewatered area; pumping water out of the isolated work area; relocating fish from the work area (discussed separately); and restoring flow to the project site upon project completion. The maximum length of contiguous stream reach that will be dewatered for any one project is 500 feet.

Table 7. Number and percentage of FRGP projects that required dewatering each year (CDFG 2014, 2013, 2012, 2011, 2010, 2009; Collins 2005).

Year	# Dewatering Sites*	# Ongoing or Completed Projects	Percentage of Projects that Involved Dewatering
2004	19	143	13
2005	25	149	17
2006	19	136	14
2007	19	147	13
2008	17	120	14
2009	8	101	8
2010	10	223	4
2011	24	118	20
2012	20	102	20
2013	13	86	15
2014	19	79	24
* Based on number of fish relocation sites			

Because the proposed dewatering and relocation will occur during the summer low flow period, the species and life stages most likely to be exposed to potential effects of dewatering are juvenile coho salmon and juvenile steelhead. Few juvenile Chinook salmon are expected to be in the action area at that time because instream activities will occur after most have migrated to the ocean. A small number of juvenile Chinook salmon, especially with a "stream-type" life history strategy, as well as adult summer steelhead and half-pounder steelhead, may be exposed where these individuals are present at or near the proposed project sites, although past relocation results suggest the chances of encountering these species and life stages are very low (California Department of Fish and Game (CDFG) 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012 and CDFW 2013, 2014, and 2015b). No adult or half-pounder steelhead have been found during past FRGP dewatering, although one adult Chinook salmon was found in a dewatered area permitted under a previous RGP, but the Chinook salmon was outside of the range of the CC Chinook salmon ESU (CDFG 2009). Dewatering is expected to occur mostly during the first half of the instream construction window (*e.g.*, to accommodate for the necessary construction time needed), and therefore should avoid impacting adult Chinook and coho salmon that typically enter streams following heavy rains in October/November.

Juvenile coho salmon, steelhead, and to a much lesser extent, Chinook salmon (due to the timing of Chinook salmon juvenile occurrence), could be killed or injured if crushed during placement of the temporary barriers, such as cofferdams, though direct mortality is expected to be minimal because most juveniles will avoid the barrier-construction area. Stream flow diversions could harm salmonids by concentrating or stranding them in residual wetted areas (Cushman 1985) before they are relocated, or causing them to move to adjacent areas of poor habitat (Clothier 1953, Clothier 1954, Kraft 1972, Campbell and Scott 1984). Salmonids that are not caught during the relocation efforts would be killed from either construction activities or desiccation. These fish would likely be juveniles because adults, given their size, are unlikely to be missed during sampling efforts.

The number of fish lost to dewatering activities is difficult to predict, because observing and documenting "left behind" fish is problematic (*i.e.*, fish not captured are often hidden from sight, or are preyed upon before being noticed). NMFS expects that the number of coho salmon, Chinook salmon, or steelhead killed as a result of crushing (when barriers are placed) or desiccation during site dewatering activities is very low, based upon the low percentage of projects that require dewatering (*i.e.*, generally up to 25 percent of projects), efforts to capture the fish before dewatering, the small area affected during dewatering at each site, and the low number of juveniles typically found in degraded habitat conditions common to proposed restoration sites. Given the required expertise of fish relocation biologists working on FRGP projects, NMFS expects that the percentage of fish missed by the biologists that will later die from crushing or desiccation will be no more than 1 percent of those fish captured at any given Project site. Utilizing past RGP12 sampling data to inform a "worst case" estimation of fish lost due to dewatering at the ESU/DPS scale, NMFS applied the 1percent loss to the highest capture amount for each salmon ESU and steelhead DPS (see Table 8).

All project sites that require dewatering will include efforts to relocate fish. CDFW personnel (or designated agents) will capture and relocate fish (and amphibians) away from the work site of the restoration project. Fish within the immediate project area will be captured by seine, dip net, and/or electrofishing. Captured fish will be transported to a suitable instream location and released there. Fish relocation activities may injure or kill rearing juvenile coho salmon and steelhead because these individuals are most likely to be present in the project sites. Any fish collecting gear, whether passive or active (Hayes 1983) has some associated risk to fish, including stress, disease transmission, injury, or death. The amount of unintentional injury and mortality attributable to fish capture varies widely depending on the method used, the ambient conditions, and the expertise and experience of the field crew. The effects of seining and dip netting on juvenile salmonids include stress, scale loss, physical damage, suffocation, and desiccation. Electrofishing can kill juvenile salmonids, and researchers have found serious sublethal effects, including spinal injuries (Reynolds 1983, Habera *et al.* 1996, Nielsen 1998, Habera *et al.* 1999, Nordwall 1999, Snyder 2003). However, the effects of electrofishing are expected to be low because CDFW personnel or their designated agents will capture the fish following NMFS (NMFS 2000) and CDFW (Flosi *et al.* 2010) electrofishing guidelines. Data on fish relocation activities associated with habitat restoration projects since 2004 show that average mortality rates are predominantly below 3 percent for salmonids (Collins 2004, NOAA Restoration Center 2012).[8] NMFS expects that fish loss due to relocation efforts will be very small, no more than 3 percent of those fish captured at any given Project site. To inform a "worst case" estimate of fish that may be lost at the ESU/DPS scale, NMFS utilized past RGP12 sampling data and applied the 3 percent loss to the highest annual capture amounts documented for each salmon ESU and steelhead DPS during the past 11 years (see Table 8).

[8] Since 2004, a maximum of 15 ESA-listed juvenile steelhead have been injured and 26 killed annually. Likewise, the maximum number of juvenile coho salmon injured or killed each year from all fish relocation activities associated with RGP 12 restoration projects was 3 and 11, respectively.

Table 8: Estimated maximum past injury or death of juveniles per ESU or DPS resulting from projects authorized under RGP12 in the years between 2005 and 2015, based on observed capture numbers and estimated mortality rates resulting from dewatering and relocation.

	Number Collected					
	Coho Salmon		**Chinook salmon**	**Steelhead**		
Year	SONCC	CCC	CC	NC	CCC	S-CCC
2005	344	46	0	590	817	0
2006	185	65	3	2269	14	0
2007	267	0	18	5887	0	0
2008	267	0	0	5559	0	0
2009	1	0	0	14	1	0
2010	3	0	0	13	2	0
2011	445	107	0	1488	625	0
2012	1088	200	0	2232	411	0
2013	3	1	2	11	5	0
2014	4	5	0	17	5	0
2015	0	274	0	54	243	0
Maximum No. Juveniles Captured in Any Year	1088	274	18	5887	817	0[9]
1 Percent Mortality (Dewatering)	11	3	1	59	8	0
3 Percent Mortality (Relocation)	33	9	1	177	25	0

Once juveniles enter the ocean, marine survival is generally low. For example, in Freshwater Creek, a tributary to Humboldt Bay, the smolt to adult return estimates were all less than 5 percent from 2006 to 2013 and were as low as 0.7 percent (Anderson *et al.* 2015). Assuming marine survival of 5 percent, the number of adult equivalents that would have resulted from the maximum number of juvenile fish killed in any year is low: two SONCC coho salmon adults, one CCC coho salmon adult, no CC Chinook salmon adults, twelve NC steelhead adults, two CCC steelhead adults, and no S-CCC steelhead adults. Given that all of these numbers are for entire ESUs or DPSs, not all of these adults within an ESU or DPS would have come from one watershed; rather, they would have been spread across the populations that make up each ESU or DPS, minimizing the impact to any particular population.

[9] As no S-CCC steelhead were relocated from 2005 to 2015, likely reflecting the relative scarcity of this species, there was no impact of relocation on this DPS.

In summary, fish relocation activities are anticipated to only affect a small number of rearing juvenile coho salmon and/or steelhead within a small project reach at and near each affected restoration project site and relocation release site(s). Rearing juvenile coho salmon and/or steelhead present in the immediate project work area will be subject to disturbance, capture, relocation, and related short-term effects. Most of the take associated with fish relocation activities is anticipated to be non-lethal; however, a very low number of rearing juvenile (mostly YOY) coho salmon and/or steelhead captured may become injured or die. Due to low marine survival rates, the number of adult equivalents that would have resulted from these juveniles is low.

2.4.2.1.2 Effects to critical habitat

Benthic (*i.e.*, bottom dwelling) aquatic macroinvertebrates may be temporarily lost or their abundance reduced when stream habitat is dewatered (Cushman 1985). Effects to aquatic macroinvertebrates resulting from stream flow diversions and dewatering will be minor due to the relatively small section of stream dewatered (less than 500 feet) and the expected rapid recolonization (about one to two months) of disturbed areas by macroinvertebrates following reintroduction of water (Cushman 1985, Thomas 1985, Harvey 1986). Macroinvertebrate production upstream and downstream of the dewatered area will likely be unaffected. Based on the foregoing, the loss of aquatic macroinvertebrates and short-term loss of dewatered habitat resulting from dewatering activities is expected to be insignificant. Ephemeral and smaller intermittent drainages will likely be dry at the time of work and so will not be dewatered.

2.4.2.2 Increased Mobilization of Sediment within the Stream Channel

2.4.2.2.1 Effects to fishes

Instream habitat restoration, road decommissioning, streambank stabilization, and fish passage improvement projects involve various degrees of earth disturbance, and inherent with earth disturbance is the potential to increase background instream suspended sediment loads for a short period during and following project completion. In general, sediment-related impacts are expected during the summer construction season (June 15-November 1), as well as during the initial peak-flow winter storm event that mobilizes project-related sediment. During summer construction, the species and life stages most likely to be exposed to potential effects of increased sediment mobilization are juvenile coho salmon and juvenile steelhead. Adult Chinook salmon, coho salmon, and steelhead may also be exposed to increased turbidity once sediment is mobilized by initial high winter flows. Increased mobilization of sediment into streams and increased turbidity at the project site are expected to extend up to 1,500 feet downstream.

Sediment may affect salmonids in several ways. High concentrations of suspended sediment can disrupt normal feeding behavior and efficiency (Cordone and Kelly 1961, Bjorn *et al*. 1977, Berg and Northcote 1985), reduce growth rates (Crouse *et al*. 1981), and increase plasma cortisol levels (Servizi and Martens 1992). High turbidity concentrations can lower dissolved oxygen in the water column, reduce respiratory function, lower disease resistance, and even cause fish mortality (Sigler *et al.* 1984, Berg and Northcote 1985, Gregory and Northcote 1993, Velagic 1995, Waters 1995). Even small pulses of turbid water may cause salmonids to disperse from established territories (Waters 1995), which can displace fish into less suitable habitat and/or increase competition and predation, thus decreasing survival. In addition, increased sediment deposition can fill pools and reduce the amount of cover available to fish, decreasing the survival of juvenile salmonids (Alexander and Hansen 1986).

Most of the research discussed above focused on turbidity levels significantly higher than the levels likely to result from the proposed restoration activities, especially with implementation of the proposed minimization measures (Section 1.3.2.2). The lower concentrations of sediment and turbidity expected from the proposed restoration activities are unlikely to be severe enough to cause injury or death of listed juvenile coho salmon and/or steelhead. Instead, the anticipated low levels of turbidity and suspended sediment resulting from instream restoration projects will likely result in only temporary behavioral effects. Past monitoring of newly replaced culverts[10] within the action area detailed a range in turbidity changes downstream of newly replaced culverts following winter storm events (Humboldt County 2002, 2003 and 2004). During the first winter following construction, the intensity of turbidity downstream of newly replaced culverts increased an average of 19 percent when compared to measurements directly above the culvert. However, the range of increases within the eleven monitored culverts was large (n=11; range 123 percent to -21 percent). Monitoring results from one and two year-old culverts were much less variable (n=11; range: 12 percent to -9 percent), with an average increase in downstream turbidity of 1 percent. Although the culvert monitoring results show decreasing sediment effects as projects age from year one to year three, a more important consideration is that most measurements fell within levels that were likely to only cause slight behavioral changes *[e.g.*, increased gill flaring (Berg and Northcote 1985), elevated cough frequency (Servizi and Martens 1992), and avoidance behavior (Sigler *et al.* 1984)]. Turbidity levels necessary to impair feeding are likely in the 100-150 NTU range (Harvey and White 2008, Gregory and Northcote 1993). However, only one of the Humboldt County measurements exceeded 100 NTU (NF Anker Creek, year one), whereas the majority (81 percent) of downstream readings were less than 20 NTU. Importantly, proposed minimization measures (Section 1.3.2.2), some of which were not included in the culvert work analyzed by Humboldt County (2002, 2003, 2004), will likely ensure that future sediment effects from fish passage projects will be less than those discussed above. Therefore, the small pulses of moderately turbid water expected from the proposed instream restoration projects will likely cause only temporary, minor physiological and behavioral effects, such as dispersing salmonids from established territories, and potentially increasing interspecific and intraspecific competition, as well as temporarily increasing predation risk for the small number of affected juveniles.

[10]When compared to other instream restoration projects (*e.g.*, bank stabilization, instream structure placement, etc.), the mobilization of the upstream sediment wedge during the winter following construction likely represents the largest sediment release associated with the proposed action. Thus, we have chosen to focus on this aspect as a "worst case" scenario when analyzing potential sediment effects from instream projects.

2.4.2.2.2 Effects to critical habitat

Once suspended sediment settles out of the water column and deposits on the streambed, it may degrade instream habitat quality and diversity. Increased sediment loads can dramatically alter channel morphology. Pools may fill, channels may widen (Lisle 1982), riparian vegetation may become buried, streambank heights may increase, and floodplain and flood prone areas may become disconnected (Kelsey 1980, Lisle 1982, Roberts and Church 1986). These alterations in geomorphology (*i.e.,* excess sediment buildup, changes in proportion of fines) can increase the frequency and magnitude of localized flood events. It may take decades before channels impacted by large aggradation events can fully recover (Madej *et al.* 2009). Lowland river systems are particularly susceptible to the effects of excess sedimentation owing to their low energy and limited ability to recover to their natural form (Kemp *et al.* 2011). In spawning gravels, deposited fine sediment fills interstitial spaces between particles, reducing intergravel flow and inhibiting alevin movement, thereby decreasing survival rates (Kondolf 2000 and Greig *et al.* 2005). Excess fine sediment smothers habitat used by benthic organisms, decreasing the production of algae and macroinvertebrates that are an important food source for fry, juveniles, and smolts (Suttle *et al.* 2004, Cover *et al.* 2008). It can also decrease habitat availability and cover thereby increasing predation risks. However, streams subject to infrequent episodes adding small volumes of sediment to the channel may not experience dramatic morphological changes (Rogers 2000).

Suspended sediment levels, and by extension sediment deposition levels, that result from the proposed action will likely be much less severe than those evaluated in the scientific literature. The effects of mobilized sediment are expected to be relatively minor and spatially isolated due to the relatively small volume of sediment released and the minimization measures (Section 1.3.2.2) and sideboards that will be followed. For example, projects to improve fish passage require removal of at least 80 percent of the upstream sediment wedge, keeping this sediment from waterways. For restoration actions located in upslope or riparian areas, sediment mobilization will be minimized through road outsloping, reseeding and mulching disturbed areas, and other erosion control measures. These erosion control measures are expected to prevent a majority of the sediment from reaching fish bearing streams.

NMFS does not expect sediment effects to accumulate downstream of restoration sites within a given watershed. Studies of sediment effects from culvert construction determined that the level of sediment accumulation within the streambed returned to control levels between 358 to 1,442 meters downstream of the culvert (LaChance *et al.* 2008). Due to the proposed sediment minimization measures (Section 1.3.2.2), downstream sediment effects from the proposed restoration projects are expected to extend downstream for a distance consistent with the low end of the range presented by LaChance *et al.* (2008). The planned 1,500-foot buffer between instream projects (which also describes how far the sediment effects are expected to extend downstream) is likely large enough to preclude sediment effects from accumulating at downstream project sites, and is the buffer recommended by LaChance *et al.* (2008). Furthermore, the temporal and spatial scale at which project activities are expected to occur will also likely preclude additive sediment-related effects. Assuming projects will be funded and implemented similar to the past several years, NMFS expects that individual restoration projects sites will occur over a broad spatial scale each year. In other words, the occurrence of restoration projects in close proximity to each other during a given restoration season is unlikely, thus diminishing the chance that project effects would combine. Finally, effects to instream habitat and fish are expected to be short-term, because most project-related sediment will mobilize during the initial high-flow event the following winter season. Subsequent sediment mobilization may occur following the next two winter seasons, but generally should subside to baseline conditions by the third year as found in other studies, such as Klein *et al.* 2006 and the Humboldt County data (Humboldt County 2004).

2.5 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.

Listed salmonid species may be affected by numerous future non-federal activities, such as timber harvest, road construction, residential development, and agriculture, which are described in the *Environmental Baseline* section. A search of upcoming timber harvest plans on the CalFire website (http://www.fire.ca.gov/ResourceManagement/THPStatusUpload/THPStatusTable.html) confirms that timber harvesting will likely continue for up to seven years. NMFS assumes these activities, and similar resultant effects, on listed salmonid species will continue through the five-year period of this opinion.

Marijuana cultivation occurs throughout many of the watersheds in the action area, and diverts water from rivers and tributaries, introduces chemicals and waste into the environment, damages stream channels (*e.g.*, streambank and channel alterations), potentially increases stream temperatures, and disturbs soil and forest resources (Bauer *et al.* 2015). Such impacts will likely result in sediment delivery to streams (Bauer *et al.* 2015).

Habitat restoration actions carried out by state or private entities without Federal involvement are expected to have similar impacts to those described in this opinion, and would contribute to cumulative sediment impacts.

The sideboards on the total number of sediment-producing projects per watershed are conservative in recognition of the potential of the additive effects of these sediment-producing activities.

2.6 Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 2.4) to the environmental baseline (Section 2.3) and the cumulative effects (Section 2.5), taking into account the status of the species and critical habitat (section 2.2), to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) reduce the value of designated or proposed critical habitat for the conservation of the species.

2.6.1 Listed Species

2.6.1.1 Coho Salmon

Coho salmon populations throughout the action area have shown a dramatic decrease in both numbers and distribution; SONCC coho salmon and CCC coho salmon do not occupy many of the streams where they occurred historically. Although SONCC coho salmon within the action area are relatively more abundant and better distributed than CCC coho salmon, both the presence-absence and trend data available suggest that many SONCC coho salmon populations in the larger basins (*e.g.*, Eel and Klamath) continue to decline. Available information suggests that CCC coho salmon abundance is very low, the ESU is not able to produce enough offspring to maintain itself (population growth rates are negative), and populations have experienced range constriction, fragmentation, and a loss genetic diversity. Many subpopulations that may have acted to support the species' overall numbers and geographic distribution have likely been extirpated (*i.e.* San Francisco Bay Area, Napa HUCs). The poor condition of their habitat in many areas and the compromised genetic integrity of some stocks pose a serious risk to the survival and recovery of SONCC coho salmon and CCC coho salmon. Based on the above information, recent status reviews have concluded that SONCC coho salmon are likely to become endangered in the foreseeable future, and CCC coho salmon are presently in danger of extinction, therefore the likelihood of both survival and recovery are reduced compared to an ESU at low risk of extinction..

2.6.1.2 Steelhead

Steelhead populations throughout central and northern California have also decreased in abundance, but are still widely distributed in most coastal areas of their DPS. However, S-CCC steelhead are not evenly distributed throughout the DPS. Distribution of S-CCC steelhead within many watersheds across the DPS is very patchy, with better distribution in the coastal basins (*e.g.*, Carmel and Central Coast HUCs) and poor distribution in the interior basins (*e.g.*, Pajaro and Salinas River HUCs). Although NC steelhead, CCC steelhead, and S-CCC steelhead have experienced significant declines in abundance, and long-term population trends suggest a negative growth rate, they have maintained a better distribution overall when compared to coho salmon ESUs. This suggests that, while there are significant threats to the population, they possess a resilience (based in part, on a more flexible life history) that likely slows their decline. However, the poor condition of their habitat in many areas and the compromised genetic integrity of some stocks pose a risk to the survival and recovery of NC steelhead, CCC steelhead, and S-CCC steelhead. Based on the above information, recent status reviews and available information indicate NC steelhead, CCC steelhead, and S-CCC steelhead are likely to become endangered in the foreseeable future. Therefore, the likelihood of both survival and recovery are reduced compared to an ESU at low risk of extinction..

2.6.1.3 Chinook Salmon

The most recent Chinook salmon status review found continued evidence of low population sizes relative to historical abundance. Although mixed abundance trends within some larger watersheds of northern California may suggest some populations are persisting, the low abundance, low productivity, and potential extirpations of populations in the southern part of the CC Chinook salmon ESU are of concern. The reduced abundance contributes significantly to the long-term risk of extinction, and is likely to contribute to the short-term risk of extinction in the foreseeable future. The ESU's geographic distribution has been moderately reduced, but especially for southern populations in general and spring-run Chinook salmon populations in particular. Based on the above information, recent status reviews and available information indicate CC Chinook salmon are likely to become endangered in the foreseeable future. Therefore, the likelihood of both survival and recovery are reduced compared to an ESU at low risk of extinction.

2.6.2 Critical Habitat

Currently accessible salmonid habitat throughout the action area has been severely degraded, and the condition of designated critical habitats, specifically their ability to provide for long-term salmonid conservation, has also been degraded from conditions known to support viable salmonid populations. Intensive land and stream manipulation during the past century (*e.g.*, logging, agricultural/livestock development, mining, urbanization, and river dams/diversion) has modified and eliminated much of the historic salmonid habitat in central and northern California. Impacts of concern include: water diversions, alteration of stream bank and channel morphology, alteration of water temperatures, loss of spawning and rearing habitat, fragmentation of habitat, loss of downstream recruitment of spawning gravels and LWD, degradation of water quality, removal of riparian vegetation resulting in increased stream bank erosion, increases in erosion from upland areas, loss of shade (higher water temperatures), and loss of nutrient inputs (61 FR 56138).

2.7 Conclusion

Although projects authorized by the RGP are intended to restore anadromous salmonid habitat, small amounts of take of listed salmonids will likely result from fish relocation and de-watering activities and the temporary effects of sediment mobilization, modified hydrology, and other minor impacts. Adverse effects to listed salmonids at these sites are primarily expected to be in the form of short-term behavioral effects with minimal mortality. Short-term impacts to salmonid habitat from restoration activities will be minimal and localized at each project site. The temporal and spatial limits (*i.e.*, sideboards) included in the proposed action will preclude significant additive effects. The duration and magnitude of direct effects to listed salmonids and to designated critical habitat associated with implementation of individual restoration projects will be significantly minimized due to the numerous minimization measures (Section 1.3.2.2) that will be utilized during implementation. NMFS anticipates the effects of individual restoration projects will not significantly reduce the number of returning listed salmonid adults.

NMFS has determined these effects are not likely to appreciably reduce the numbers, distribution, or reproduction of salmon and/or steelhead within each watershed where restoration projects occur. This is based on the FRGP's numeric limit per year and per watershed, the low percentage of projects that result in direct effects to salmonids, the low mortality rates associated with fish relocation activities, and the minor short-term effects resulting from increased turbidity levels. The restoration projects are intended to restore degraded salmonid habitat and associated riparian zones; improve instream cover, pool habitat, and spawning gravel; remove barriers to fish passage; and reduce or eliminate erosion and sedimentation impacts. Although there will be short-term impacts to salmonid habitat associated with a small percentage of projects implemented annually, NMFS anticipates most projects will provide improvements to salmonid habitat over the long term. NMFS also anticipates that the additive beneficial effects to salmonid habitat over the five-year period of the proposed action should improve local instream salmonid habitat conditions for multiple life stages of salmonids and should improve survival of local populations of salmonids into the future. Restored habitat resulting from restoration projects should improve adult spawning success, juvenile survival, and smolt outmigration, which will in tum lead to improved abundance, productivity, spatial structure, and diversity within each affected watershed population. As individual population viability improves, the viability of the diversity strata and ESUs/DPSs will improve as well.

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, effects of interrelated and interdependent activities, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of SONCC coho salmon, CCC coho salmon, CC Chinook salmon, NC steelhead, CCC steelhead, or S-CCC steelhead or destroy or adversely modify the designated critical habitat for these species.

2.8 Incidental Take Statement

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

2.8.1 Amount or Extent of Take

In the biological opinion, NMFS determined that incidental take would occur as follows:

NMFS estimates that a small number (up to 3 percent) of juvenile coho salmon, steelhead, and Chinook salmon may be injured or killed during relocation activities in the areas to be dewatered. A small number of fish (1 percent of fish present) will avoid capture. These fish will be exposed to dewatering and construction activities at the project site and will be injured or killed by crushing or desiccation. Table 9 lists the estimated annual take for each ESU/DPS, as first presented in the Effects Section.

Table 9: Maximum annual future take amounts based on observed capture numbers from 2005 to 2015, and estimated mortality rates, resulting from dewatering and relocation.

	Coho Salmon		Chinook salmon	Steelhead		
	SONCC	CCC	CC	NC	CCC	S-CCC
Maximum No. Juveniles Captured in Any Year 2005-2015	1088	274	18	5887	817	408[11]
1 Percent Mortality (Dewatering)	11	3	1	59	8	4
3 Percent Mortality (Relocation)	33	9	1	177	25	12

The total extent of take is associated with projects at least 1,500 feet apart and limited at each project site to no more than 500 contiguous feet of stream channel and to the maximum annual number of instream projects conducted under the proposed RGP for each size of HUC 10 watershed (Table 10).

[11] As no S-CCC steelhead were relocated from 2005 to 2015, likely reflecting the relative scarcity of this species, there was no impact of relocation on this DPS. However, it is possible that the number of fish in this DPS may improve over the period of the proposed action, or different locations may be utilized than during the past 11 years, so take is allowed for this DPS based on half of the take observed in the adjacent CCC steelhead DPS.

Table 10. Maximum number of projects to be carried out in each HUC-10 per year, based on the size of the HUC-10.

Size of HUC-10 watershed (mi^2)	Maximum number of instream projects per year
<50	2
51-100	3
101-150	4
151-250	5
251-350	6
351-500	9
>500	12

2.8.2 Effect of the Take

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

2.8.3 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 SONCC coho salmon, CCC coho salmon, CC Chinook salmon, NC steelhead, CCC steelhead, and S-CCC steelhead:

1. Take measures to minimize harm and mortality to listed salmonids resulting from fish relocation, dewatering, or instream construction activities.

2. Take measures to ensure that individual restoration projects authorized annually through the RGP will minimize take of listed salmonids, and monitor and report take of listed salmonids on individual projects to better assess the effects and benefits of salmonid restoration projects authorized through the RGP.

3. Utilize information collected from the implementation, effectiveness, and validation monitoring to reduce impacts on listed salmonids and advance restoration science.

2.8.4 Terms and Conditions

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

1. The following term and condition implements reasonable and prudent measure 1:

    a. Fish relocation data must be provided annually as described in Term and Condition 2b(i) below. Any injuries or mortality from a fish relocation site that exceeds 3 percent[12] of a listed species shall be reported to the nearest NMFS office within 48 hours.

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

    a. The Corps and/or CDFW shall provide NMFS annual notification of all new or ongoing projects that are authorized through the RGP for that year. The notification shall be submitted at least 14 days prior to project implementation and must include raw data, presented in spreadsheet form, documenting specific project information: The name of project, project type (FRGP code), location of project (creek, HUC-10 (5th field) watershed, city or town, and county) and the size (square miles) of the HUC-10 for each project. In addition, a summary of the number of projects of sediment-producing project types (see opinion for list) per HUC-10 of each size shall be provided, also due at least 14 days prior to project implementation. See table below for template.

[12] Only when injury or mortality exceeds 5 individuals of the affected species, to minimize the need to report when only a small number of listed species are injured or killed from a small total capture size.

Size of HUC-10 watershed (mi^2)	Maximum number of sediment-producing projects per year	Planned number of sediment-producing projects for year x
<50	2	
51-100	3	
101-150	4	
151-250	5	
251-350	6	
351-500	9	
>500	12	

The annual notification shall be submitted to the following NMFS offices:

National Marine Fisheries Service
North Central California Office
777 Sonoma Avenue, Room 325
Santa Rosa, California 95404

National Marine Fisheries Service
Northern California Office
1655 Heindon Road
Arcata, California 95521

b. In order to monitor the impact to, and to track incidental take of listed salmonids, the Corps and/or CDFW must annually submit to NMFS a report of the previous year's restoration activities. The annual report shall include a summary of the specific type and location of each project, stratified by individual project, HUC-10, affected species, and ESU/DPS:

i. Raw data documenting the number and species, HUC-10, and ESU or DPS of each fish relocated, injured, or killed (including adult salmonids or half-pounder steelhead) shall be provided in spreadsheet form. Any injuries or mortality from a fish relocation site that exceeds 3.0 percent of the affected listed species shall have an explanation describing why. In addition, a summary of the number of fish relocated, injured or killed for each ESU/DPS shall be provided. See table below for template.

ESU or DPS	Number Fish Relocated in Year x (e.g., 2017)	Number Fish Injured in Year x	Number of Fish Killed in Year x
SONCC coho salmon			
etc.			

ii. Raw data presented in spreadsheet form documenting the number of new or ongoing sediment-producing projects carried out in given year per HUC-10, including both new and ongoing projects. A summary of the number of projects from all sediment-producing project types for each size of HUC-10, along with the size of each HUC-10, shall be provided. See table below for template.

Size of HUC-10 watershed (mi^2)	Maximum number of sediment-producing projects per year	Actual number of sediment-producing projects for year x
<50	2	
51-100	3	
101-150	4	
151-250	5	
251-350	6	
351-500	9	
>500	12	

iii. The number and type of instream structures implemented within the stream channel.

iv. The length of streambank (feet) stabilized or planted with riparian species.

v. The number of culverts replaced or repaired, including the number of miles of restored access to unoccupied salmonid habitat.

vi. The distance (miles) of road decommissioned.

vii. The distance (feet) of aquatic habitat disturbed at each project site.

Submit this report annually by March 1 to the following NMFS offices:

National Marine Fisheries Service
777 Sonoma Avenue, Room 325
Santa Rosa, California 95404

National Marine Fisheries Service
1655 Heindon Road
Arcata, California 95521

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

   a. Within one year, develop a team of NMFS and CDFW to review the results of implementation, effectiveness, and validation monitoring and assess if there are opportunities to reduce impacts on listed salmonids and/or advance restoration science.

2.9 Conservation Recommendations

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

NMFS suggests the following conservation recommendations:

1. The Corps and/or CDFW should ensure that disturbed and compacted areas will be revegetated with native plant species at the earliest dormant window (late fall through end of winter) following completion of each RGP-authorized project. Such planting will help increase the value of critical habitat to threatened and endangered species. The plant species used should be specific to the project vicinity or the region of the state where the project is located, and comprise a diverse community structure (plantings should include both woody and herbaceous species). Plant at a minimum ratio of three plantings to one removed woody plant.

2. Revegetation sites will be monitored yearly in spring or fall months for three years following completion of the project. All plants that have died will be replaced during the next planting cycle (generally the fall or early spring) and monitored for a period of three years after planting. Following these recommendations will help improve the value of critical habitat of listed species by improving habitat quality, and will enhance recovery of the listed species that utilize the habitat.

3. The Corps and/or CDFW should incorporate project data into a format compatible with the CDFW/NMFS/Pacific Fisheries Management Council Geographic Information System (GIS) database, ultimately allowing scanned project-specific reports and documents to be linked graphically within the GIS database. The Corps and/or CDFW should make reports, assessments, and surveys more readily accessible to the public via their website (*e.g.*, Grant Program website and/or Calfish.org). Such activities would enhance information sharing between entities carrying out habitat restoration, leading to

more efficient and effective habitat restoration and promoting recovery of listed species that use the habitat.

In order for NMFS to keep informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, NMFS requests notification of the implementation of any conservation recommendations.

2.10 Reinitiation of Consultation

This concludes formal consultation for the Corps Issuance of an RGP to the CDFW for implementation of the FRGP program in coastal Northern and Central California.

As 50 CFR 402.16 states, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and if: (1) the amount or extent of incidental taking specified in the incidental take statement is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

2.11 "Not Likely to Adversely Affect" Determinations

NMFS does not anticipate the proposed action will take southern DPS Pacific eulachon. Adult eulachon spawning has been documented in the Mad River, Redwood Creek, and the Klamath River. Critical habitat for spawning and migration extends from 11 to 13 miles upstream in these rivers (NMFS 2010). Spawning begins and ends in April in the Mad River and Redwood Creek, and begins in December and ends in May in the Klamath River (NMFS 2010). Restoration actions may occur within tributaries that drain into San Francisco Bay, where green sturgeon migrate and rear as the pass from upstream spawning areas to marine foraging habitat. Sediment may be released into the Klamath River, Mad River, Redwood Creek, and San Francisco Bay tributaries during restoration action, but as stated in the Effects Section, sediment impacts to critical habitat from restoration actions are expected to be minor and short-lived, and are unlikely to cumulatively combine within downstream habitat when multiple projects occur in one watershed. This reasoning also applies to potential impacts in downstream estuarine habitat. Furthermore, any minor sediment effects that do convey to the estuary environment or the Klamath River will quickly dissipate within the larger spatial area of the receiving water body. Thus, based upon this analysis, NMFS concurs with the Corps determination that the proposed action is not likely to adversely affect Pacific eulachon or its critical habitat because its effects are expected to be insignificant.

NMFS does not anticipate the proposed action will take southern DPS Green Sturgeon (*Acipenser medirostris*). Within the action area, Green Sturgeon may occur within San Francisco Bay and the Klamath River and estuary, downstream of Ishi Pishi Falls near the town of Orleans. Restoration actions may occur within tributaries that drain into San Francisco Bay and the

Klamath River/estuary, and sediment may be released into these water bodies from restoration actions. However, any impacts to critical habitat or Green Sturgeon are expected to be minor and short-lived due to the proposed minimization measures (Section 1.3.2.2) and project "sideboards," and are unlikely to cumulatively combine as they extend downstream (see Effects Section). Furthermore, any minor sediment effects that do convey to the estuary environment or the Klamath River will quickly dissipate within the larger spatial area of the receiving water body. Thus, based upon this analysis, NMFS concurs with the Corps determination that the proposed action is not likely to adversely affect Green Sturgeon or its critical habitat because its effects are expected to be insignificant.

NMFS does not anticipate the proposed action will take Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon California or Central Valley steelhead, or affect their critical habitat. These species typically spawn and rear within the Sacramento/San Joaquin river system upstream of the action area, and do not enter riverine habitat that drains into San Francisco Bay. Sediment arising from restoration actions in San Francisco Bay tributaries may enter estuarine habitat, but the likelihood this sediment would significantly impact juvenile salmonids or their habitat is very low and are expected to be minor and short-lived due to the proposed minimization measures (Section 1.3.2.2) and project "sideboards". Furthermore, sediment impacts are unlikely to cumulatively combine as they extend downstream (see Effects Section). Finally, any minor sediment effects that do convey to the estuary environment will likely quickly dissipate within the larger spatial area of the receiving water body. Thus, based upon this analysis, NMFS concurs with the Corps determination that the proposed action is not likely to adversely affect Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon or California Central Valley steelhead, or their critical habitats, because its effects are expected to be insignificant.

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

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

This analysis is based, in part, on descriptions of EFH for Pacific coast salmon (PFMC 1999) contained in the fishery management plan developed by the Pacific Fishery Management Council and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

Pacific Coast Salmon EFH

3.2 Adverse Effects on Essential Fish Habitat

EFH will likely be adversely affected by implementation of the Program. As described and analyzed in the accompanying biological opinion, NMFS anticipates some short-term sediment and turbidity will occur up to about 1,500 feet downstream of the project locations. Increased turbidity could further degrade already degraded habitat conditions in many of the proposed project locations. Flowing water may be temporarily diverted up to 500 feet around some projects, resulting in short-term loss of habitat space and short-term reductions in macroinvertebrates (food for salmon). Chemical spills from construction equipment may occur; the chance of spills is low based on the minimization measures (Section 1.3.2.2) to be implemented when heavy construction equipment is used, and to reduce the impact of a spill should one occur.

The duration and magnitude of direct effects to EFH associated with implementation of individual conservation projects will be significantly minimized due to the multiple minimization measures (Section 1.3.2.2) utilized during project implementation. The temporal scale (construction restricted to the dry portion of the year) and spatial scale (a maximum number of proposed instream projects per HUC 10 watershed per year [Table 10 in the associated biological opinion]) at which individual restoration project activities are expected to occur (the entire regulatory jurisdiction of the Corps' San Francisco District - Figure 1 in the biological opinion) in the next five years of the proposed action will likely preclude significant additive effects. Implementation of the proposed restoration activities is expected to improve the function and value of EFH within the watersheds; short-term adverse effects will be offset by anticipated long-term benefits.

3.3 Essential Fish Habitat Conservation Recommendations

NMFS recommends that Conservation Recommendation 1 and 2 (in section 2.9 of the associated biological opinion), regarding the replanting of disturbed riparian vegetation, be implemented by the Corps or the applicant in order to address the adverse effects of ground disturbance leading to sediment release and loss of riparian vegetation.

3.4 Statutory Response Requirement

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

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

3.5 Supplemental Consultation

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

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

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

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended user of this opinion is the Corps. Other interested users could include the CDFW and residents of San Benito, San Luis Obispo, Monterey, Santa Cruz, San Mateo, Santa Clara, San Francisco, Alameda, Contra Costa, Solano, Napa, Marin, Sonoma, Mendocino, Humboldt, Del Norte, Shasta, Siskiyou, Trinity, Glen, and Lake Counties. Individual copies of this opinion were provided to the Corps. This opinion will be posted on the Public Consultation Tracking System web site (https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts). The format and naming adheres to conventional standards for style.

4.2 Integrity

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

4.3 Objectivity

Information Product Category: Natural Resource Plan

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

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

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

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

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